

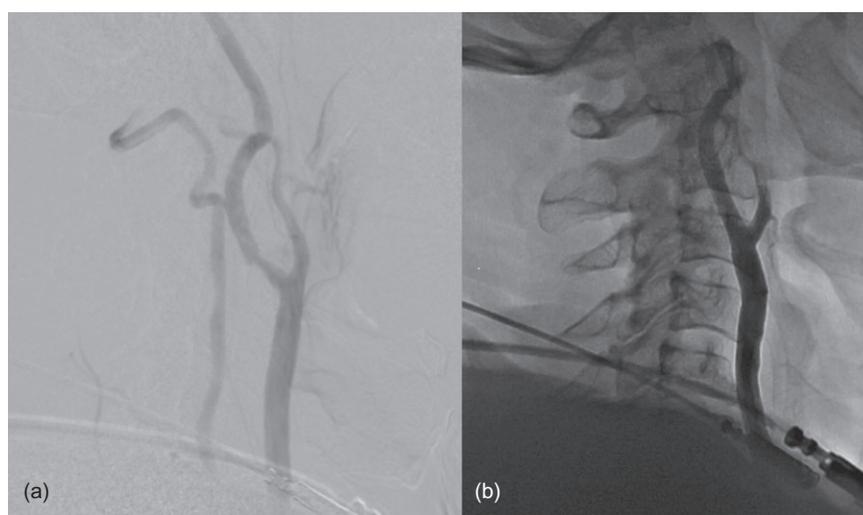
WSC-1515

**Acute Neuroimaging****Contrast agent neurotoxicity mimicking subarachnoid hemorrhage during carotid angiography: Case report**A N Alagoz<sup>1</sup>, N Can Ucaroglu<sup>1</sup>, A Boluk<sup>1</sup><sup>1</sup>Neurology, Sakarya University Medicine Faculty Research and Education Hospital, Sakarya, Turkey

*Introduction:* Various types of brain damage may occur during angiographic procedures. These damages may present in an embolic, hemodynamic and hemorrhagic nature. Hemorrhagic complications may include intracerebral hemorrhages, like subarachnoid hemorrhage. However, some cases were reported to present as subarachnoid hemorrhage in the cranial computerized tomography due to the extravasation of the contrast agent used during angiography by disrupting the blood brain barrier.

*Case:* Our case who underwent carotid angiography and stent implantation for carotid stenosis was seen to show impairment in his general condition and consciousness about 2 hours after the procedure (Fig. 1). The NM showed that the patient was somnolent, his cooperation was restricted, spatial and temporal orientation was reduced, speech was slightly dysarthric, and bilateral Babinski was positive. Cranial CT revealed diffusely increased density in the cisternal spaces, suggesting subarachnoid hemorrhage associated with extravasation of the contrast agent used (Fig. 2). The patient was admitted to the intensive care and put on supportive and anti-edema therapy. The neurological examination of the patient 48 hours after the incident was normal. The cranial CT showed complete resolution (Fig. 3).

*Result:* We contend that our case supports the literature.



**Fig. 1** Carotid angiography.



**Fig. 2** Cranial CT revealed diffusely increased density in the cisternal spaces, suggesting subarachnoid hemorrhage associated with extravasation of the contrast agent used.



**Fig. 3** Control cranial CT showed full resolution.

## WSC-1067

### Acute Neuroimaging Microembolus (MES) detection by TCD in acute stroke service

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**Introduction:** Micro embolic signal (MES) detection is one of the key applications of TCD in stroke. Micro embolic signals (MES) are reported to be an independent risk factor for stroke. In addition it also helps in defining the underlying pathophysiology and assessing the response to various treatments.

**Aims:** Our study's aim is to evaluate the yield of TCD in detecting MES, predictors for positive MES and recurrence of stroke.

**Methods:** We did retrospective analysis of all stroke and TIA patients who were evaluated in the University of Alberta hospital between January 2006 until July 2013. All cases had bilateral TCD monitoring of MCA /ACA or PCA vessels. Positive MES TCD monitoring was defined by the presence of  $\geq 1$  MES on either hemisphere.

**Results:** 49 patients out of 455 (10.7%) who underwent TCD monitoring were MES positive. Mean age was 54.7(20), 67.3% were male, Median duration of monitoring was 50 minutes (27.5–60). The Risk of MES positive was calculated using multiple logistic regression analysis. Number of infarcts was associated with increased odds of having positive MES (OR 2.98 (95% CI 1.75–5.10)  $P \leq 0.000$ ). In addition, the presence of valvular heart disease (OR 5.12 (95% CI 1.17–22.87)  $P \leq 0.029$ ).

Patients with positive MES on TCD monitoring are twice risk of stroke recurrence than ones with negative MES. (13.5% for positive MES versus 6.5% for negative one ( $P = 0.100$ )).

**Conclusions:** Our study showed that the presences of multiple infarcts on neuroimaging and valvular heart disease on echo are associated with positive MES on TCD emboli monitoring.

## WSC-1103

### Acute Neuroimaging Characteristics of positive microembolus (MES)

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**Introduction:** Micro embolic signal (MES) found on transcranial Doppler (TCD) ranges from harmless air bubbles to large solid particulate emboli from the heart and large vessels. We are describing characteristics of positive MES in our study.

**Aims:** Our study's aim is to describe the characteristics of positive MES on Transcranial Power M mode Doppler (PMD).

**Methods:** We did retrospective analysis of all stroke and TIA patients who were evaluated in the University of Alberta hospital between January 2006 until July 2013. All cases had bilateral TCD monitoring of MCA /ACA or PCA vessels for minimum of 50 minutes. The positive emboli on spectrogram were defined based on the consensus criteria. Positive MES TCD monitoring was defined by the presence of  $\geq 1$  MES on either hemisphere.

**Results:** 49 patients out of 455 (10.7%) who underwent TCD monitoring were MES positive. Mean age was 54.7 (20), 67.3% were male. The mean total count of MES was 8.94 (11.48), 62% of MES was seen in right hemisphere and in majority (86%) MES were found in MCA. They were predominantly diastolic (54.0%). Characteristics of MES are below (Table 1).

**Conclusions:** Our study showed that there are specific patterns of MES which can help in predicting outcome.

Table 1

	Positive MES Mean $\pm$ SD
Counts	8.94 $\pm$ 11.48
Max I, dB	9.69 $\pm$ 5.39
Max D, msec	1.61 $\pm$ 0.68
MGTT, msec	3.12 $\pm$ 1.46
DIST, mm	16.81 $\pm$ 7.05
<i>Arterial trajectory</i>	
M1	41.8%
MI-M2	30.6%
ICA-M1	10.0%
ICA-M1-M2	4.7%
A1	5.3%
P1	4.7%
BA- PCA	1.7%
<i>Pattern</i>	
Single	93.5%
Couplet	4.7%
Train	1.8%

## WSC-1313

### Acute Neuroimaging Utility of vasoCT in the diagnosis of intracranial artery dissection

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**Background:** Intracranial artery dissections (IAD) are rarely reported in the literature and possibly underdiagnosed. Vaso-computed tomography (vasoCT) is increasingly being used in recent years for better visualization of intraarterial and intravenous interventions. Here we present a patient with IAD, which could not be detected by using routine diagnostic approaches but via vasoCT imaging.

**Case report:** A 41-year-old man was admitted to our emergency department complaining of thunderclap-like hemicranial headache over right temporal region, which awakened him at morning hours. He denied any associated neurological symptom. The patient stated that he consumed high amounts of energy drinks and alcohol the day before. His past medical history was unremarkable except for heavy smoking (20 pack-year) and causal alcohol intake. His family history revealed that his father had stroke around his forties. His neurological examination was normal. Cranial CT was normal. Cranial magnetic resonance imaging (MRI) showed hyperintense signal changes in right middle cerebral artery (MCA) territory in diffusion-weighted images; T1, T2 and FLAIR-weighted images were normal. CT-angiography was also normal. The authors considered the case as reversible cerebral vasoconstriction syndrome. Two days later, however, repeated cranial MRI showed cerebral infarction. Detailed etiological work-up excluded atherosclerosis, cardio-embolism, vasculitic or hematological diseases. Cerebral digital subtraction angiography also revealed no abnormality. At this point, we performed intraarterial vasoCT, which showed dissection in M1 segment of right MCA.

**Conclusion:** As cerebral imaging techniques advance, patients with stroke of unknown etiology would diminish secondary to easier diagnosis of rare and difficult-to-diagnose etiologies as intracranial dissections.

## WSC-0467

### Acute Neuroimaging Prognostic value of CT perfusion in acute stroke patients treated with endovascular therapy

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**Aims:** To clarify whether CT Perfusion (CTP) parameters are predictive for clinical and radiological outcomes in acute stroke patients treated with endovascular therapy.

**Methods:** We retrospectively evaluated 24 patients with middle cerebral artery acute stroke who had undergone intra-arterial thrombolysis or mechanical thrombectomy within 8 hours after symptom onset and pre-treatment multimodal CT protocol including nonenhanced CT (NECT), CT Angiography (CTA) and CTP. After identification by visual inspection on mean transit time (MTT) and cerebral blood volume (CBV) maps, total hypoperfusion, infarct core and ischemic penumbra volumes were calculated by manually drawing MTT, CBV and MTT-CBV (CTP mismatch) lesions, respectively. Recanalization was assessed on 24 hour CTA according to TIC1 criteria. Reperfusion was defined as a percentage reduction > 80% in the baseline-24 hour MTT lesion. Final infarct volume was manually outlined on 3 month NECT. The modified Rankin scale (mRS) was recorded at 3 months.

**Results:** A CTP mismatch was detected at onset in all patients. CBV infarct core volume was positively correlated with final infarct volume ( $p < 0.02$ ) in recanalized patients, was smaller in patients with good than in those with poor outcome ( $p < 0.05$ ) and was positively associated with mRS ( $p < 0.02$ ). No further significant differences or correlations were found between CTP parameters and outcome measures.

**Conclusions:** Our study suggests that CTP represents a useful tool for predicting prognosis in stroke patients treated with endovascular therapy because, in presence of a CTP mismatch, CBV lesion volume is strongly related to outcome.

## WSC-0979

### Acute Neuroimaging Ischemic core estimation in patients with acute ischemic stroke: Effect of extended CT perfusion acquisition time

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**Introduction:** Although a CT Perfusion (CTP) acquisition time of 90 seconds is recommended to prevent time attenuation curve (TAC) truncation, 50 seconds is common in most hospitals.

**Aims:** To investigate if 48 seconds CTP acquisition is sufficient for accurate ischemic core estimation in patients with acute stroke due to an occlusion in the intracranial proximal anterior circulation.

**Methods:** Fifty-eight patients included in the MR CLEAN trial in the Academic Medical Center and University Medical Center Utrecht underwent CTP analysis with a total acquisition time of 210 seconds. After exclusion due to severe movement and insufficient contrast supply we analyzed CTP data of 36 patients. TACs were classified as complete or truncated. Ischemic core and penumbra volumes from standard 48 seconds and extended 210 seconds data sets were compared by median paired differences and interquartile ranges (IQR).

**Results:** For the 48 seconds acquisition, 24 (67%) of the cases showed truncation of the TACs in the ischemic core. Truncation of the arterial input function was found in 2 patients and truncation of the venous output function in 5 patients. The extended acquisition time resulted in smaller ischemic cores with a median difference of 13.2 (IQR: 4.37–26.0) ml ( $P < 0.001$ ), and larger penumbras with a median difference of 12.4 (IQR: 4.1–25.7) ml ( $P < 0.001$ ).

**Conclusions:** TAC truncation in ischemic core is common in 48 seconds CTP data of patients with acute stroke due to an occlusion in the intracranial proximal anterior circulation. Extended acquisition times prevent truncation and result in smaller ischemic core estimations.

## WSC-1494

### Acute Neuroimaging Exploring practice of 24 hour post thrombolysis CT brain in acute stroke patients

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Currently there is no consensus in UK with regard to routine CT scanning at 24 hours post-thrombolysis. This study aimed to assess current practice amongst a national sample of stroke physicians.

**Methodology:** We distributed an online survey through the British Association of Stroke Physicians, designed to assess the national opinion on use of CT Brain 24 hours post thrombolysis in acute stroke patients.

**Results:**

N = 100; 72% Stroke Physicians; 20% Geriatricians; 12% Neurologists. 85% Consultants.

92% routinely performed a 24-hour post-thrombolysis CT scan.

The majority justified the scan as a method to identify hemorrhage and guide the use of antiplatelet agents.

Other possible clinical indications suggested:

- Fluctuating neurology
- Headache and vomiting
- Assess prognosis if poor progression
- Higher bleeding risk
- Hemispherectomy candidates
- Research

Respondents were asked which features would prompt them to perform a repeat CT scan.

- 45% -NIHSS increased by  $\geq 2$  points from baseline
- 65% -drop in GCS
- 18% -AF
- 35% -severe stroke on presentation (NIHSS > 20)

Many referred to 24-hour scans as routine practice, although the above features may prompt earlier repeat scanning.

In severe stroke patients in AF, 65% would routinely CT scan before starting Warfarin or a novel oral anticoagulant.

**Conclusions:** The post-thrombolysis scan is routine practice in many departments across the UK. Cogent reasons were put forward that question this practice and suggest that this is offered only in patients with clear clinical indications.

*Does this practice have clinical benefit or does it support the confidence of the physician?*

**WSC-1421****Acute Neuroimaging****Safety and efficacy of CT perfusion in extending the benefit of thrombolysis to strokes of uncertain onset**D Collas<sup>1</sup>, S K Gill<sup>1</sup>, N Tessier<sup>2</sup><sup>1</sup>Stroke Medicine, Watford General Hospital, Watford, United Kingdom<sup>2</sup>Radiology, Watford General Hospital, Watford, United Kingdom

**Introduction:** If tissue not time is used as the criteria for thrombolysis, based on CT perfusion (CTP) fewer patients would be excluded.

**Aims:** To compare outcomes in patients thrombolysed with known and unknown time of onset, where the latter decision was based on CTP mismatch.

**Methods:** We reviewed all stroke admissions from Oct 2011 to Jul 2013; all thrombolysed patients and all CTP patients were compared for mortality, NIH and mRS scores, hemorrhagic complications and door to needle time (DTN).

**Results:** 89/1097 (7%) strokes had uncertain onset (75 wake-up, 14 no history), 65 underwent CTP, 22 showed mismatch and were thrombolysed, plus one with no mismatch. DTN was 2 mins longer for CTP (median 58 v 56 mins). Mortality was 2/23 (8.7%, day 1 & 29, neither with hemorrhage) compared with 33/213 (15.5%) overall. There were 2 symptomatic and one asymptomatic hemorrhages at 24 hours. The matched defect case died at 24 hours; post-mortem showed infarct with no hemorrhage, consistent with a completed infarct at presentation (no penumbra). Five with normal perfusion were re-diagnosed (3 fits, 1 migraine, 1 TIA). Two CTP failed due to extravasation and movement artefact. Median NIH fell from 15 to 5.5 at 24 hours, and median mRS at discharge was 2.

**Conclusions:** Using CTP to identify potentially salvageable tissue in strokes of uncertain onset enabled a further 11% of patients to receive thrombolysis, with evidence of benefit in NIH and mRS without increased risk of hemorrhage or significantly prolonged door to needle time.

**WSC-1109****Acute Neuroimaging****Occult anterograde flow in acute ischemic stroke: An under-recognized but crucial predictor of early recanalization with IV tPA using standard CT perfusion T0 maps**C D d'Esterre<sup>1</sup>, S Hwan<sup>1</sup>, A M Demchuk<sup>2</sup>, E Qazi<sup>1</sup>, T Y Lee<sup>3</sup>, M Al-mekhlafi<sup>1</sup>, M Goyal<sup>1</sup>, B K Menon<sup>2</sup><sup>1</sup>Radiology, University of Calgary, Calgary, Canada<sup>2</sup>Neurology, University of Calgary, Calgary, Canada<sup>3</sup>Imaging, Lawson Health Research Institute, London, Canada

**Intro/Aim:** Clot lysis in acute ischemic stroke is dependent on the ability of blood and lytics to permeate clot. We devise a novel technique to quantify occult anterograde flow (OAF) through intracranial clot and determine if OAF predicts early recanalization with IV tPA.

**Methods:** From the PROVE-IT stroke-imaging database, IV tPA treated patients were analyzed. Using a CT perfusion T0 map generated from delay in arrival time of contrast within the intracranial arterial tree relative to an arterial input function, a "positive sloped" regression line of T0 values from distal clot interface along the artery profile indicated presence of OAF. T0 values at the distal and proximal clot interface (pre- and postclot) were also measured. Early recanalization was assessed on subsequent conventional angiography or on 4 hr CTA after tPA injection.

**Results:** Of 50 patients analyzed, early recanalization rate was higher in patients with OAF (12/17 versus 10/33,  $p < 0.01$ ). Mean T0 value difference was significantly less in recanalizers (0.6 versus 3.8,  $p < 0.01$ ). Those with OAF and maximum T0 difference  $< 4.5$  s were most likely to achieve recanalization ( $n = 16$ , 75%) versus those with only one parameter ( $n = 24$ , 37.5%) or those with neither parameters ( $n = 10$ , 10%).

**Conclusion:** Occult Anterograde Flow can be measured by CT perfusion T0 maps and is a robust predictor of early recanalization with IV tPA.

**WSC-1084****Acute Neuroimaging****CT perfusion cerebral blood volume predictive value for infarct core and penumbra in acute ischemic stroke**C d'Esterre<sup>1</sup>, T Y Lee<sup>2</sup>, S Ceruti<sup>3</sup>, G Roversi<sup>4</sup>, A Saletti<sup>3</sup>, E Fainardi<sup>3</sup><sup>1</sup>Radiology, University of Calgary, Calgary, Canada<sup>2</sup>Imaging, Lawson Health Research Institute, London, Canada<sup>3</sup>Neuroradiology, Azienda Ospedaliero-Universitaria di Ferrara, Ferrara, Canada<sup>4</sup>Neurology, Azienda Ospedaliero-Universitaria di Ferrara, Ferrara, Canada

**Introduction:** We investigate the practical clinical utility of the CT Perfusion (CTP) CBV parameter for differentiating salvageable from nonsalvageable tissue in acute ischemic stroke (AIS).

**Materials and methods:** We evaluated 55 patients with AIS<sub>D</sub> was outlined using previously established gray and white matter CBV thresholds for infarct core. Final infarct volume was drawn on 3-month NCCT (NCCT<sub>D</sub>) and, then superimposed onto the admission CBV and CBF maps.

**Results:** Patients with recanalization and no truncation had the highest correlation ( $R = 0.81$ ) and regression slope (0.80) between CBV<sub>D</sub> and NCCT<sub>D</sub>. Regression slopes were close to zero for patients with admission hypervolemia with/without recanalization. Hypervolemia underestimated ( $p = 0.01$ ), while recanalization and ITDC truncation overestimated ( $p = 0.03$  and  $p = 0.04$ , respectively) the final infarct volume. Among patients with confirmed recanalization at 24 hours, a matched decrease in CBF and CBV at onset within areas of slightly hypodensity on corresponding NCCT was observed in 62% (20/32) of them. All these patients developed infarction in the same region in the 3 months post NCCT. The remaining 38% (12/32) patients who recanalized at 24 hours had an admission CBF/CBV mismatch within areas of little or no early ischemic change on respective NCCT images. Of this sub-group, 83% (10/12) of patients developed infarction at 3 month NCCT in hypervolemic (CBF/CBV mismatch) tissue at admission.

**Conclusions:** Low CBV or a matched decrease in CBF/CBV is a predictor of infarct core when ITDC truncation and hypervolemia are absent, while high CBV may not always indicate salvageable tissue.

**WSC-1085****Acute Neuroimaging****Comparing multiple neuroimaging techniques and histology in a porcine model of endothelin-1 induced cerebral ischemia: Defining the acute infarct core**C D d'Esterre<sup>1</sup>, R I Aviv<sup>2</sup>, E Fainardi<sup>3</sup>, T Y Lee<sup>4</sup><sup>1</sup>Radiology, University of Calgary, Calgary, Canada<sup>2</sup>Neuroradiology, Sunnybrook Medical Centre, Toronto, Canada<sup>3</sup>Neuroradiology, Azienda Ospedaliero-Universitaria di Ferrara, Ferrara, Italy<sup>4</sup>Imaging, Lawson Health Research Institute, London, Canada

**Introduction/Aim:** In a porcine ischemic stroke model, we sought to compare the acute predicted infarct volume (PIV) defined by CT Perfusion (CTP)-hemodynamic parameters and MR-DWI/ADC, with the true infarct volume (TIV) as defined by histology. Knowing the acute infarct volume could inform thrombolysis treatment.

**Methods:** Ten Duroc-cross pigs had a CTP scan prior to injection of endothelin-1 (ET-1) into the left striatum. CTP scans were used to monitor ischemic progression. A second dose of ET-1 was injected 2 hours from the first injection. The animal was moved to a 3T MRI scanner where diffusion-weighted imaging (DWI) was performed. CTP imaging was acquired immediately after the MR imaging. Next, the brain was removed and stained with tetrazolium-chloride (TTC). Bland-Altman plots were used to correlate the PIV measured by each imaging modality to that of the TIV from the histological gold standard.

**Results:** The best Bland-Altman agreement was observed with CTP-CBF parameter. PIV from MR-DWI, ADC and CTP-CBF overestimated the TIV defined with histology. Within the TIV, a complete CBF/CBV mismatch

(hypervolemia without a CBV defect), partial mismatch (hypervolemia with a CBV defect) and absent mismatch (no hypervolemia) was observed in 3/10 (30%), 3/10 (30%), and 4/10 (40%) of animals, respectively.

**Conclusion:** We show that the PIV defined with absolute gray and white matter CT-CBF thresholds correlates best with the TIV, and is similar to both MR-DWI and ADC defined PIVs. Further, the acute CBF/CBV mismatch may not indicate penumbral tissue in the acute stroke setting.

#### WSC-1099

##### Acute Neuroimaging CT perfusion thresholds to separate acute infarct core from penumbra using optimized imaging and advanced postprocessing

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**Introduction/Aim:** CT Perfusion (CTP) may change thrombolytic/endovascular treatment decisions when compared to NCCT/CTA alone.

**Methods:** CTP (120 s, 8 cm) was performed on 180 patients within 12 hrs of ischemic stroke. Two patient cohorts were analyzed: (1) recanalization (TICI 2b,3) <90 mins post CTP and (2) persistent occlusion at 24 hrs. Follow-up DWI occurred between 8–48 hrs. CTP 4D-GE Healthcare was used to calculate cerebral blood flow (CBF), cerebral blood volume (CBV), Tmax maps. DWI hyper-intensity on follow-up was 3D-registered to admission CTP maps. For group (1) CBF, CBV, and Tmax values were obtained from within this region, and a peri-infarct region with Tmax>6 s. For group (2) CBF, CBV, and Tmax values were obtained from within the final infarct region, and total ipsilateral hemisphere, excluding infarction. CBF, CBV and Tmax were used in univariate regression models.

**Results:** For group (1) [n = 11], mean time from CTP to recanalization was 60 ± 19 min. CBF parameter (thresholds for gray and white matter 7.2 and 5.2 ml·min<sup>-1</sup>·(100 g)<sup>-1</sup>) had the highest sensitivity (90.9%) and specificity (81.8%) for infarction. For group (2) [n = 15], the Tmax parameter (thresholds for gray and white matter 11.3 s and 11.8 s) had the highest sensitivity (86.6%) and specificity (80.0%) for penumbra.

**Conclusion:** Knowing the status of recanalization within 90 minutes of CTP allows for accurate delineation of infarct core, as infarct expansion will be limited. Absolute CBF gray and white matter thresholds were highly sensitive to define tissue that will be nonsalvageable very soon. An absolute Tmax threshold is most accurate for tissue volume that will die if the clot is not removed (volume of severe hypoperfusion).

#### WSC-0609

##### Acute Neuroimaging Hypoperfusion syndrome at susceptibility-weighted MR imaging in experimental model of acute focal cerebral ischemia

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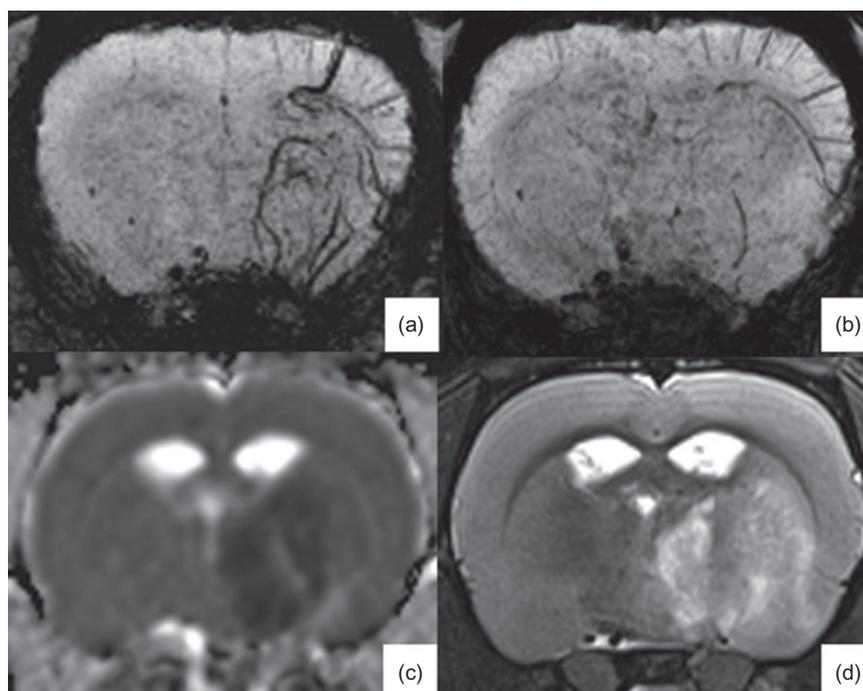
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SWI has a high sensitivity to magnetic susceptibility. Deoxyhemoglobin can induce susceptibility change. In veins draining brain ischemic zone is a hypoperfusion, thus the relative concentration of deoxyhemoglobin there is significantly higher. Later allows determining the increase of its using SWI and may assist in identifying of infarct zone.

12 rats were subjected to 60-minutes MCAO by an intraluminal monofilament. During surgery and MRI inhalation anesthesia was used (isoflurane, oxygen). MRI was performed: during occlusion, immediately after recanalization, 24 hours and at 2, 4 and 7 days after.

For better visualization of syndrome all investigated animals breathed pure oxygen. Thus normal veins are not visualized and the draining veins in the focus of stroke are clearly defined. In this way, the appearance of syndrome is associated with decrease perfusion in the ischemic zone, increasing the relative concentration of deoxyhemoglobin in blood and a manifestation of the paramagnetic properties of vessel as a whole.

Hypoperfusion syndrome at SWI was observed in 7 rats from 12. Syndrome persisted until 24 hours after MCAO. 2 days after MCAO syndrome was not observed. Number, area and the position of visualized veins depended on the location and size of the ischemic zone.



**Fig.** (a) – SWI immediately after recanalization; (b) – SWI, (c) – ADC, (d) – T2WI after 24 hours.

## WSC-0922

## Acute Neuroimaging

## Hyperintense cerebrospinal fluid on fluid attenuation inverse recover image caused by left internal carotid artery stenosis

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**Introduction:** The term ‘hyperintense CSF’ is used to describe failed suppression or hyperintensity of CSF on FLAIR imaging of the brain. We report a case that hyperintense CSF on FLAIR was observed in the patient with left ICA stenosis.

**Case:** A 76 year-old man was admitted with dysarthria 5 hours before. He underwent carotid endarterectomy on right ICA stenosis. Also he had an asymptomatic left ICA stenosis. DWI (Fig. 1) showed recent ischemic changes in watershed zone. CSF study were normal. On the third day, right hemiparesis and mutism were developed. So DWI and MR perfusion images were done and a perfusion-diffusion mismatch was observed. At day 4, in axial FLAIR image (Fig. 2a), high signal lesion is observed in the left vitreous body and in the CSF spaces throughout the left hemisphere, notably in the sulci and on cortical surface. The axial T1 and T2 weighted images (Fig. 2b,c) also show a similar distribution in the cerebral sulci. A stent insertion procedure was done and symptoms were improved gradually.

**Discussion:** The term ‘hyperintense acute reperfusion marker (HARM)’ is used to describe hyperintense CSF caused by gadolinium contrast agents crossing a disrupted BBB on FLAIR imaging in a stroke patient. Some studies suggested that HARM is a marker of reperfusion injury, hemorrhagic transformation and poor prognosis. However the hypothesis was not applicable to our case. FLAIR images of our patient were same to those of previous reported HARM cases but there was no reperfusion injury, hemorrhagic transformation.

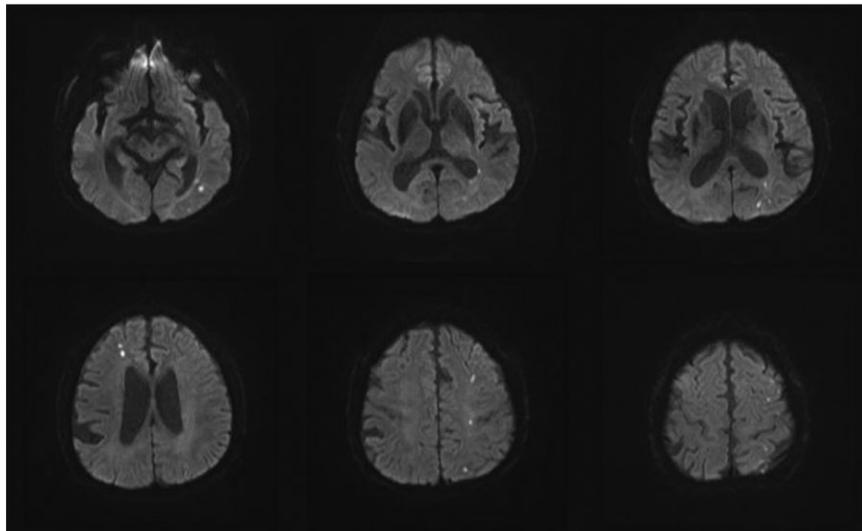


Fig. 1

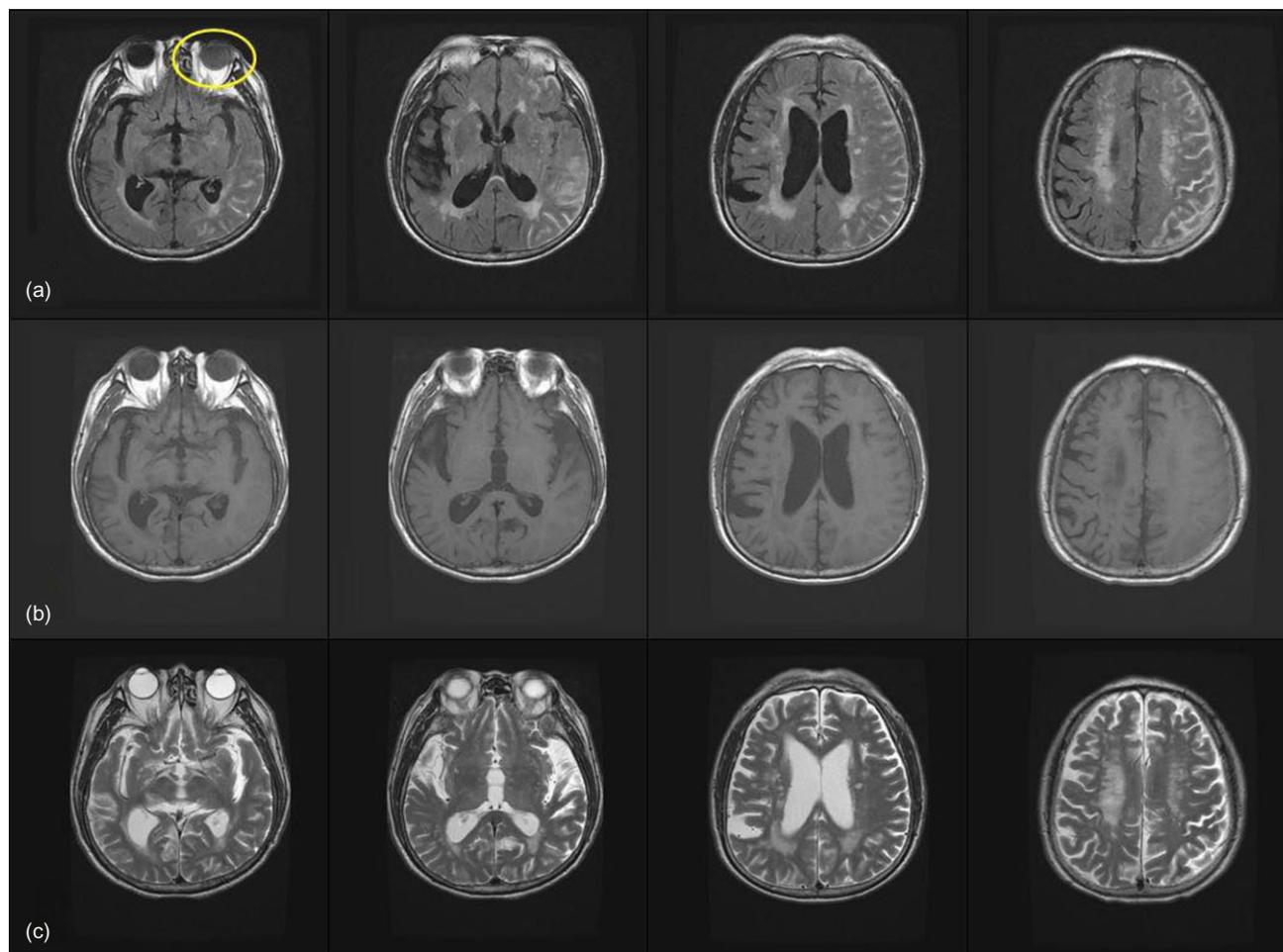


Fig. 2

**WSC-1328**  
**Acute Neuroimaging**  
**MRI diffusion-weighted imaging in intracranial hemorrhage (ICH)**

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*Abstract purpose:* To assess the role of MRI DWI in detection and characterization of ICH.

*Patients and methods:* 61 patients with intracranial hemorrhage who underwent MRI (including DWI, ADC, and GRE) and CT were retrospectively included in this study. MRI DWIs were analyzed for age, type, (primary parenchymal hemorrhage or hemorrhagic lesion) and location of the hemorrhage. The results were compared with conventional MRI sequences, GRE, and CT to assess the diagnostic accuracy of DWI in assessment of patients with intracranial hematoma.

*Results:* We had 61 patients with intracranial hemorrhage, six cases were missed by DWI. MRI DWI was accurate for the detection of hyperacute, medium, large sized acute, early and late sub acute, subdural, hemorrhagic components of arterial and venous infarction, intraventricular hemorrhage.

DWI showed low sensitivity in detection of subarachnoid and small intraparenchymal hemorrhage. The ADC measurements in hyperacute, acute, early and late subacute hematoma were statistically equivalent and were significantly less than the late subacute hematoma as well as the contralateral white matter.

*Conclusion:* MRI DWI was accurate in detection, characterization and staging hyperacute, acute, subacute hemorrhage as well as hemorrhagic components of arterial and venous infarctions and of low diagnostic accuracy in subarachnoid and small parenchymal hemorrhage.

**WSC-0654**  
**Acute Neuroimaging**  
**Evaluation of C-arm cerebral blood volume measurement and volumetric anatomical vascular image analysis for acute ischemic stroke patients**

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*Introduction:* Technological advancements of C-arm angiographic systems allow acquiring CT-like images and measuring the cerebral blood volume (C-arm CBV). The purpose of this study was to evaluate the C-arm CBV and volumetric vascular images for acute ischemic stroke patients.

*Materials and methods:* 27 acute ischemic stroke patients with intracranial artery occlusions (ICA: 6, MCA: 19, and BA: 2) were investigated. C-arm CBV datasets were acquired comprising each 2 rotations: a non-contrasted initial rotation (mask run) followed by a second rotation with appropriate contrast medium injection (fill run). All studies were performed by aortic arch contrast injection via a 4F diagnostic IA catheter

placed above the aortic valve. On the C-arm CBV maps, ROIs were placed in the ischemic core and salvaged lesions that were identified on MRI or CT maps, acquired 24–48 hours after treatment. We calculated the mean CBV value for each lesion and the relative CBV ratio to the normal hemisphere, respectively. An additional reconstruction of the fill run dataset was performed to evaluate the cerebral vasculature using slab MIP images.

**Results:** All studies were successful, without complications. Mean CBV values and relative CBV ratio for ischemic core and salvaged lesions were ( $1.29 \pm 0.51$  ml/100 g,  $0.41 \pm 0.17$ ) and ( $3.19 \pm 0.17$  ml/100 g,  $0.80 \pm 0.10$ ), respectively. Occluded lesions of the artery were detected as contrast filling defect, and the postocclusion vascular condition could be assessed with slab MIP images.

**Conclusion:** Acquiring C-arm CBV and vascular images at the same time may be beneficial in making decisions for acute ischemic stroke treatment.

### WSC-1351

#### Acute Neuroimaging Clinical evaluation of cerebral vasospasm requiring endovascular treatment by transcranial color-coded duplex sonography

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**Introduction/Aims:** This study was designed to assess the usefulness of transcranial color-coded duplex sonography (TCCS) for the evaluation of cerebral vasospasm potentially requiring endovascular treatment.

**Methods:** Sixty-two consecutive patients with subarachnoid hemorrhage (SAH) were studied. Peak-systolic flow velocity was measured on TCCS in both M1 segments of the middle cerebral arteries. Seventeen patients initially underwent TCCS within 0–6 days before cerebral angiography or endovascular treatment for cerebral vasospasm and were subsequently confirmed to have cerebral vasospasm on angiography. These patients were included in further analysis. The maximum recorded peak-systolic flow velocity calculated on TCCS initially performed within 0–6 days before cerebral angiography or endovascular treatment for cerebral vasospasm was analyzed.

**Results:** For the evaluation of cerebral vasospasm, TCCS could be performed significantly earlier ( $5.6 \pm 2.9$  days after admission) and more frequently ( $3.94 \pm 1.11$  times) than cerebral angiography ( $12.8 \pm 5.4$  days and  $1.02 \pm 0.15$  times), three-dimensional CT angiography ( $10.5 \pm 5.0$  days and  $1.39 \pm 0.56$  times), and magnetic resonance angiography ( $21.5 \pm 9.4$  days and  $1.06 \pm 0.25$  times) ( $P < 0.005$ ). Seven of the 17 patients included in further analysis underwent endovascular treatment for cerebral vasospasm. The mean peak-systolic flow velocity in patients who received endovascular treatment ( $245 \pm 64.0$  cm/s) was significantly higher than that in patients who did not receive endovascular treatment ( $133 \pm 55.4$  cm/s) ( $P < 0.005$ ).

**Conclusions:** TCCS analyses before cerebral angiography or endovascular treatment for cerebral vasospasm may be useful for assessing cerebral vasospasm likely to require endovascular treatment.

### WSC-1479

#### Acute Neuroimaging Does CT angiography spot sign predict hematoma expansion and outcome in early primary intracerebral hemorrhage?

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**Background:** We explored the presence of spot sign in patients with primary intracerebral hemorrhage (ICH) and correlated it with hematoma expansion and outcome.

**Methods:** This is an on-going prospective observational cohort study. Patients over 18 years of age with ICH who presented to the Stroke unit of Christian Medical College, Ludhiana from February 2013 to January 2014, presenting within 24 hours of onset were recruited. Each patient underwent a NCCT head at presentation followed by CT angiography on a 128 slice Philips ingenuity CT scanner. A repeat NCCT was done within 48 hours. The outcome measures were modified Rankin Scale (mRS,  $\leq 2$  good outcome) at 3 months and hematoma expansion at 48 hours. The statistical analysis was done using SPSS version 21. The statistical tests used were Fisher Exact test, independent t-test and Mann Whitney U test.

**Results:** Two (6.5%) out of 31 patients studied had 'spot sign'. At baseline the stroke severity NIHSS [spot sign positive: median: 19 (14–24) versus spot sign negative: 14 (9–17);  $P = 0.31$ ] and hematoma volume [spot sign positive: median 22 (3–41) versus spot sign negative: 9 (5–34);  $P = 0.84$ ] were similar. Hematoma expansion in 'spot sign' positive patients was seen in 1 (50%) versus 5 (17%) of spot sign negative patients ( $P = 0.36$ ). The mortality was higher in patients with spot sign ( $n = 2$ , 100%) as compared to spot sign negative patients ( $n = 5$ , 17%) ( $P = 0.03$ ).

**Conclusions:** Our preliminary results show a low occurrence of spot sign in our ICH cohort. However the outcome is similar to other reports.

### WSC-0194

#### Acute Neuroimaging Prevalence of intracranial stenosis using transcranial Doppler ultrasonography and its diagnostic accuracy in patients with acute vertebrobasilar infarction

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**Introduction:** Acute vertebrobasilar ischemia is an important cause of acute neurological disease. Therefore, emergent non invasive assessment of posterior circulation is critical. Transcranial Doppler (TCD) is a fast, non invasive tool that can detect, localize and grade the severity of intracranial stenosis in acute ischemic stroke.

**Objective:** The objectives of this study were to determine the prevalence rate of intracranial stenosis using TCD among patients with vertebrobasilar ischemia and to evaluate the diagnostic accuracy of TCD compared with Cranial Magnetic Resonance Angiography (MRA) in the detection of intracranial stenosis.

**Methods:** This is a prospective study conducted in Jose R. Reyes Memorial Medical Center (JRRMMC) Neurology Ward from January 2012 to December 2012. Consecutive patients admitted to the ward with definite clinical diagnosis of acute vertebrobasilar ischemia underwent TCD and brain MRI with MRA done 48 hours after admission. A second TCD was done one week after admission. SONIA criteria for mean flow velocity (MFV) cutoffs on TCD were used for identification of  $>50\%$  stenosis.

**Results:** Twenty patients were included in the study. Results showed that 75% (15 out of 20) of patients with vertebrobasilar infarctions have intracranial stenosis in MRA. Out of the 15 patients with vertebrobasilar stenosis detected by MRA, 6 of them registered high mean flow velocity on

TCD. TCD showed high specificity (100%) but less sensitivity (40%) in the detection of vertebrobasilar stenosis.

**Conclusion:** TCD can be suggested as a screening tool in detecting intracranial stenosis in patients with acute vertebrobasilar infarctions.

### WSC-1491

#### Acute Neuroimaging

##### Application of CISS sequence for detecting abducens nerve palsy caused by basilar artery dolichoectasia

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Abducens nerve palsy is one of the most frequent isolated cranial nerve palsies. Abducens nerve may be damaged anywhere along its course by different pathologies but basilar artery dolichoectasia is a rare feature among these causes. We presented a young, 39 year-old female patient admitted with headache and diplopia at the horizontal direction of gaze. Neurological examination revealed isolated left abducens palsy. Blood tests and cerebrospinal fluid examination findings were normal. Cranial computed tomography (CT), magnetic resonance (MR) images with T2, T1 and flair sequences were normal. CISS (constructive interference in steady state) sequence of MR uses strong T2-weighted 3D gradient echo technique and produces high resolution isotropic images and provides excellent contrast between cerebrospinal fluid and other structures in the brain. CISS sequence of our patient revealed inflammation and compression of left abducens nerve due to basilar artery dolichoectasia at brainstem. Pulse steroid therapy was administered 7 days. Headache was decreased but diplopia persisted. Although abducens nerve palsy is a common cranial neuropathy, in most cases no pathological findings can be shown on MR scanning. We want to draw attention to CISS sequence in evaluating obscure brainstem vascular and cranial nerves pathologies. **Key words:** abducens nerve palsy, basilar artery dolichoectasia, CISS sequence.

### WSC-1032

#### Acute Neuroimaging

##### Effects of cerebrolysin on motor recovery of stroke patients: A diffusion tensor imaging study

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**Introduction:** Previous reports demonstrated effect of Cerebrolysin on stroke recovery, however, the effects of cerebrolysin on corticospinal tract (CST) properties have not been examined.

**Aims:** We acquired diffusion tensor imaging (DTI) data and assessed the effects of Cerebrolysin on motor recovery in stroke patients in terms of changes in CST integrity.

**Methods:** This study is a multicenter, double-blind, placebo-controlled trial. Cerebrolysin group received 3 weeks of daily injection of Cerebrolysin from 8 days after onset, while placebo group received saline solution.

Behavioral and DTI data were acquired 3 times: before (T1) and after treatment (T2) and 3 months (T3) after onset. We applied a template CST acquired from healthy controls to individual patients' DTI-derived parameter maps to measure fractional anisotropy (FA), axial diffusivity (AD) and radial diffusivity (RD).

**Results:** The subgroup of participants (20 Cerebrolysin, 17 placebo groups) who suffered from severe motor involvement at baseline (FMA < 50) showed a significant interaction between time and group for the FMA score until 3 months after onset. In these patients, FA decreased continuously in placebo group, whereas it increased at T3 in Cerebrolysin group. For both AD and RD, there were significant interactions between time and group, such that an increase in the diffusivity was restricted only in Cerebrolysin group.

**Conclusion:** Considering that elevations of AD and RD reflect degenerative and demyelination processes respectively, a decrease or stagnant increase in the diffusivity may indicate the neurotrophic and neuroprotective effects of Cerebrolysin during stroke recovery (This study is funded by EBEWE Neuro Pharma GmbH).

**Key words:** cerebrolysin, motor recovery, diffusion tensor imaging.

### WSC-1040

#### Acute Neuroimaging

##### AvCTP maps: A quick and easy process imaging tool for use in acute ischemic stroke

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**Introduction and purpose:** Delineation of hyper-acute infarct core can inform ischemic stroke treatment decisions. NCCT-ASPECTS and CT-perfusion (CTP) blood flow maps have shown promise; but the former has modest interobserver reliability, while the latter is hampered by variability in CTP acquisition and postprocessing algorithms. CTP images calculated as the average Hounsfield unit/voxel over the first-pass acquisition (AvCTP) provide a standardized method of assessing tissue perfusion without complex processing. Using 24 hour imaging as the primary endpoint, we sought to determine the performance of AvCTP ASPECTS compared to admission NCCT, cerebral blood volume (CBV), and cerebral blood flow (CBF) maps.

**Methods:** This pilot phase included 51 patients from the prospective PRoveIT study. ASPECTS was scored on admission NCCT (5 mm), CBF, CBV, AvCTP maps (5 mm slice-thickness), and follow-up imaging in a blinded fashion. Established infarct thresholds were used for CBF and CBV maps. Loss of gray-white differentiation and focal white matter hypodensity were considered for ASPECTS scoring on AvCTP.

**Results:** Mean ASPECTS on admission NCCT, AvCTP, CBV, CBF and follow-up scans were 8.1 ± 2.2, 7.7 ± 2.7, 8.0 ± 2.2, 6.5 ± 2.9, and 7.3 ± 2.6 respectively. On admission imaging, AvCTP ASPECTS correlated most strongly with CBV ( $\rho = 0.601$ ,  $P < 0.00001$ ). Follow-up imaging demonstrated a strong relationship with admission NCCT ( $\rho = 0.470$ ,  $P < 0.001$ ), AvCTP ( $\rho = 0.409$ ,  $P = 0.003$ ), and CBV ASPECTS ( $\rho = 0.450$ ,  $P < 0.001$ ). This correlation was modest for CBF ASPECTS ( $\rho = 0.364$ ,  $P = 0.009$ ).

**Conclusion:** AvCTP map is a quick, and easy to process imaging tool that delineates hyper-acute infarct core on admission. Its predictive validity when compared to NCCT, CBV and CBF maps will be tested in the larger PRoveIT study.

**WSC-1045****Acute Neuroimaging  
CTA recanalization score – A reliable measure of  
recanalization**

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**Introduction:** Recanalization is associated with a 4 fold increase in good outcomes in acute ischemic stroke. CTA has become the clinical and research standard of cerebrovascular assessment. Currently, there is no validated standardized CTA recanalization scoring system.

**Purpose:** We aimed to develop a CTA-based recanalization scale, and test the reliability of its components.

**Methods:** Data is from INTERSeCT, a multi-center prospective study, examining clot characteristics associated with early recanalization. Three raters assessed CTAs of 30 randomly selected patients at baseline and 2–6 h later. Baseline scans were scored for site of primary intracranial arterial occlusive lesion (PIAOL), residual flow through PIAOL and distal thrombus burden (DTB). Recanalization was assessed on follow-up CTA using PIAOL debulking, change in residual flow, and DTB. A CTA Recanalization Score (CTARS) consisting of 8 categories was used to summarize recanalization of PIAOL and its distal vasculature. Reliability was quantified using kappa.

**Results:** Agreement on PIAOL location varied from excellent proximally (ICA, M1, proximal M2) to poor for more distal sites. Agreement was moderate to substantial on residual flow (Kw = 0.67, 0.49, 0.55), and fair to moderate on DTB (Kw = 0.41, 0.17, 0.31) at baseline. Reliability was excellent for PIAOL debulking (Kw = 0.87, 0.90, 0.92), residual flow change (Kw = 0.91, 0.88, 0.86), and moderate to substantial for follow-up DTB (Kw = 0.78, 0.43, 0.51). Near perfect agreement was obtained on final CTARS (Kw = 0.90, 0.96, 0.88).

**Conclusion:** CTARS is a reliable method of assessing recanalization of PIAOL and its' distal vasculature. Future studies should focus on prospective scale validation and performance with other imaging modalities.

**WSC-0531****Acute Neuroimaging  
High resolution MRI and transcranial Doppler findings  
in patients with acute atherosclerotic pontine infarction**

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**Introduction:** Basilar artery stenosis on transcranial Doppler (TCD) does not correlated with MR angiography in some cases of pontine infarctions.  
**Aim:** We aim to investigate the basilar artery findings by different imaging studies in patients with pontine infarct.

**Methods:** Consecutive patients with pontine infarction who were admitted within 7-day after stroke onset were included. Pontine infarcts were classified into three groups according to lesion extension on the MRI: paramedian pontine infarcts, lacunar pontine infarcts, and mixed type infarct. We analyzed clinical data, the vascular findings on the MR angiography, and transcranial Doppler (TCD). High-resolution MRI and Time-

of-flight MR angiography (TOR MRA) were obtained for the analysis of the parent basilar artery atherosclerotic plaques.

**Results:** Our study consisted of 36 patients (15 women and 21 men); 28 paramedian pontine infarcts and 8 lacunar pontine infarcts. Normal TOF MRA findings and atherosclerotic plaques on HR MRI were identified in 15 patients (53.6%) of paramedian pontine infarcts and 3 (37.5%) of lacunar pontine infarcts. TCD provided better sensitivity for identifying basilar stenosis compared with TOF MRA (54.7% versus 34.6%). All 11 patients with abnormally increased flow velocities of the basilar artery showed basilar atherosclerotic plaques on HR MRI, whereas TOF MRA of basilar artery appeared normal.

**Conclusions:** HR MRI is useful for identification of basilar atherosclerotic plaques in patients with pontine infarcts. HR MRI and TCD reveal a basilar atherosclerotic stenosis, although TOF MRA of basilar artery may appear normal.

**WSC-0401****Acute Neuroimaging  
Magnetic resonance imaging findings in posterior  
reversible encephalopathy syndrome**

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**Introduction:** Posterior reversible encephalopathy syndrome (PRES) is typically characterized as symmetric and reversible vasogenic edema of posterior cerebral hemisphere.

**Aims:** To analyze the MRI findings and clinical manifestations of PRES.  
**Methods:** We included 16 patients who were diagnosed with PRES, based on clinical manifestations and MRI findings. We reviewed clinical information, including cause of PRES, presenting symptoms, and MRI findings. We analyzed MRI findings according to the location of the lesion, presence of hemorrhage, restricted diffusion, abnormal gadolinium enhancement, and irreversible lesions.

**Results:** The etiologies of PRES were hypertension, 43.8%; chronic kidney disease, 25.0%; eclampsia, 12.5%; multiple organ dysfunction, 6.2%; and unclear cause, 12.5%. Common presenting symptoms were seizure, 43.8%; encephalopathy, 68.8%; headache, 31.2%; dizziness, 18.8%; and visual disturbance, 18.8%. The location of lesions were parieto-occipital, 87.5%; posterior frontal, 62.5%; temporal, 50.0%; brainstem, 37.5%; cerebellar, 43.8%; thalamus, 37.5%; basal ganglia, 31.2%; and corpus callosum 18.8%. The incidence of atypical MRI manifestations were abnormal gadolinium enhancement, 50.0%; restricted diffusion, 31.3%; hemorrhage, 12.5%; unilateral lesion, 0%; and irreversible lesion, 41.7%.

**Conclusions:** This results suggest that atypical MRI manifestations, such as abnormal gadolinium enhancement, irreversible lesions, restricted diffusion, are not uncommon and underestimated.

**WSC-0660****Acute Neuroimaging  
Clinical predictors of abnormalities in headache  
patients as confirmed by three-dimensional computed  
tomographic angiography**

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**Introduction:** Headache patients with normal neurologic examination findings who visit the emergency department (ED) should be differentially diagnosed for the presence of cerebral vessel disease.

**Aim:** The purpose of this study was to analyze the abnormal three dimensional cerebral computed tomographic angiography (3D-CTA) findings of patients presenting headache, and investigate the clinical factors predictive of an intracranial abnormality.

**Methods:** A total of 227 patients visiting the ED presenting headache were enrolled. We compared the results of the 3D-CTA and the final clinical diagnosis. The patient were divided into two groups: an abnormal group, as confirmed by 3D-CTA, and a nonabnormal group. We compared the clinical manifestations, and the clinical factors predictive of abnormality between the two groups.

**Results:** Of the total patients, 44 were identified with abnormal findings by nonenhanced CT, and 61 patients were identified with abnormal findings by 3D-CTA. SAH was found in 29 patients and unruptured aneurysm was discovered in 17 patients. The time interval between onset of headache to arrival at the ED was shorter in the SAH group ( $p = 0.012$ ), and sudden bursting headache was observed in 22 subarachnoid hemorrhage patients ( $p < 0.001$ ). Statistically significant differences were observed between the two groups for symptoms of nausea, vomiting, neck stiffness and seizure. According to the results of the multivariate logistic regression analysis, sudden bursting headache and neck stiffness were independent predictable variables that affected the abnormal 3D-CTA group.

**Conclusion:** Sudden bursting headache, neck stiffness, vomiting, and advanced age were independent predictable variables observed in the abnormal 3D-CTA group.

### WSC-0651

#### Acute Neuroimaging Acute infarction due to basilar artery dissection and giant multiple aneurysms

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A 63-year-old hypertensive and asthma woman was referred with sudden loss of consciousness. On emergency department admission the patient displayed decerebrate posturing and stupor and fixed pinpoint pupils. Results of MDCT (multi-detector row computed tomography) angiography scanning revealed dissecting basilar aneurysm and giant fusiform aneurysm of both middle cerebral arteries (Figs 1 and 2). A diffusion MR imaging study restricted acute infarction in Rt side midbrain, Rt side pons, and Rt cerebellar hemisphere. Basilar artery dissections are rare lesions and carried significant morbidity and death due to Ischemia or SAH. The patient presented with extensive brainstem ischemia from BA dissection and had severe neurological sequelae from the initial infarct. MDCT angiography is an important study detecting dissecting and multiple aneurysms. Therapeutic strategy for ischemic BA dissection has not yet been established and controversial.



**Fig. 1** Contrast axial MDCT image: Basilar artery dissection with giant multiple middle cerebral aneurysms.



**Fig. 2** MDCT angiography: Giant multiple middle cerebral aneurysms.

### WSC-0745

#### Acute Neuroimaging Correlations between Fugl-Meyer assessment and diffusion indices within acute ischemic lesions in the posterior limb of the internal capsule in pure motor lacunar stroke patients

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**Introduction:** Pure motor lacunar stroke (PMLS) is a stroke syndrome exclusively involving motor weakness. Fugl-Meyer assessment (FMA) is a quantitative scale comprehensively measuring degree of motor weakness. Diffusion tensor imaging (DTI) is an imaging technique, which reveals diffusion indices representing brain tissue integrity.

**Aim:** To reveal the correlations between FMA score and diffusion indices measured within the ischemic lesions in patients with acute PMLS.

**Methods:** We recruited acute PMLS patients with ischemic lesions involving the posterior limb of the internal capsule (PLIC). The degree of motor weakness was determined by FMA. DTI was performed within 72 hours after the stroke onset. Diffusion indices including fraction anisotropy (FA), mean diffusivity (MD), axial diffusivity (AxD) and radial diffusivity (RaD) were extracted from the acute ischemic lesions. The correlation between the FMA score and each diffusion index were analyzed.

**Results:** 18 acute stroke patients with PMLS were recruited. Nine patients had acute ischemic lesions involving PLIC. There were significant positive correlations between FMA score and MD as well as RaD ( $R = 0.679$ ,  $P < 0.05$ ;  $R = 0.682$ ,  $P < 0.05$ , respectively). There was a positive correlation approaching significant between FMA score and AxD ( $R = 0.643$ ,  $P = 0.06$ ). There was no significant correlation between FMA score and FA.

**Conclusions:** Changing of MD and RaD within acute ischemic lesions revealed by DTI may correlate with degree of weakness in acute stroke patients. Our results suggest that diffusion indices within acute ischemic lesion may be useful to predict degree of deficits in acute stroke patients.

**WSC-0961**  
**Acute Neuroimaging**  
**Reduced eGFR increase the risk of hemorrhagic transformation in ischemic stroke especially in small-artery occlusion lacunar without thrombolytic therapy**

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**Introduction:** Many studies have found that renal dysfunction may contribute to hemorrhagic stroke and bad outcomes, and trials suggest that thrombolysis is a major risk factor of hemorrhagic transformation (HT) in patients with acute ischemic stroke. As some trials showed that asymptomatic hemorrhagic transformation may also have negative outcomes. However the association between renal dysfunction and hemorrhagic transformation in ischemic stroke subtypes without thrombolytic therapy is still unknown.

**Aims:** This prospective study was designed to identify whether reduced eGFR is an independent risk factor of hemorrhagic transformation (HT) in acute ischemic stroke patients without thrombolytic therapy, especially in small-artery occlusion lacunar.

**Methods:** 1654 acute ischemic stroke patients without thrombolytic therapy were consecutively enrolled. All of them had emergency CT scan and followed MRI or CT in 2–3 days since onset. HT were examined by computed tomography (CT) or magnetic resonance imaging (MRI). The estimated glomerular filtration rate (eGFR) was calculated by the Modification of Diet in Renal Disease equation. Reduced estimate of the glomerular filtration rate was defined as eGFR < 60 ml/min/1.73 m<sup>2</sup>, and the patients were divided into two groups, eGFR ≥ 60 ml/min/1.73 m<sup>2</sup>, and eGFR < 60 ml/min/1.73 m<sup>2</sup>.

**Results:** 5.6% (92/1654) of the included patients developed hemorrhagic transformation. Reduced eGFR is an independent risk factor of HT in acute ischemic stroke patients with no thrombolytic therapy (OR = 1.849, 95% CI 1.036–3.300, p = 0.037), so as in the patients with small-artery occlusion lacunar, (OR = 326, 95% CI 1.87–5696.2, p = 0.028).

**Conclusion:** We found that eGFR is associated with hemorrhagic transformation in the acute stroke patients, especially in the patients with small-artery occlusion lacunar.

**WSC-1102**  
**Acute Neuroimaging**  
**Clot characteristics on baseline imaging predicts recanalization with IV TPA in the IMS III Trial**

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**Objective:** In IMS-III trial patients, we evaluate if clot characteristics on baseline noncontrast CT (NCCT) or CT-angio (CTA) determine recanalization with IV-tPA using classification and regression tree analysis (CART).

**Methods:** IMS-III protocol is published. Two readers assessed clot characteristics on NCCT [hyperdense(HD) sign location, length, ratio of maximal Hounsfield Unit (HU) HDS/contralateral MCA (rHU)] and

CTA [Clot burden score, length, residual flow through clot, ratio of contrast HU at proximal/distal clot interface (cirHU)] by consensus. Very early arterial weighted CTAs were excluded; appropriate imputation techniques used whenever distal clot interface was not measured. Early recanalization with IV-tPA was assessed on first angio (only in the endovascular arm) while 24-hour recanalization with IV-tPA was assessed on follow-up CTA (only in the IV-tPA alone arm).

**Results:** Of 263 patients with anterior circulation clots on baseline CTA, after excluding patients with missing data, 64 in the IV-tPA and 175 in the endovascular arm were analyzed. CART models for early and 24-hr recanalization with IV-tPA are shown in Figs 1 and 2 respectively.

**Conclusion:** Clot characteristics on NCCT and CTA can help physicians estimate a range of early and late recanalization rates with IV-tPA.

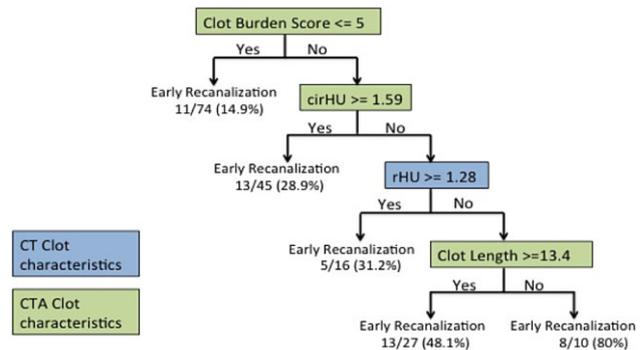


Fig. 1 CART model determining early recanalization with IV TPA.

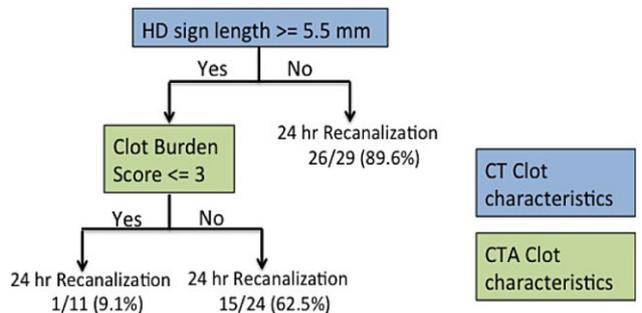


Fig. 2 CART model determining 24-hour recanalization with IV TPA.

**WSC-0917**  
**Acute Neuroimaging**  
**Similar performance on aspect scoring between stroke experts and an automated algorithm (e-ASPECTS) on CT scans of acute ischemic stroke patients**

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**Introduction:** The Alberta Stroke Program Early CT score (ASPECTS) is an established 10-point quantitative topographic CT scan score to reliably assess early ischemic changes of acute stroke patients.

**Aims:** We compared the performance of an automated algorithm prototype (e-ASPECTS; www.brainomix.com) with those of stroke physicians at different professional levels.

**Methods:** The baseline noncontrast enhanced CT scans of 37 acute stroke patients, in whom CT and MRI scans were obtained within two hours, were retrospectively scored by e-ASPECTS (eASP) as well as by three stroke experts (EXP) and three trainees (TRAI) blinded to any clinical information. The gold standard was defined as the ASPECTS on DWI scored by another two nonblinded independent experts on consensus basis. Sensitivity and specificity were calculated over all regions for e-ASP, EXP and TRAI as compared to DWI.

**Results:** In total 680 (34 × 20) regions were scored. Three cases were excluded due to poor scan quality. Mean time from onset to CT was 172 ± 135 min and mean time difference between CT and MRI was 41 ± 31 min. Overall sensitivity was 42.4% for eASP, 31.7 ± 13.3% for EXP (mean p-value 0.52) and 14.8 ± 3.1% for TRAI (mean p-value 0.003). Overall specificity was 83% for eASP, 92.3% ± 3.9% for EXP (mean p-value 0.44) and 92.4 ± 3.1% for TRAI (mean p-value 0.43) when compared to DWI.

**Conclusions:** e-ASPECTS showed a 34% relative increase in sensitivity and 10% relative decrease in specificity compared to the experts' assessment of the ASPECTS on CT scans of acute stroke patients. e-ASPECTS is a promising tool that warrants further evaluation.

### WSC-0403

#### Acute Neuroimaging

#### A case of posterior reversible encephalopathy syndrome presenting an atypical feature

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**Introduction:** Posterior reversible encephalopathy syndrome (PRES) is a clinical and radiological syndrome characterized by headache, visual change, potentially reversible neurological deficits (altered mentation, seizure) and the presence of vasogenic edema in different areas of brain parenchyma.

**Aims:** Whereas asymmetric PRES has been reported with other disease, purely unilateral cases are rare.

**Methods:** We report a patient of PRES who showed unilateral expression of clinical and radiologic feature.

**Results:** A 19-year-old woman presented with generalized tonic-clonic seizure followed by severe headache, which had persisted. On admission, her blood pressure was normal (124/62 mmHg) and her neurologic examination had no focal deficit except a right homonymous hemianopsia. Systemic investigations, including electrocardiography, chest x-ray and blood tests for coagulopathy were normal. Computed tomography (CT) revealed a subtle hypodensity in the left occipital lobe and brain magnetic resonance (MRI) imaging showed hyperintense lesions predominantly in the left occipital cortex and white matter on fluid-attenuated inversion recovery (FLAIR) image and diffusion-weighted images. The patient's visual symptom improved concurrently with normalization of the follow up MRI performed 60 days after admission.

**Conclusions:** Unilateral expression of clinical (homonymous hemianopsia) and radiologic feature made it difficult for us to make exact diagnosis. In fact, atypical (partial and asymmetric) distribution of vasogenic edema is more common than previously thought. In conclusion, atypical presen-

tation of PRES should be considered when clinician confront the patient with reversible clinical and radiologic features even though there is no possible underlying comorbidities and hypertension.

### WSC-0173

#### Acute Neuroimaging

#### Cerebral ischemic lesions on fluid-attenuated inversion recovery imaging are not associated with neuropsychological decline after cardiac surgery

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**Background:** Coronary Artery Bypass Graft (CABG) and cardiac valve surgery are frequently performed surgical procedures that can be associated with neuropsychological complications. A number of studies have demonstrated that new focal brain lesions, detected by MRI can develop after cardiac surgery. Additionally, it has been suggested that the presence of new lesions is associated with a decline in neuropsychological test performance. Here we investigate the incidence and location of new ischemic lesions on MRI and the controversial relationship between new ischemic lesions and neuropsychological decline.

**Methods:** Seventy-six patients (5 Female; mean [SD] age 62.2 [11.7] undergoing CABG (26), Valve (36) and combined procedures (14) were studied. Neuropsychological and MRI examinations were performed 1 week before and 8 weeks after surgery. Neuropsychological decline from baseline score was determined by z-score analysis, where a 20% decline in z-score (change > -0.2) in at least 2 of 6 tests was assumed indicative of cognitive decline. Demographic, clinical, and radiographic characteristics of the patients are presented and compared.

**Results:** Twenty-four of the 76 patients (32%) developed new ischemic lesions after cardiac surgery (range 1–6/patient). The lesions were small, rounded and multiple (multiple: 8 of 24 patients). Fifty-two of the 76 patients (68%) experienced neuropsychological decline of which 16 (31%) patients had new ischemic lesions. Eight of the 24 patients (33%) with new MRI lesions had no neuropsychological decline. There was no statistical significance between the decline in neuropsychological test score and new ischemic lesions on postoperative MRI scans (Chi-Squared test: p = 0.823).

**Conclusion:** This study provides an estimate of the incidence of postoperative ischemic lesions and cognitive impairment 8 weeks after cardiac surgery. We find that postoperative FLAIR abnormalities occur even in patients with no measureable neuropsychological deficit.

### WSC-0569

#### Acute Neuroimaging

#### DWI negative stroke syndromes

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**Introduction:** DWI has an undisputed role in detection of acute ischemic changes starting on from very early hours after the onset of stroke. Nonetheless, despite a near perfect accuracy in acute ischemic stroke setting, DWI might not reveal any abnormalities in certain subpopulations of patients.

**Aims:** To analyze imaging features associated with normal DWI findings in patients with acute ischemic stroke.

**Methods:** We retrospectively screened our prospectively collected institutional database for ischemic stroke patients with normal DWI obtained within 12 hours after symptom onset. Patients with transient neurological symptoms lasting <24 hours were not included into analyses.

**Results:** We identified 13 (4%) patients with no evidence of ischemia on DWI despite persistence of symptoms out of 312 ischemic stroke patients undergoing imaging within the predefined time window. Ischemic lesions were localized to brainstem or internal capsule in 7 and cerebral cortex in 2 of these patients on follow-up studies. Three additional patients had evidence of proximal arterial occlusion or perfusion deficit despite normal DWI. The last patient, who had evidence of cytotoxic edema on her initial imaging at another center, had negative DWI findings when imaged later at our institution following intravenous thrombolysis.

**Conclusions:** The majority of ischemic stroke patients with normal findings on DWI are comprised of patients with brainstem or capsular strokes, where white matter tracts show a compact organization and might interfere with sensitivity of DWI. Other patients might have normal imaging findings due to small cortical lesions, DWI reversal or presence of penumbra tissue without core.

antegrade flow across the occluded vessel has been regarded as one of predictors of successful recanalization after intraarterial thrombolysis. We aimed to predict antegrade flow noninvasively using brain noncontrast CT and clinical manifestation.

**Methods:** We collected patients who had acute ischemic stroke within 6 hours from onset and 50 patients who underwent endovascular treatment were included. All patients had ICA or MCA occlusion. Sulcal effacement (SE) in the insular area and facial palsy were assessed. We evaluated SE, facial palsy, angiographic findings (antegrade flow and recanalization) and clinical outcome.

**Results:** Of 50 patients, 17 (34.0%) patients had mild facial palsy (NIHSS 4, 0 or 1) without insular SE (Figure). Antegrade flow on digital subtraction angiography were more frequently observed (15 [88.2%] vs. 12 [36.4%],  $p < 0.001$ ). This group showed more successful recanalization. Clinical outcomes were also better. Favorable outcome at 3 months (mRS 0–2) was more frequently seen (12 [75.0%] vs. 10 [30.3%],  $p = 0.003$ ).

**Conclusion:** We can easily predict the presence of antegrade flow in hyperacute stroke using brain noncontrast CT and clinical manifestation, before taking invasive angiography. Mild facial palsy without insular SE is associated with higher recanalization rates and good clinical outcome.

**WSC-1499**

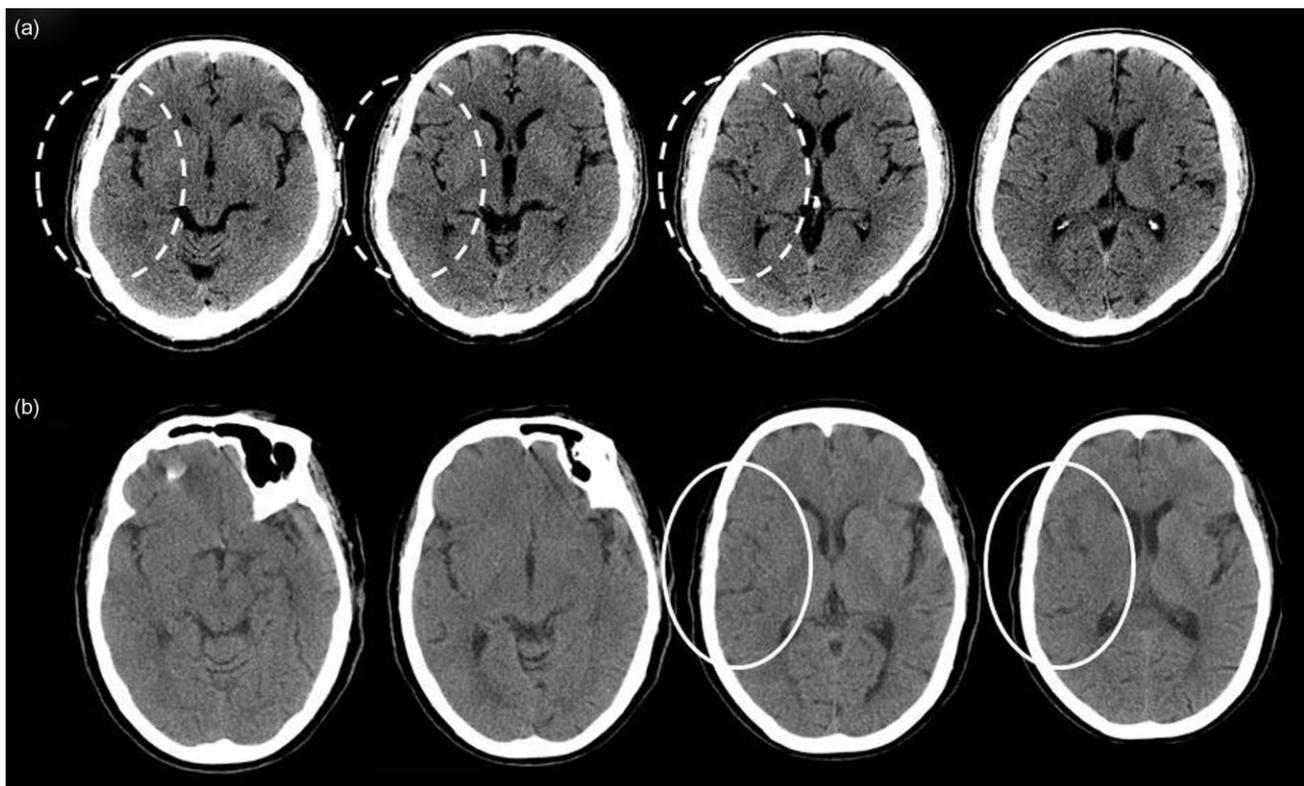
**Acute Neuroimaging**

**Prediction of antegrade flow in hyperacute stroke**

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<sup>1</sup>Neurology, Samsung Medical Center, Seoul, Korea

**Background:** Recanalization of an occluded vessel has been shown to improve clinical outcomes in hyperacute ischemic strokes. Presence of



**Fig.** Two cases of the right MCA infarction. Insular sulcal effacement is not seen (a, dotted circles), but is observed on the bottom (b, circles).

WSC-1489

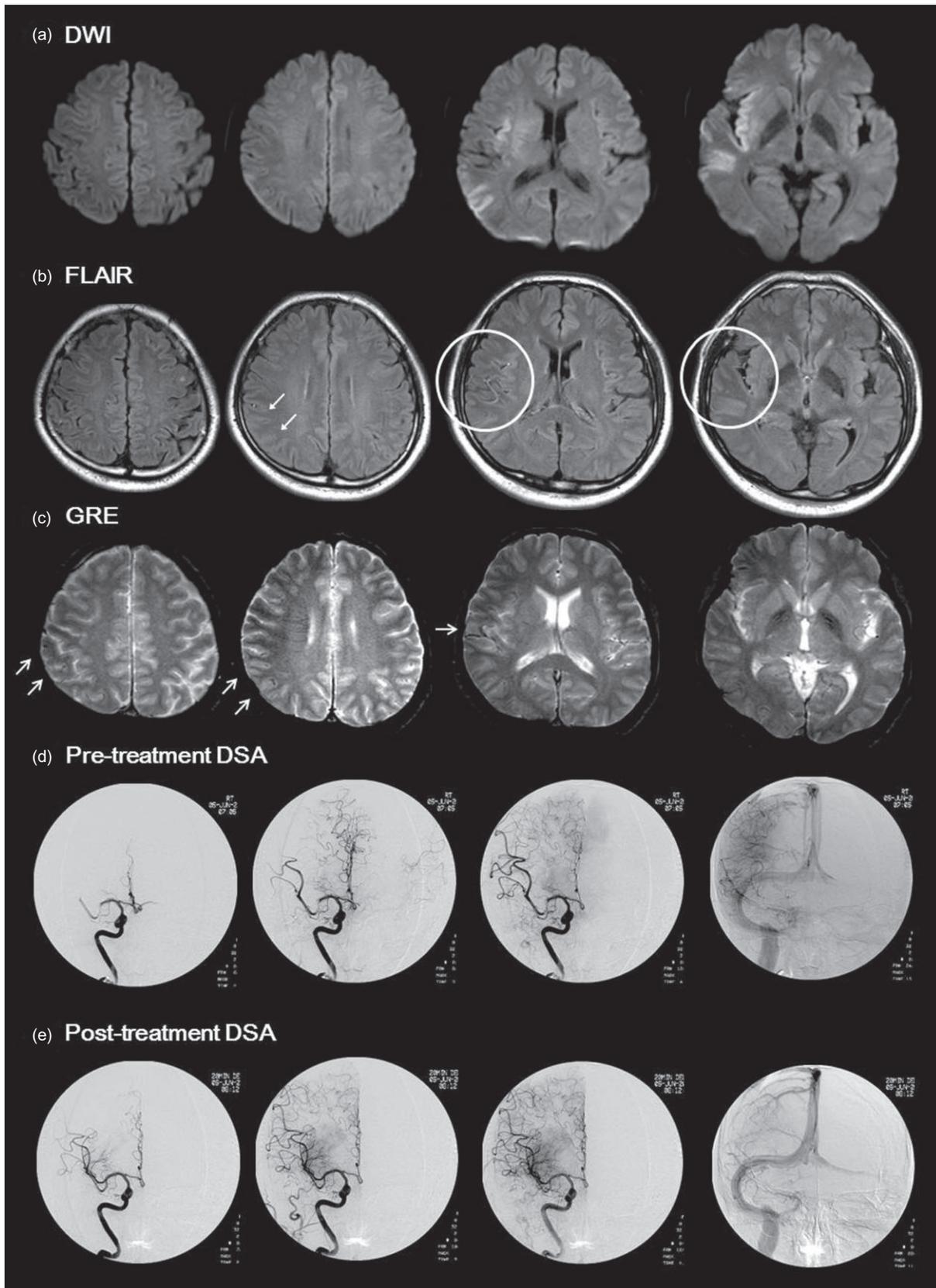
**Acute Neuroimaging  
Prediction of antegrade flow using FLAIR and GRE in  
hyperacute stroke**S Ryoo<sup>1</sup>, J Kim<sup>1</sup>, K Lee<sup>1</sup><sup>1</sup>Neurology, Samsung Medical Center, Seoul, Korea

**Background:** Recanalization has been shown to improve clinical outcomes in hyperacute ischemic strokes. Antegrade flow has been regarded as a predictor of successful recanalization. We aimed to predict antegrade flow using FLAIR and GRE images.

**Methods:** We included patients who had ischemic stroke within 6 hours and underwent endovascular treatment. FLAIR hyperintense vessels (FHVs) were defined as linear hyperintensity were observed. Dark intensity on GRE (GRE vein) and FLAIR sulcal effacement (SE) were assessed. We divided patients into 2 groups: (1) Group 1 = patients with insular FHVs (M2 and/or M3) and distal SE or GRE vein(beyond M4 area) (Figure); 2) Group 2 = the others. We evaluated angiographic findings and clinical outcome.

**Results:** Of 50 patients, 25 (50.0%) patients were allocated into group 1. Antegrade flow were more observed in group 1 (22 [88%] vs. 5 [20%],  $p < 0.001$ ). Group 1 showed more successful recanalization (22 [88%] vs. 12 [50%],  $p = 0.004$ ). Clinical outcomes were also better. Early neurological improvement ( $\Delta$ NIHSS at 24 hours  $\geq 8$  or NIHSS at 24 hours  $\leq 2$ ) and favorable outcome at 3 months (mRS 0–2) were more seen (ENI, 13 [52.0%] vs. 2 [9.1%],  $p = 0.002$ ; favorable outcome, 19 [79.2%] vs. 3 [12.0%],  $p < 0.001$ ). Nine patients in group 1 showed diffusion lesions in the insular area. We performed subgroup analysis. Despite diffusion volume was not different (52.1 [6.4–95.9] vs.  $62.2 \pm 6.9$  mL), antegrade flow and successful recanalization were more common and clinical outcome was better in group 1.

**Conclusion:** Insular FHVs with distal SE or GRE vein is a marker for antegrade flow in hyperacute stroke. It is associated with higher recanalization rates and good clinical outcome, regardless of diffusion lesion volume.



**Fig.** A 53 year-old male patient has the right MCA infarction (a). FLAIR hyperintense vessels in the insular area (circle) and distal sulcal effacement (arrows) are seen (b). On GRE images, GRE hypointensities (GRE veins, open arrows) are observed (c). He performed endovascular treatment after taking brain MRI. Antegrade flow is maintained across the right M1 segment on pretreatment DSA (d). Successful recanalization was achieved after endovascular treatment.

## WSC-0912

### Acute Neuroimaging Behavioral neglect – Anatomic and psychometric relationships

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To specify anatomical and psychometric relationships of behavioral spatial neglect with the classical components of neglect (visual-perceptual, perceptual-motor, personal) and anosognosia, in patients with right hemisphere stroke.

**Methods:** We analyzed 24 neglect and 21 nonneglect patients for behavioral difficulties in daily living (using the Catherine Bergego scale) and main components of neglect (using conventional clinical tests). Voxel-based lesion-symptom mapping identified brain areas whose lesions explained the severity of bias in each assessment ( $p < 0.001$ ).

**Results:** Behavioral neglect resulted from lesions centered on the superior temporal gyrus, extending into the middle temporal gyrus, temporo-parietal junction, temporo-occipital junction and subcortical white matter, including the superior longitudinal fasciculus. Perceptual neglect and perceptual-motor neglect resulted from limited lesions centered on the superior temporal gyrus and temporo-parietal junction, with severe subcortical extension and extension to the temporo-occipital junction for the latter. Body neglect predominantly resulted from lesions centered on the parietal cortex. On psychometric and anatomic points of view, behavioral neglect was in close relationships with visual-perceptual and visual-motor neglect, but partial divergences were found for personal neglect and anosognosia.

**Conclusion:** Behavioral neglect was principally related to visual-perceptual and visual-motor neglect. Superior temporal gyrus lesions had a pivotal role for explaining patient difficulties.

## WSC-0872

### Acute Neuroimaging Clinical course and predisposing factors for improvement of vertebral artery dissection in Japanese

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**Introduction & aims:** We investigated how long it took for vertebral arterial dissection (VAD) to be repaired and predisposing factors associated with the VAD restoration.

**Methods:** This study was a single-center and observational study from November 2002 to March 2013. We registered 59 patients (42 males,  $52 \pm 11$  years of age) with acute VAD without intracerebral hemorrhage, atherosclerosis, trauma and fenestration. All patients underwent digital subtraction angiography (DSA), MR examination and ultrasound examination during the acute phase. Follow up evaluation of the vascular lesion was performed at 1, 3, 6, and 12 months after the onset by DSA or MR angiography. We analyzed how long it took for the VAD to improve and what factors were associated with the improvement of the VAD.

**Results:** DSA demonstrated on admission pearl and string sign in 16 patients, pearl sign in 5, string sign in 15, and occlusion in 23. The improvement of the VAD was noted in 17% by a month after the onset, 34% by 3 months, 46% by 6 months, and 47% by 12 months. In the multiple regression analysis, Presence of end diastolic velocity (EDV) of the VA in ultrasound (OR = 5.4,  $P = 0.01$ ), absence of smoking history (OR = 4.5,  $P = 0.01$ ) showed independent association with the improvement of VAD at 6 months.

**Conclusion:** It seems that the improvement of VAD occurs mainly within the first 6 months after the onset. The presence of EDV of the VA in ultrasound and no smoking history are significantly associated with the improvement of VAD at 6 months.

## WSC-0902

### Acute Neuroimaging A case of intravascular ultrasound image during carotid artery stenting in blunt cerebrovascular injury

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**Introduction & background:** Extracranial cerebrovascular structural damage is directly attributable to a known high-energy nonpenetrating injury. Blunt carotid arterial injuries are uncommon. Diagnosis is often delayed and usually occurs only after a stroke, and neurologic morbidity and mortality is relatively high.

**Case report:** A 55-year-old man was transferred from other hospital with diagnosis of flail chest and cerebral infarction. He was buried under the landslide during construction works of water supply.

On admission, he had multiple rib fractures and left hemiplegia. On brain MRI, DWI depicted high signal intensity in right middle cerebral artery territory, but intracranial arteries showed their patency. Carotid duplex images showed intravascular floating flap-like lesion in right common carotid artery. During stenting procedure, intravascular ultrasound (IVUS) showed dissection lesion. The stent deployment was performed successfully. After thoracic surgical treatment, he was transferred to rehabilitation ward. Three months later, his neurologic symptoms improved, activities of daily living score showed 53.

**Conclusion:** The present case was uncommon cerebral infarct secondary to blunt cerebrovascular injury (BCVI) involving common carotid artery. IVUS image showed floating intimal flap suggesting traumatic dissection. Although IVUS is an invasive and can be performed during angiography procedure, it is useful in understanding the nature and dynamics of intravascular abnormality especially in carotid artery dissection after BCVI.

## WSC-1374

### Acute Neuroimaging Analysis of the risk of hemorrhagic complications in acute ischemic stroke patients with microbleeds after intravenous recombinant tissue plasminogen activator therapy

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**Purpose:** This study aimed to evaluate the risk of hemorrhagic complications in acute ischemic stroke patients with microbleeds (MBs) after intravenous recombinant tissue plasminogen activator (rt-PA) therapy.

**Methods:** We registered 82 consecutive patients (52 male and 30 female patients, mean age: 75 years old) with ischemic stroke treated with intravenous rt-PA between September 2007 and March 2014 from our hospital, and MRI scans, including T2\*-weighted, performed prior to rt-PA treatment. We compared the frequency of hemorrhagic complications after thrombolysis in patients with and without MBs on their baseline.

**Results:** MBs were identified in 26 patients (31.7%, mean MBs count  $2.2 \pm 2.2$ ) on baseline T2\* MRI imaging. Symptomatic intracerebral hemorrhage occurred in 3 of 26 patients (11.5%, mean MBs count  $3.7 \pm 2.3$ ) with MBs compared with 1 of 56 patients (1.8%) without. There was no

significant difference in the frequency of either symptomatic or asymptomatic hemorrhagic complications after thrombolysis between patients with and without MBs.

**Conclusion:** The presence of cerebral MBs does not relate to substantially increase the risk of either symptomatic or asymptomatic brain hemorrhage after intravenous rt-PA treatment. However, pretreatment screening of thrombolytic candidates with T2\*-weighted MRI sequences may be useful in the future to identify the increased risk of hemorrhagic complications.

## WSC-1041

### Acute Neuroimaging

#### Cortical interhemispheric modulation by motion induced interactions of the upper limbs in acute ischemic stroke

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**Introduction:** Research on cortical interhemispheric modulation during mobilization of upper limbs in stroke patients is relevant to support clinical decisions in motor neurorehabilitation. Motion facilitation by mobilizing the affected arm, with restraint of contralateral limb, is believed to optimize motor function.

**Aims:** To identify the cortical neural circuits during arm elevation in presence or absence of contralateral limb restriction.

**Methods:** We recorded brain activity of 20 stroke patients [10 right (7M/3F; mean age: 67,4 years) and 10 with a left hemispheric lesion (1M/9F; mean age: 69,4 years)] of the territory of middle cerebral artery using a block design composed by rest (baseline) and two main conditions (plegic/paretic arm elevation with and without contralateral upper limb restriction). Statistical brain group maps were processed using random effects analysis and false discovery rate correction ( $p < .05$ ).

**Results:** Different neural patterns were found in left and right hemisphere stroke groups. The left plegic/paretic arm elevation involved the bilateral activation of supplementary motor area and contralateral sensorimotor cortex. The combination with contralateral restraint changed the dominant localization of the activation to the ipsilesional sensorimotor cortex. The right plegic/paretic arm elevation induced different patterns depending on the motion phase. The association of the contralateral limb restriction silenced all cortical areas.

**Conclusions:** Our results suggest different strategies for motor rehabilitation as function of brain lesion side. Thus, constraint induced movement therapy and transcranial magnetic stimulation approaches may depend on the affected hemisphere. The neurophysiological effects of restraint of the less affected upper limb may help drive neuroplasticity.

## WSC-1342

### Acute Neuroimaging

#### MRI characterization of thrombi retrieved from patients with acute ischemic stroke

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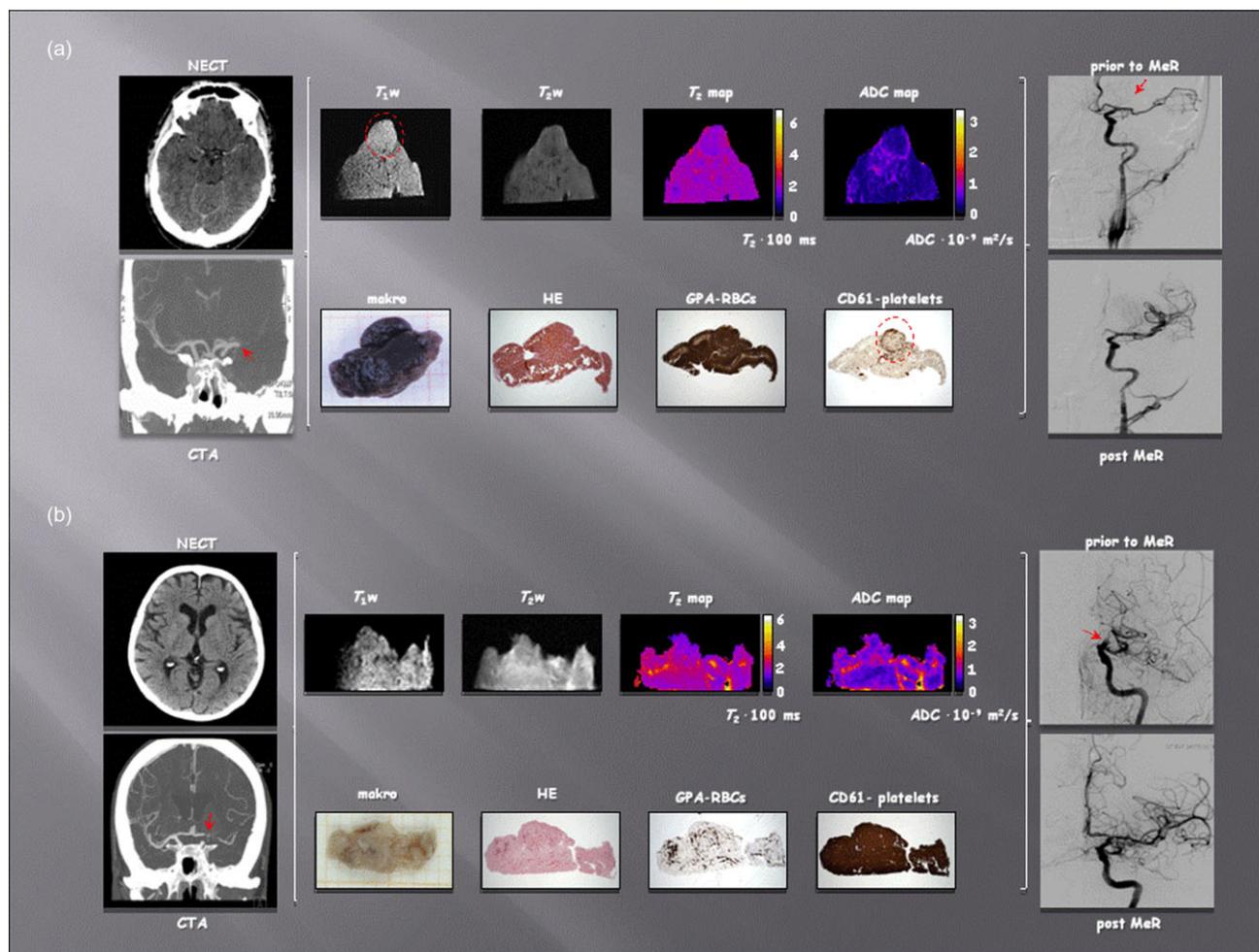
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**Introduction:** Susceptibility of thrombi to intravenous thrombolysis or to mechanical thrombectomy procedures depends on thrombi structure. Therefore, an accurate noninvasive assessment of the structure prior to treatment is essential in decision management.

**Aims:** To characterize structure of thrombi that were retrieved during mechanical recanalization (MeR) based on their NMR relaxation and diffusion properties.

**Methods:** 9 thrombi acquired from MeR were scanned by the high-resolution 3D  $T_1$ -weighted spin-echo method and by  $T_2$  and ADC mapping. Differences among different thrombi regions were analyzed by multi-parametric MRI consisting of based on signal intensity analysis of  $T_1$ -w and  $T_2$ -w images as well as  $T_2$  and ADC maps. Specific immunohistochemical analysis was used as a reference.

**Results:** The analysis was successful in discrimination between RBC-rich regions (hypointense on  $T_1$ -w images and low values in ADC and  $T_2$  maps, representative case *a*) and regions with high platelet-to-fibrin content (hyperintense on  $T_1$ -w images and moderate values in ADC and  $T_2$  maps, representative case *b*). Location of retrieval was in both cases middle cerebral artery (marked with red arrows).



**Conclusions:** Multi-parametric MRI is an efficient method for discrimination between RBC-rich and platelet-rich regions of thrombi and could therefore potentially serve as a method for noninvasive assessment of thrombi prior to treatment; however, prospective studies are needed.

#### WSC-1127

### Acute Neuroimaging Microembolic signals (MES) detection in intracranial artery dissection

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**Introduction:** Spontaneous Intracranial arterial dissection is rare, but it has to think for stroke in the young healthy people. Diagnosis has been made by magnetic resonance imaging and magnetic resonance angiography, but Transcranial Doppler we can use to find stenosis and for MES detection.

**Aim:** Our aim is to show the role of TCD and MES detection signal in intracranial artery dissections.

**Methods:** We report a case of a 22-year-old female, without any medical problem, smoker. She presented with transient episode of dysphasia and right hemiparesis. The first symptom started day before she admitted,

with transient episode of dysphasia and sharp pain on left upper jaw. The pain was moderate. First CT scan on local Hospital was normal. She admitted in our Hospital with mild right hemiparesis and motor dysphasia.

Cervical ultrasonography was normal, but TCD revealed high grade stenosis of MCA-M1 segment, and repeated CT showed acute ischemic lesion on right insula. CTA has found significant stenosis of left MCA.

TCD detected 70 MES on left MCA, and suggested MRA.

MRA with 3D TOF confirmed high grade stenosis of left MCA M1 segment, with prestenotic turbulent flow. These findings suggested arterial dissection and recommended anticoagulant therapy and TCD follow-up.

On repeated TCD received signal was normal on the left MCA, MES signals were not detected.

Control MRA showed good flow on left MCA, without stenosis.

**Conclusion:** TCD is important in identifying the causes of stroke in young people as well as for monitoring response to therapy.

**WSC-0727****Acute Neuroimaging  
Identification of ruptured atherosclerotic plaques of  
internal carotid artery in a patient with acute ischemic  
stroke of MCA territory by 18F-NAF PET/CT**C Y Wei<sup>1</sup>, T Y Chen<sup>2</sup>, G U Hung<sup>3</sup>, C H Kao<sup>4</sup><sup>1</sup>Department of Neurology, Chang Bing Show-Chwan Memorial Hospital, Changhua County, Taiwan<sup>2</sup>Department of Radiology, Chang Bing Show-Chwan Memorial Hospital, Changhua County, Taiwan<sup>3</sup>Department of Nuclear Medicine, Chang Bing Show-Chwan Memorial Hospital, Changhua County, Taiwan<sup>4</sup>Department of Nuclear Medicine, China Medical University Hospital, Taichung City, Taiwan

**Introduction:** 18F-NaF positron emission tomography (PET) is a clinically routine imaging modality used for detecting bony metastasis. In recent, it was found to be the first noninvasive imaging method which successfully identified ruptured or vulnerable coronary plaques.

**Aims:** We first use 18F-NaF PET/computed tomography (CT) scan to identify ruptured atherosclerotic plaques in acute ischemic infarction.

**Methods:** Here we presented an 81 year-old female patient who suffered from acute ischemic stroke involving the territory of left middle cerebral artery (MCA). She received intravenous (IV) tissue plasminogen activator (tPA) within 3 hours of symptom onset in the Emergency Department. Although the symptom improved, she still suffered from motor aphasia, dysphagia and Rt. hemiparesis. Based on these clinical and imaging features, she was considered as the subtype of "large-artery atherosclerosis" of TOAST classification. She received 99mTc-Ethyl-Cysteinate Dimer (ECD) brain perfusion single photon-emission computed tomography (SPECT) for assessing the extent and severity of cerebral ischemia and infarction, and also 18F-NaF PET/CT for assessing ruptured (or vulnerable) plaques of carotid or cerebral arteries.

**Results:** The ECD SPECT showed moderate to severe grade of cerebral perfusion defects in watershed areas of left fronto-parietal lobes and basal ganglia, compatible with cerebral infarction and peri-infarct ischemia in left MCA territory. 18F-NaF PET/CT showed an irregularly calcified plaque in left internal carotid artery on CT images with nearby high NaF uptake on PET.

**Conclusions:** This suggested that the plaque had high-grade of microcalcifications and might be considered as a ruptured plaque, resulting in the thromboembolism of downstream MCA artery.

**WSC-1111****Acute Neuroimaging  
A case of acute "heart appearance" infarction of the  
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Medial medullary infarction constitutes less than 1% of all cases of vertebrobasilar stroke and bilateral medial medullary stroke is an extremely rare form of cerebrovascular accident presenting with quadriplegia as the main symptom. The "heart appearance" sign on brain MRI is the characteristic of bilateral medial medullary infarction.

A 77-year-old female was admitted to our hospital with symptoms of quadriplegia, sensory loss and dysphagia and possible diagnosis of posterior circulation stroke. The patient had been diagnosed with diabetes mellitus, hypertension and dyslipidemia. On admission she had complete motor weakness of upper and lower extremities bilaterally. The deep tendon reflex was enhanced with bilateral extensor plantar responses. Pharyngeal reflex was absent. There was no sensation below the neck. Transthoracic echocardiography and carotid and vertebral artery triplex ultrasound scan were normal. Holter monitor detected paroxysmal atrial

fibrillation. Brain magnetic resonance imaging revealed heart-shaped hyperintensities in the bilateral ventral territory of the medulla. Magnetic resonance angiography was normal.

Bilateral medial medullary infarction is an extremely rare variety of stroke with quadriplegia and poor functional prognosis. The "heart appearance" is a sign unique to this cerebrovascular event. The sign is thought to develop when the infarct occurs in the anteriorlateral and anteriormedial area of the medulla.

**WSC-1373****Acute Neuroimaging  
Our experience of the use of MRI in a hyperacute  
stroke unit in a district general hospital**R Despiney<sup>1</sup>, G Zachariah<sup>1</sup>, V Umachandran<sup>1</sup><sup>1</sup>Stroke Medicine, Broomfield Hospital, Chelmsford, United Kingdom

**Objective:** Investigate the use of MRI imaging on stroke patients admitted to Broomfield Hospital. We aimed to determine; percentage of patients who received an MRI scan once admitted to the stroke unit in the last 6 months, to identify reasons for MRI requesting and to analyze how they contributed to patient care.

**Method:** A retrospective data collection between June and December 2013 in a district general hospital, hyperacute stroke unit. Broomfield Hospital caters for a population of 320 000 in North East London, UK. Data was collected from hospital records and imaging reporting system.

**Results:** During the six months there were 580 patients admitted to the stroke unit with suspected stroke. Majority of patients underwent initial non contrast CT Head (nCT). Approximately a quarter of patients underwent further imaging with MRI. MRI modalities included brain, venogram, angiogram and spine. The most observed reasons for requesting MRI included; confirming posterior circulation infarcts, confirming infarcts suspected on CT, assessing pathology related to the infarct (age, extension and hemorrhagic transformation), excluding other possible intracerebral pathologies and monitoring intracerebral hemorrhages.

Initial nCT in a proportion of patients was often diagnostically inconclusive and subsequent MRI imaging was found to influence care of 62% of patients. Further detailed results will be available in due time.

**Conclusion:** In selected patients with suspected stroke the use of MRI has shown to be useful, it allows accurate diagnosis and influences patient care.

**WSC-1179****Acute Neuroimaging  
Effectiveness OF TCCS in diagnosis of middle cerebral  
artery spasm resulting SAH -Compared to DSA as  
reference standard**N Zanic<sup>1</sup>, N Milovanovic-Kovacevic<sup>1</sup>, M Savic<sup>1</sup>, L Nikcevic<sup>1</sup><sup>1</sup>Ultrasound Department, Hospital for Cerebrovascular Diseases Sveti Sava, Belgrade, Serbia

**Purpose:** Vasospasm of the cerebral vessel remains a major source for morbidity and mortality after aneurysmal subarachnoid hemorrhage (SAH). The aim of our study was to determine the accuracy of transcranial color coded duplex ultrasonography (TCCS) for diagnosis of middle cerebral artery spasm, with digital subtraction angiography (DSA) used as the reference standard.

**Methods:** The study included 69 patients (age 55 ± 10 years) who had aneurysm clipping surgery for SAH due to a ruptured aneurysm, admitted to the St Sava Hospital from January 1 to December 31, 2013. At least one DSA was performed between day 3 and 14 after SAH, and at the same time total number of TCCS measurement was 207 (3 for each patient). MCA/

ICA index and blood flow velocity (BFV) of the M1 and M2 branches were measured with TCCS and compared with DSA findings.

**Results:** PSV and MFV for both M1 and M2 were significantly higher in patients with spasm than in those without spasm ( $p > 0.01$ ), and MCA/ICA index was  $>3$ . The ROC curve identified the best cut-off point for M1 (PSV 250 cm/s and MFV 125 cm/s) and for M2 (PSV 160 cm/s and MFV 80 cm/s). Comparison of TCCS and DSA was possible in 58 cases. DSA showed vasospasm in 46 cases, confirmed by TCCS in 31 cases (67%).

**Conclusion:** Our results confirm the good diagnostic accuracy of TCCS for the detection of aneurysmal-related vasospasm. TCCS monitors the hemodynamic state of the anterior part of the circle of Willis, which could expose the patient to a delayed ischemic deficit.

## WSC-0960

### Acute Reperfusion Treatment Intracranial hemorrhage after intravenous thrombolytic therapy in patients with ischemic stroke: An experience of regional stroke center in Sverdlovsk Regional Clinical Hospital #1

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The only approved method of reperfusion therapy in ischemic stroke is intravenous infusion of rtPA. In some cases it leads to hemorrhagic complications. Frequency of symptomatic intracranial hemorrhage (sICH) worldwide according to different criteria is 2,9% (SITS criteria) – 7,3% (NINDS criteria).

The aim of our work was to investigate the occurrence of hemorrhagic complications in patients that have received intravenous thrombolytic therapy (IVT) after ischemic stroke in stroke center of Sverdlovsk Region. The study comprised 85 consecutive patients with ischemic stroke that received IVT in Sverdlovsk Regional Clinical Hospital 1 in 2011–2013. We registered intracranial hemorrhage in 13 (15,3%) patients (3 women and 10 men). We tried to analyze risk factors that according to literature are implicated in increasing the risk of symptomatic intracranial hemorrhage. Time to IVT in patients with intracranial hemorrhage ranged from 165 to 255 min. Five patients (38%) smoked before stroke onset. Three patients (23%) had atrial fibrillation. Glucose level at stroke onset ranged from 5,2 to 18,1 mmol/l. It should be noted that intracranial hemorrhage was symptomatic (per the National Institute of Neurological Disorders and Stroke definition) only in 3 patients. The statistical analysis of mentioned risk factors didn't reach the level of significance due to small sample size. We plan to validate existing predictive scores for intracranial hemorrhage and poor stroke outcome in greater population of patients with IVT after ischemic stroke.

## WSC-0453

### Acute Reperfusion Treatment Patients' attitudes and preferences toward decision-making for intravenous stroke thrombolysis in Singapore

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Early initiation of stroke thrombolysis is associated with improved outcomes and lower risks. Procurement of consent is often a key factor

prolonging the door-to-needle duration. We aimed to determine patients' attitudes and preferences toward decision-making for stroke thrombolysis in Singapore.

We surveyed acute ischemic stroke patients admitted to a large tertiary hospital in Singapore who presented beyond the 4.5-hour therapeutic window using a standardized questionnaire with hypothetical scenarios regarding consent for intravenous thrombolysis. Institutional Review Board approval was obtained.

Of the 112 patients surveyed, 57% were willing to receive thrombolysis if recommended by the doctor. In a scenario that the patient is mentally incapacitated, 82% were agreeable for their next-of-kin to decide on their behalf. If the next-of-kin was not present, 71% would be agreeable for the doctor to proceed with thrombolysis. When given a choice 61% preferred to follow their next-of-kin's decision and 39% the doctor's. In another scenario where the patient is mentally incapacitated and the doctor recommends thrombolysis but the next-of-kin disagrees, there was an equal split in preference to follow the doctor's (50%) or next-of-kin's (50%) decision. None of the responses were associated with age, gender, ethnicity, education level, marital status or having adult children.

In Singapore, the attitudes and preferences toward decision-making for stroke thrombolysis vary and are not influenced by demographic and social factors. Nonetheless, doctors should practice within the Singapore Mental Capacity Act requirements that the doctor should be the decision-maker for emergency treatment such as stroke thrombolysis for a mentally incapacitated patient.

## WSC-0336

### Acute Reperfusion Treatment DDFPe extends window for successful tissue plasminogen activator therapy in an ischemic rabbit stroke model

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**Introduction:** Tissue plasminogen activator (tPA) is the only FDA approved pharmacotherapy for treating acute ischemic stroke at  $< 3$  hrs. Neuroprotective effects of dodecafluoropentane emulsion (DDFPe), a potent oxygen transporter, were tested for extending the window for tPA stroke therapy to 9 hrs in the rabbit stroke model.

**Aims:** To determine if DDFPe will safely extend the limited time available prior to tPA therapy to 9 hrs.

**Methods:** (N = 24) New Zealand rabbits (4–5 kg) had angiographic placement of a 4 mm clot in the internal carotid artery for flow directed middle cerebral artery occlusion. Rabbits were either 24 hr control, 9 hr tPA (0.9 mg/kg), or 0.3 ml/kg DDFPe + 9 hr tPA (n = 11, 8, or 5, respectively). Starting 1 hr post occlusion test rabbits got 6-DDFPe (0.3 ml/kg) IV injections at 90 min intervals and standard tPA therapy 9 hrs post occlusion. At 24 hrs rabbits received neurological assessment scores (NAS) followed by pathological measurement of percent stroke volume (%SV) using TTC vital brain staining.

**Results:** The %SV were significantly decreased ( $P = 0.029$ ) in DDFPe + 9 hr tPA ( $0.27 \pm .12\%$ ) vs. 9 hr tPA ( $1.82 \pm .47\%$ ). The DDFPe + 9 hr tPA was significant compared to controls ( $3.59 \pm 1.2\%$ ) at  $P = 0.037$ . Historic 1 hr tPA rabbits,  $2.28 \pm 0.67\%$ , were similar to these 9 hr tPA,  $P = 0.51$ . NAS values were reduced in DDFPe + 9 hr tPA vs. 9 hr tPA and control group animals at  $P = 0.012$  and  $P = 0.051$ , respectively.

**Conclusion:** Six doses of DDFPe at 90 min intervals provided neuroprotection until tPA therapy was provided at 9 hrs, significantly reducing %SV and NAS the next day. This is superior to historic rabbit results with much earlier tPA therapy.

### WSC-0714

#### Acute Reperfusion Treatment

#### Hyperdense artery sign effect in acute stroke

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**Aim:** To find out the effect of hyperdense artery sign (HAS) on clinical outcome and recanalization in acute stroke patients who received intravenous thrombolysis (IVT).

**Methods:** 252 acute anterior circulation stroke patients were retrospectively evaluated with baseline CT for presence of hyper dense internal carotid artery sign (HICAS), hyperdense middle cerebral artery sign (HMCAS) and MCA dot sign; ensuing CT for hemorrhagic transformation; baseline and follow up NIHSS, mRS scores for clinical outcome. Transcranial doppler (TCD) monitorization could be obtained in 127 patients by initiation of IVT for presence and timing of recanalization.

**Results:** HAS was detected in 99 of 252 patients (%39,3); 12 HICAS, 64 HMCAS, 23 MCA dot sign. At 1st and 24th hour TCD monitorizations, no partial (TIMI 2–3) or complete recanalization (TIMI 4–5) obtained in patients with HICAS (0/7  $p=0,000$ ). Complete recanalization was achieved at 24th hour in 16 patients with HMCAS (16/41  $p=0,000$ ); 9 patients with MCA dot sign (9/17  $p=0,196$ ). After 3 months poor outcome (mRS 3–6) was seen in; all patients with HICAS ( $p=0,000$ ), 49 with HMCAS ( $p=0,000$ ), and 9 with MCA dot sign ( $p=0,210$ ).

**Conclusions:** This study suggests that in acute anterior circulation stroke treated with IVT; presence of MCA dot sign without HMCAS or HICAS is associated with favorable outcome and high complete recanalization rate. Although HMCAS is a poor prognostic factor, IVT may be beneficial in some patients considering initial clinical findings. IVT may not be effective in presence of HICAS, therefore mechanical thrombolysis may be considered in these patients.

### WSC-1440

#### Acute Reperfusion Treatment

#### Catheter directed intra-arterial heparin therapy in acute ischemic stroke with long segment carotid artery disease beyond thrombolysis time window

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**Purpose:** Acute ischemic stroke (AIS) patients with long segment carotid artery diseases are usually managed by antiplatelet drugs beyond thrombolysis time window. Long-segment carotid artery disease are generally left alone, if they present for arterial intervention beyond the intra-arterial thrombolysis window.

We evaluated the role of catheter directed intra-arterial heparin (CDIAH) therapy into the carotid artery in recanalizing the long-segment carotid artery disease in the setting of AIS presenting to us beyond thrombolysis time window.

**Materials and methods:** We had six patients with AIS, presenting to us within one week of stroke onset ranging from 1 day to 4 days after stroke onset with long segment carotid artery disease with or without vertebral artery disease.

These patients were treated with 5000 units of intra-arterial heparin under angiographic guidance into the diseased carotid artery. Check angiogram (DSA) was done after 24 hrs after CDIAH. Good recanalization was achieved in all the patients. Focal stenosis was seen in four patients after recanalization with CDIAH. They were treated with additional carotid artery stenting.

**Results:** All the patients had significant carotid artery recanalization after CDIAH therapy without any fresh neurological deterioration. Carotid artery stenting was done subsequently in four patients, who also had short-segment significant stenosis due to atherosclerotic disease. After the procedure, there were no new neurological deficits in any of these patients.

**Conclusion:** Catheter directed heparin therapy is safe and useful in the setting of sub-acute ischemic stroke with long segment carotid artery disease in recanalizing the carotid arteries.

### WSC-1101

#### Acute Reperfusion Treatment

#### Stent retrievers versus other intra-arterial approaches in the MR CLEAN pretrial cohort. The MR CLEAN pretrial investigators

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**Background:** Stent retrievers (SR) provide better recanalization than other retraction devices (ORD) in the treatment of acute ischemic stroke. Their effect on functional recovery is not clear. We compared the effect of SR, ORD and intra-arterial thrombolysis (IAT) on recanalization and functional recovery in the MR CLEAN pretrial cohort.

**Methods:** Patients aged 18 years or older with an arterial occlusion of the anterior circulation. Treatment was started within 6 hours from onset. Primary outcome was recanalization (TICI 2b or 3). Secondary outcome was the modified Rankin Score after 7 days. We used ordinal regression with adjustment for age, sex, time, experience, carotid top occlusions and IV alteplase.

**Results:** In total 304 patients were included, 99 (32.6%) were primarily treated with SR, 83 (27.3%) with ORD and 122 (40.1%) with IAT. SR more often recanalized than IAT (aOR 2.90; 95% CI:1.42–5.96) and ORD (aOR 1.57; 95% CI:0.78–3.18). There were no significant differences in functional outcome after 7 days for the stent retrievers compared to the IAT group (aOR 1.26; 95% CI:0.73–2.15) or the other mechanical group (aOR 0.93; 95% CI:0.53–1.64). However, ORD led to functional recovery less often than IAT (aOR 0.58; 95% CI 0.34–0.97). Overall, 47 patients (15.4%) died and symptomatic intracranial hemorrhage occurred in 30 patients (9.9%), without differences between the three groups.

**Conclusion:** Treatment of acute ischemic stroke with SR leads to improved recanalization. IAT was associated with a better functional outcome than ORD. We observed no association of SR use with better short-term functional outcome.

**WSC-1058****Acute Reperfusion Treatment  
Reperfusion therapies for wake up stroke: A  
systematic review**G A Ford<sup>1</sup>, D Buck<sup>2</sup>, L Shaw<sup>2</sup>, C I Price<sup>2</sup><sup>1</sup>Medical Sciences Division, University of Oxford, Oxford, United Kingdom<sup>2</sup>Institute for Ageing and Health, Newcastle University, Newcastle, United Kingdom

**Introduction:** There are no guideline recommendations for reperfusion treatment of wake up stroke (WUS) due to the unknown onset time. Radiological and observational studies suggest patient benefit.

**Aims:** We systematically reviewed studies reporting outcomes following reperfusion interventions for WUS.

**Methods:** A PubMed search to June 2013 using terms: wake, awake, sleep, asleep, unclear-onset, unclear onset, witness, unwitness AND stroke. Due to the small number of publications, all study designs were included. Meta-analyses were not feasible.

**Results:** Twelve of 881 articles were retained: 3 case series, 7 registers and 2 randomized clinical trials of abciximab. Five cohorts received IV thrombolysis alone. Reported outcomes varied due to study size (range 2–68 patients) and heterogeneity; 3 month modified Rankin Score (mRS) were: in treated WUS 0–1 range (13–30%), 0–2 (30–58%); in untreated WUS 0–1 (3–31%), 0–2 (20–60%). After adjustment for baseline variables two studies reported a statistically significant treatment advantage for mRS 0–2 at 3 months (OR 5.2; 1.3–20.3; IV only;  $p = 0.02$ ) and discharge (28% vs 13%; IV  $\pm$  IA;  $p = 0.006$ ). Asymptomatic hemorrhage rates were 9–19%. Only the abciximab trial described excessive symptomatic bleeding. When imaging and treatment modality were clearly stated, the symptomatic hemorrhage rate following IV rtPA was 1/58 (1.7%) for MRI and 2/68 (2.9%) for CT approaches.

**Conclusion:** Data on benefits and risks of reperfusion treatment for WUS reperfusion treatment are limited and insufficient to recommend treatment in routine practice. Randomized trials are required with clear description of imaging criteria used for patient selection.

**WSC-0843****Acute Reperfusion Treatment  
Endovascular treatment for acute stroke patients with  
baseline NIHSS score of 8 or more before approval of  
mechanical thrombectomy devices in Japan**M Hayakawa<sup>1</sup>, H Yamagami<sup>2</sup>, N Sakai<sup>3</sup>, Y Matsumaru<sup>4</sup>, S Yoshimura<sup>5</sup>, K Toyoda<sup>6</sup><sup>1</sup>Department of Cerebrovascular Medicine, National Cerebral and Cardiovascular Center, Suita Osaka, Japan<sup>2</sup>Department of Neurology, National Cerebral and Cardiovascular Center, Suita Osaka, Japan<sup>3</sup>Department of Neurosurgery, Kobe City Medical Center General Hospital, Kobe, Japan<sup>4</sup>Department of Endovascular Neurosurgery, Toranomon Hospital, Tokyo, Japan<sup>5</sup>Department of Neurosurgery, Hyogo College of Medicine, Nishinomiya, Japan<sup>6</sup>Department of Cerebrovascular Medicine, National Cerebral and Cardiovascular Center, Suita Osaka, Japan

The aim of this study was to clarify the general status and predictors of clinical outcome and recanalization of acute stroke patients undergoing endovascular therapy (EVT) before approval of mechanical thrombectomy devices in Japan. A total of 1409 acute ischemic stroke patients undergoing EVT were registered in the Japanese Registry of Neuroendovascular Therapy (JR-NET) and JR-NET 2 from 2005 to 2009. We extracted 757 patients with baseline NIHSS score  $\geq 8$  with clinical and procedural data fully available (283 women, 70.8  $\pm$  11.6 years). The

median baseline NIHSS score was 19, and the occluded arteries were ICA in 23.2%, MCA in 53.8% and BA in 20.3%. Intravenous thrombolysis was administered to 9.3% of the patients. EVT mainly consisted of intraarterial thrombolysis and balloon angioplasty, and 45.8% of the patients underwent EVT with multiple procedures. Recanalization (partial or complete) rate was 82.6%, and the clinical outcome was favorable (mRS 0–2) in 31.2% and fatal in 13.3% at 30 days after onset. Multivariate analyses showed that younger age, lower baseline NIHSS score, non ICA occlusion (ICAO), earlier onset-to-treatment time and better recanalization status were predictors of favorable outcome. Higher baseline NIHSS score, ICAO, EVT using multiple procedures and non-use of intravenous thrombolysis were associated with fatal outcome, and lower baseline NIHSS score and non ICAO were associated with recanalization. These results could be considered as baseline data that can be used to validate the beneficial effects of novel EVT devices in Japan.

**WSC-0407****Acute Reperfusion Treatment  
Endovascular treatment of acute basilar artery  
occlusion: Time to treatment is crucial**R Herzig<sup>1</sup>, T Dornak<sup>2</sup>, M Kuliha<sup>3</sup>, R Havlicek<sup>4</sup>, D Skoloudik<sup>2</sup>, J Lacman<sup>5</sup>, M Kocher<sup>6</sup>, V Prochazka<sup>7</sup>, A Krajina<sup>8</sup>, D Krajickova<sup>9</sup><sup>1</sup>Military University Hospital, Department of Neurosurgery, Prague, Czech Republic<sup>2</sup>Palacky University and University Hospital, Department of Neurology, Olomouc, Czech Republic<sup>3</sup>Ostrava University and University Hospital, Department of Neurology, Ostrava-Poruba, Czech Republic<sup>4</sup>Military University Hospital, Department of Neurology, Prague, Czech Republic<sup>5</sup>Military University Hospital, Department of Radiology, Prague, Czech Republic<sup>6</sup>Palacky University and University Hospital, Department of Radiology, Olomouc, Czech Republic<sup>7</sup>Ostrava University and University, Department of Radiology, Ostrava-Poruba, Czech Republic<sup>8</sup>Charles University and University Hospital, Department of Radiology, Hradec Kralove, Czech Republic<sup>9</sup>Charles University and University Hospital, Department of Neurology, Hradec Kralove, Czech Republic

**Introduction:** Acute ischemic stroke (AIS) caused by basilar artery occlusion (BAO) is often associated with a severe and persistent neurological deficit and a high mortality rate. Nevertheless, the most effective therapeutic approach has not been established yet.

**Aims:** To evaluate safety and efficacy of multimodal endovascular treatment (EVT) of acute BAO, including bridging therapy (intravenous thrombolysis [IVT] with subsequent EVT) and to identify predictors of good clinical outcome.

**Methods:** In the retrospective, multicenter study, the set consisted of 72 AIS patients (51 males; mean age 59.1  $\pm$  13.3 years) with radiologically confirmed BAO. Following data was collected: baseline characteristics, risk factors, pre-event antithrombotic treatment, neurological deficit at time of treatment, localization of occlusion, time to therapy, recanalization rate, posttreatment imaging findings. 30-day and 90-day outcomes were assessed using modified Rankin scale with good clinical outcome defined as 0–3 points.

**Results:** Successful recanalization was achieved in 94.4% patients. Step-wise binary logistic regression analysis identified time to treatment (OR = 0.073 and OR = 0.067, resp.), presence of arterial hypertension (OR = 0.829 and OR = 0.864, resp.) and NIHSS value at the time of treatment (OR = 0.556 and OR = 0.502, resp.) as significant independent predictors of good 30-day and 90-day outcome.

**Conclusions:** Data in this multicenter study showed that multimodal EVT was an effective recanalization method of acute BAO. Bridging therapy

shortens the time to treatment which was identified as the only modifiable outcome predictor.

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#### WSC-0474

### Acute Reperfusion Treatment Ultraearly emergency embolectomy for acute occlusion of the internal carotid artery and middle cerebral artery

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**Introduction and aims:** Surgical embolectomy, first introduced in 1956, is the most promising therapy to physically remove intra-arterial clots from major cerebral arteries. However, it is regarded as a relic since it requires time-consuming steps, including anesthesia, craniotomy, and microsurgery. We established seamless collaboration among all services involved, refined surgical techniques, and prospectively investigated the feasibility and safety of emergency surgical embolectomy.

**Methods:** Surgical indications included the presence of acute hemispheric symptoms within 3 hours of the onset, absence of low-density area on computed tomography, evidence of intracranial internal carotid artery (ICA) or proximal middle cerebral artery (MCA) occlusion. Primary outcomes were recanalization assessed by angiography, and secondary outcomes were neurological status at 90 days.

**Results:** From 2006 to 2013, microsurgical embolectomy was performed for 11 consecutive patients (age, 57–78 years) with a National Institutes of Health Stroke Scale score >14 (mean, 20) at baseline. The occlusion site was MCA in 8 patients and ICA in 3 patients. All patients showed complete recanalization (TICI3). The median times from admission to start of surgery, from surgery to recanalization, and from onset to recanalization were 90 (45–128) minutes, 73 (55–110) minutes, and 210 (140–280) minutes, respectively. No significant procedural adverse events occurred. Ten patients survived, and 6 had good functional outcome (modified Rankin Scale score, 0–3).

**Conclusions:** Our results suggest that microsurgical embolectomy can rapidly, safely, and completely retrieve clots and deserves reappraisal in current acute stroke therapy, although the choice largely depends on local institutional expertise and experience.)

#### WSC-0907

### Acute Reperfusion Treatment Intraarterial mechanical thrombectomy performed after eight hours from symptom onset for the patients with basilar artery occlusion

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**Introduction:** The prognosis of basilar artery occlusion (BAO) is usually devastating when not treated. Therefore strategy for treatment of acute BAO is often aggressive.

**Aim:** We evaluated the clinical characteristics and outcome of patients who treated with intraarterial mechanical thrombectomy (IAT) after 8 hours from the symptom onset.

**Methods:** Baseline characters and clinical course of neurologic deficit was evaluated. Time interval of onset-to-femoral puncture and puncture-to-recanalization were recorded. To define lesion size, 10-point score on DWI

was assessed before IAT and 24 hours later. Occlusion site and final recanalization grade were evaluated by angiography. Favorable outcome was defined as 3 month mRS 0–2.

**Results:** During the study period, 29 patients with BAO underwent IAT. Of them, 7 patients performed IAT after 8 hours from the symptom onset. All patients showed gradual progressive or fluctuating neurologic deficit from the onset. The median time interval from the symptom onset to start of IAT was 18 hours (range 10.4–115.6 hours). Median lesion score of DWI was 2 (range 1–3.5) before IAT. Successful recanalization (TICI 2b–3) was achieved in 6 of 7 patients. And, of the 6 recanalized patients, 5 patients showed dramatic recovery after IAT and 3 month-favorable outcome. Lesion scores in these patients were 1.5 to 4 at 24 hours.

**Conclusion:** In acute BAO patients, IAT should be considered even after 8 hour-time window if the patient showed progressive or fluctuating neurologic deficit. In these patients, successful recanalization with IAT is essential for the favorable outcome.

#### WSC-0971

### Acute Reperfusion Treatment Influence of prior aspirin use on the functional outcome in patients with acute ischemic stroke treated by intravenous thrombolysis

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**Introduction and aims:** The effect of prior use of aspirin on the functional outcome in patients treated with intravenous (IV) thrombolysis is uncertain. There were conflicting results in previous studies, and that was not evaluated according to the stroke subtypes. The aim of this study was to determine its effect on the functional outcome in patients treated with IV thrombolysis and evaluate it according to the stroke subtypes.

**Methods:** We used data from the Clinical Research Center For Stroke, a nationwide, multicenter, prospective registry for acute stroke patients. We identified 2451 patients treated with IV thrombolysis between 2008 and 2012. Among them, we excluded patients with oral anticoagulants, antiplatelet drugs other than aspirin, unavailable medication history and mRS score at discharge. Finally, a total of 1633 patients were included. We used an end-point analytic technique to evaluate the association between prior use of aspirin and functional outcomes: dichotomized analysis for functional dependency (a discharge mRS score ≥ 3).

**Results:** Of the 1633 patients, 301 (11.1%) were on aspirin at stroke onset. The dichotomized analysis failed to show a significant association between prior use of aspirin and functional outcome (adjusted OR, 0.76 ;95% CI, 0.55 to 1.05). However, the subgroup analysis according to the stroke subtypes showed that prior use of aspirin was significantly associated with functional outcome in cardioembolic stroke (adjusted OR, 0.13; 95% CI, 0.02 to 0.84).

**Conclusion:** Although we failed to show the beneficial effect of prior use of aspirin in overall stroke patients, we demonstrated it in patients with cardioembolic stroke.

#### WSC-0592

### Acute Reperfusion Treatment Clinical features and prognosis of ischemic wake-up stroke to meet an indication for thrombolytic therapy in our hospital

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**Purpose:** It has been reported that wake-up ischemic strokes (WUIS) account for approximately 20% of all ischemic strokes. However, WUIS

are excluded from thrombolytic therapy even if they have an indication for treatment in other clinical and imaging criteria, because time of onset is unclear. The objective of this study is to show the clinical features and prognosis of patients with WUIS who are eligible for thrombolytic therapy.

**Methods:** Of 829 consecutive patients admitted to our hospital with acute ischemic stroke from Sept. 2011 to Aug. 2013, we retrospectively analyzed the characteristics and the rate of favorable outcomes at 3 months (modified Rankin Scale 0 or 1) of WUIS patients which inclusion criteria were last seen normal <12 hours or >4.5 hour.

**Results:** We identified 103 (12.4%) WUIS patients. Based on the mechanism of ischemic stroke, 45 (43.6%) patients are small vessel diseases {baseline NIHSS: 3 (2–4), rate of mRS (0–1): 64.4%}, 28 (27.2%) atherosclerosis of a large artery {3 (2–15), 32.1%}, and 26 (25.2%) embolism of cardiac origin {10 (3–14), 25.2%}. Of these, 21 (20.4%) patients were considered to be eligible for thrombolytic therapy with NIHSS > 4 and the presence of a DWI-FLAIR mismatch and the rate of mRS (0 or 1) was 23.8%, whereas thrombolysed patients with intravenous tissue plasminogen activator (IV tPA) within 0 to 4.5 hours in our hospital was 45.8%.

**Conclusion:** Small-vessel disease mechanism is likely to be observed in WUIS. The selected WUIS patients with clinical and imaging criteria may be reasonable candidates for thrombolytic therapy.

### WSC-1089

#### Acute Reperfusion Treatment Does a history of past stroke modify the effect of intravenous thrombolysis?

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**Introduction and aim:** Our aim was to evaluate safety and effectiveness of intravenous thrombolysis for stroke in patients with a history stroke, especially if the previous stroke occurred ≤3 months before the treatment.

**Methods:** We analyzed the data of all cases reported to the Safe Implementation of Treatments for Stroke – Eastern Europe registry who received intravenous alteplase between October 2003 and December 2011. Odds ratios were calculated using patients with first-ever stroke as a reference.

**Results:** A history of stroke was positive in 1215 of 8739 patients (14%), including 178 (2%) who had previous stroke ≤3 months before thrombolysis. Compared to the reference group, patients with any history of stroke or previous stroke >3 months were significantly older, more burdened with vascular risk factors and had worse outcome but those with previous ≤3 months were similar to those with first-ever stroke. Logistic regression adjusted for age, sex, hypertension, atrial fibrillation, congestive heart failure, diabetes, preexisting disability and stroke severity showed that previous stroke >3 months increased risk of death at 3 months (OR 1.25), but did not affect the likelihood of symptomatic intracranial hemorrhage, significant neurological improvement or favorable outcome at 3 months. No negative associations were found for previous stroke ≤3 months.

**Conclusion:** Patients with a history of past stroke have less favorable vascular profile and may have slightly worse prognosis after thrombolysis than those with first-ever stroke. However, previous stroke ≤3 months appear not to have clear deleterious effect thus considering it a routine contraindication may be excessive.

### WSC-1333

#### Acute Reperfusion Treatment Revascularization success whether measured by recanalization or angiographic reperfusion is associated with favorable clinical outcome in the IMS III Trial

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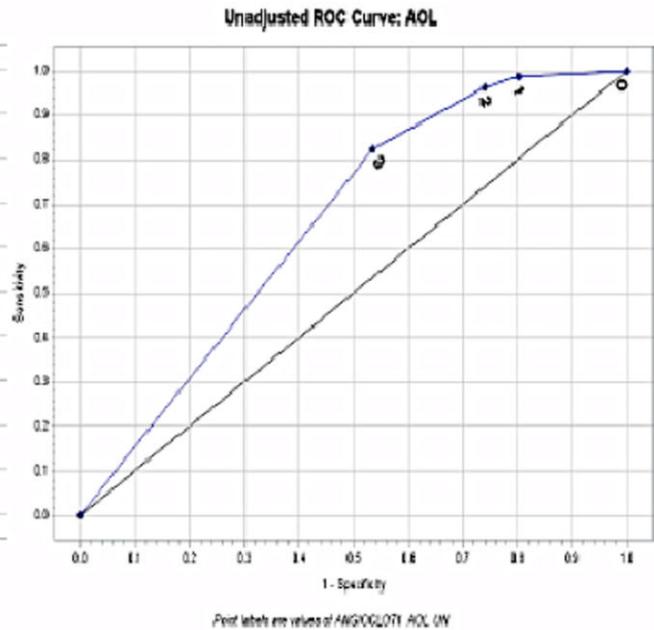
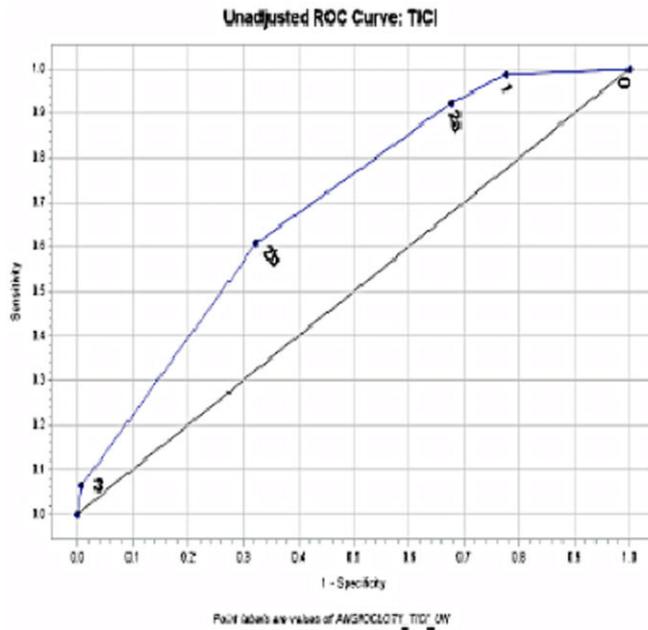
**Introduction:** The IMS III trial provides a large, prospective data set of endovascular subjects with core lab-adjudicated revascularization results and blinded 90-day clinical outcomes.

**Aims:** We sought to determine which revascularization scale – reperfusion (modified Thrombolysis in Cerebral Infarctions, mTICI) versus recanalization (Arterial Occlusive Lesion, AOL) – better predicted clinical outcome.

**Methods:** We limited the analysis to ICAT, M1, and M2 complete occlusions treated at ≤7 hours from onset (n = 240). We compared mTICI vs AOL scales for accuracy in predicting favorable outcomes (mRS 0–2) using ROC analysis. We also identified the optimal threshold (maximal sensitivity and specificity) for each scale.

**Results:** Both higher mTICI scores (0–2.7%, 1–23.8%, 2a–30.5%, 2b–45.7%, 3–83.3%; p < 0.0001) and higher AOL scores (0–3.0%, 1–17%, 2–25%, 3–43%; p < 0.0001) were associated with better outcomes rates (mRS 0–2). mTICI and AOL predicted outcome comparably [AUC 0.69 (95% CI 0.63–0.76) vs 0.66 (95% CI 0.61–0.72); p = 0.21] The optimal threshold for the predictive accuracy of mTICI was 2b–3 (sensitivity 61%, specificity 68%). The optimal threshold for AOL's predictive accuracy was 3 (sensitivity 82%, specificity 47%). The mTICI analysis was limited by only six subjects with TICI 3.

**Conclusions:** Both reperfusion (mTICI) and recanalization (AOL) predicted clinical outcome with comparable accuracy, and demonstrated better outcomes with higher scores. This is reassuring given the variability of revascularization scales used in major trials to date.



**WSC-1269**  
**Acute Reperfusion Treatment**  
**Outcomes of acute stroke thrombolysis in a Welsh hospital**

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*Introduction:* Intravenous thrombolysis with rtPA, if administered within 4.5 hours of onset, has been shown to improve outcomes in acute ischemic stroke. We deliver a 24 hour thrombolysis service, 7 days a week. The aim of this study was to analyze the outcome of stroke patients, thrombolysed over a 3.5 year period.

*Method:* Of the 764 patients who presented between July 2010 and December 2013, a total of 210 patients were thrombolysed for acute stroke in University Hospital of Wales. The data was analyzed retrospectively.

*Results:* The median age of thrombolysed patients was 75 yrs (range 28–100 yrs). Majority of the patients (90%) had anterior circulation stroke. The median length of time between onset of symptoms and arrival was 70 min, from door to CT scan was 33 min, from CT scan to thrombolysis was 54 min and door to thrombolysis was 94.5 min. Following thrombolysis 59.2% of patients achieved good functional outcome (modified Rankin score 0–2). 2/210 patients (0.95%) developed symptomatic intracranial hemorrhage and 1 died (0.48%). 31/210 (14.76%) were found to have asymptomatic micro hemorrhages on CT scan. Short term mortality rate within 3 months was 16.66% (35 out of 210).

*Conclusion:* Our experience confirms that the overall improvement in functional outcome offsets the risk of bleeding following thrombolysis. Following this review, we have introduced a number of steps to reduce the door to needle time by more efficient initial assessment of acute stroke patients.

**WSC-0881**  
**Acute Reperfusion Treatment**  
**Low-dose versus standard-dose TPA for acute ischemic strokes: A comparative effectiveness research**

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*Introduction:* A low-dose (0.6 mg/Kg) tPA strategy to treat acute ischemic stroke patients is adopted to the clinical practice in Asian countries. However, the supporting evidence of the alternative treatment is only derived from a registry database without a comparing group.

*Methods:* A total of 1572 acute ischemic stroke patients who arrived within 4.5 hours from their last seen normal, consisted of 464 low-dose tPA cases (29.5%) and 1108 standard-dose tPA (0.9 mg/Kg) cases (70.5%), was identified from a prospective, multicenter and nationwide stroke registry database. Primary outcome was a mRS score 0–1 at 3 months after stroke and symptomatic hemorrhagic transformation (HT). Inverse probability of low-dose tPA weighting (IPTW) by propensity score was utilized to remove baseline imbalance between the two groups.

*Results:* A low-dose tPA treatment was comparable to the standard-dose treatment regarding mRS score 0–1 at 3 months after stroke (IPTW and covariates adjusted OR, 1.10; 95% CI, 0.80–1.53), symptomatic HT (0.96; 0.57–1.62) and mortality at 3 months (0.62; 0.38–1.03). In cases of intra-

venously treated without endovascular recanalization, mRS score 0–1 at 3 months (1.15; 0.78–1.70) and symptomatic HT (1.01; 0.51–1.99) was not different between two treatment strategies; but a low-dose tPA was associated with decreased odds of 3-month mortality (0.54; 0.30–0.97) than the standard-dose treatment.

**Conclusion:** Intravenous thrombolysis with 0.6 mg/Kg of tPA may be as effective and safe as standard dose of 0.9 mg/Kg treatment.

## WSC-0827

### Acute Reperfusion Treatment Seasonal difference in the incidence of ischemic stroke patients treated with intravenous tissue plasminogen activator

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**Introduction:** In Japan, intravenous therapy with tissue plasminogen activator (t-PA) was approved in 2005 within 3 hours of onset. The time window for t-PA was subsequently widened to 4.5 hours, and this resulted in a marked increase in the number of patients eligible for t-PA therapy.

**Aims:** The purpose of the present study was to investigate seasonal and monthly differences in the numbers of stroke patients eligible for t-PA therapy.

**Methods:** In our hospital, 158 acute ischemic stroke patients received t-PA from November 2005 to October 2013. One 111 were male and 47 were female. We investigated seasonal and monthly variations in the number and gender of these patients.

**Results:** The number of female ischemic stroke patients treated with t-PA was significantly higher in summer than in winter ( $p < 0.05$ ). Among males, the monthly incidence was significantly higher in August than in September ( $p < 0.01$ ). As for stroke subtype, the incidence of cardiogenic embolism was significantly higher in summer than in winter ( $p < 0.05$ ), and the highest incidence was in August. This finding is in contrast to a previous report that cardiogenic embolism was most common in winter. We found no significant seasonal or monthly difference in incidence of atherothrombotic infarction.

**Conclusion:** In our hospital, the incidence of ischemic stroke patients with cardiogenic embolism eligible for t-PA treatment was significantly higher in summer than in winter. Possible explanations include delay of detection of onset and delay in transfer to hospital in winter, resulting in ineligibility for t-PA.

## WSC-0556

### Acute Reperfusion Treatment Endovascular treatment for acute ischemic stroke with large vessel occlusion: The experience of a regional stroke service

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**Introduction and aims:** Endovascular techniques provide therapeutic options for patients with acute ischemic stroke (AIS) and large vessel

occlusion. We report our experience with endovascular treatment in the context of a regional referral service.

**Methods:** We performed a prospective review of 93 consecutive cases receiving endovascular treatment for AIS over a 42-month period (January 2010 to June 2013). The NIHSS, location of large vessel occlusion, details of endovascular procedures, and degree of reperfusion achieved (TICI score) were recorded. Mortality and functional outcome (mRS) were measured at 90 days.

**Results:** The mean patient age was 62 years (range 26–87). The mean NIHSS at presentation was 16 (range 6–29). All patients had confirmed proximal large artery occlusion on CT angiography: 87 anterior circulation, 6 posterior circulation. Of the 93 patients treated, 64 (69%) received IV thrombolysis. Successful reperfusion (TICI grade 2a–3) was achieved in 80 (86%). There were 13 (14%) cases of failed vessel recanalization (TICI grade 0). Good functional outcome (mRS  $\leq 2$ ) was achieved in 51 (55%) cases. The 90-day mortality was 20 (22%) cases. 57 (61%) cases were transferred from outside centers. There was no increase in morbidity or mortality for transferred patients.

**Conclusions:** Successful endovascular recanalization can result in good functional outcomes for patients with AIS and large vessel occlusion. Our interventional neuroradiology service provides endovascular treatment as part of a regional stroke service without increase in morbidity or mortality for patients transferred from outside institutions.

## WSC-0510

### Acute Reperfusion Treatment Do arch and carotid characteristics on CT angiography predict delay in puncture to device deployment time in acute ischemic strokes?

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**Introduction:** Time to successful reperfusion is a significant predictor of good clinical outcome in acute ischemic stroke.

**Aim:** To identify whether certain anatomical characteristics of aortic arch and carotid artery on CTA predicted delays in groin puncture to first device deployment time during IA therapy.

**Methods:** We included patients with clinically-disabling stroke and anterior circulation proximal occlusion on CTA that underwent endovascular therapy from January 2011 to February 2013. We explored 10 anatomical characteristics pertaining to descending aorta, aortic arch, cervical, and intracranial carotid arteries (Table 1). Groin puncture to first device deployment (PD) time was the primary end point.

**Results:** 125 patients (males 55.2%, median age 69 [IQR 16]) years were identified. Median time for puncture to first run was 5 mins (7), puncture to first device deployment 20 mins (15) and puncture to recanalization 43 mins (48).

An atypical origin of great vessels from the arch predicted delay in PD time ( $p = 0.02$ ). CCA tortuosity and cervical ICA loops increased PD time. Other characteristics including types of arch did not show significant PD time delays.

Logistic regression analysis showed that presence of any one of these characteristics viz. atypical origin of great vessels from arch, CCA tortuosity and cervical ICA loops increased the odds ratio for PD time delay of more than 30 mins by 2.54 [95% CI: 1.04 to 6.23],  $p = 0.04$ .

**Conclusion:** Presence of atypical origin of great vessels from the arch, CCA tortuosity or cervical ICA loops predicts delay in puncture to device deployment time.

**Table 1** Anatomical characteristics analyzed

Variables	Categories and definition
Origin of great vessels	0 – Typical origin of great vessels (Brachiocephalic, left CCA and left Subclavian arising separately from the Arch) 1 – Common origin of left CCA and Brachiocephalic 2 – left CCA arising from innominate artery
Types of arch	0 – Type 1 (Brachiocephalic/CCA arise at the same level as the top of arch) 1 – Type 2 (Brachiocephalic / CCA arise at lower level from top of arch. The distance between origin of these vessels and top of arch is 2 – Type 3 (Brachiocephalic / CCA arise at lower level from top of arch. The distance between origin of these vessels and top of arch is > twice the diameter of CCA)
Arch atheroma	0 – No atheroma 1 – Atheroma present
Stenosis	0 – No stenosis 1 – Stenosis present
ILCT	0 – No thrombus 1 – Thrombus present
CCA tortuosity	0 – No tortuosity 1 – Tortuosity present
Cervical ICA Tortuosity (loops)	0 – No loop 1 – One loop 2 – Two or more loops (Each loop is 180 degree turn)
Intracranial ICA tortuosity	0 – No tortuosity 1 – Tortuosity present
Descending Aorta	0 – Straight 1 – Aorta swings to the right 2 – Aorta swings to the left
Horizontal distance between descending aorta and origin of target vessel	0 – < 4 cm 1 – ≥ 4 cm

**WSC-1056****Acute Reperfusion Treatment Outcome at discharge after thrombolysis does not differ between cardiogenic and noncardiogenic strokes**

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**Introduction:** While a recanalization based Spanish study showed superior response to intravenous thrombolysis in cardiogenic stroke compared to noncardiogenic subtypes, a clinical outcome based Portuguese study failed to show better results for cardiogenic type.

**Aim:** We aimed to determine whether clinical outcome at discharge on intravenous thrombolysis differed between stroke subtypes in a South Indian Tamilian population.

**Methods:** Data on risk factors, TOAST and OCSF subtypes, modified Rankin scale and NIH Stroke Scores at admission and at discharge were collected prospectively by Neurology residents for all ischemic stroke patients admitted in a tertiary care acute stroke unit. Cardiogenic stroke was defined according to updated ASCO phenotyping. Difference in outcome scales with reference to baseline functional status between

cardiogenic and noncardiogenic stroke subtypes explored using SPSS19, with appropriate statistical tests.

**Results:** Prospective parallel group study. Over 3.5 years, among 237 ischemic strokes, 39 underwent IV tPA thrombolysis. Mean age 50.9 (SD 17.9); male 70%, hypertension 42%, smoking 33%, dyslipidemia 25% and diabetes mellitus 20%. 36% were cardiogenic and remaining 64% noncardiogenic. Baseline parameters including antithrombotic therapy and functional scales did not differ between the cardiogenic and noncardiogenic groups. Good outcome (mRS ≤ 3) at discharge was seen in 6 (46%) of cardiogenic and 11 (50%) noncardiogenic strokes (P = 0.82; OR = 0.67 [0.13–3.11]) while mortality in cardiogenic group 23% and 13% in noncardiogenic group (P = 0.64; OR: 0.52 [0.08–3.1]). Mean hospital stay 8.7 and 7.7 days respectively.

**Conclusion:** Among thrombolysed patients, there was no difference in clinical outcome at discharge between cardiogenic and noncardiogenic strokes.

**WSC-1008****Acute Reperfusion Treatment Comparison of mechanical thrombectomy and intravenous thrombolysis in acute ischemic stroke with middle cerebral artery hyperdense sign**

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**Introduction:** Occlusion of middle cerebral artery (MCA) often heralds an unfavorable prognosis, despite administration of intravenous thrombolysis. Alternative methods are tested to promote the vessel recanalization and improve clinical outcome.

**Aims:** We compared the outcome of acute stroke patients treated with catheter-based therapy (CBT) and rtPA in the matched study groups.

**Methods:** Twenty consecutive patients underwent direct mechanical thrombectomy (CBT group) and were compared to twenty matched individuals, who were treated by intravenous thrombolysis (IVT group). All 40 patients had a hyperdense sign of middle cerebral artery on initial CT scan. Initial NIHSS was of 15 points in CBT group (10 females, average 64 yrs, range 32–83) and of 16 points in IVT group (10 females, average 64 yrs, range 36–78). Mean onset to needle time was 140 min in CBT group and 143 min in IVT group.

**Results:** Early MCA recanalization was achieved in 16 subjects in CBT group and in six patients in IVT group as assessed by ultrasound. Symptomatic intracerebral hemorrhage occurred in two subjects in both groups. Favorable outcome (mRS 0–2) in 3 months was achieved in eleven individuals treated by CBT and in six persons, who received IVT.

**Conclusion:** The results show promising outcome (angiographic and clinical) after direct CBT when it is initiated with minimal door-to-needle delay.

Supported by the Charles University Prague Research Projects P34, P35 and 260045/SVV/2014

**WSC-0350****Acute Reperfusion Treatment Next of kin's (NOK) attitudes and preferences toward decision-making for intravenous stroke thrombolysis in singapore**

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**Introduction:** Early initiation of stroke thrombolysis is associated with better outcomes and lower risks. One of the key factors prolonging the

door-to-needle time is procurement of consent. We studied the attitudes and preferences of NOK of stroke patients toward consent for stroke thrombolysis in Singapore, and investigated for potential associations with demographic and social factors.

**Methods:** We surveyed 105 NOK of acute ischemic stroke patients admitted to a large tertiary hospital in Singapore who presented beyond the 4.5-hour therapeutic window using a standardized questionnaire with hypothetical scenarios regarding consent for intravenous thrombolysis.

**Results:** In a scenario of a mentally competent patient, 78% of the NOK surveyed preferred to have their opinion sought before the patient made any decision for the stroke thrombolysis. If requested by the mentally competent patient, 71% of NOK were willing to decide on the patient's behalf. Fewer Malay ( $p = 0.047$ ) and male ( $p = 0.019$ ) NOK were willing to make this decision. In a scenario where the patient is mentally incapacitated, 61% of the NOK were comfortable with letting the doctors decide and 73% were willing to decide on the patient's behalf if asked.

**Conclusion:** Stroke patient's NOK are willing to play an active role in decision-making for stroke thrombolysis for both mentally competent and incapacitated patients. However, under Singapore's Mental Capacity Act, there is no legal basis for the NOK giving or refusing consent for a mentally incapacitated patient for emergency treatments ie stroke thrombolysis.

### WSC-1211

#### Acute Reperfusion Treatment Mechanical thrombectomy with Solitaire stent and forced arterial suction thrombectomy (FAST) with penumbra reperfusion catheter: Which device is fast and effective?

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**Introduction:** Mechanical thrombectomy with many devices has improved recanalization rates when compared to clot disruption with a wire and microcatheter alone.

**Aims:** to compare our immediate recanalization rates with these two available mechanical devices and switch technique of these devices.

**Methods:** A retrospective review from March 2010 to December 2013 was performed on patients who underwent mechanical thrombectomy for large vessel occlusion.

**Results:** Fifty four procedures were performed on 52 patients using Solitaire-FR (SOL): 32 and FAST: 22. Nine cases underwent thrombectomy using both FAST and Solitaire devices. The M:F ratio was 1:1. The average needle to recanalization time was 67 minutes (SOL: 61 and FAST: 76). Additional rescue procedures were performed in 27.8% (15/54) of the cases [SOL: 9.4% (3/32) and FAST: 54.5% (12/22)]. The number of Solitaire stent passes was 1.9 (range 1–6) in solitaire only cases, but the number of FAST was 2.5 (range 1–3) in FAST only cases. Complete recanalization was achieved in 61.1% (13/22) [SOL: 65.6% (21/32) and FAST: 54.5% (12/22)]. The rate of recanalization and additional rescue procedure were statistically significant for the Solitaire group vs. the FAST group ( $<0.05$ ).

**Conclusion:** The study reveals a higher rate of angiographic recanalization using the Solitaire-FR device, requiring a lesser number of passes and other associated procedures as compared to FAST. Thus, Stent retrievers (Solitaire-FR) are advantageous in faster device delivery and quick flow restoration. In difficult cases, switch technique from Solitaire stent to the FAST was more effective than vice versa.

### WSC-0894

#### Acute Reperfusion Treatment Neurothrombectomy in acute ischemic stroke due to occlusion of intracranial arteries: Impact of device type on outcome

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**Background:** New generation devices (NGD) such as Revive, Trevo, Solitaire and 5 max have been introduced to obtain a better safety and efficacy profile as compared to the Penumbra System (PS) in the treatment of patients with acute ischemic stroke (AIS).

**Aim:** To compare outcome measures of different devices.

**Materials and methods:** clinical and radiological data of consecutive AIS patients with large intracranial occlusions treated by thrombectomy were retrospectively analyzed. 3-month modified Rankin Scale (mRS) was assessed.

**Results:** 118 patients were collected. Two had spontaneous vessel recanalization. The 116 remaining were categorized as follows: PS ( $n = 41$ ), NGD ( $n = 60$ ), combination of them ( $n = 15$ ). The three groups did not significantly differ in baseline clinical and radiological characteristics. Patients in the combination group had longer puncture-to-recanalization time (72 and 83, respectively vs 178 minutes;  $p = 0.01$ ) without differences in onset-to-arterial puncture ( $p = 0.56$ ) and onset-to-recanalization times ( $p = 0.35$ ). Rate any intracranial hemorrhage (ICH) was significantly higher in the combination group (8/16 vs 19/41 vs 16/60;  $p = 0.049$ ), without difference in the rate of symptomatic ICH (6/41 vs 3/15 vs 2/60;  $p = 0.21$ ). Rate of arterial recanalization as well as 3-month outcome and mortality did not differ between the 3 groups.

**Conclusions:** This single-center experience did not show an increase rate of favorable outcome after treatment by NGD as compared to PS. The combination of different devices required longer procedural times and led to an increased risk of hemorrhagic complications without differences in outcome and mortality. Further research is needed to identify predictors of good outcome.

### WSC-0701

#### Acute Reperfusion Treatment The prognostic value of collateral flow in patients with acute ischemic stroke due to occlusion of intracranial arteries treated by neurothrombectomy

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**Background:** Intracranial collateral flow (ICF) has been related to functional outcome in patients with acute ischemic stroke (AIS). The aim of the study was to assess the prognostic value of ICF in patients with occlusion of intracranial arteries of anterior circulation.

**Methods:** Pretreatment noncontrast CT (NCT), CT angiography (CTA) and digital subtraction angiography (DSA) of patients treated by endovascular treatment (ET) were retrospectively analyzed. Effectiveness of

ICF was scored on both CTA and DSA sequences. ASPECTS was calculated on NCT and CTA. 3 months mRS was evaluated.

**Results:** Of 118 patients treated by ET 100/118 (84%) had anterior circulation strokes. Data on collaterals were available in 76/100 (76%). Based on DSA, patients were classified as good (1–2; n = 48) or poor (3–5; n = 28) ICF. Concordance between DSA and CTA in the ICF final score was good (concordance index = 0.83; kappa index = 0.64). Multivariate analysis showed any significant differences between G and P in baseline characteristics. Patients with G-ICF had higher ASPECTS on CTA ( $6.1 \pm 1.77$  vs  $3.2 \pm 2.48$ ;  $p < 0.0001$ ) and NECT ( $7.53 \pm 1.19$  vs  $6.3 \pm 1.97$ ;  $p = 0.0001$ ) as compared to P-ICF. At discharge and 3-months follow-up, patients in the G-ICF group had higher rates of favorable outcome (i.e. mRS  $\leq 2$ ) (17/48 vs 1/28;  $p = 0.001$ ; 23/43 vs 6/26;  $p = 0.01$ ) and lower mortality rate (3/48 vs 8/28;  $p = 0.001$ ; 7/48 vs 11/28;  $p = 0.01$ ) as compared to P-ICF.

**Conclusion:** Patients with AIS and good collaterals have better chance of favorable outcome and lower mortality at 3-months. CTA seems to be a valid tool for selection of patients candidate to ET.

### WSC-0269

#### Acute Reperfusion Treatment Stroke IV thrombolysis out of inclusion & exclusion criteria; a case series and review of literature

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**Introduction:** Thrombolytic therapy with intravenous alteplase for ischemic stroke is restricted by guidelines, because of the risk of hemorrhage, especially in the brain, and only a small number of selected patients are being treated. Findings from meta-analyses and post licensing experience suggest that more subjects, who otherwise have a poor predicted outcome without treatment, might benefit from intravenous.

**Methods:** We retrospectively assessed clinical safety of the IV stroke thrombolysis beyond guidelines in 20 patients out of 140 total patients thrombolysed by IV rtPA in our department. Patient eligible for thrombolysis within 3 hours were selected by CT or MRI and beyond 3 h only by MRI brain. Imaging study was done at the time of presentation and after 24 hrs to rule out symptomatic ICH.

**Finding:** We have not recorded any symptomatic ICH in any patients which we thrombolysed beyond guide line. Two patients had asymptomatic hemorrhagic transformation.

**Conclusion:** This document does not intend to change the guidelines but reviews the literature on the use of intravenous alteplase for stroke beyond guidelines and in particular conditions which help in more and more patients can be benefited by stroke thrombolysis.

### WSC-0636

#### Acute Reperfusion Treatment Acute reperfusion therapy for stroke patients on maintenance hemodialysis

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**Purpose:** To examine the effect of intravenous rt-PA therapy and mechanical thrombectomy for stroke patients receiving maintenance hemodialysis (HD).

**Methods:** Of 3854 ischemic stroke patients who admitted to our hospital, 442 patients (7 patients on HD) who were treated with intravenous rt-PA using 0.6 mg/kg alteplase or mechanical thrombectomy were retrospectively registered. Outcome measures were symptomatic intracranial hemorrhage (sICH, accompanying an increase in NIHSS score  $>4$  from baseline within 36 hours), favorable outcome (mRS, 0–2), unfavorable outcome (mRS, 5–6) and mortality at 3 months.

**Results:** Of the 7 HD patients (4 men; mean age,  $69 \pm 7$  years; the median NIHSS score, 13), 6 patients had cardioembolic stroke and 1 had atherothrombotic stroke. 4 patients were treated with intravenous thrombolysis, 2 (29%) with mechanical thrombectomy, and 1 (14%) with both. Of the remaining 435 non-HD patients (279 men; mean age,  $74 \pm 13$  years; the median NIHSS score, 13), 364 patients (84%) were treated with intravenous thrombolysis, 21 (5%) with mechanical thrombectomy, and 50 (11%) with both. The sICH were present in 1 HD patient (14.2%) and 8 (1.9%) non-HD patients ( $p = 0.08$ ). The favorable outcome were shown in 3 (43%) and 176 (48%) ( $p = 1.00$ ), the unfavorable outcome were in 4 (57%) and 75 (21%) ( $p = 0.04$ ), and the mortality were 43% and 7% ( $p = 0.01$ ), respectively.

**Conclusion:** Although acute reperfusion therapy might improve stroke outcome in stroke patients receiving maintenance HD, a careful risk-benefit assessment should be made before starting the therapy because of high mortality rate.

### WSC-1108

#### Acute Reperfusion Treatment Differences in clinical outcome in endovascular treated patients in the MR CLEAN pretrial cohort: General versus local anesthesia (The MR CLEAN Pretrial Investigators)

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**Introduction:** Recent studies indicate that general anesthesia (GA) during intra-arterial treatment (IAT) in patients with acute ischemic stroke (AIS) is associated with poor clinical outcome, even when adjusted for baseline stroke severity. Several factors could contribute to these findings, including intubation, blood pressure shifts and prolonged hypercapnia during GA. Furthermore GA could cause important treatment delay. On the other hand local anesthesia (LA) allows patient movement during procedures resulting in a possible higher rate of periprocedural complications. Unfortunately, previous studies presented limited results due to methodological inconsistencies. Therefore, definite conclusions could not be drawn yet. It is still unknown whether general or local anesthesia – with or without conscious sedation – is a better choice during IAT in acute ischemic stroke regarding clinical outcome.

**Aims:** To determine the differences in clinical outcome in endovascular treated patients with AIS of the anterior circulation treated under GA or LA.

**Methods:** In the MR CLEAN pretrial study 368 patients with an acute ischemic stroke of the anterior circulation were treated with IAT between 2005–2013 in 16 Dutch Hospitals. Primary outcome was functional outcome on the modified Rankin Scale at discharge. Secondary outcomes

included differences in recanalization rates, peri- and post procedural complications and treatment time intervals between the 2 groups. A logistic regression analysis was performed to determine independent predictors of outcome.

*Results:* Results will be presented at the conference.

### WSC-0663

#### Acute Reperfusion Treatment Acute ischemic stroke recanalization with IV TPA causing cerebral hyperperfusion syndrome

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*Introduction/Aim:* Cerebral hyperperfusion syndrome (CHS) occurs with surgical/endovascular revascularization of a chronically atherosclerotic carotid artery. This phenomenon is unexpected when an acutely occluded artery is recanalized by IV-TPA in acute ischemic stroke. We describe a series of 9 patients with CHS seen on multimodal hemodynamic and functional evaluations.

*Methods:* Consecutive patients in whom the occluded internal carotid artery or middle cerebral artery showed recanalization in the day-2 CT-Angiogram, were observed for any new neuropsychiatric symptoms/signs that were unexpected or had considerable mismatch between clinical and neuroimaging findings. If present they underwent multimodal evaluation with serial transcranial Doppler (TCD), quantitative electroencephalography (QEEG) and HMPAO-SPECT. CHS was deemed to have occurred if the unexpected neuropsychiatric signs corresponded with TCD flow velocity >100% of the contralateral vessel, EEG showed abnormal activity and HMPAO-SPECT scan showed markedly increased cerebral perfusion compared to contralateral side.

*Results:* From 2012–2013, 165 patients treated with IV-TPA, 8 (4.8%) patients fulfilled our definition of CHS. All 8 patients developed these unexpected symptoms 2–3 days after thrombolysis. Abnormalities on TCD, QEEG and HMPAO-SPECT were observed in all patients. Unexpected symptoms included dull-aching headache (4 cases), unexplained persistent drowsiness (3 cases), visual neglect (2 cases), aphasia (2 cases) and severe suicidal thoughts despite complete neurological recovery (1 case). Upright posture and aggressive blood pressure control resulted in resolution of abnormal neurological features within a week. None of them developed intracranial hemorrhage.

*Conclusion:* Patients with Cerebral Hyperperfusion Syndrome after recanalization by intravenous thrombolysis in acute ischemic stroke can develop unexplained neuropsychiatric manifestations.

### WSC-0316

#### Acute Stroke Management Association of baseline dyslipidemia with stroke recurrence within 5 years after ischemic stroke

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*Background and purpose:* The association between dyslipidemia (DL) and stroke recurrence is unclear, but may be influenced by different subtypes

of stroke. This study aims to explore whether DL contributes to the recurrence of certain subtypes of ischemic stroke (IS).

*Methods:* Data from the Ege Stroke Registry was examined and 5 years follow-up data for stroke recurrence was analyzed. Trial of Org 10172 in Acute Stroke Treatment criteria was used to classify the subtypes of all IS. Recurrent stroke was defined as a new neurological deficit compatible to IS or intracerebral hemorrhage. The association between DL and stroke recurrence in patients with different IS subtypes was analyzed by using univariable and multivariable logistic regression models. Survival curves were estimated with Kaplan-Meier methods, and survival analyses were undertaken using Cox Proportional-hazards models.

*Results:* Of 9 940 patients with IS, 5838 (58.7%) had DL and 2202 (22.2%) experienced a stroke recurrence within 5 years. The frequency of stroke recurrence of patients with DL was insignificantly higher than those without at 5 years of follow-up (18.0% versus 17.0%;  $P=0.21$ ). After stratification by Trial of Org 10172 in Acute Stroke Treatment subtypes, multivariable analysis revealed a significant association between DL and stroke recurrence in all ischemic stroke at 5 years (odds ratio, 1.2; 95% confidence interval, 1.02–1.42), and in the large-artery disease subtype (odds ratio, 1.46; 95% confidence interval, 1.12–1.91) but not in the other stroke subtypes (cardioembolic: odds ratio, 1.18; 95% confidence interval, 0.84–1.65; small-artery disease: odds ratio, 1.24; 95% confidence interval, 0.87–1.76; other subtype: odds ratio, 0.79; 95% confidence interval, 0.48–1.31). The probability of stroke recurrence increased in patients with LAD and DL compared to other subtypes of stroke (log rank test (Mantel-Cox)  $P < 0.013$ ).

*Conclusions:* Our results showed that DL is related to the recurrent strokes in patients with IS within 5 years after ischemic stroke, specifically to the large-artery disease subtype.

### WSC-0323

#### Acute Stroke Management Association of leukoaraiosis with stroke recurrence within 5 years after ischemic stroke

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*Background and purpose:* Leukoaraiosis (LA) is closely associated ischemic stroke. The association between leukoaraiosis and stroke recurrence and dementia is unclear, but may be influenced by different subtypes of stroke. In this study we sought to identify whether leukoaraiosis contributes to the recurrence of certain subtypes of stroke.

*Methods:* Data from the Ege Stroke Registry was examined and 5 years follow-up data for leukoaraiosis and stroke recurrence was analyzed. Leukoaraiosis was defined as white matter hyperintensity within the region starting at the lateral ventricular border and extending up to the cortico-medullary junction on MR images and hypodensity on CT scan. Recurrent stroke was defined as a new neurological deficit compatible to ischemic stroke or intracerebral hemorrhage. The association between leukoaraiosis and stroke recurrence in patients with different stroke subtypes was analyzed by using univariable and multivariable logistic regression models. Survival curves were estimated with Kaplan-Meier methods, and survival analyses were undertaken using Cox Proportional-hazards models.

*Results:* Of 9 522 patients with stroke patients, 1280 (41.3%) with LA and 91 (58.7%) without LA experienced a stroke recurrence within 5 years (odds ratio, 1.5; 95% confidence interval, 1.39–1.69). The frequency of stroke recurrence of patients with LA was insignificantly higher than those without at 5 years of follow-up (18.0% versus 17.0%;  $P=0.21$ ). After stratification by stroke subtypes, multivariable analysis revealed a significant association between LA and large-artery disease (LAD (OR, 1.39; 95% CI, 1.18–1.64), in the small-artery disease (SAD) (OR, 1.57; 95% CI, 1.27–1.94), and in the intracerebral hemorrhage (ICH) subtype

(OR, 1.88; 95% CI, 1.32–2.66), except cardioembolic stroke and “other” stroke subtypes at 5 years after stroke onset. The survival analysis showed that stroke recurrence was significantly higher in patients with severe LA compared those with mild/moderate LA (log rank test (Mantel-Cox)  $P < 0.001$ ).

**Conclusions:** Our results showed that *leukoaraiosis* is related to the recurrent strokes in all patients with stroke within 5 years after ischemic stroke, specifically to the large-artery disease, small-artery disease, and intracerebral hemorrhage subtypes.

## WSC-1224

### Acute Stroke Management Neuroprotective consequences of postconditioning on embolic model of cerebral ischemia in rat

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**Objective(s):** It has been reported that ischemic postconditioning, conducted by a series of brief occlusion and release of the bilateral common carotid arteries, confers neuroprotection in permanent or transient models of stroke. However, consequences of postconditioning on embolic stroke have not yet been investigated.

**Materials and methods:** In the present study, rats were subjected to embolic stroke ( $n = 30$ ) or sham stroke ( $n = 5$ ). Stroke animals were divided into control ( $n = 10$ ) or three different patterns of postconditioning treatments ( $n = 20$ ). In the first pattern of postconditioning (PC10,  $n = 10$ ), the common carotid arteries (CCA) were occluded and reopened 10 and 30 sec, respectively for 5 cycles. Both occluding and releasing times in pattern 2 (PC30,  $n = 5$ ) and 3 (PC60,  $n = 5$ ) of postconditionings, were five cycles of 30 or 60 sec, respectively. Postconditioning was induced at 30 min following the stroke. Subsequently, cerebral blood flow (CBF) was measured from 5 min before to 60 min following to stroke induction. Infarct size, brain edema and neurological deficits and reactive oxygen species (ROS) level was measured two days later.

**Results:** While PC10 ( $P < 0.001$ ), PC30 and PC60 ( $P < 0.05$ ) significantly decreased infarct volume, only PC10 decreased brain edema and neurological deficits ( $P < 0.05$ ). Correspondingly, PC10 prevented the hyperemia of brain at 35, 40, 50 and 60 min after the embolic stroke ( $P < 0.005$ ). No significant difference in ROS level was observed between PC10 and control group.

**Conclusion:** Ischemic postconditioning reduces infarct volume and brain edema, decreases hyperemia following to injury and improves neurological functions after the embolic model of stroke.

## WSC-1485

### Acute Stroke Management An open-label evaluator-blinded study of minocycline protection in ischemic stroke: Gender-dependent effect

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**Introduction:** Minocycline is an antibiotic which has been found to have neuroprotective effect in some neurodegenerative diseases.

**Aims:** In this study, we sought to determine the efficacy of oral minocycline adjunct to standard basic therapy in improving neurological outcomes of patients with ischemic stroke during 3 months follow-up.

**Methods:** In an open-label evaluator-blinded trial, sixty patients with ischemic stroke were allocated into two groups to receive either 200 mg of oral minocycline daily during 6–24 hours following onset of signs and symptoms for 5 days, or not receiving any, as control; all patients also

received standard basic therapy. Clinical assessment at baseline, days 30, 60, and 90 were evaluated using National Institutes of Health Stroke Scale (NIHSS) score.

**Results:** Fifty-three patients (88.3%) completed study. The females in treatment and control groups were 53.8% and 51.9%, respectively ( $p = 0.884$ ). NIHSS score was significantly lower in minocycline-treated group compared with control on day 90 ( $5.73 \pm 2.69$  versus  $7 \pm 2.62$ ,  $p = 0.031$ ). Among males, NIHSS was higher in control as compared with minocycline received subjects on days 30, 60 and 90 ( $p < 0.005$ ); however, females did not show any significant differences. No adverse outcomes including myocardial infarction, recurrent stroke, and mortality were observed in both groups.

**Conclusions:** Patients with acute ischemic stroke who received oral minocycline daily for five days had significantly better neurological outcomes at 90-day follow-up period as compared with patients received none. However, female subjects did not show any significant clinical improvement in comparison with males.

## WSC-1399

### Acute Stroke Management Intravenous thrombolysis of acute ischemic stroke – Five years clinical experience

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**Aim:** To summarize and analyze the own results of treating patients with acute ischemic stroke (AIS) with Actilyse® for five years period of time.

**Methods:** For the period from 2009 to 2013 in the territory of the Second Clinic of Neurology with ICU- University Hospital “St. Marina”- Varna are conducted 166 (3.1%) thrombolysis in patients with acute ischemic stroke, from total 5353 patients, hospitalized with the letter diagnosis, classified by using etiopathogenic classification TOAST. Neurological status in each of the patients is examined and estimated with NIHSS. It is performed laboratory test, applied twice a CT scan of the brain (after hospitalization and one more within 24 hours after the thrombolysis) and also Duplex Scanning of the magistral brain vessels in the first 24 hours after the onset of the symptoms. The evaluation of the functional status of the patients, is twice performed with modified Rankin Scale (mRS) before hospital discharge and after 3 month from the incident.

**Results:** Among the thrombolysed patients with AIS, the highest relative part has thrombotic stroke – 43.3% (72/166), followed by the cardioembolic stroke – 33.7% (56/166), cryptogenic – 12.8% (20/166) and lacunar – 10.8% (18/166) stroke. Summarized mean time from admitting the patients in ER to starting the thrombolysis (door-to-needle time) is  $75.5 \pm 28.3$  min. The neurological deficit in admission, estimated with NIHSS, varies from 7 to 21 points, mean  $13.3 \pm 6.9$  points, after hospital discharge, the rates are between 1 and 19 points, mean  $6.12 \pm 5.1$  points. The functional status of the survived patients with thrombolysis according mRS (0–2) is registered in 27.6% (37/134) and with mRS (3–5) are 73.8% (99/134) of the patients. In 90th day after the stroke with mRS (0–2) i.e. functional independence or without significant neurological deficit are 69.6% (85/122) of the patients, and with significant neurological deficit – mRS (3–5) are 27.9% (34/122). Symptomatic intracerebral hemorrhage are observed in 11 patients (6.6%) with thrombolysis. Died during the hospitalization are 19.7% (32/166) of the patients.

**Conclusions:** The study suggests relative low rate of treatment with thrombolysis in patients with AIS and similar rate of complications, compared with other studies.

**Key words:** acute ischemic stroke, thrombolysis.

**WSC-1401****Acute Stroke Management  
Treatment of acute stroke in patients on  
anticoagulation therapy**S Andonova<sup>1</sup>, T Dimitrova<sup>1</sup>, E Kalevska<sup>1</sup>, M Petkova<sup>1</sup>, V Argirova<sup>1</sup>, T Tzvetkov<sup>1</sup><sup>1</sup>Department of Neurology, University Hospital "St. Marina", Varna, Bulgaria

**Aim:** Cerebrovascular diseases are global medical and social problem due to high prevalence (morbidity), mortality and disability, caused by them. One of the leading causes of ischemic stroke is atrial fibrillation (AF). It is proven that anticoagulation therapy can reduce the risk of stroke and has been used for many years in cardioembolic stroke patients. The aim of the study is to summarize and analyze the own results of treating patients with acute ischemic stroke (AIS) on anticoagulation therapy.

**Methods:** For the period from 2007 to 2013 in the territory of the Second Clinic of Neurology with Intensive Care Unit (ICU) – University Hospital "St. Marina" – Varna are conducted 186 (3.3%) thrombolysis in patients with acute ischemic stroke, from total 8199 patients, hospitalized with the letter diagnosis, classified by using etiopathogenic classification TOAST. Neurological status in each of the patients is examined with NIHSS. It is performed laboratory test, applied ones or twice a CT scan of the brain (after hospitalization and one more within 24 hours by patients underwent thrombolysis) and also Duplex Scanning of the magistral brain vessels in the first 24 hours after the onset of the symptoms. The evaluation of the functional status of the patients, is twice performed with modified Rankin Scale (mRS) – before hospital discharge and after 3 month from the incident.

**Results:** According etiopathogenic classification TOAST, patients, treated with iv rt-PA are classified as: 45.3% – with thrombotic stroke, 38.5% – cardioembolic stroke, followed by cryptogenic – 8.6% and lacunar – 7.6 stroke. From all 38.5% with cardioembolic stroke treated with rt PA, 48% were on tradition anticoagulation therapy with INR less than 1.5. The neurological deficit in admission, estimated with NIHSS, varies from 7 to 21 points, mean  $14.3 \pm 5.5$  points, after hospital discharge, the rates are between 1 and 19 points, mean  $6.12 \pm 5.1$  points.

**Conclusions:** The study suggests relative low rate of treatment with thrombolysis in patients with AIS on anticoagulation therapy and similar rate of complications, compared with other studies. By virtue of all the case reports and studies, there is well-established protocol for patients taking traditional anticoagulants as thrombolytic agents. Since the approval of new oral anticoagulants, such as dabigatran, rivaroxaban, and apixaban, there are not readily detected by standard coagulation tests. However, there is no standard protocol for the use of thrombolytic therapies in patients who are using the new anticoagulants. That is the one major issue nowadays, because more and more patients are treated with the new oral anticoagulants.

**Key words:** acute ischemic stroke, thrombolysis, anticoagulation therapy.

**WSC-0189****Acute Stroke Management  
FAST-AV scale for early recognition of posterior  
circulation strokes**K Antonenko<sup>1</sup>, L Sokolova<sup>1</sup><sup>1</sup>Neurology, Bogomolets National Medical University, Kiev, Ukraine

The Face Arm Speech Test (FAST) tool is used for rapid recognition of strokes but has limitations in identifying those affecting the posterior circulation (PC). PC strokes are often presented with more than one symptom and their clinical picture can be different against to the affected anatomical PC structures.

**Objective:** to mark out main symptoms of PC strokes and increase recognition of PC ischemic strokes by the use of FAST-AV scale (Patent 74909 Ukraine IPCA 61B 5/00 from 12.11.2012).

**Patients and methods:** 70 patients (38 men and 32 woman, age range 32–82 years, mean 58,7) with acute ischemic PC strokes were assessed with respect to the FAST tool, compared to the FAST-AV scale.

FAST-AV Screening Tool – F: Facial weakness; A: Arm weakness; S: Speech problems; A: Ataxia (cerebellar dysfunction); V: Visual disturbances.

Localization of the ischemic lesion in the sequel was verified with DWI.

**Results:** 21% of the ischemic lesions were located within proximal PC territory, 28% within middle and 51% within distal. Presenting features included vertigo (58,6%), sensory pain/temperature hypoesthesia (50,0%), nausea/vomiting (51,4%), cerebellar ataxia (48,6%), dysarthria (45,7%), headache (41,4%), motor dysfunction (35,7%), tactile hypoesthesia (32,9%), nystagmus (31,4%), hemianopsia (24,3%), disturbed consciousness (15,7%). 40 patients (57,1%) were FAST positive but with the use of FAST-AV tool diagnosis of ischemic stroke in PC was revealed in 88,6% patients.

**Conclusions:** FAST remains as important screening tool but supplementary FAST-AV screening test should help the early recognition of FAST-negative strokes and minimize time interval to referral and treatment.

**WSC-0605****Acute Stroke Management  
The multidisciplinary participatory swallowing team  
approach significantly decreased the rate of  
pneumonia in acute stroke patients**S Aoki<sup>1</sup>, N Hosomi<sup>1</sup>, J Hirayama<sup>2</sup>, M Nakamori<sup>1</sup>, T Nezu<sup>1</sup>, S Kubo<sup>1</sup>, K Ochi<sup>1</sup>, H Yamamoto<sup>2</sup>, H Maruyama<sup>1</sup>, M Matsumoto<sup>1</sup><sup>1</sup>Clinical Neuroscience and Therapeutics, Hiroshima University Hospital, Hiroshima, Japan<sup>2</sup>Nursing, Hiroshima University Hospital, Hiroshima, Japan

**Introduction:** Dysphagia is caused in acute stroke patients at high rates, and many of them have suffered aspiration pneumonia. Pneumonia incurs extended hospitalization and decreases the rate of discharge to home. So, early intervention for dysphagia is important to prevent aspiration pneumonia for acute stroke patients. Team approaches with cooperation of various professions have the power of improving the quality of medical care utilizing specialized knowledge and skills of each profession. In our hospital, a multidisciplinary participatory swallowing team was organized in April 2011.

**Aims:** This study was to clarify the influence of team approach by comparing the rate of pneumonia in acute stroke patients between prior and post team organization.

**Methods:** We examined the patients' characteristics, stroke severity, examination findings of consecutive acute stroke patients who were admitted in our hospital, and evaluated difference in the rate of pneumonia between prior and post team organization each for 2 years, and factors that influence pneumonia.

**Results:** We recruited 132 patients in the prior period (April 2009–March 2010) and 120 patients in the post period (April 2011–March 2012). Age, sex, and NIHSS on admission were shown no significant differences between two groups. The rate of pneumonia was significantly lower in the post period than the prior period (7.5% vs. 17.4%, respectively;  $P = 0.02$ ). With multivariate logistic analysis, NIHSS > 9 on admission, diabetes mellitus, and not receiving a swallowing team approach were independently related to pneumonia.

**Conclusions:** The multidisciplinary participatory swallowing team approach is quite effective for decreasing pneumonia for acute stroke patients.

**WSC-0963****Acute Stroke Management  
Continue versus stop temporarily prestroke  
anti-hypertensive drugs: Meta-analysis of individual  
patient data from randomized trials**P M W Bath<sup>1</sup>, L Woodhouse<sup>1</sup>, E Berge<sup>2</sup>, E C Sandset<sup>3</sup>, T Robinson<sup>4</sup><sup>1</sup>Stroke – Division of Clinical Neuroscience, University of Nottingham, Nottingham, United Kingdom<sup>2</sup>Department of Internal Medicine, Oslo University Hospital, Oslo, Norway<sup>3</sup>Department of Neurology, Oslo University Hospital, Oslo, Norway<sup>4</sup>Department of Cardiovascular Sciences, University of Leicester, Leicester, United Kingdom

**Background:** Around 50% of patients with an acute stroke were taking regular antihypertensive drugs before ictus. Whether to continue or stop these temporarily during the acute phase of stroke remains unclear.

**Methods:** We searched for randomized controlled trials in patients with acute stroke that involved continuing versus stopping antihypertensive drugs: angiotensin converting enzyme-inhibitors (ACE-I), angiotensin receptor antagonists (ARA), beta-receptor antagonists ( $\beta$ -RA), calcium channel blockers, diuretics, alpha-receptor antagonists, and centrally acting drugs. The effect of continuing versus stopping drugs on outcome (modified Rankin Scale, mRS; Barthel Index, BI) and blood pressure were assessed using ordinal logistic regression and multiple regression, with adjustment for baseline prognostic factors and the number of BP-lowering drugs. Three sets of analyses were performed: (a) trials comparing continue vs stop prestroke antihypertensive drugs; (b) trials involving continuing vs stopping inhibitors of the renin-angiotensin-aldosterone-system (RAAS: ACE-I, ARA,  $\beta$ -RA); and (c) trials involving continuing vs stopping drugs that do not inhibit the RAAS.

**Results and conclusion:** Individual patient data were obtained for three trials: COSSACS, ENOS, SCAST, these involving 6,803 patients. ENOS has yet to report its primary results so the results of this meta-analysis based on individual patient data will be available to present in October.

**WSC-0886****Acute Stroke Management  
Effect of glyceryl trinitrate on outcome in acute stroke  
by time to treatment: An individual patient data  
meta-analysis**P M W Bath<sup>1</sup>, L Woodhouse<sup>1</sup>, K Krishnan<sup>1</sup><sup>1</sup>Stroke – Division of Clinical Neuroscience, University of Nottingham, Nottingham, United Kingdom

**Background:** Nitric oxide (NO) is a candidate treatment for acute stroke due to its multimodal activity, including vasodilator, blood pressure lowering and neuroprotection. Glyceryl trinitrate (GTN), a NO donor, has been studied in several trials in patients with ultraacute, hyperacute, acute or subacute stroke.

**Methods:** Randomized controlled trials of GTN versus control were identified through electronic searches of databases and individual patient data collated. The effect of GTN on outcome (modified Rankin Scale, mRS; Barthel Index, BI) and blood pressure were assessed both overall and in prespecified subgroups, including by time to treatment. Data are number (%) or mean (standard deviation).

**Results:** Five trials (4 phase II, 1 phase III) were identified, these involving 4,197 patients (GTN 2113, no GTN 2084) treated with acute or subacute stroke: age 70 (12) years, male 57%, Scandinavian Stroke Scale 32 (12), patients enrolled within 6 hours 314 (7%). Individually, GTN significantly improved the mRS in one small trial (n = 41) of ultra-acute treatment (<4 hours) and had no effect on mRS in 3 other small trials when administered later than 6 hours. The primary results of the large ENOS trial

(n = 4,011, including n = 273 enrolled <6 hours) have yet to be presented thereby precluding reporting of outcome data at this stage.

**Conclusion:** The overall results of this individual patient data meta-analysis will be available to present at WSC, Istanbul.

**WSC-0967****Acute Stroke Management  
Cochrane systematic review of interventions for  
dysphagia in acute stroke**P M W Bath<sup>1</sup>, H S Lee<sup>1</sup><sup>1</sup>Stroke – Division of Clinical Neuroscience, University of Nottingham, Nottingham, United Kingdom

**Background:** Dysphagia is common (~50%) after stroke and is associated with a poor outcome. However, the treatment of dysphagia remains unclear.

**Methods:** We updated our Cochrane systematic review that assesses the effectiveness of interventions in stroke patients with dysphagia. Searches were carried out on the Cochrane Stroke Group trials register, databases, review articles and reference lists (January 2014). Randomized controlled trials in dysphagic patients within 3 months of stroke were included. Odds Ratios (OR, 95% confidence intervals) and mean differences (MD) were calculated using random effects models in view of heterogeneity. Results are reported where there is more than one trial with relevant data.

**Results:** Dysphagia was reduced with acupuncture (OR 0.24, 95% CI 0.13–0.45) and behavioral interventions (BH: OR 0.52, 95% CI 0.30–0.88). Trends to reduced length of stay in hospital were present for BH (MD –2.7, 95% CI –5.7, 0.28) and electrical pharyngeal stimulation (EPS: MD –12.6, 95% CI –26.6, 1.3). On videofluoroscopy, EPS was associated with a reduced penetration aspirations score (MD –4.3, 95% CI –8.3, –0.3). Treatment failure was less common with PEG than nasogastric tube feeding (OR 0.08, 95% CI 0.01–0.49). Nutritional supplementation was associated with less pressure sores (OR 0.56, 95% CI 0.32–0.96) and higher energy and protein intake.

**Conclusions:** The numbers of management strategies for poststroke dysphagia, and trials and recruited patients, are increasing. Although several strategies have potentially useful effects, none yet have definitive evidence across multiple outcome domains to support their widespread routine use.

**WSC-1170****Acute Stroke Management  
Timing of the delivery of intra-arterial treatment for  
acute ischemic stroke (on behalf of the MR CLEAN  
Investigators)**O A Berkhemer<sup>1</sup>, N Boedt<sup>2</sup>, P S S Fransen<sup>2</sup>, D Beumer<sup>3</sup>, W H van Zwam<sup>4</sup>, R J van Oostenbrugge<sup>3</sup>, A van der Lugt<sup>5</sup>, Y B W E M Roos<sup>6</sup>, C B L M Majoie<sup>1</sup>, D W J Dippel<sup>2</sup><sup>1</sup>Radiology, Academic Medical Center, Amsterdam, Netherlands<sup>2</sup>Neurology, Erasmus MC University Medical Center, Rotterdam, Netherlands<sup>3</sup>Neurology, Maastricht University Medical Center, Maastricht, Netherlands<sup>4</sup>Radiology, Maastricht University Medical Center, Maastricht, Netherlands<sup>5</sup>Radiology, Erasmus MC University Medical Center, Rotterdam, Netherlands<sup>6</sup>Neurology, Academic Medical Center, Amsterdam, Netherlands

**Introduction:** Short time to treatment is a first requirement to obtain good functional outcome in patients with acute ischemic stroke.

**Aims:** We investigated if and when delays from stroke onset to intra-arterial treatment (IAT) occurred and assessed factors related to such delay.

**Methods:** Prospective evaluation of predefined time factors was conducted in patients undergoing intra-arterial therapy in 13 Dutch hospitals of the MR CLEAN trial, a randomized clinical trial of IAT versus no IAT. We used multivariable linear regression models to analyze time delays.

**Results:** A total of 353 patients (mean age 64 years; 62% male; mean NIHSS 17) were included, of which 156 (45%) received IAT. Median onset to IAT time was 265 minutes (interquartile range (IQR) 225–305), median onset to door time was 87 minutes (IQR 45–190) and median door to IAT time was 130 minutes (IQR 98–170). Initial presentation in an intervention center decreased time to intra-arterial therapy with 101 minutes compared to referral for trial participation from other outside hospitals. Furthermore, for every minute a patient presented earlier, in-hospital time delay increased with 0.4 minutes (95% CI: 0.3–0.4). General anesthesia caused time delay of 15.1 minutes (95% CI: 6.9–23.4).

**Conclusions:** Improving time to treatment remains a major challenge in treatment of acute ischemic stroke. Our findings suggest that time to treatment could be shortened by reducing transfer delays or by avoiding transfer. Furthermore, there is room for improvement of in-hospital delay, especially in patients with early presentation.

## WSC-1081

### Acute Stroke Management

#### Frequency of intra-arterial occlusion in acute ischemic stroke: Potential impact on clinical stroke care

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**Introduction and aims:** The relative frequency of proximal intracranial arterial occlusion (PIAO) in acute ischemic stroke (AIS) is unknown. Since this is important clinically, for manpower planning and resource allocation, we estimated the proportion of patients with PIAO and assessed the percentage eligible for intra-arterial treatment.

**Methods:** We collected data from a registry of consecutive stroke patients at the emergency department from 2006 to 2012. PIAO of branches of the internal carotid, vertebral and basilar arteries were considered relevant if neurologic symptoms were consistent with the location of the occlusion.

**Results:** Of 1103 consecutive patients, 618 arrived after 6 hours, 144 patients had a CTA more than 7 hours after stroke onset and 38 patients were stroke mimics. The remaining 303 patients had a mean age of 63 years (SD ± 16), 151 patients (50%) were male. The median NIHSS was 6 (IQR 0–22). In total, 87 patients (29%; 95% CI: 24% to 34%) had a relevant PIAO. In 68 patients (78%) this concerned a PIAO in the carotid, in 19 (22%) the vertebrobasilar distribution. In total, 76 (87%) patients were eligible for intra-arterial treatment, this amounts to 7.9% (95% CI: 6.4% to 9.4%) of all patients with AIS. The only significant predictor of PIAO was NIHSS Score (OR per item point: 1.15, 95% CI: 1.10 to 1.19) adjusted for age and sex.

**Conclusion:** Almost one third of patients with acute ischemic stroke have a relevant PIAO. This has great consequences for stroke care if intra-arterial treatment has been proven effective.

## WSC-1321

### Acute Stroke Management

#### Acute neurovascular syndrome in a patient with acute carotid occlusion: A case report management

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**Introduction:** Carotid occlusion is catastrophic, incidence and prevalence difficult to know. Clinical manifestations from asymptomatic to great neurological deficit/death due to collateral flow, which change according body posture, hydration, cardiac output, etc.

**Aims:** To report an acute management with carotid endarterectomy.

**Case report:** A 50 yo man consults with headache, unconsciousness, right paresis and paresthesia. Evaluated by neurologist as an ANS, CT disclosed ASPECTS 10, NIHSS 6 which improved to 1, then deteriorates with aphasia and right paresia (NIHSS 9) with improvement in recumbent position. With change in body posture (up/down) NIHSS fluctuated. An arteriography disclosed a LCCA sub-occlusion. A surgical thromboembolotomy was performed, local anesthesia, 9 minutes of carotid clipping. NIHSS after procedure was 2 and control CT showed a small hypodensity, ASPECTS 9. During following evaluations NIHSS improved to 1 and 0. At discharge time a lacunar lesion was disclosed in CT. The TEE showed aortic atheromas with trombi. No cardiac arrhythmia was documented, neither coagulopathy.

**Results:** A successful surgical therapy with reperfusion in a patient with a carotid sub-occlusion. Good recovery from fluctuating NIHSS 6-1-9 according body posture to 2 postsurgery and 0 at discharge.

**Conclusions:** The immediate CBF reestablishment in a short period of time improves morbidity/mortality in patients with acute carotid sub-occlusive lesions. Today studies with endovascular thrombectomy are on going and surgical therapy is an option, which has been reported but is not always in mind.

## WSC-1609

### Acute Stroke Management

#### Effective mechanical thrombectomy in a patient with hyperacute ischemic stroke associated with cardiac myxoma

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**Introduction:** We report a patient with hyperacute stroke caused by cardiac myxoma and who had a good outcome with rapid recanalization through mechanical thrombectomy.

**Case:** A 46-year-old man was admitted because of right hemiplegia developed 50 minutes ago. He had no history of illness. His mental status was alert, but he had global aphasia and right hemiplegia. Brain CT revealed no hemorrhage. Perfusion CT revealed hypoperfusion in left middle cerebral artery (MCA) territory. CT angiography showed T-occlusion of left internal carotid artery (ICA). Intravenous recombinant tissue plasminogen activation was administered. However, his clinical symptoms were not improved. Forced-suction thrombectomy with balloon tipped guiding catheter was attempted. A large amount of gray whitish to reddish clot was removed. The left distal ICA and MCA M1 were fully recanalized,

although left M2 superior division was re-occluded. Micro-suction thrombectomy was performed with Penumbra system reperfusion catheter and achieving revascularization of the left M2. However, the left ICA angiogram showed that the choroidal crescent was not seen. The following day, his global aphasia was improved, but he complained left eye blindness. It was thought that cilioretinal artery occlusion contributed to visual loss. A pathologic examination of the retrieved clot revealed a removal of cardiac myxoma. Echocardiogram revealed left atrial myxoma. The patient underwent resection of the myxoma and pathology confirmed an atrial myxoma.

**Conclusion:** Reperfusion therapy with mechanical thrombectomy might be safe and effective for rapid revascularization of large vessel occlusion in hyperacute ischemic stroke, with which the tumor thrombi can be retrieved.

### WSC-0833

#### Acute Stroke Management

#### A decade of acute stroke progress at a Melbourne hospital

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**Introduction:** Box Hill Hospital (BHH) began thrombolysing acute stroke patients in 2003. Since then, acute stroke care has seen the expansion of the treatment window and CT capabilities, the emergence of code stroke teams and new models of care; all in an effort to provide first class treatment to our patients.

**Aim:** To document the evolution of stroke thrombolysis practices at BHH in the last decade.

**Methods:** We performed a retrospective analysis of our stroke thrombolysis database, comparing annual presentations, treatment times and protocol changes.

**Results:** Since the stroke unit opened in 2003, BHH has seen many process changes. The first acute stroke nurse was employed in 2004, multimodal scans became routine care in 2009 and we formalized our code stroke team in 2010. Ongoing collaboration with Ambulance Victoria since 2004 has seen improvements in prehospital notifications, which facilitated a Direct to CT protocol in 2013. Since 2003, annual stroke presentations have risen 70% (381 to 648), with a 280% increase in Code Stroke calls (150 to 564). Annual thrombolysis rates have risen from 11% to 18%, (a 300% increase in patient numbers), while overall treatment times have decreased (Door-to-CT [DTCT] 40 mins to 21 mins; Door-to-Needle [DTN] 93 mins to 60 mins), with even greater reductions in-hours (DTCT 13 mins; DTN 43 mins).

**Conclusions:** In the last decade, BHH has seen many changes to acute stroke management. Through innovation and collaboration we have, and continue to, improve our stroke services to ensure best practice and optimal outcomes for our patients.

### WSC-1142

#### Acute Stroke Management

#### Establish a specialist in neurology program in Brunei Darussalam with the help of telemedicine

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**Introduction:** Neurology will be one of the major columns of medicine. With a worldwide lack of neurological knowledge there is an obvious high need for specialist in Neurology training as well as a need of neurological centers. Since 7/2010, a transcontinental cooperation between the Brunei Neuroscience Stroke and Rehabilitation Centre (BNSRC), Brunei Darussalam (BD) and the Department of Neurology, Krankenhaus Nordwest (KHNW), Frankfurt, Germany has been successfully implemented. BNSRC is the 1st neurological facility in BD, therefore local doctors has to be trained in the field of neurology to ensure that they can handle the patients as well as to get a curriculum of neurology in order to become specialist in neurology. This program is established and conducted by Universiti Brunei Darussalam, the University of Heidelberg, Germany, Johns Hopkins, USA, KHNW and BNSRC.

**Methods:** The total duration shall normally be at least 60 months full-time. We established a Teleteaching program including on site teaching. It consists of different modules; electrophysiology training, EEG education, clinical examination including scales for different diseases and the grand round. The grand round is basically a teaching ward round performed by Head of Department and consultant neurologists to discuss selected patients. The local doctor report the history, demonstrate physical symptoms, diagnostic work up and therapeutic strategies are discussed as well as all medical findings.

**Results:** 2 local doctors are enrolled, overall 7 doctors have taken part and past all assessments.

**Conclusion:** Neurological diseases are a major column and the prevention of stroke and other neurological diseases are more important than ever. As there is a need of specialists in Neurology worldwide, this specialist in neurology program can set a milestone in teaching of neurologic skills with the help of telemedicine to overcome distances.

### WSC-0691

#### Acute Stroke Management

#### Clinical factors impacting dehydration in acute stroke

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**Introduction/Aims:** Acute stroke patients with dysphagia are at increased risk for dehydration. This study examined clinical factors that might impact dehydration in acute stroke patients.

**Methods:** A retrospective chart review was completed on 67 stroke patients who were in a prior study of nutrition and hydration status during acute care. Prior results indicated that patients with dysphagia demonstrated greater dehydration and blood urea nitrogen/creatinine ratios (BUN/Cr) increased during inpatient care. This chart review evaluated clinical variables potentially impacting hydration status: diuretics, intravenous (IV) fluids, tube feeding, oral diet, and nonoral (NPO) days.

**Results:** Patients with dysphagia demonstrated significantly higher BUN/Cr values at admission and values increased selectively during acute care (5.4 vs  $-0.01$  in patients without dysphagia). Dysphagia cases demonstrated significantly more NPO days, tube fed days, and IV fluid days, but not oral fed days, or days on diuretics. BUN/Cr  $>20:1$  at discharge was not associated with NPO days, IV fluid days, oral fed days, or days on diuretics. Patients on modified liquids had significantly higher BUN/Cr values at discharge (28.50 vs. 17.81) and greater change in this biomarker during inpatient care (8.73 vs.  $-0.64$ ). Patients on modified solid diets had significantly higher BUN/Cr values at discharge (31.11 vs. 17.23) and greater change during inpatient care (9.83 vs.  $-0.74$ ). No difference was noted between these subgroups at baseline (regular vs. modified liquids/diets).

**Conclusion:** Results from this study indicate that liquid and diet modifications prescribed for acute stroke patients with dysphagia may increase their risk of dehydration.

### WSC-1094

#### Acute Stroke Management Temporal trends of intravenous thrombolysis among acute ischemic stroke patients in a tertiary care center in northern India

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**Background:** Acute ischemic stroke (AIS) is a significant time dependent treatable cause of morbidity and mortality. Community awareness and proper planning has increased rates of intravenous tissue plasminogen activator (tPA) use in treating AIS.

**Aims:** To determine the trend in patient characteristics and rates of tPA use in AIS patients in a tertiary care center in northern India.

**Methods and results:** We analyzed all AIS patients (n = 461) presenting within 8 hour of symptoms onset from hospital stroke registry. Patients were managed as per standard guidelines. Out of 461 patients, 109 (23.64%) patients received intravenous thrombolysis (IVT) with tPA. Patient's onset-to-door time was  $\leq 2$  hours in 64.2%,  $\leq 3$  hours in 23.9% and  $\leq 4.5$  hours in 11%. A substantial change in onset-to-door time was seen over 3 years. IVT in  $<3$  hours of symptoms increased from 3.8% to 57.7% and in  $<2$  hours from 21.4% to 48.6% ( $P < 0.05$ ). Door-to-CT time (median 25 versus 18 minutes,  $P = 0.037$ ) and door-to-needle time (median 75 versus 65 minutes,  $P = 0.014$ ) improved, with 61.5% of tPA-treated patients getting imaged  $\leq 25$  minutes after arrival. Post IVT, hemorrhage was noticed in 15 (13.76%) patients. Median NIHSS at presentation was 12 while favorable mRS (0–2) at 3 months was 47.71% with improved trends.

**Conclusions:** Community awareness has significant impact in treating AIS, where time is vital. Developing countries like India show encouraging trends of treatment with IV tPA therapy in AIS patients.

### WSC-0389

#### Acute Stroke Management A rare case of stent-assisted angioplasty in patient with posttraumatic bilateral internal carotid artery dissection in the intrapetrous segment of the artery

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**Background:** Arterial dissection is a pathologic process characterized by splitting of the media or subadventitial layer of the arterial wall which

could lead to relevant narrowing of the arterial lumen. The clinical manifestation is with cerebral ischemic symptoms. Transient ischemic attacks are reported in 20% to 60% of cases. In as many as 20% of cases it is bilateral or associated with vertebral artery dissection. The intrapetrous segment is extremely rare location for an internal carotid artery dissection.

**Case report:** A 43-year-old female was admitted to our clinic 10 days after the onset of the disease. She complained of neck pain and tinnitus on the day of admittance. The patient reported an episode of speech difficulties, numbness and weakness of right extremities lasting 40 minutes, occurred 10 days prior to admittance. The patient reported being in a car accident two weeks prior to admittance, leading to head and neck trauma, consistent with whiplash syndrome.

The patient had no history of significant cardiovascular pathology. She denied smoking, drug abuse and alcohol consumption. On admission the patient was stable with a normal physical and neurological examination. The laboratory examinations were unremarkable. The ultrasonographic Doppler examination of the cervico-cerebral arteries showed thrombosis of the left internal carotid artery (LICA) and  $>70\%$  stenosis of the right internal carotid artery (RICA). Head MRI showed no structural abnormalities. The results of MRI-angiography confirmed the thrombosis of LICA in its intrapetrous segment and stenosis of the RICA due to dissection of the arteries. The patient was transferred to Clinic of Angiology and Phlebology of City Clinic Sofia for angiography and endovascular treatment. Angioplasty and RICA stenting were performed. The follow-up Doppler examination after the intervention showed patent stent in the RICA and persistent thrombosis of the LICA. The next follow up Doppler examination was one month later and showed patent stent in the RICA and recanalization of the thrombosis of the LICA.

**Conclusions:** Intrapetrous carotid artery dissection is a rare complication of head and neck trauma due to motor vehicle collision, that can be successfully treated with endovascular procedures.

### WSC-0193

#### Acute Stroke Management The relationship of 24-hours blood pressure and angiotensin-converting enzyme (ACE) gene polymorphism in acute stroke

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**Introduction:** The understanding of the potential impact of blood pressure (BP) in acute stroke remains incomplete. The ACE gene polymorphism is a possible associate with hypertension and increase risk of ischemic stroke (IS).

**Aim:** To determine the relationship of BP in acute IS and genetic variants of I/D ACE gene polymorphism.

**Methods:** 101 patients included in study (age  $64.8 \pm 0.96$ , males 42, females 59) with clinical and MRI proven diagnosis of IS. 24-hours BP monitoring was performed in first 72 hours. All patients were genotyped for I/D ACE gene polymorphism by polymerase chain reaction.

**Results:** The frequencies of ACE genotypes: II in 19 (18.8%), ID in 53 (52.5%) and DD in 29 (28.7%). Mean daytime systolic/diastolic BP was significantly higher in patients with DD ( $160.7 \pm 5.4/83.9 \pm 2.7$  mmHg) than with ID ( $154.5 \pm 3.2/80.6 \pm 1.8$  mmHg) ( $p < 0.05$ ) and II ( $147.4 \pm 4.6/76.6 \pm 3.7$  mmHg) ( $p < 0.05$ ) genotype. The raised BP variability observed in 65 (64.4%) patients from which 18.4% with II, 46.2% with ID and 35.4% with DD genotype. Nocturnal systolic/diastolic BP fall was lack in all genetic variants of ACE gene polymorphism but lower in DD genotype.

**Conclusion:** In patients with acute IS the pathological changes of a daily structure of BP – a higher level of systolic and diastolic BP, modified

circadian rhythm and raised BP variability was more significant in patients with ID and DD genotype. Daily monitoring of BP according ACE genotype is important for effective management of acute stroke.

### WSC-0219

#### Acute Stroke Management Management of stroke in a service of internal medicine of the suburbs of Dakar

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**Introduction:** Stroke is nowadays a real public health problem. Indeed, they remain frequent and severe due to their high mortality and sequelae they generate.

**Aims:** The objective of this study was to investigate the epidemiological and clinical profile of stroke and their care.

**Methods:** We evaluate by a retrospective and descriptive study, various epidemiological and clinical parameters of stroke in internal medicine service of NHC of Pikine.

**Results:** 34 cases were collected over a period of 24 months. Hospital prevalence was 2.1%. Women were more affected than men with a sex ratio of 0.66. The patients were on average 63.97 years. Women were more affected than men with a sex ratio of 0.54. All patients had consulted late beyond the third hour. Hypertension was the major risk factor. It was observed in 64.7% of patients. Obesity was present in 32.4%. Type 2 diabetes was noted in 29.4%. The ischemic strokes were 67.6% and 32.4% hemorrhagic strokes. For ischemic stroke, signs of atherosclerosis were identified in 35.3%, cardioembolic mechanism in 20.6%. Hypertension was observed in 81.2% with hemorrhagic stroke. Clinical examination showed a hemiplegia in 55.8% of cases and hemiparesis in 29.4% of cases. Twenty-six percent of patients had a deep coma on admission with a Glasgow score less than 9. The short-term outlook was favorable without recurrence in 9 patients or 26.5%. Mortality was 26.5%.

**Conclusion:** The management of stroke should be pluridiscipline and be more focused on primary prevention.

### WSC-0298

#### Acute Stroke Management Telephone consultation and teleradiology guided intravenous stroke thrombolysis can achieve similar outcome and safety as thrombolysis by neurologist on-site in a regional hospital

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**Introduction:** Due to the limitation of on-site neurology workforce, telestroke was implemented to provide stroke thrombolysis when neurologist was not on duty.

**Aim:** To explore the efficacy and safety of intravenous stroke thrombolysis service by telestroke in form of telephone consultation and teleradiology.

**Method:** From Jan 2009 to Dec 2012, we compared patients treated with intravenous stroke thrombolysis by telestroke, to patients treated after in-person assessment by the same team of neurologists in a regional

hospital. Door to needle time, symptomatic intracranial hemorrhage and functional outcome at 3 months were prospectively collected and compared between the groups.

**Results:** 152 patients were treated with intravenous thrombolysis. 102 patients were treated with neurologist onsite while 50 patients were treated by internists with telestroke. Fifty-two percent of the telemedical group achieved excellent outcome compared to 43% of the neurologist on-site group ( $P = 0.30$ ). Symptomatic intracranial hemorrhage rate (4.0% vs. 4.9%,  $P = 1.0$ ) and mortality (8.2% vs. 11.9%,  $P = 0.49$ ) were comparable. Using the multiple logistic regression analysis: age, baseline stroke severity and extent of early ischemic change on CT scan brain, are independent predictors for excellent outcome, while the presence of neurologist on site is not correlated with the outcome.

**Conclusion:** Patients treated without neurologist on site achieved similar outcome. Telephone consultation and teleradiology guided intravenous stroke thrombolysis, with the support of on-site internist appeared safe and efficacious.

### WSC-0404

#### Acute Stroke Management Outcome and stroke recurrence in stroke patients with prior cardiovascular atherothrombotic disease ~Fukuoka Stroke Registry~

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**Introduction and aims:** Patients with prior cardiovascular atherothrombotic diseases were at high risk state for stroke occurrence. We investigated predictive factors for the acute stroke recurrence and outcome in Japanese stroke patients with prior cardiovascular atherothrombotic diseases.

**Methods:** Among the consecutive 7077 ischemic stroke patients, 1015 patients with acute noncardioembolic stroke who were admitted within 24 hours, with prior cardiovascular atherothrombotic diseases (stroke, transient ischemic attack, ischemic heart disease, or peripheral artery disease) and prior modified Rankin scale (mRS) of 0 or 1 were included in the present study. We observed acute stroke recurrences and outcome during 3 months.

**Results:** Acute stroke recurrence was observed in 52 (5.1%) patients. Good outcome (mRS of 0 or 1) at 3 months was less frequent in patients with than without acute stroke recurrence (49.0% vs 69.5%,  $p = 0.005$ ). Major cerebral artery stenosis of 50% or more in diameter (63.4% vs 35.1%,  $p < 0.0001$ ), dyslipidemia (75.0% vs 57.3%,  $p = 0.0118$ ), prior ischemic stroke (44.2% vs 33.1%,  $p = 0.0989$ ), the initial NIH stroke scale score (5.39 vs 3.58,  $p = 0.0058$ ), and pulse rate (79.7 bpm vs 75.6 bpm,  $p = 0.0579$ ) was higher in patients with than without acute stroke recurrence. On the multivariate analysis, major cerebral artery stenosis of 50% or more (OR 2.97, 95% CI 1.57–5.62), dyslipidemia (OR 3.99, 95% CI 1.82–8.77), and the initial pulse rate (OR 1.02, 95% CI 1.00–1.05) had a positive association with acute stroke recurrence.

**Conclusions:** Major cerebral artery stenosis, dyslipidemia, and the initial pulse rate was significant predictors for acute stroke recurrence in patients with prior cardiovascular atherothrombotic diseases.

## WSC-0259

### Acute Stroke Management Clinical review of 24 patients with acute cholecystitis after acute cerebral infarction

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**Introduction:** Acute cholecystitis (AC) after acute cerebral infarction is rare and has not been fully investigated.

**Aims:** The purpose of this study was to investigate the clinical features of AC after acute cerebral infarction.

**Method:** Among the 1682 patients with acute cerebral infarction admitted to our hospital between April 2007 and July 2012, AC after acute cerebral infarction was diagnosed in 24 (1.4%). Age, sex, past history, fasting period, period until onset of cholecystitis from admission, clinical type, severity of cholecystitis, the diffusion-weighted imaging- the Alberta Stroke Program Early Computed Tomography Score, the National Institutes of Health Stroke Scale (NIHSS) score at onset and the modified Rankin scale at 90 days was investigated.

**Result:** Mean age of the 24 patients (15 men, 9 women) was  $74.2 \pm 11.9$  years (range, 45–90 years). Clinical type was atherothrombosis in 5, lacunar in 7, cerebral infarction in 10, and dissection in 2. Past history was atrial fibrillation in 10 (42%), hypertension in 20 (83%), and diabetes in 11 (46%). Mean duration of fasting was 10.7 days (range, 1–32 days). Mean interval between onset of cholecystitis and admission was 8.3 days (range, 0–24 days). Median NIHSS score at onset of cerebral infarction was 10, and 23 cases (96%) were bedridden at onset of cholecystitis.

**Conclusion:** AC after acute cerebral infarction was frequently seen with severe hemiparesis and in fasting patients. It is important to identify symptoms, diagnose the AC, and provide treatment as soon as possible.

## WSC-1465

### Acute Stroke Management Hemostatic changes and outcome in patients treated with I.V. thrombolysis for ischemic stroke

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**Introduction:** Ischemic stroke (IS) develops in conjunction with specific hemostatic disturbances such as attenuation of antithrombotic and fibrinolytic patency, augmentation of procoagulant activity. But influence of these changes on the functional outcome in patients treated with i.v.thrombolysis for IS remains unclear.

**Aims:** To evaluate the hemostatic changes on i.v.thrombolysis for IS and to determine if it could predict the outcome of patients with IS.

**Methods:** We analyzed data of 65 patients treated with i.v.thrombolysis for IS (IVT group) and 35 patients with IS which had not received reperfusion therapy due to late admission. Groups were comparable by the demographic characteristics, NIHSS score at admission, distribution by TOAST criteria. Hemostasis parameters and clinical blood analysis were performed at first 24 hours after the stroke onset. Functional outcome was assessed by modified Rankin scale at 3 months after IS.

**Results:** The functional outcomes were significantly better in IVT group than in control group. The fibrinogen was higher in control group than in IVT group (4.44 [3.40; 5.10] vs 3.14 [2.71; 3.86] g/l,  $p < 0.001$ ), and ESR – 26 [13; 39] vs 11 [4; 19] mm/hour,  $p < 0.003$ , respectively. Recanalized patients ( $n = 31$ ) had higher APTT and better outcome comparing to patients without recanalization. In IVT group patients with favorable outcome ( $mRS \leq 2$ ) had lower level of leucocytes than patients with  $mRS > 2$ , and there was a direct correlation of functional outcome and level of leucocytes ( $r = 0.31$ ).

**Conclusions:** I.V. thrombolysis influences hemostatic and inflammatory response during IS in such a way that these processes might affect outcome after the thrombolytic therapy.

## WSC-0376

### Acute Stroke Management Association between acute kidney injury and unfavorable outcomes in acute stroke

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**Introduction:** Information about the incidence of acute kidney injury (AKI) in patients with stroke and its effect on stroke outcomes is limited. **Aim:** The aim was to investigate the incidence, severity, and prognostic significance of AKI in patients with stroke.

**Methods:** 172 patients admitted to Stroke Center (81 men and 91 women, mean age was  $67 \pm 11$  years) were studied. Patients who were died during first admission day were excluded. The severity of neurological deficit was determined by the National Institutes of Health Stroke Scale (NIHSS). Serum creatinine at hospital admission was adopted as basal.

**Results:** In-hospital AKI developed in 47 (27%) of patients (34 with ischemic stroke and 13 with intracranial hemorrhagic; 11 patients had 2–3 AKI stages). Stroke NIHSS score was higher in patients with AKI ( $12.2 \pm 12.4$  and  $6.7 \pm 6.6$  points,  $p = 0.035$ ). The negative dynamics of neurological status is associated with an increase in the total clinical score more than 2 points NIHSS and was significantly worse in AKI-group (AKI-group 17 (36.2%) versus non-AKI 20(16%);  $p = 0.042$ ). The duration of Hospital stay was longer in AKI group (add 4 days;  $p = 0.04$ ). AKI was observed in 13 of 19 patients who died on 2 or late days after admission. After adjustment for age, sex, stroke type, time from onset to hospitalization AKI was independently associated with in-hospital mortality (odds ratio: 2.5; 95% confidence interval: 1.7–3.8).

**Conclusions:** The incidence of in-hospital AKI was 27% in patients with stroke and is associated with worse neurological deficit, longer hospitalization and adverse outcome.

## WSC-0688

### Acute Stroke Management Timing of hyperthermia after ischemic stroke and its relation with infarct size and functional outcome

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**Introduction:** Increased body temperatures in the first days after stroke onset have been associated with larger infarct size and poor outcome, but the temporal profile of this relation is uncertain.

**Aims:** We assessed the relation between body temperature in the first three days after stroke and infarct size and functional outcome.

**Methods:** Data of 157 patients (mean age 67.0 years ( $\pm 14.1$ ); 62% male) with acute ischemic stroke in the Dutch acute Stroke Trial were analyzed. Body temperatures were collected up till 72 hours after admission. Infarct size was measured on CT at three days ( $\pm 2$  days). Poor outcome was defined as a modified Rankin Scale score  $> 2$  at three months.

**Results:** Body temperature on admission was not related to infarct size ( $r = 0.05$ ,  $P = 0.53$ ) or poor outcome (odds ratio (OR) = 1.0 (95% confidence interval (CI), 1.00–1.01)). However, higher body temperatures on days 1, 2, and 3 after admission were associated with larger infarct size and poor outcome. This relation was strongest on day 2: for infarct size,  $r = 0.37$  ( $P < 0.001$ ) and for poor outcome, OR = 2.5 (95% CI, 1.8–3.6;

P < 0.001). For each 1.0° Celsius increase in body temperature on day 2, infarct size became three times as large.

**Conclusions:** In patients with ischemic stroke, higher body temperatures during the first three days, though not on admission, are associated with larger infarct size and poor functional outcome. Preventing fever in the first three days could improve outcomes.

**WSC-0572**

**Acute Stroke Management**

**Metabolic therapy for ischemic stroke**

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**Introduction:** The problem of stroke in Ukraine is extremely acute. The frequency of stroke is 2.9–3.0 cases per 1000 population per year. Therefore, studying the therapeutical aspects of ischemic stroke (IS) is very important.

**Aim:** Aspects of metabolic treatment of IS studying.

**Methods:** Were examined 500 patients with acute IS. Were used clinical-neurological, instrumental, biochemical methods. All data were statistically proceeded.

**Results:** Particular attention was paid to the various parts of biochemical abnormalities. Obtained data shown, that drug therapy should be directed to the correction of neurometabolic, neurotransmitter, neurotrophic and other reactions, that lead to degenerative and destructive changes in neurons and the formation of neurological dysfunction. The basic aspects of the pathogenetic cascade are development of the oxidative stress, which leads to the formation of free radicals; neurotoxic effect, especially regarding to the mitochondrial respiratory chain enzymes; changing in the activity of ribosomes and protein synthesis disorders. This significantly reduces the adaptive- compensatory potential of neurons and increase the neuro-metabolic disorders with a worsening of the ‘phenomenon of excitotoxicity’. Thus, for therapy IS is necessary to use complex metabolic preparations.

**Conclusions:** The most important task of metabolic therapy is the maximum possible limit polypharmacy. It is based on drugs, a major challenge is to implement an integrated neuroprotection aimed primarily

at optimizing the energy of neurons in combination with pharmacological protection of mitochondria (Gliyaton (Citicoline), Vazopro (Meldonium), Lira (Choline alfoscerate)).

**WSC-0992**

**Acute Stroke Management**

**Time distribution in acute stroke work up based on a trauma team structure: The Copenhagen model**

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**Introduction:** Minimizing in-hospital delays in acute stroke treatment remains highly important. Numerous studies have evaluated and approved their door-to-needle time, but few report in detail about the time distribution.

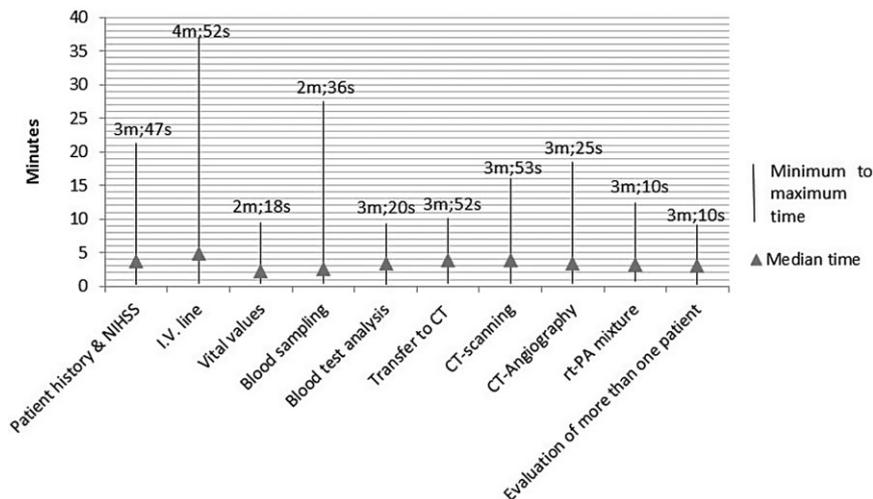
**Aim:** To determine the distribution of time used on all subtasks in acute stroke evaluation in the Copenhagen stroke model.

**Methods:** A median door-to-needle time of 20 minutes has been achieved in our institution by an organizational intervention based on reorganization of patient admission and a stroke team working by trauma team principles. The team includes a neurologist, a radiologist, a stroke nurse, a radiographer and a hospital porter, working in parallel to reduce delays. During a 3-month registration period an external operator registered the time spent on all acute stroke evaluation covering each profession and the time used on all individual tasks.

**Results:** A total of 148 patients and 25 subtasks were registered. In the Figure the 10 most time consuming subtasks are presented. IV line is the most time consuming task, with a median time at 4 minutes and 52 seconds, most likely because only patients the EMS could not provide with an IV line need this procedure after arrival.

**Conclusion:** These results demonstrate that short duration of tasks involved in thrombolysis favors a team structure enabling working in parallel.

**Thrombolysis subtask time consumption**



**WSC-0949****Acute Stroke Management  
Surveillance of initial therapy for patients with mild stroke admitted within 4.5 hours of onset**

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**Introduction:** Although stroke patients with mild symptom (NIHSS  $\leq 4$ ) are usually excluded from intravenous rt-PA therapy (IV rt-PA), such patients are increasing because of utilization of Dr-heli and recent TTW extension in Japan.

**Aims:** We conducted prospective survey to clarify clinical characteristics of mild stroke patients and current initial therapies.

**Methods:** Patients who admitted with acute ischemic stroke within 4.5 hours of onset were divided into mild (NIHSS  $\leq 4$ ) and nonmild groups. Their background characteristics, onset-to-door time, details of initial therapy, TOAST classification, and modified Rankin Scale (mRS) at 3 months were compared.

**Results:** In total, 27 patients (71.9  $\pm$  9.0 year, 17 men) were enrolled from April 2012 to March 2014. Fourteen patients (mild group: 69.4  $\pm$  10.3 year, 10 men) had NIHSS  $\leq 4$  (3 of them had cortical signs), and the diagnoses were 3 small vessel occlusions (SVO), 7 large artery atherosclerosis (LAA) and 4 cardioembolisms (CE). The other 13 patients (nonmild group: 75.4  $\pm$  6.3 year, 7 men) exhibiting median NIHSS of 17 (5–35) consisted with 1 LAA and 12 CE. Aspirin 200 mg was selected as initial therapy in 9 patients of mild-group. IV rt-PA was performed in 1, 7 of mild, nonmild groups, respectively. Median mRS in mild group was 0, while that in nonmild was 3 (2 with IV rt-PA and 5 without).

**Conclusion:** LAA and CE were the predominant etiology among mild stroke patients. Aspirin administration within 4.5 hours would be an option to prepare/prevent symptom deterioration.

**WSC-1488****Acute Stroke Management  
Results of the adoption of an interdisciplinary dysphagia protocol in the kick-off of a new stroke unit in a dedicated ward**

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**Introduction:** There is a reported incidence of dysphagia in stroke patients of 27% to 69%, mainly due to a delayed swallowing reflex, a decreased pharyngeal peristalsis and an altered lingual control. Its main complication is pulmonary aspiration, which usually have a fatal outcome for patients.

**Aims:** To assess the effectiveness of the adoption of an interdisciplinary dysphagia protocol in stroke unit.

**Methods:** A pilot study is conducted in the Stroke Unit of the University Hospital Virgen Macarena, in a follow up of patients in the six first months after stroke, which presented dysphagia (detected with the Gugging Swallowing Screen-GuSS test). The participants received an interdisciplinary multifactorial intervention program with stimulation of the level of consciousness, postural alignment, respiratory physiotherapy, orofacial stimulation, functional stimulation for deglutition (applied to five patients), supervision and training to the caregiver and follow up after hospital discharge.

**Results:** From a total of 246 patients admitted to the Stroke Unit, 92 of them presented physical deficits and 41 dysphagia (16.6%) with a GuSS value of 0 to 8 points. From them, 31.14% required a NG tube (GuSS 0), and 65.86% thickener and mashed food (GuSS 8). At discharge, 56.09% tolerated normal diet (GuSS 20), 16 patients (39%) with GuSS 8, and 4 (9.7%) with GuSS 0. That means that at discharge, only 20 of 246 patients (8.13%) presented dysphagia. No incidents of pulmonary aspiration reported.

**Conclusions:** The dysphagia program conducted in the Stroke unit has been effective to avoid pulmonary aspiration and to reduce the incidence of dysphagia.

**WSC-0981****Acute Stroke Management  
Comparison of stroke thrombolysis rates and delays in a centralized (Helsinki, Finland) and decentralized (Tempis Telestroke Unit Network, Germany) setting**

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**Introduction:** Intravenous thrombolysis is beneficial in reducing disability when initiated early in selected acute ischemic stroke patients. Centralized systems allow accumulation of experience but may suffer from longer prehospital transfer delays.

**Aims:** To compare stroke thrombolysis rates and delays in a centralized predominantly urban/suburban area (Province of Helsinki and Uusimaa, Finland, 1.56 million inhabitants, 9096 km<sup>2</sup>, 172/km<sup>2</sup>) and a decentralized TeleStroke Unit network in rural/suburban areas (TEMPiS, Bavaria, Germany, 1.94 million, 14992 km<sup>2</sup>, 129/km<sup>2</sup>).

**Methods:** All consecutive thrombolysis patients were prospectively registered in both settings. We compared tPA rates per annual ischemic stroke admission in the Helsinki University Central Hospital (HUCH) and the 14 TEMPiS network hospitals, and in all hospitals of the whole Helsinki and TEMPiS area. For delay comparisons we excluded basilar artery thromboses, in-hospital strokes and those being treated after 270 minutes. **Results:** From 2011 to 2013, 912 patients received thrombolysis in HUCH and 1779 in the TEMPiS hospitals. Annual tPA rates were higher in HUCH (304/1129 ischemic strokes; 26.9%) vs. TEMPiS hospitals (593/3810; 15.6%), with no difference in area-based tPA rates (13.0% of 2239 ischemic strokes in Helsinki area vs. 13.4% of 4426 ischemic strokes in TEMPiS area;  $p = 0.64$ ). Median prehospital delays were shorter in TEMPiS (88; IQR 60–135 vs. 65; 48–101 minutes;  $p < 0.001$ ).

**Conclusions:** Optimized stroke thrombolysis systems appear to offer similar treatment rates and delays in centralized and decentralized settings. The first two authors (GJ Hubert and A. Meretoja) contributed equally to this study.

**WSC-1199****Acute Stroke Management  
Acute ischemic stroke attributable to internal carotid occlusion with collateral middle cerebral artery: Does recanalization help?**

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**Introduction:** It is unclear who will benefit from endovascular treatment in patients presenting as acute ischemic stroke (AIS) attributable to

internal carotid occlusion (ICAO) with collateral middle cerebral artery (cMCA).

**Aims:** The aim of this study was to describe the outcomes based on the performance of endovascular revascularization therapy (ERT).

**Methods:** A total of 49 patients of ICAO with cMCA were selected for analysis retrospectively. The performance of ERT was based on the attending physicians' decisions. Successful angiographic recanalization was defined as TIC1 scale 2b-3. Recanalization status was also assessed using MR angiography within 7-day. Favorable outcome was defined as a mRS score 0-2 at 3-month.

**Results:** Twenty-two (44.9%) patients received ERT (baseline NIHSS, 18). Successful recanalization and favorable outcome was achieved in 15 patients and in 10 patients. Among 27 patients who received no ERT (baseline NIHSS, 14), favorable outcome was achieved in 9 patients. In 35 patients who had taken follow-up angiography, favorable outcome was observed 15 of 24 (62.5%) with recanalization and 4 of 11 (36.4%) without recanalization ( $p = 0.150$ ). Binary logistic regression analysis showed that younger age and recanalization within 7-day were independent predictors of favorable outcome.

**Conclusions:** In patients of ICAO with cMCA, the performance of ERT does not seem to improve functional outcome in our cohort. However, the recanalization status within 7-day was independently associated with functional outcome, so the treatment including ERT to recanalize ICAO despite the cMCA can be considered as a rescue option.

## WSC-1370

### Acute Stroke Management Characteristics of catecholamine concentration and prognostic value in patients with aneurysmal subarachnoid hemorrhage

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**Introduction & aims:** The characteristics of serum catecholamine concentration at the hyper-acute phase of aneurysmal subarachnoid hemorrhage (SAH) and its relationship between patient outcome and delayed vasospasm were investigated.

**Methods:** Patients with aneurysmal SAH (170) were prospectively studied between August 2008 and June 2011. Baseline demographic data and physiological parameters, including plasma concentrations of adrenaline (AD), noradrenaline (NA) and dopamine (DP) were evaluated for all patients.

**Results:** On admission, plasma AD, NA and DP levels were significantly higher in patients with a poor clinical grade on admission (Hunt & Kosnik: IV-V), compared to those with a good clinical grade on admission (Hunt & Kosnik: I-III). AD showed a markedly high concentration immediately after the onset of SAH and then rapidly decreased. NA levels peaked within 6 hours after onset, then significantly decreased. The increase of DP with time was not significant, but showed a similar trend to that of NA. The level of each catecholamine showed significant mutual correlation.

Multivariate analyses demonstrated age, poor clinical grade, plasma AD and NA levels were predictors of poor patient outcome, and poor clinical grade, Fisher scale and plasma AD level were predictors of the development of delayed vasospasm.

**Conclusions:** The present findings suggest that sympathetic activation in patients in the acute phase of SAH reflects the severity of SAH, and is closely related to the development of delayed vasospasm, leading to the subsequent immune response and inflammatory reactions. Strategies for suppressing catecholamine at the hyper-acute phase may contribute to vasospasm prevention and improve patient outcome.

## WSC-1372

### Acute Stroke Management Acute hematoma regrowth in patients with spontaneous intracerebral hemorrhage: Characteristics and prognostic factors

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**Introduction & aims:** Early hematoma enlargement is known to contribute to brain injury and worse prognosis after spontaneous intracerebral hemorrhage (ICH). The aim of this study was to identify potential predictors associated with hematoma growth in patients with ICH.

**Methods:** Medical records of 226 consecutive patients with acute primary basal ganglia hemorrhage (within 6 hours of stroke onset) were retrospectively reviewed. The volume of the ICH on admission, and at 24 hours were measured on CT/MRI scan. Thirteen clinical, biochemical, and neuroimaging values were registered. Hematoma growth was diagnosed when the volume increased above 33% and/or 12.5 ml. With logistic regression analysis, factors associated with hematoma growth were investigated.

**Results:** Hematoma growth occurred in 21 patients (9.2%). ICH volume above 25 ml (95% CI 1.6 to 61.3,  $p = 0.014$ ), heterogeneity of ICH (95% CI 1.9 to 59.0,  $p = 0.008$ ), and elevating systolic blood pressure (SBP) after admission despite medication (95% CI 1.0 to 1.1,  $p = 0.002$ ) were associated with hematoma growth in multivariate analyses.

**Conclusions:** Large and/or heterogeneous hematoma is a predictor of hematoma growth. Strict SBP control is essential especially in those patients with acute spontaneous ICH.

## WSC-1334

### Acute Stroke Management Combined neurovascular approach for elderly patients with aneurysmal subarachnoid hemorrhage: A single comprehensive stroke center experience and clinical results

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**Introduction & aims:** A team approach by cerebrovascular surgeons and endovascular interventionists is currently recommended to evaluate each patient and to tailor the best treatment plan for patients with aneurysmal subarachnoid hemorrhage (SAH). The indications, however, have not been elucidated well. The aim of this study was to analyze the therapeutic results in elderly patients with SAH in a single comprehensive stroke center with a combined neurovascular team, where treatment modality was mainly decided on aneurysmal topography.

**Methods:** Medical chart of consecutive 64 elderly patients (age > 75 y.o.) with aneurysmal SAH who underwent surgical repair (clipping 34, coiling 30) during a 25-month period was retrospectively reviewed to access the clinical outcome.

**Results:** There was no significant difference in the occurrence of delayed ischemic neurological deficit, hydrocephalus and clinical outcome between clipping and coiling groups. However, coiling contributed to better outcome than clipping in patients aged more than 80 y.o. (mRS 3.33 vs 4.61;  $P = 0.017$ ).

**Conclusions:** The proper selection of surgical or endovascular treatment for ruptured aneurysms on the basis of aneurysmal topography can

achieve acceptable efficacy in both modalities even in elderly patients. Conversely, coiling is advocated in very elderly patients aged over 80 y.o.

### WSC-1337

#### Acute Stroke Management Antihypertensive treatment and risk of acute renal injury in patients with intracerebral hemorrhage

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**Introduction & aims:** Whether aggressive blood pressure reduction precipitate acute renal injury in patients with acute intracerebral hemorrhage (ICH) remains to be elucidated.

**Methods:** Medical records of 104 consecutive patients with acute ICH (within 6 hours of stroke onset) between May and September 2013 were retrospectively reviewed. All patients received intensive treatment to lower their blood pressure (with a target systolic level of <140 mmHg). Systolic blood pressure (SBP) was compared at initial hospitalization and 6 hours later. The lowering rate of SBP >35% was defined as aggressive reduction group (N = 50), and <35% was defined as normal reduction group (N = 54). Creatinine clearance (CCr) was also measured at initial hospitalization and 24 hours after admission.

**Results:** Significant decrease of CCr (<25%) was observed in 8 patients (14.0%) in the normal reduction group and 6 patients (12.0%) in the aggressive reduction group. The difference was not significant.

**Conclusions:** Recently, intensive BP reduction was recommended for the patients with ICH. Our data support the notion that acute renal injury is associated with such antihypertensive treatment, but a trend in association between extent of the reduction and renal impairment was not observed. Further prospective studies with large volume is needed to understand the appropriate BP control.

### WSC-1320

#### Acute Stroke Management Correlation between pathological evidence and outcome in lobar cerebral hemorrhage due to amyloid angiopathy

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**Introduction & aims:** Cerebral amyloid angiopathy (CAA) contributes to lobar intracerebral hemorrhage in older patients. Diagnosis of CAA refers to the Boston Criteria, which requires that “definitive” cases be confirmed by pathologic evidence. The purpose of this study was to investigate the incidence and outcome of pathologically proven CAA patients.

**Methods:** The medical chart of 19 consecutive lobar hemorrhage patients with radiographic characteristics of CAA by Boston criteria, who underwent craniotomy and hematoma evacuation between 2011–2012 was retrospectively reviewed. Cortical vessels at the site of corticotomy was histopathologically investigated for amyloid deposition. The outcome has been established by the modified Rankin Scale (mRS).

**Results:** Six patients (31.5%) were histologically diagnosed with CAA. Remaining 13 patients with “probable CAA” were considered as hypertensive bleeding. There is no difference in patient age (mean 78.5 vs 73.6 y.o.), hematoma volume (mean 76.6 vs 67.0 ml), and mRS at discharge (mean 3.7 vs 4.4). The postoperative bleeding occurred in 1 patient with CAA (16%), but there was no surgery-related morbidity.

**Conclusions:** Neurosurgery can be performed safely in patients with possible CAA-related lobar hemorrhage. The proportion of definitive case are relatively low and pathological results does not influence the presentation and outcome.

### WSC-0250

#### Acute Stroke Management Investigation of effects of high-dose argatroban therapy compared with conventional therapy on ischemic stroke

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**Background and aim:** Argatroban, a synthetic direct thrombin inhibitor, is used for cerebral infarction. The present study was performed to retrospectively investigate the effects of high-dose argatroban therapy (HDAT) on the outcome in patients with acute ischemic stroke, and to compare with those of conventional argatroban therapy (CAT) at the time of discharge.

**Methods:** Seventy-four consecutive patients (36 males and 38 females: mean aged 78.6 years, range 48–97 years) with acute ischemic stroke who were admitted to our institution within 48 hours after stroke onset were enrolled. Subtypes of strokes were lacunar infarction in 10 (13%), atherothrombotic infarction in 42 (57%), and cardio-embolic infarction in 22 (30%). Of 74 patients, 39 (53%) patients received an argatroban infusion of 60–120 mg for 60 minutes followed by 10 mg/3 hrs twice a day for 5 days (HDAT-group), while 35 (47%) had an argatroban infusion of 60 mg/24 hrs for 2 days continuously followed by 10 mg/3 hrs twice a day for 5 days (CAT-group). All patients were evaluated by modified Rankin Scale (mRS) score at discharge.

**Results:** Overall outcomes at the time of discharge were favorable (mRS score 0–2) in 38 (51%), and unfavorable (mRS score 3–6) in 36 (49%). A univariate logistic regression analysis revealed that HDAT-group showed a favorable effect (p = 0.099) compared to CAT-group. However, we did not identify the most suitable dose and time up to the use of argatroban.

**Conclusion:** High-dose argatroban therapy showed a favorable effect on the outcome compared to conventional therapy. Further investigation is required to clarify the best dose and time.

### WSC-1120

#### Acute Stroke Management The presence of cerebral microhemorrhage is associated with parenchymal hematoma hemorrhagic conversion following thrombolysis for acute ischemic stroke

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**Introduction:** Hemorrhagic conversion remains a concerning complication of thrombolysis for acute ischemic stroke (AIS). Cerebral microhemorrhages (CMH) have been associated with intracerebral hemorrhage (ICH) and may serve as a biomarker for post thrombolytic hemorrhagic conversion AIS.

**Aim:** To determine the relationship between CMH and post-thrombolysis hemorrhagic conversion of AIS.

**Method:** We identified patients with AIS treated with intravenous tPA between January 1, 2012 and July 31, 2013 in our institutional stroke registry who had an MRI with gradient recovery echo (GRE) sequence performed 24 hours post-thrombolysis. The presence and locations of CMH were recorded and compared with the presence of post-thrombolytic ICH. Patient demographics, clinical history (hypertension, diabetes mellitus, hyperlipidemia, atrial fibrillation, coronary artery

disease, congestive heart failure, chronic renal insufficiency), NIHSS, LDL, HDL, HbA1c, total cholesterol and ejection fraction on transthoracic echocardiogram were collected and analyzed. Statistical analysis was done using fisher exact test for categorical and t-test for continuous variables. **Result:** 117 patients were identified and studied. Thirty patients (25.6%) had CMH, while a total number of 70 CMH (50 lobar; 20 nonlobar) were observed. Hemorrhagic conversion was more frequent in patients with CMH but not statistically significant (16.7% vs 6.9%  $p = 0.147$ ). Parenchymal hematoma was more frequent in the CMH group (16.7% vs 3.6%  $p = 0.031$ ). Of the clinical and laboratory variables, only atrial fibrillation was significantly different between groups (10% vs 28.7%  $p = 0.047$ ). **Conclusion:** The presence of CMH on MRI/GRE sequence is associated with an increased frequency of parenchymal hematoma type hemorrhagic conversion following intravenous thrombolysis for AIS.

## WSC-0276

### Acute Stroke Management Socio-clinical prognosis of acute stroke among young patients with mental disabilities in emergency neurology

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**The purpose:** To carry out social and clinical prognosis of acute stroke in young patients with mental disabilities in emergency neurology. Examined 68 patients (41 – men (60.3%), women – 27 (39.7%) with mental disorders.

**Material/methods:** admitted to emergency neurology dept. with acute cerebral stroke. To obtain reliable prognostic information was applied method of initial data analysis – clinical, instrumental, etc.

**Results:** 3 groups of prognostic criteria were allocated: 1 – main regularities of disease development, 2 – factors which predetermine characteristics of disease, 3 – features of reactions on factors that can change course/level of patients' social adaptation.

Clinical features of acute stroke can be caused by many reasons. It is determined the difficulty of predicting the clinical course. There are following stages marked out:

- 1 with symptoms of neurasthenia in 31 (45.6%) cases,
- 2 with mental disorders (vascular – organic nature) in 25 (36.8%) cases,
- 3 with mental defect symptoms (dementia) – in 12 (17.6%) cases.

The most favorable socio-clinical prognosis in the first stage. In the second stage, the prognosis remains favorable in 25 cases. Clinical manifestations are more resistant, have significantly less possibility of reverse develop-

ment under influence of therapeutic/preventive measures. 12 patients have disability, which embarrass their social adaptation. These clinical/paraclinical examinations showed symptoms of diffuse and focal – destructive brain lesions, disorders of blood flow/blood supply. 44 patients had epileptiform seizures, perceptual abnormalities in 38 (55.9%) cases. Compensation of mental defect is impossible.

**Conclusion:** This method allows to combine the most important features for reliable socio-clinical prognosis.

## WSC-0821

### Acute Stroke Management Blood pressure variability in acute ischemic stroke patients: Preliminary results of PREWISE study

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**Introduction:** There is scarcity of data about the prognostic role of blood pressure (BP) variability (BPV) during the acute phase of ischemic stroke (AIS).

**Aims:** Our purpose is to present the preliminary results of PREWISE study (NCT01915862) concerning the relationship between BPV in the acute phase of stroke evaluated with ambulatory 24-hour BP monitoring (ABPM) and stroke outcome.

**Methods:** Twenty-seven consecutive patients with AIS underwent ABPM every 20 minutes within 24 hours of admission using an automated oscillometric device (TM 2430, A&D Company Ltd) during day-time (7:00–22:59) and night-time (23:00–6:59). Mean BP parameters and several BP variability indices such as range, standard deviation, successive and coefficient of variation, sample entropy of both systolic and diastolic BP and ambulatory arterial stiffness index (AASI), were calculated. End-point was an increase in NIHSS between admission and discharge  $\geq 2$ .

**Results:** Five patients (18.5%) whose clinical characteristics did not differ from the rest population reached the end-point (Table 1). In these patients, all BP parameters were higher but not statistically significant from stroke patients without significant decline. From BPV indices, only sample entropy was higher (2.21 vs 2.09,  $p = 0.029$ ) (Table 2).

**Conclusions:** Sample entropy as BPV index which describes the irregularity of a time series, could be a useful predictive factor of outcome in stroke patients but this must be confirmed in larger studies.

**Table 1** Clinical characteristics and known stroke risk factors

Variables	Population (n = 27)	Deterioration (n = 5)	Others (n = 22)	p
NIHSS on admission	11.2 (10.3)	16 (6.2)	10.1 (10.9)	0.252
NIHSS at discharge	11.4 (14.5)	32.6 (13.7)	6.6 (9.7)	<0.001
Age (years)	81.4 (5.9)	82 (4.4)	81.2 (6.3)	0.799
Male gender	10 (37%)	2 (40%)	8 (36.4%)	1.000
Cerebrovascular disease	9 (33.3%)	2 (40%)	7 (31.8%)	1.000
Hypertension	24 (88.9%)	3 (60%)	21 (95.5%)	0.079
Dyslipidemia	17 (63%)	4 (80%)	13 (59.1%)	0.621
Diabetes mellitus	9 (33.3%)	1 (20%)	8 (36.4%)	0.636
Atrial fibrillation	10 (37%)	3 (60%)	7 (31.8%)	0.326
Smoking	3 (11.1%)	0 (0%)	3 (13.6%)	1.000
Coronary artery disease	6 (22.2%)	3 (60%)	3 (13.6%)	0.056
Body mass index	28.8 (4.2)	27.8 (4)	29 (4.3)	0.566

Statistical analysis for continuous data (mean  $\pm$  standard deviation) was made by Student's T-test, while for noncontinuous data (numbers and percentages) chi-square test was used.

**Table 2** Parameters derived by 24-h ABPM

Variables	Population (n = 27)	Deterioration (n = 5)	Others (n = 22)	p
Mean SBP (mmHg)	150.6 (20.1)	159.1 (23.1)	148.7 (19.4)	0.302
Mean day SBP (mmHg)	151.1 (19.7)	159.2 (23.2)	149.3 (18.90)	0.317
Mean night SBP (mmHg)	149.5 (22.5)	159.5 (26.3)	147.3 (21.6)	0.279
Range SBP (mmHg)	94.3 (37.9)	94.4 (39.3)	94.2 (38.5)	0.993
SD SBP (mmHg)	18.9 (8.1)	16.4 (4.9)	19.4 (8.6)	0.456
Nocturnal decline SBP (%)	1.17 (6.3)	-0.14 (8.3)	1.5 (6)	0.615
Weighted SD SBP (mmHg)	18.3 (8)	15.3 (4.1)	18.9 (8.6)	0.374
Successive variation SBP (mmHg)	19.7 (7.6)	18.6 (6.7)	19.9 (7.9)	0.729
Coefficient of variation SBP	0.13 (0.05)	0.10 (0.03)	0.13 (0.05)	0.210
Sample entropy SBP	2.11 (0.12)	2.21 (0.09)	2.09 (0.11)	<b>0.029</b>
Mean DBP (mmHg)	80.1 (11.9)	87.2 (11.9)	78.5 (11.6)	0.143
Mean day DBP (mmHg)	80.9 (11.6)	87.8 (11.5)	79.3 (11.3)	0.142
Mean night DBP (mmHg)	78.5 (13.6)	86.1 (13.4)	76.8 (13.3)	0.167
Range DBP (mmHg)	82 (27.3)	95 (12.5)	79.1 (29.1)	0.075
SD DBP (mmHg)	14.1 (5.1)	12.7 (1.6)	14.4 (5.6)	0.222
Nocturnal decline DBP (%)	3.1 (7.8)	2.1 (5.5)	3.3 (8.3)	0.770
Weighted SD DBP (mmHg)	13.6 (5)	12.1 (1.9)	13.9 (5.5)	0.229
Successive variation DBP (mmHg)	97 (33.3)	94.6 (10.2)	97.6 (36.8)	0.740
Coefficient of variation DBP	0.18 (0.06)	0.15 (0.02)	0.18 (0.06)	0.225
Sample entropy DBP	1.98 (0.29)	1.82 (0.46)	2.02 (0.24)	0.177
AASI	0.61 (0.19)	0.58 (0.17)	0.61 (0.19)	0.747

Statistical analysis for continuous data (mean  $\pm$  standard deviation) was made by Student's T-test.

**WSC-0818****Acute Stroke Management****Association of circadian blood pressure and heart rate patterns with severity of acute ischemic stroke:****Preliminary results**

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**Introduction:** Blood pressure (BP) is increased in up to 75% to 80% of patients with acute ischemic stroke (AIS) and usually decreases spontaneously over the next few days.

**Aims:** Our purpose is to study the relationship between BP course in the acute phase of stroke by ambulatory 24-hour BP monitoring (ABPM) and

stroke severity assessed with the National Institutes of Health Stroke Scale (NIHSS).

**Methods:** Twenty-two consecutive patients with AIS underwent ABPM according recent guidelines, within 24 hours of onset of stroke using an automated oscillometric device (TM 2430, A&D Company Ltd) during day-time (7:00–22:59) and night-time (23:00–6:59). Known stroke risk factors and clinical findings on admission were recorded. Statistical analysis for continuous data (mean  $\pm$  standard deviation) was made by Student's T-test, while for noncontinuous data (numbers and percentages) chi-square test was used.

**Results:** Thirteen patients (59.1%) whose clinical characteristics did not differ from the rest population, except for frequency of atrial fibrillation (53.8% vs 11.1%, respectively;  $p = 0.04$ ), had NIHSS > 4 (Table 1). Furthermore, in these patients, all (mean, day and night) BP parameters derived by ABPM did not differ from stroke patients with NIHSS  $\leq 4$ , but all heart rate (HR) parameters were higher. The group with minor AIS had lower diastolic BP (DBP) (70.1 vs 75.2 mmHg,  $p = 0.009$ ) and lower HR (60.2 vs 65.4 bpm,  $p = 0.009$ ) during night compared to the day values (Table 2).

**Conclusions:** Lower values of DBP (dipping pattern) and HR during night in AIS patients derived by ABPM are associated with minor AIS. Furthermore, higher HR values during 24 h are associated with moderate/severe AIS.

**Table 1** Clinical characteristics and known stroke risk factors on admission

Variables	Population (n = 22)	NIHSS < 5 (n = 9)	NIHSS > 4 (n = 13)	p
Pre-stroke mRS > 2	18 (81.8%)	7 (77.8%)	11 (84.6%)	1.000
NIHSS admission	9.9 (9.1)	2.3 (1.1)	15.2 (8,5)	<b>&lt;0.001</b>
Age (years)	79.3 (7)	77.8 (5.6)	80.4 (7.9)	0.404
Male gender	12 (54.5%)	6 (66.7%)	6 (46.2%)	0.342
Cerebrovascular disease	6 (27.3%)	3 (33.3%)	3 (23.1%)	0.595
Hypertension	19 (86.4%)	8 (88.9%)	11 (84.6%)	1.000
Dyslipidemia	15 (68.2%)	7 (77.8%)	8 (61.5%)	0.421
Diabetes mellitus	8 (36.4%)	2 (22.2%)	6 (46.2%)	0.251
Atrial fibrillation	8 (36.4%)	1 (11.1%)	7 (53.8%)	<b>0.040</b>
Smoking	6 (27.3%)	3 (33.3%)	3 (23.1%)	0.595
Coronary artery disease	5 (22.7%)	1 (11.1%)	4 (30.8%)	0.279
Congestive heart failure	3 (13.6%)	0 (0%)	3 (23.1%)	0.240
Body mass index	29.4 (5.1)	29.6 (5)	29.4 (5.3)	0.927

Continuous data are presented as mean (standard deviation); noncontinuous data are presented as numbers and percentages.

**Table 2** Parameters derived by 24-h ABPM

Variables	Population (n = 22)	NIHSS < 5 (n = 9)	NIHSS > 4 (n = 13)	p
Mean SBP	147.7 (17.7)	143.8 (14)	149.6 (20)	0.460
Day SBP	147.4 (16.9)	144.8 (14.7)	149.2 (18.7)	0.557
Night SBP	146.5 (22.2)	140 (16.8)	150.9 (24.9)	0.266
<b>p</b> (day/night)	<b>0.715</b>	<b>0.284</b>	<b>0.607</b>	
Mean DBP	77.4 (11)	74.1 (11.7)	79.7 (11.7)	0.251
Day DBP	78.1 (11)	75.2 (9.9)	80.2 (11.6)	0.313
Night DBP	75.1 (11.8)	70.1 (8.8)	78.6 (12.6)	0.097
<b>p</b> (day/night)	<b>0.033</b>	<b>0.009</b>	<b>0.438</b>	
Mean MAP	100.3 (12.7)	96.9 (10.5)	102.7 (13.9)	0.303
Day MAP	100.9 (12.5)	98 (11.3)	102.8 (13.4)	0.386
Night MAP	98.6 (14.6)	93.1 (10.8)	102.5 (16)	0.142
<b>p</b> (day/night)	<b>0.159</b>	<b>0.060</b>	<b>0.849</b>	
Mean HR	72.7 (13.7)	63.9 (6.8)	79.1 (13.9)	<b>0.003</b>
Day HR	73.2 (12.6)	65.4 (6.9)	78.5 (13)	<b>0.006</b>
Night HR	72.7 (17.4)	60.2 (7.5)	81.3 (17.1)	<b>0.001</b>
<b>p</b> (day/night)	<b>0.771</b>	<b>0.009</b>	<b>0.250</b>	

Continuous data are presented as mean (standard deviation); noncontinuous data are presented as numbers and percentages.

**WSC-1242**

**Acute Stroke Management**

**The impact of beta-blockers on blood pressure variability in acute ischemic stroke: Preliminary results of the PREVISE study**

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**Introduction:** Reduction of blood pressure (BP) variability (BPV) has been proposed to be the next target for antihypertensive treatment in order to prevent cardiovascular events and especially stroke. Some studies suggested that calcium-channel blockers are more effective antihypertensive agents (AA) in terms of BPV reduction than beta-blockers.

**Aims:** The aim of the present study was to evaluate the effects of beta-blocker monotherapy compared with other AA on BPV during the acute phase of stroke in cases enrolled in the observational PREVISE study (NCT01915862).

**Methods:** Among 27 consecutive patients with acute ischemic stroke (AIS) who underwent ambulatory 24-hour BP monitoring (ABPM) every 20 minutes within 24 hours of admission using an automated oscillometric device (TM2430, A&D Company Ltd) during day-time (7:00–22:59) and night-time (23:00–6:59), 22 patients who were already under antihypertensive treatment were selected. BP parameters, heart rate and BPV indices, were calculated.

**Results:** Six patients (27.3%) received beta-blocker monotherapy during the acute phase of stroke. Clinical characteristics did not differ between the former patients and those receiving other AA (Table 1). Patients on beta-blocker monotherapy had higher range of both systolic (126.7 vs 85.3, p = 0.027) and diastolic BP (98.3 vs 73.9, p = 0.023), higher SD of diastolic BP (18.7 vs 12.3, p = 0.010) and higher SV of both systolic (26.8 vs 16.7, p = 0.005) and diastolic BP (118.8 vs 85.2, p = 0.04) (Table 2).

**Conclusions:** Monotherapy with beta-blockers is associated with higher range and successive variation of BP during the acute phase of AIS and thus higher BPV. However, patients treated with beta-blockers had similar outcome compared with patients treated with other AA. These preliminary findings remain to be confirmed or refuted in larger studies.

**Table 1** Clinical characteristics and known stroke risk factors

Variables	Population (n = 22)	b-blocker (n = 6)	Others (n = 18)	p
Age (years)	81.5 (4.9)	82.2 (3.9)	81.3 (5.3)	0.707
Male gender	8 (36.4%)	1 (16.7%)	7 (43.8%)	0.351
Cerebrovascular disease	7 (31.8%)	1 (16.7%)	6 (37.5%)	0.616
Hypertension	21 (95.5%)	6 (100%)	15 (93.8%)	1.000
Dyslipidemia	15 (68.2%)	3 (50%)	12 (75%)	0.334
Diabetes mellitus	8 (36.5%)	3 (50%)	5 (31.3%)	0.624
Atrial fibrillation	9 (40.9%)	3 (50%)	6 (37.5%)	0.655
Smoking	2 (9.1%)	0 (0%)	2 (12.5%)	1.000
Coronary artery disease	6 (27.3%)	1 (16.7%)	5 (31.3%)	0.634
Body mass index	28.8 (4.4)	26.9 (3.3)	29.5 (4.6)	0.220
Prestroke number of AA	2.5 (1.4)	2.7 (1.9)	2.5 (1.3)	0.845
Poststroke number of AA	2 (1.3)	1 (0)	2.3 (1.4)	<b>0.001</b>
Interval onset to arrival (min)	168.1 (139.4)	218 (226.6)	149.4 (93.4)	0.501
NIHSS on admission	10.6 (9.6)	7.3 (6.1)	11.8 (10.5)	0.349
mRS > 4 at discharge	9 (40.9%)	2 (33.3%)	7 (43.8%)	1.000

Statistical analysis for continuous data (mean ± standard deviation) was made by Student's T-test, while for noncontinuous data (numbers and percentages) Fisher's exact test was used. AA; antihypertensive agents.

**Table 2** Blood pressure and heart rate parameters at ED and derived by 24-h ABPM

Variables	Population (n = 22)	b-blocker (n = 6)	Others (n = 18)	p
ED casual SBP (mmHg)	162.9 (28.7)	160.3 (35.7)	163. (26.9)	0.807
Mean SBP (mmHg)	151 (19.3)	160.1 (14)	147.6 (20.3)	0.183
Range SBP (mmHg)	96.6 (40.1)	126.7 (50.3)	85.3 (30.1)	<b>0.027</b>
Mean day SBP (mmHg)	151.2 (18.5)	160.5 (12.4)	147.7 (19.4)	0.153
Mean night SBP (mmHg)	150.7 (22.6)	158.9 (19.5)	147.6 (23.5)	0.310
Nocturnal decline SBP (%)	0.5 (6.7)	1.2 (6.7)	0.2 (6.9)	0.779
SD SBP (mmHg)	19 (8.5)	26.6 (12.9)	16.2 (3.9)	0.106
Weighted SD SBP (mmHg)	18.4 (8.5)	26.1 (12.6)	15.5 (3.8)	0.094
Successive variation SBP (mmHg)	19.4 (8)	26.8 (9.10)	16.7 (5.6)	<b>0.005</b>
Coefficient of variation SBP	0.13 (0.05)	0.17 (0.07)	0.11 (0.03)	0.127
Sample entropy SBP	2.11 (0.12)	2.03 (0.19)	2.14 (0.07)	0.063
ED casual DBP (mmHg)	90.2 (22.8)	93.2 (23.8)	89.1 (23.2)	0.721
Mean DBP (mmHg)	79.1 (12)	86.6 (10)	76.3 (11.8)	0.074
Range DBP (mmHg)	80.6 (29.5)	98.3 (14.7)	73.9 (11.8)	<b>0.023</b>
Mean day DBP (mmHg)	79.7 (11.5)	87.1 (9.1)	76.9 (11.3)	0.065
Mean night DBP (mmHg)	77.8 (14.2)	85.1 (13.1)	75.1 (13.9)	0.142
Nocturnal decline DBP (%)	2.6 (8.4)	2.5 (7.3)	2.6 (9)	0.993
SD DBP (mmHg)	14 (5.5)	18.7 (5.9)	12.3 (4.3)	<b>0.010</b>
Weighted SD DBP (mmHg)	13.5 (5.4)	18.3 (6)	11.7 (4)	<b>0.007</b>
Successive variation DBP (mmHg)	94.4 (34.8)	118.8 (24.9)	85.2 (34)	<b>0.040</b>
Coefficient of variation DBP	0.18 (0.06)	0.22 (0.07)	0.16 (0.05)	0.055
Sample entropy DBP	1.98 (0.32)	1.95 (0.15)	1.99 (0.37)	0.839
AASI	0.61 (0.19)	0.67 (0.15)	0.59 (0.21)	0.421
ED casual HR (bpm)	80.2 (16)	82.7 (10.3)	79.3 (17.9)	0.666
Mean HR (bpm)	72.2 (12.4)	72.9 (9.2)	72 (13.7)	0.881
Mean day HR (bpm)	72.7 (11.5)	73.2 (8.3)	72.5 (12.8)	0.915
Mean night HR (bpm)	71.3 (15.2)	72.3 (12.4)	70.9 (16.5)	0.857

Statistical analysis for continuous data (mean  $\pm$  standard deviation) was made by Student's T-test.

### WSC-0332

#### Acute Stroke Management Factors influencing non administration of thrombolytic therapy in early arrival ischemic strokes in a university hospital from Hyderabad, India

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**Introduction:** Even among the patients of acute ischemic stroke who arrive in hospital within window period, all do not receive the thrombolytic therapy.

**Aims:** To evaluate causes of nonadministration of rt-PA in early arrival ischemic strokes in a University hospital in India.

**Methods:** The data of all patients of acute ischemic strokes who reached the hospital within 4.5 hours of onset between January 2010 and December 2013 was analyzed including the factors influencing non administration of rt-PA.

**Results:** Out of 93 ischemic stroke patients, 71 (76.3%) received intravenous rt-PA. Among the 22 nonthrombolysed patients (23.7%), 4 patients could not afford the treatment. Another 5 patients were not thrombolysed because of rapidly improving symptoms. Two patients had large cerebral infarcts on CT scan, one of whom had hemorrhagic conversion. One patient had preceding upper gastrointestinal bleed, and one had recent cataract surgery. One patient was on oral anticoagulants with high INR. Infusion was stopped in one patient because of bleeding diathesis and in other due to persistent hypertension despite treatment. Two patients were notified late to the stroke team by the emergency department. Two patients could not be thrombolysed because of difficulty in organizing the endovascular treatment during night.

**Conclusions:** Our study highlighted the fact that even in a tertiary care hospital, one fourth of early arrival ischemic stroke patients could not be thrombolysed. Some of the reasons are potentially preventable by subsidizing the cost, preventing intra-hospital delay, modifying the strict thrombolysis protocol and making endovascular interventions accessible round the clock.

### WSC-1097

#### Acute Stroke Management Combined intravenous and intraarterial thrombolysis for acute basilar artery occlusion: The Cypriot experience

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**Introduction:** Basilar artery occlusion (BAO) has a high mortality rate about %90 if untreated.

**Aims:** We describe the first case series of BAO treated with thrombolytic therapy in Cyprus.

**Methods:** 4 patients with acute BAO treated with combined intravenous and intraarterial thrombolysis from September 2011 to January 2014. Initial and posttreatment neurological status of the patients were graded according to the National Institute of Health Stroke Scale (NIHSS). Baseline characteristics, frequencies of recanalization and intracranial hemorrhage and 3-month outcome were evaluated.

**Results:** The mean age of the patients was 71 years. Mean initial NIHSS score was 38. Recanalization was observed in all patients. 3 out of 4 patients, recanalization achieved within fourth hour of symptom onset.

Mean NIHSS score after 24 hours of treatment was 4. One of the patients who had recanalization within the eighth hour of symptom onset had European Cooperative Acute Stroke Study (ECASS) parenchymal hematoma type 2 and died 3 days after the treatment. Mean modified Rankin scale (mRS) score of living patients was 1 in their 3-month follow-up. The underlying cause of stroke was cardioembolism in all patients.

**Conclusions:** Our experience demonstrated that the mortality and morbidity were significantly reduced after the thrombolytic treatment. We observed that severity of stroke (NIHSS > 25) does not prohibit good outcome and should not be a contraindication for thrombolytic treatment. Recanalization time is related with outcome and intracranial bleeding. Mechanical thrombectomy may improve the rate and speed of recanalization and possibly decrease the incidence of symptomatic hemorrhage.

### WSC-0888

#### Acute Stroke Management Complications of endovascular treatment in acute stroke patients: Results from a tertiary referral center

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**Introduction:** Endovascular therapies have emerged as a promising approach and are used with increasing frequency for the treatment of selected patients with acute ischemic stroke.

**Aims:** We evaluated the complications that can be seen during and after the endovascular interventional modalities in our patient group presenting with acute ischemic stroke and discussed these findings with respect to the data in the literature.

**Methods:** We retrospectively analyzed the early outcome of the treatment and complications of intravenous tissue plasminogen activator (iv-tPA) followed by intraarterial (IA) thrombolytic treatment, thrombolysis with mechanical clot disruption and stent assisted thrombectomy (SAT) or SAT alone in a group of 28 patients presenting with acute ischemic stroke.

**Results:** 28 patients presented with a total of 31 vascular occlusions. 19 patients were treated with iv-tPA followed by endovascular intervention and 9 were treated by SAT alone. The anatomical distribution of these vascular occlusions were; 18 middle cerebral arteries (MCA), 6 basilar arteries and 6 internal carotid arteries (ICA) and 1 truncus brachiocephalicus. 28 of the 31 occluded arteries recanalized ( $\geq$ Thrombolysis in Cerebral Infarction Score (TICI 2a)). No intervention was made for truncus brachiocephalicus. In this group of patients undergoing endovascular treatment complications were; 3/30 spontaneous vascular dissection, 1/30 stent detachment, 1/30 carotidocavernous fistula, 7/30 hemorrhage, 1/30 hyperperfusion syndrome, 1/30 distal embolization of the occlusive plaque and 2/30 reocclusion.

**Conclusions:** The possible periprocedural complications in endovascular stroke treatment should be updated in parallel to the increase in number of cases treated.

### WSC-0849

#### Acute Stroke Management Tirofiban injection after solitaire stent deployment as rescue technique in intra-arterial thrombectomy: Single center experience

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Mechanical thrombectomy using solitaire stent (ev3 Inc, Irvine, CA, USA) has been introduced effective method in acute ischemic stroke. However,

there were no consensus on treatment strategies after the failure of the thrombectomy using solitaire stent. We described experiences about tirofiban injection after solitaire stent deployment as a rescue therapy after the failure of thrombectomy.

**Material and method:** Data on 11 patients treated with mechanical thrombectomy using solitaire stent were collected, retrospectively. Solitaire stent was used as primary thrombectomy method in all 11 patients. If more two times thrombectomy with solitaire stent failed, we performed the tirofiban injection after solitaire stent deployment as rescue method. **Result:** Median age and initial NIHSS was 68 years (range, 50–87) and 14 (range, 6–20). Female was 4 (36.3%). Mean time of FAT was 78.5 minutes. The vessel occlusions were 8 cases in the middle cerebral artery, 1 in distal internal carotid artery, and 2 in basilar artery.

Successful recanalization (TICI grade 2b and 3) using rescue method was achieved in 9 (81.8%) of all 11 patients. In two patients with no successful recanalization after rescue method, angioplasty with stent insertion was performed and successful recanalization was achieved in all 2 patients. Periprocedural complications occurred in 3 patients (distal embolization, n = 2; wire perforation, n = 1). Mortality occurred in one patient. Eight patients experienced the neurological improvement.

**Conclusion:** We suggest that tirofiban injection after solitaire stent deployment may be effective and safe for successful recanalization after the failure of thrombectomy using solitaire stent in acute ischemic stroke.

### WSC-0620

#### Acute Stroke Management The second elevation of neuron-specific enolase level after ischemic stroke is associated with hemorrhagic transformation

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**Introduction:** Neuron-specific enolase (NSE) is a surrogate marker for the extent of brain damage and well predicted the outcome of ischemic stroke.

**Aims:** We hypothesized that the pattern of NSE change during the acute period of ischemic stroke is different according to the stroke mechanism and it is associated with hemorrhagic transformation.

**Methods:** Acute ischemic stroke patients visiting our center within 24 hours from onset were recruited. The level of NSE was obtained daily, and the pattern of change was categorized into; no significant change, continuously increasing, decreasing, with one peak and with two-peaks. Clinical, laboratory and imaging variables were compared among the groups. Multivariate analysis was performed to verify the independent association between the second peak of NSE and hemorrhagic transformation after adjusting potential confounders.

**Results:** Among the 83 patients included in this study, NSE was stationary in 22 (26.5%) patients, increased in 9 (10.8%), decreased in 18 (21.7%), and showed one-peak in 17 (20%) and two peak in 17 (20%) patients. The incidence of atrial fibrillation ( $p = 0.02$ ) and hemorrhagic transformation ( $p = 0.02$ ) was high in patients with a two NSE peaks. Finally, the second peak of NSE during the acute stage (OR = 6.844,  $p = 0.04$ ) and the initial DWI lesion volume (OR = 1.024,  $p = 0.02$ ) was independently associated with the occurrence of hemorrhagic transformation after adjusting potential confounders.

**Conclusions:** Serial analysis of NSE during the acute period of ischemic stroke may be a useful surrogate marker for monitoring the status of blood brain barrier disruption and hemorrhagic transformation.

## WSC-0353

## Acute Stroke Management

**ABCD2 and ABCD3-I scores are predictive for early worsening but not for recurrent cerebrovascular events in TIA or minor stroke patients treated on stroke units**

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**Introduction and aims:** Patients with TIA and Minor Stroke (MS) are at high risk of early recurrent cerebrovascular events. Recently risk scores have been suggested to aid general practitioners and emergency physicians to estimate the risk of early recurrence and urgency of neurological evaluation. Yet it is unknown if the predictive capacity of the score extends also to patients treated in the highly specialized setting of acute stroke unit care. This might become increasingly important as patients with high ABCD2 scores might profit from early intensified antithrombotic therapy. **Methods and results:** Since December 2010 various risk scores have been prospectively documented in 5768 patients with TIA or MS treated on Austrian Stroke Units within 24 hours of symptom onset. Early sustained worsening on stroke unit stay (median 2 days) and 3-month recurrent cerebrovascular (TIA or ischemic stroke after stroke unit stay) was seen in 3.3% and 3.2% of TIA/MS patients. With increasing ABCD2 and ABCD3-I scores the rate of early worsening increased from 0% to 6.7% and 0% to 16.7% whereas the frequency of recurrent cerebrovascular events did not show any correlation with increasing scores.

**Conclusions:** In Patients with TIA or MS treated on Austrian Stroke Units the ABCD2 and ABCD3-I scores are a good predictive instruments for early neurological deterioration during Stroke Unit stay but not for 3-month recurrent cerebrovascular event and therefore might not be optimal to select high-risk patients qualifying for short term dual antiplatelet therapy in this setting.

## WSC-0737

## Acute Stroke Management

**Higher peak expiratory flow of voluntary cough is associated with lower risk of pneumonia in acute stroke patients who are at risk of aspiration**

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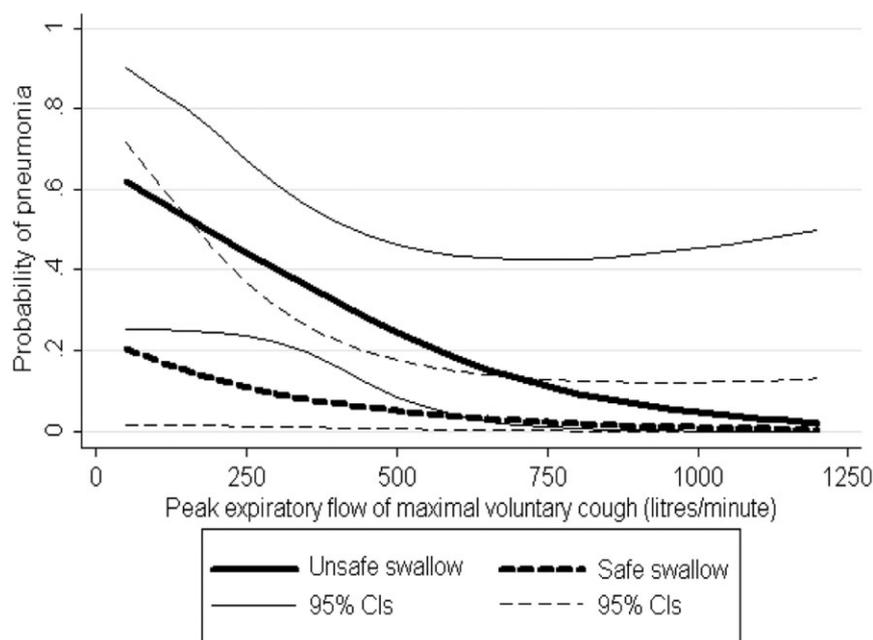
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**Background:** Impaired cough after stroke is associated with increased pneumonia risk.

**Aims:** To explore how cough intensity modifies pneumonia risk in acute stroke patients with and without aspiration risk.

**Methods:** Seventy-two stroke patients included in a study of respiratory training in stroke (ISRCTN40298220) were stratified according to aspiration risk, using bedside swallowing assessment. Cough intensity (peak expiratory flow of maximal voluntary cough and capsaicin-induced involuntary cough) was assessed within two weeks of stroke. Incidence of pneumonia was observed for four weeks.

**Results:** The mean age of 72 patients was 65 (SD 14) years with a median NIHSS score of 8 (range 3–25). Of these, 33 were at high and 39 at low risk of aspiration. For patients at high risk of aspiration (unsafe swallow), each increase in voluntary cough flow by 50 L/Min was associated with a statistically significant decrease in pneumonia risk (OR 0.73, 95% CI 0.51–0.95,  $p = 0.012$ ) up to the threshold of 600 L/min (Fig. 1). For involuntary cough this was not statistically significant (OR 0.87, 95% CI 0.60–1.20,  $p = 0.45$ ). For patients at low risk of aspiration (safe swallow), there was no association between either voluntary (OR 1.01, 95% CI 0.74–1.33,  $p = 0.89$ ) or involuntary cough (OR 1.11, 95% CI 0.55–2.23,  $p = 0.84$ ) and pneumonia.



**Fig. 1** Probability of pneumonia according to swallow safety and cough strength.

**Conclusion:** The findings suggest that stronger voluntary cough protects from aspiration-related pneumonia after stroke. Further confirmatory studies are required.

### WSC-1533

#### Acute Stroke Management

#### Results of intravenous thrombolysis in Turkey: A multicenter study

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**Introduction:** The aim of this study was to create a nationwide registry in order to prompt wider usage of rt-PA in acute ischemic stroke (AIS) patients.

**Method:** Patients presenting with AIS and treated by rt-PA were prospectively registered in our database between 2006 and 2013. We collected demographic data, imaging features, time from stroke onset to treatment, admission and 24-hour NIHSS and 3-month modified Rankin Scale (mRS) scores.

**Results:** A total of 1133 patients were enrolled into the registry by 39 centers in 20 cities. Nearly a 4-fold increase both in study population and number of participating centers were observed over the 6 years of the study. The mean ( $\pm$  SD) age of the study population was  $64 \pm 13$  years 653 (57%) of whom were females. The mean baseline NIHSS score was  $14.5 \pm 5.7$ , and symptomatic hemorrhage rate was 4.9%. Overall 54% of cases had NIHSS improvement  $\geq 4$  points, and 60% of cases had improvement by 20% after 24 h of thrombolysis when compared initial NIHSS. 65% of cases were functionally independent at 3 months mortality rates from all causes decreased from 22% to 11% in the six years of enrollment.

**Conclusions:** We observed a decreasing trend in mortality and stable and acceptable rates of symptomatic hemorrhage over the years with continuous addition of new centers to the registry.

### WSC-1622

#### Acute Stroke Management

#### A systematic review of traditional Chinese medicine for cerebral hemorrhage

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**Objective:** A large number of Traditional Chinese Medicine (TCM) are widely used for the treatment of patients with cerebral hemorrhage in China. The aim of this study is to systematically review the existing clinical evidence on TCM treatment for cerebral hemorrhage.

**Methods:** Randomized controlled trails (RCTs) of TCM treatment of cerebral hemorrhage were identified, eligible studies were included, the methodological quality of inclusive trails was assessed by the modified Jadad scale. The Cochrane Collaboration's Revman 5.20 was used for data analysis.

**Results:** 69 RCTs (6866 patients) were available and included. Meta-analysis indicated that relative risk of overall effective rate of Sanqi, Ciwujia, Chuanxiongqin and Naoxueshu was significant difference; SMD (95%CI) of neural function defect score was  $SMD = -0.46$ , 95% CI (-0.56, -0.35) of Sanqi, Danshen, Qingkailing, Liangxuetongyufang; SMD (95% CI) of the reduce of cerebral hemorrhage was  $SMD = -0.98$ , 95% CI (-1.32, -0.63) of Danshen, Dahuang, Ciwujia, Qingkailing, Liangxuetongyufang.

**Conclusion:** The evidence currently available showed that the TCM which included do not increase the death rate and adverse reaction of the patients with cerebral hemorrhage, TCM may reduce neurological deficit and improve absorption of hematoma.

### WSC-0221

#### Acute Stroke Management

#### A study of decompressive craniectomy in acute stroke

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**Background:** Decompressive craniectomy is a life saving emergency surgery in patients with stroke with mass effect and midline shift. Sparse data are available from India regarding the outcome of patients who underwent this procedure for stroke.

**Material and methods:** Retrospective study of case records of consecutive patients with stroke who underwent decompressive craniectomy at our tertiary care center between January 2001 to December 2011.

**Results:** During the study period, 97 patients underwent decompressive craniectomy for stroke. Their mean age was  $41.5 \pm 15.2$  years; there were 53 males. Risk factors associated with stroke included hypertension (22.7%), diabetes mellitus (10.3%), tobacco smoking (34%), and alcohol consumption (29.9%). Most of the patients presented with altered sensorium (87.6%), motor weakness followed by headache (62.9%), vomitings (59.7%), seizures (47.4%) and pupillary asymmetry on examination (36%). Large artery thrombosis (46.4%) followed by venous thrombosis (41.2%), hemorrhagic causes (11.3%) were the major causes of stroke; cardioembolic (1%) stroke was rare. Ischemic stroke (87.7%) was more common than hemorrhagic stroke (11.3%). midline shift on CT brain was evident in 91.8% patients. In comparison with survivors, patients who died had a significantly lower mean Glasgow Coma Scale (GCS) values at admission [ $10.21 \pm 3.15$  Vs  $7.60 \pm 2.66$  ( $p = 0.003$ )]; and at 24 hours after surgery [ $9.15 \pm 2.82$  Vs  $6.73 \pm 2.57$  ( $p = 0.003$ )]; longer duration of ventilation after surgery [1 (1-2) Vs 4 (2-7) ( $p = 0.000$ )]; and a more prolonged hospital stay [ $13.95 \pm 8.67$  Vs  $16.47 \pm 18.64$  ( $p = 0.406$ )]. Overall, 15 (15.5%) patients died. Of the 40 patients with venous thrombosis, 28 (70%) showed complete recovery without any focal neurological deficit.

**Conclusions:** Decompressive craniectomy is a life saving emergency surgical intervention especially in patients with venous thrombosis. Lower GCS at admission and 24 hours after surgery and need for prolonged mechanical ventilation following surgery are useful prognostic markers of death in these patients.

**WSC-0479****Acute Stroke Management  
Predictors of fever in stroke patients**

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**Background:** Fever frequently occurs in stroke patients and worsens their prognosis. However, only few studies have assessed the possible determinants of fever during the acute phase of stroke.

**Methods:** This study included 636 consecutive patients with acute stroke, 247 of whom (38.8%) had fever. Among the clinical and laboratory variables available during the first 24 hours from admission, we searched for those predictive of the subsequent appearance of fever (defined as a temperature  $\geq 37.5$  °C associated with antibiotic prescription).

**Results:** In univariate analysis many variables were predictive of fever, but in multivariate analysis only oxygen administration ( $P = 0.0001$ ), C-reactive protein ( $P = 0.0002$ ), leukocyte count ( $P = 0.0002$ ), National Institutes of Health Stroke Scale (NIHSS) score ( $P = 0.003$ ) and nonlacunar syndromes (non-LACS) ( $P = 0.03$ ) remained independently associated with the appearance of fever. In a further model, including only the presumable causal factors, the following 6 factors remained associated with fever (odds ratio [95% confidence interval],  $P$  value): nasogastric tube (3.1 [1.8–5.6], 0.0001), hemorrhagic stroke (2.8 [1.5–5.1], 0.001), Glasgow Coma Scale  $\leq 13$  (2.2 [1.4–3.7], 0.001), non-LACS (2.5 [1.4–4.6], 0.002), NIHSS  $\geq 12$  (2.0 [1.3–3.2], 0.003) and parenteral nutrition (4.3 [1.6–12.2], 0.004). Among the 169 (26.6%) patients with 3 or more factors, 121 (71.6%) had fever.

**Conclusions:** In addition to oxygen administration, which probably in many cases reflects the presence of pulmonary infection, 6 possible causal factors were found to be independently associated with fever. Among them, nasogastric tube was the most significant one. When 3 or more of these factors are present the risk of fever becomes elevated.

**WSC-0765****Acute Stroke Management  
Is fracture a relative or absolute contraindication for  
thrombolysis? – A case of stroke thrombolysis with  
missed fractured neck of femur**

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**Introduction:** There is no consensus between guidelines on thrombolysis in ischemic stroke complicated by fracture. Fracture has complicated 0.8% of strokes in case series. This presentation highlights a case of ischemic stroke that was thrombolysed, with an existing fractured neck of femur later diagnosed.

**Aim:** To review the evidence for thrombolysis after fractures.

**Methods – Case report:** An 80-year old woman presented with expressive dysphasia and right-sided pyramidal features leading to a fall. NIHSS 14, GCS 10. She was thrombolysed following a normal noncontrast CT brain at 120 minutes. Six hours post-thrombolysis, she developed a hematoma on right leg, which was shortened and externally rotated. Hip X-Ray showed fractured right neck of femur. She was managed conservatively for fracture and later for a myocardial infarction. The thigh hematoma resolved. She was discharged with residual symptoms of the stroke.

**Results:** This patient was thrombolysed with a fractured neck of femur but did not suffer major complications. There are hardly any case reports of patients thrombolysed after major fractures. However there is evidence

in thrombolysis of acute MI after rib fractures caused by prolonged CPR. Off-license thrombolysis in stroke following minor fractures, recent surgery and head trauma without brain injury have been associated with good outcomes with no major bleeding risks.

**Conclusions:** There are only anecdotal reports of thrombolysis in ischemic stroke complicated by fractured neck of femur. We recommend the creation of a registry of ischemic stroke complicated by major fracture and a randomized control trial to define guidelines on thrombolysis.

**WSC-0565****Acute Stroke Management  
Hyperglycemia control and outcome in acute ischemic  
stroke**

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**Introduction:** Several studies have shown that hyperglycemia during admission portends poor functional outcome after stroke. There is little data with respect to regulation of blood sugar after admission and its association with functional outcome in acute ischemic stroke.

**Aims:** To determine whether admission hyperglycemia and average hospitalization glucose are independently associated with poor 3 month functional outcome in patients with acute ischemic stroke and whether glucose normalization in them is associated with improved functional outcome.

**Methods:** Patients with acute ischemic stroke admitted within 48 hours of symptom onset with National Institute of Health Stroke scale (NIHSS) of  $\geq 4$  were prospectively enrolled. Demographic data, risk factors, NIHSS, blood glucose values and its control were noted. The primary outcome was modified Rankin scale (mRS) at three months (Good outcome – mRS  $\leq 2$ ).

**Results:** From September 2010 to September 2013, 347 patients were enrolled. Mean age was 62 years (range 18–88) and 64.2% were males. The median admission NIHSS was 10 (range 4 to 38). Achievement of mean blood glucose  $< 110$  mg/dl in the first week of admission was associated with a better outcome (mRS  $\leq 2$ ) compared with higher mean blood glucose values (61.2% vs 41.7%,  $p$  value 0.043). Requirement for insulin portended a poorer outcome (59.0% vs 45.9%,  $p$  value 0.014). There was no statistically significant relation between blood sugar at admission and 3 month functional outcome.

**Conclusions:** Patients who achieved a mean blood glucose below 110 mg/dl in the first week of acute ischemic stroke had better outcomes. High blood glucose at admission did not independently predict the outcome of acute ischemic stroke.

**WSC-1290****Acute Stroke Management  
Efficiency of cerebrolysin in treatment of patients with  
acute ischemic stroke**

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**Introduction:** Cerebrolysin is a neuropeptide drug with low molecular weight and free amino acids, a compound with neurotrophic and neuroprotective activity. Beneficial effects of this drug has been proved in various animal models of cerebral ischemia and has shown clinical efficacy and good safety in several controlled clinical studies in ischemic stroke.

**Aims:** Efficiency of cerebrolysin in treatment of patients with ischemic stroke.

**Methods:** This study is a randomized clinical trial on ischemic stroke patients admitted to URMIA Emam Khomeini educational medical center which is based on inclusion and exclusion criteria. Patients in the intervention group were treated with cerebrolysin (30 ml) injection for 10 days that added to standard treatments (antiplatelet, anticoagulant) and control group receiving placebo. The clinical observation period for each patient with National Institute of Health Stroke Scales (NIHSS) score criteria will be 3 months and will include four clinical evaluation visits at Baseline (day 1) and on study days 30, 60, and 90.

And results compare in cerebrolysin group vs control.

**Result:** 46 patients with acute ischemic stroke were included in the study. Of these, 23 patients receiving cerebrolysin and 23 patients considered as control group received placebo. NIHSS score in patients receiving cerebrolysin were statistically lower from control group in second and third months of follow up.

**Conclusion:** Patients with acute ischemic stroke had significantly better outcome with cerebrolysin treatment as compared with control group. The above findings suggest that cerebrolysin can be helpful in reducing the clinical deficits after acute ischemic stroke.

### WSC-0738

#### Acute Stroke Management Use of adenosine triphosphate-induced transient cardiac arrest for deflation of cerebral aneurysms during clipping surgery

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**Introduction:** Clipping operation for cerebral aneurysms occasionally requires transient deflation of the aneurysm to prevent its rupture or to manage premature rupture. Temporary occlusion of the parent artery is an effective method to reduce the pressure of the aneurysm. However, in some case, blocking the parent artery may not be feasible. Transient cardiac arrest (TCA) induced by adenosine triphosphate (ATP) is an effective alternative in such cases. This method leads to temporary softening of the aneurysm. Adenosine is a purine nucleoside that suppresses atrioventricular conduction. A bolus dose of ATP causes momentary cardiac arrest.

**Aims:** Here, we present the advantages of inducing TCA to the clipping process.

**Methods:** 264 consecutive patients with aneurysms (ruptured aneurysm: 125, unruptured aneurysm: 139) were surgically treated between 2007 and 2014. Of these, 8 patients with anterior circulation aneurysms underwent TCA-inclusive surgery. Bolus intravenous injection of ATP (10–120 mg) was administered. Microsurgery was performed during the short period of cardiac arrest.

**Results:** We observed 3–40 s of cardiac arrest and noted remarkable softening or collapse of the aneurysms in all cases. In every case, the aneurysms were successfully obliterated. Complications associated with TCA were not observed in any of these patients.

**Conclusions:** TCA facilitated safe and quick dissection of the aneurysm and clip application during the clipping operation. This approach is useful when temporary occlusion of the parent artery is difficult. ATP-induced TCA is a quite useful and safe approach, although the former requires close monitoring by an experienced anesthesiologist.

### WSC-0815

#### Acute Stroke Management Combination therapy during admission after acute ischemic stroke is not more effective than monotherapy to improve short-term outcome

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**Introduction:** It remains uncertain that combination of clopidogrel and aspirin is efficacious in the secondary prevention after acute ischemic stroke.

**Aim:** We assessed whether dual antiplatelet therapy (combination therapy of clopidogrel and aspirin, DAT) during hospital stay after acute ischemic stroke is more effective than monotherapy of aspirin or clopidogrel to improve short-term outcome.

**Methods:** From a multicenter prospective registry, which recruited patients with acute stroke or TIA admitted to 12 academic hospitals. The primary outcome was the proportion of 3-month mRS0–2. Secondary outcome was composite vascular events (nonfatal stroke, nonfatal myocardial infarction, and vascular death) at 3-month follow-up. We estimated the propensity score between DAT and monotherapy group, using unbalanced variables, hospital, age, and sex.

**Result:** Among total of 3,089 patients (age, 62.7 ± 13.4; men, 59.6%), 749 patients (24.2%) were taking DAT during admission. Compared with those in monotherapy group, patients in DAT group were older and have more large artery atherosclerosis, multiple risk factors, and severe initial NIHSS score. Before PSM, the proportion of 3-month mRS 0–2 in monotherapy group was more often than that of combination therapy group (unadjusted odd ratios [OR]; 95% confidence interval [CI], 1.70 [1.39–2.08]). After PSM, in 810 matched patients, the proportion of 3-month mRS 0–2 of combination group did not significantly different from that of monotherapy group (0.97, [0.70–1.35]). Regarding to secondary outcome, there were no significant difference between two groups; composite vascular events at 3-month follow-up, 0.77 [0.38, 15.56].

**Conclusion:** The effect of DAT was not different to that of monotherapy in the improvement of functional outcome and the reduction of composite vascular events in ischemic stroke.

## WSC-1539

### Acute Stroke Management Sonographic evaluation of carotid intima-media complexes in stroke patients at Obafemi Awolowo University Teaching Hospital

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**Background:** Atherosclerosis has been implicated in the pathophysiology of stroke. Noninvasive assessment of carotid intima-media thickness (C-IMT) is been widely used as a surrogate marker of atherosclerosis. There are data showing that C-IMT is increased with cerebrovascular risk factors and stroke. The objective of this paper is to evaluate the association between C-IMT and cerebrovascular risk factors, stroke and all stroke subtypes.

**Aim:** The study aims to determine the occurrence of carotid artery intima-media thickening in stroke patients, association of carotid intima-media thickness with stroke types/subtypes and cerebrovascular risk factors.

**Method:** Case-control approach is used among 50 strokes subjects between 18 and 90 years, 50 healthy controls matched for age and sex and 50 control subjects matched for the cerebrovascular risk factors. Between July 2013 and June 2014, all research subjects undergo ultrasound examination of carotid arteries to assess the intima-media thickness, sonographic appearance of plaques and velocities. Determination of their serum lipid profile, fasting blood sugar and urea/creatinine is based on hospital records.

**Results:** Recruitment of the control subjects is ongoing. However 55 stroke cases have been studied (12 hemorrhagic and 43 ischemic types). The mean intima media thickness is higher in ischemic stroke (1.45 mm) compared to hemorrhagic stroke (1.15 mm). Amongst the ischemic subtypes, the mean thickness is higher in the nonlacunar subtype (1.5 mm) compared to lacunar (1.35 mm) and cardio-embolic subtype (1.20 mm). Plaques were seen in all the different subtypes of ischemic stroke but those in nonlacunar and lacunar strokes showed features of ulceration. The cardio-embolic subtype had multiple foci of infarctions in the brain. The commonest risk factors in the stroke subjects were hypertension and diabetes mellitus. The velocities in all the stroke subjects will be compared to those of controls after recruitment of control subjects when completed.

**Conclusion:** A conclusion will be drawn after the recruitment of the control patients.

## WSC-1546

### Acute Stroke Management Sonographic evaluation of endothelial dysfunction in brachial arteries of stroke patients at Obafemi Awolowo University Teaching Hospital, Ile Ife

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**Background:** Endothelial dysfunction has been identified as an early feature of atherosclerosis. Noninvasive assessment of flow mediated vasodilation (FMD) in brachial arteries has been widely used to assess endothelial function. Data that FMD is impaired in stroke patients and with stroke risk factors are limited. The objective of the study is to evaluate association between FMD with cerebrovascular risk factors, stroke and stroke subtypes.

**Aims:** The study aims to determine the occurrence of endothelial dysfunction in stroke, association of impaired endothelial function with flow mediated dilatation (FMD) with stroke types/subtypes and cerebrovascular risk factors.

**Method:** Case-control approach is used among 50 stroke subjects, 18–90 years, 50 healthy controls matched for age and sex only and 50 controls matched for various cerebrovascular risk factors. Between July, 2013 and August, 2014, all subjects undergo ultrasound examination of brachial

arteries to assess their luminal diameter before shear stress and 90 seconds after shear stress removal and velocity changes with shear stress removal. Determination of their serum lipid profile, fasting blood sugar and urea/creatinine is based on hospital records.

**Results:** Recruitment of the two control groups is ongoing. However, 50 stroke cases have been studied (12 hemorrhagic and 38 ischemic types). The percent FMD in the stroke patients ranged from 0 to 6.3%. The mean value was lower in ischemic stroke (4.7%) than hemorrhagic stroke (5.6%). The mean value was lowest in the lacunar subtype (3.2%) compared with nonlacunar (4.3%) and cardio-embolic subtypes (4.9%). The systolic velocities were higher after removal of shear stress at 90 seconds in all the stroke subtypes. However the diastolic velocities either had no significant change or decreased after the removal of shear stress in all stroke patients. The percent FMD will be compared to control subjects after recruitment of controls is completed.

**Conclusion:** Conclusions will be drawn after the recruitment of control subjects and analysis of data.

## WSC-0315

### Acute Stroke Management Dangerous dissection and a happy ending!

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**Introduction:** Cerebral angiogram can cause carotid dissection in 0.4% of patients<sup>1</sup>. Management of such patients, if they also happen to have an arteriovenous malformation (AVM), can be very tricky. We describe one such patient.

**Case report:** A 62 year-old previously well lady, who presented with recurrent focal seizures involving left arm, was suspected to have an AV malformation on CT brain scan. It was confirmed by a formal cerebral angiogram. She was treated with levetiracetam and was referred for gamma knife treatment. A week later, she was readmitted with aphasia and right hemiparesis. A CT head & CTA confirmed left middle cerebral artery territory (MCA) infarction, left internal carotid artery dissection (at the site of the angiogram) & a thrombus in the left MCA. In view of the large MCA clot & the presence of salvageable brain tissue on perfusion scan, she was thrombolysed and the clot was retracted using a Solitaire device. As she had significant narrowing of the left internal carotid artery due to dissection, a stent was placed successfully. Over the next 3 months she made complete neurological recovery and a few months later underwent successful gamma knife therapy for the AVM.

**Conclusion:** We have described a patient with AVM who was thrombolysed successfully without any adverse events and the deployment of a stent to manage carotid dissection which complicated cerebral angiogram.

1. Cloft H J *et al.* Arterial dissections complicating cerebral angiography and cerebrovascular interventions. *AJNR Am J Neuroradiol* 2000; 21:541–5.

## WSC-0627

### Acute Stroke Management Outcomes of the 'drip, call, and retrieve' paradigm in patients with acute ischemic stroke

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**Introduction:** For managing acute main-trunk artery occlusion (MAO), in our hospital, with the method "Drip, Call and Retrieve," an endovascular specialist is called in from an outside medical facility.

**Subjects:** Between July 2012 and October 2013, we targeted 17 with acute MAO (4.3%) who received endovascular treatment. The subjects were

nine males, with the age of between 62 and 85 years. Eight were given tPA, and 14 had arterial fibrillation. At the initial visit, the median values of NIHSS and DWI-ASPECTS were 16 (0–37) and 7 (5–10), respectively. 4, 6, 4, 2 and 1 case had occlusion of the ICA, the proximal M1, the distal M1, the M2 and the proximal BA, respectively. Once MRI has confirmed MAO, we immediately contact (Call) to request a specialist.

**Results:** The average time from diagnosis to needle placement was 196 minutes (87–345 min). Recanalization was achieved within 120 minutes in 13 (77%). As for the device, we used the Merci in 5 cases, Penumbra in 12, POBA in 3 and a stent in 1. TICI 2a or better was achieved in 15 cases (88%) and TICI 2b or better in 12 (71%). The mRS scores at 3 months after treatment were 0–2 in 3 cases and 0–3 in 6.

**Discussion:** The “Drip, Call and Retrieve” protocol does not require transport of the patient and is an effective form of medical collaboration that can achieve earlier initiation of treatment. It can also serve as an effective educational system for endovascular specialists.

**WSC-1014**

**Acute Stroke Management  
Patient characteristics associated with delayed presentation in ischemic stroke**

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**Introduction:** Stroke is an emergency and timely presentation to hospital influences patient outcomes.

**Aims:** Determining the factors associated with delayed arrival (>4 h after onset) is the first step to identifying populations of patients who are potentially missing out on key interventions such as thrombolysis, and determining the potential impact delayed arrival has on patient outcomes.

**Methods:** Data were extracted from a national register, the Sentinel Stroke National Audit Programme (SSNAP), of acute ischemic stroke adults admitted to participating hospitals in England, Wales and Northern Ireland in 2013. Characteristics of those whose known onset-to-arrival time was less than 4 h were compared to those over 4 h.

**Results:** Of the 34,554 adults with a known onset admitted to 194 hospitals, 21,412 (62%) were admitted within 4 h of onset and 13,142 (38%) after 4 h. Characteristics found to be associated with a longer onset-to-arrival time were younger age (median 75 compared to 77 years) and milder stroke (NIHSS median 3 compared to 6). Reduced consciousness was associated with shorter onset-to-arrival times (59.7% of fully conscious arrivals were early versus 77.0% of reduced consciousness patients).

		Univariable odds ratio
Age:	Less than 60	–
	60–69	0.92 (0.85–0.99)
	70–79	0.82 (0.77–0.88)
	80–89	0.70 (0.65–0.75)
	90+	0.60 (0.55–0.66)
Univariable odds ratio		
NIHSS LOC:	0	–
	1	0.43 (0.39–0.47)
	2	0.48 (0.42–0.56)
	3	0.45 (0.36–0.56)
NIHSS:	(continuous)	0.91 (0.90–0.91)

**Conclusions:** Younger age and mild strokes were associated with delayed presentation. Further efforts to raise awareness of the importance of rapid recognition and response in these populations are needed.

**WSC-0645**

**Acute Stroke Management  
Outcome after decompressive craniectomy in patients with ischemic stroke**

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**Introduction:** There is a definite role of decompressive craniectomy (DCC) in salvaging patients of malignant middle cerebral artery (MCA), space-occupying cerebellar infarction and cerebral venous thrombosis (CVT) cause rapid expansion of hemorrhagic infarction.

**Aims:** The aim of this retrospective study was to evaluate survival rates and functional outcomes in three groups of patients.

**Methods:** A total of 59 patients (47 male, 12 female), median age 40 years (range 12–67) with ischemic strokes who underwent decompressive craniotomy from 2008 to 2013 were analyzed with an in-hospital, at 3-month and at 6-months follow-up. Of these, 22 (37.3%), 30 (50.8%) and 7 (11.9%) patients were diagnosed with MCA, cerebellar infarction and CVT, respectively. The right side and left side hemisphere involved in 29 and 30 patients respectively. Functional outcome was assessed by modified Rankin Scale (mRS) [0–2: excellent; 3: good; 4–5: bad; 6: mortality].

**Results:** In 59 patients, the National Institute of Health Stroke Scale (NIHSS) scores obtained ranged from 14 to 24 (median 18). Overall 67.8% patients had good outcome, while 13.6% had poor outcome. The incidence of death at in-hospital and at 3-months were 9 (15.3%) and 2 (3.4%), respectively. Of these, 8 patients died after stroke and other died due to cardiac problem and septicemia. Cerebellar infarction and CVT groups had excellent outcome with 73% and 71% recovery, respectively with mRS 0–2. In, MCA group 50% patients had good outcomes with mRS 3, while 36% had mortality with mRS 6.

**Conclusion:** Decompressive craniectomy in cases with space occupying supra and infra tentorial ischemic infarcts improves survival rates and functional outcomes. Cerebellar strokes, younger pts and venous infarcts had excellent outcome.

**WSC-1143**

**Acute Stroke Management  
Decompressive craniectomies for stroke. A strong indication with minor reservations**

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**Introduction:** The decision for decompressive craniectomies remains still one of the most controversial issues in current neurosurgical practice. Although the routine use of ICP monitoring and microdialysis have produced some acceptable guidelines regarding stroke there is a significant proportion of patients who present to the neurosurgeon with significantly worse GCS (and ICP) than the proposed by guidelines. Thus the question remains: Who really benefits from decompressive craniectomies?

**Material & method:** We are presenting our series of 40 Patients who underwent decompressive craniectomies for strokes.

15 were operated for MCA strokes as dictated by the guidelines, 16 were operated later following unsuccessful medical management and 9 were operated urgently after transfer to ER.

Mean GCS = 8,2.

**Results:** Out of 15 patients who had early craniectomies as indicated for MCA infarcts the survival rate was 93% and the mean GOS = 3,6.

Out of 16 patients who had craniectomies following unsuccessful medical ICU management the survival rate was 75% and mean GOS = 3,1. A subgroup with ICA infarcts fared worse.

Out of the 9 patients who had craniectomies “beyond” the guidelines the survival rate was 44% and mean GOS = 2,1 with only 16% of patients achieving a favorable (4–5 GOS).

**Conclusions:** Our results demonstrate that patients with MCA infarcts who undergo early decompressive craniectomies according to guidelines are the most likely to benefit the most in terms of both survival and GOS. Massive ICA stroke patients as well as “Beyond guidelines” patients fare extremely poorly especially in terms of GOS, thus should be treated with a lot of scepticism.

## WSC-1427

### Acute Stroke Management Carotid thrombendarterectomy in acute extracranial carotid occlusion

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**Introduction:** We present our experience with carotid thrombendarterectomy in acute extracranial carotid occlusion.

**Methods:** From January 1998 to November 2012 there were 49 patients operated on for extracranial carotid occlusion. Patient data were retrospectively evaluated. Morbidity was evaluated using modified Rankin score. Ultrasonography, angiography and recently CT angiography were used in confirmation of carotid occlusion. Majority of patients was in bad initial clinical status and progressing stroke was present in 35 of them. Average time from onset symptoms to surgery was 7.3 hours. Contraindication for intervention was intracerebral hemorrhage and presence of significant ischemia in ipsilateral territory.

**Results:** Overall mortality was 10%. Thirty one patients (63%) improved, ten (21%) remained stable and 3 (6%) worsened in mRS. 30d mRS  $\leq 3$  reached 74% of patients. The only predictive factor was initial mRS (1–3 vs 4–5) with OR 8.57 and p-value 0.0374 (Fisher exact test). Recanalization rate was recorded in 38 patients (78%).

**Conclusions:** We have achieved high rate of recanalization, acceptable mortality and significant postoperative morbidity improvement in our group of carotid thrombendarterectomy in acute extracranial carotid occlusion. Acute CEA remain method of choice in selected group of patients with acute carotid extracranial occlusion.

## WSC-0807

### Acute Stroke Management A reciprocal international telestroke service to assist with out of hours expert coverage

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**Introduction:** Telestroke services improve access to stroke thrombolysis.

**Aims:** To address challenges of night time coverage we explored the feasibility of a cost neutral reciprocal international telestroke service between Scotland and New Zealand taking advantage of international time zones.

**Methods:** After addressing medico-legal, governance, and cultural issues a 12-month pilot assessed patient and staff perceptions, treatment rates, door-to-needle times, technical faults, and protocol violations. The pilot was limited to two secondary hospitals with one dedicated consultant at each end. Institutional ethics approval and individual patient consent were obtained.

**Results:** Early and extensive stake-holder involvement proved essential. Colleague physicians and local hospital managerial buy-in presented initial barriers, while higher level health system managerial, government, and insurer buy-in were readily gained. To date seven of the twelve planned patient assessments have occurred. Of seven assessed patients three were treated with door-to-needle times of 53, 60, and 70 minutes. Local clinicians deemed all seven treatment decisions appropriate. No protocol violations occurred. No technical factors affected patient care. Patient feed-back has been enthusiastic, welcoming expert advice from a wide awake expert without concern for expert domicile. Staff feed-back has also been positive and this project has, in fact, improved working relationships between emergency and medical teams.

**Conclusions:** These preliminary findings indicate that an international telestroke service is feasible. The pilot is ongoing and final results will be presented at the conference. Based on these findings a larger study is in the planning stages to more comprehensively assess treatment delays, patient outcomes, and service costs.

## WSC-1049

### Acute Stroke Management Effect of extract supplementation status of snakehead fish in the status of the protein, antioxidant, oxidative stress and outcome in acute ischemic stroke

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**Introduction:** Oxidative stress overwhelms endogenous antioxidant systems and decreased of visceral proteins that play a role in the acute phase. The aim of this study was to analyze whether the snakehead fish extract (SFE) supplementation could enhance the clinical output by improving protein status, antioxidants and oxidative stress in acute ischemic stroke.

**Methods:** A randomized pretest-posttest control group design with double-blind was conducted in 61 patients. The treatment group were given 15 gr SFE immediately within 48 hours of stroke onset and continued for 1 week. The control group were given a placebo. Both group were treated according to the hospital procedure standard. Variables measured were transthyretin (TTR), transferrin (TFR), retinol binding protein (RBP), and malondialdehyde (MDA) using ELISA, albumin with Bromocresol green and TAS with Randox Colorimetry method. Clinical outcome was measured by NIHSS score. The statistical test were paired t-test, Independent sample t-test, Mann-Whitney U, Spearman's rho and Backward Stepwise.

**Results:** SFE supplementation improved 3 proteins which are albumin ( $0.08 \pm 0.35$   $p = 0.002$ ), TTR ( $88.82 \pm 87.25$   $p = 0.0001$ ), and TFR ( $63.80 \pm 51.36$   $p = 0.0001$ ), as well as SAT ( $0.03 \pm 0.09$ ,  $p = 0.007$ ), decreased MDA ( $-110.7 \pm 79.35$ ,  $p = 0.0001$ ) and NIHSS ( $-2.5 \pm 1.81$   $p = 0.007$ ). Correlation were found between improvement in albumin, TTR, and TFR with NIHSS ( $r_1 = 0.42$ ;  $r_2 = 0.43$ ;  $r_3 = 0.30$ ;  $p < 0.05$ ) also negative correlation albumin, TTR, and TFR with MDA ( $r_1 = 0.38$ ;  $r_2 = 0.53$ ;  $r_3 = 0.34$ ;  $p < 0.05$ ) There was no correlation between RBP and SAT with NIHSS. Increased levels of transthyretin more than 16.28 mg/dL had a 5.2 times greater likelihood of improved clinical outcome.

**Conclusion:** SFE Supplementation in early ischemic stroke improved protein status, antioxidant, oxidative stress and clinical outcome in stroke

and can be considered as a procedure in early treatment of acute ischemic stroke.

**Key words:** snakehead fish extract (SFE), protein, total antioxidant status (TAS), malondialdehyde (MDA), NIHSS, ischemic stroke.

### WSC-0304

#### Acute Stroke Management

##### Stroke outcome in India – An observational study

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**Introduction:** Stroke is common cause of mortality and morbidity worldwide. This is an Observational study to review the treatment pattern and outcome.

**Objectives:** To study the background characteristics and pharmacotherapy of patients admitted to hospital with stroke, at one & six months duration.

**Methods:** This was a prospective study conducted at Tertiary center (2008–12) of stroke patients. Treatment and outcome at 1 and 6 months were collected. Chi square test, student t test and ANOVA used for analysis.

**Results:** Out of 301, 229 had ischemic, 48 had hemorrhagic stroke and 24 had a TIA. The median age of the patients was 60 yrs for ischemic and 57.9 years for hemorrhagic stroke. 39 patients with ischemic stroke reached within 3 hours of symptom onset, out of which 18 were thrombolysed. Hypertension was the predominant risk factor for both ischemic 167 of 229 patients and 32 of 48 hemorrhagic strokes. Antiplatelet usage reduced at 1 month for 171 patients and at 6 months 123 patients. A total of 107 patients with ischemic stroke received low molecular weight heparin.

**Conclusion:** Stroke patients in South India present at a relatively earlier age as compared to their western counterparts. A total of 15.7% (36 of 229) deaths occurred in ischemic stroke patients, 21.3% (10 of 48) deaths in hemorrhagic patients and 1 death in a TIA patient.

### WSC-0857

#### Acute Stroke Management

##### Transient bullous rash – A rare form of severe dermatologic adverse reaction following the administration of tissue plasminogen activator (TPA) in a case of acute stroke

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**Introduction:** Tissue plasminogen activator (TPA) represents an effective treatment for patients having acute stroke. Its important adverse effects are intracranial hemorrhage, anaphylactic shock, angioedema, and rash. We would like to report the case of an unusual and severe dermatologic adverse event – transient bullous rash – following the administration of TPA.

**Case presentation:** 72 year-old female patient presented with dysarthria, dysnomnic dysphasia, right hemianopia, and right moderate flaccid hemiparesis. 60 minutes after starting IV TPA several asymmetrical cutaneous papules and vesicles overlying normal skin appeared in the right chest area and rapidly became confluent, forming bullous lesions containing clear fluid, spreading on shoulder, neck, face, chest and hand. 4 hours later they gradually disappeared without any treatment.

**Results:** A possible explanation for this reaction could be the simultaneous activation of complement system and kinin cascades by plasmin, produced by alteplase-cleavage of plasminogen. Complement cascade activation is direct, causing mast cell degranulation and histamine release with consequent vasodilatation. Another explanation might be extracellular proteolysis by plasminogen/plasmin system and metalloproteinases.

Lateralization might be triggered through acute changes in the vasomotor tone of the hemiparetic side. Contralateral autonomic imbalance might be secondary to the presence of lesions in the insular cortex, postcentral cortex, basal ganglia and internal capsule.

**Conclusions:** Bullous rash with lateralization to the paretic side following thrombolytic treatment for acute stroke represents an unusual complication of this treatment. Several possible immune mechanisms are presented as well as a review of the literature of other immunological based adverse events to thrombolysis in acute stroke.

### WSC-1293

#### Acute Stroke Management

##### Comparison of the decompressive surgery and medical therapy only results in malignant middle cerebral artery infarction

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**Background:** Decompressive craniectomy is performed in malignant middle cerebral artery (MCA) infarction besides medical treatment. The purpose of this clinical trial is comparing the differences in morbidity and mortality of malignant MCA infarction between decompressive surgery and conservative medical therapy alone (standart antiedema treatment).

**Methods:** The cases who were observed in our hospital between November 2007 and June 2011 with malignant MCA infarction, treated with decompressive craniectomy and medical therapy alone, were enrolled in this study.

**Results:** Ages of the 42 enrolled patients are between 40–80 years. Of the 42 patients in the trial, 20 were assigned to decompressive craniectomy and 22 to medical therapy. At the end of first month, 40% of surgical group and 36% of medical treatment group survived (p: 0.808).

Survival of the cases who are under 60 years old, were significantly higher than the cases over 60 years of age (p < 0.05). The survival rate of all patients who were treated within 6 hours after the symptoms onset, especially within the surgery group, was significantly higher (p < 0.05) and while the survival rate of the cases who were treated with decompressive craniectomy within 48 hours of stroke onset is 50%, the survival rate after 48 hours of stroke onset is 33%, at the end of the first month.

**Conclusion:** Survival rate in decompressive craniectomy group was higher than medical treatment group. Decompressive craniectomy should be considered in cases younger than 60 years of age and especially within 48 hours from symptoms onset, therefore mortality and morbidity can decrease.

### WSC-0538

#### Acute Stroke Management

##### Intravenous administration of EGB 761 and 90-day functional outcome in patients with acute ischemic stroke

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**Introduction:** EGB 761 is a standardized natural extract used worldwide to treat acute ischemic stroke. Although several studies have been conducted in animals, few have investigated the clinical effect of EGB 761 in acute stroke.

**Aims:** The present study assessed the clinical benefit of intravenous administration of EGB 761 in patients with acute ischemic stroke.

**Methods:** This was a retrospective study on a prospectively collected stroke database. We evaluated 232 patients with acute ischemic stroke who presented to the emergency room within 48 hours of symptom onset. All patients were treated with an antiplatelet or anticoagulation according to stroke subtype. We compared baseline characteristics between the EGB 761-treated and nontreated groups. The functional outcome measure was the modified Rankin Scale (mRS) score at 90 days after stroke onset.

**Results:** Of 232 patients, 170 received EGB 761 during the first 3 days following stroke onset and 62 patients did not receive the extract. We found no significant difference in baseline characteristics between the groups, with the exception of atrial fibrillation (EGB 761 group: 8.2% vs. control group: 11.2%;  $p = 0.032$ ). After adjusting for baseline factor, intravenous administration of EGB 761 was associated with a good 90-day functional outcome (mRS) compared with the control group ( $1.38 \pm 1.60$  vs.  $2.11 \pm 1.93$  for control;  $p = 0.013$ ).

**Conclusions:** Our results showed a clinical benefit of intravenous administration of EGB 761 for patients with acute ischemic stroke, suggesting that infusion of the natural extract is a potential neuroprotective strategy for suitable patients.

### WSC-0375

#### Acute Stroke Management Changes in salivary stress biomarkers after Stroop test in patients with acute ischemic stroke

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**Introduction/Aims:** Ischemic stroke causes a stress-mediator-induced long-lasting immune depressive state which undoubtedly contribute to the process of brain injury and recovery. We investigated the effects of acute ischemic brain insult on salivary stress marker and its response to psychological stress.

**Methods:** We studied 10 patients with acute ischemic stroke (<3 weeks, mean age of  $68 \pm 8$  years) and 6 healthy volunteers (mean age of  $28 \pm 2$  years). Saliva was collected by the passive drool technique or the Salimetrics Oral Swab and samples were stored at  $-80$  °C within the same day. Secretary alpha-amylase, cortisol, dehydroepiandrosterone (DHEA), and sIgA were determined by using enzyme-linked immunosorbent assay (ELISA). These salivary markers were determined before and after psychological stress using standardized Stroop task. All studies were performed from 4:00 pm to 6:00 pm.

**Results:** All baseline salivary biomarkers in acute stroke patients except DHEA were significantly higher than those in healthy controls (Cortisol:  $16.8 \pm 5.03$  vs  $6.7 \pm 4.25$   $p < 0.05$ , DHEA : $207.9 \pm 123.9$  vs  $441.5 \pm 336.8$   $p = 0.009$ ). Response to the Stroop task as a psychological stress were similar between stroke patients and controls.

**Conclusions:** Secretary IgA, alpha-amylase and cortisol levels in saliva were significantly increased in patients with acute stroke, implying the hypothalamic-pituitary-adrenal axis dysfunction in the acute stage of stroke. Further studies are warranted to explore the relationship with individual immunedepressive state.

### WSC-0925

#### Acute Stroke Management Pure word deafness in a patient with bilateral ischemic stroke in the parieto-temporal regions

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**Introduction:** Pure word deafness (PWD) is a rare condition which must be differentiated with sensory aphasia. The essence of PWD is the inability

to understand the speech with preserved ability to write and read. There were no neologisms in the spontaneous speech, and identification of the non-verbal sounds is correct. PWD could be a complication of ischemic stroke, may occur after brain injury, in brain tumors, and neurodegenerative disorders. Localization of the brain lesion in PWD is not well known, but uni- or bilateral damage of Heschl gyrus region is taking in account. **Case report:** 72-years old, right-handed, woman was admitted to the Neurological Department, Wroclaw Medical University after the sudden appearance of verbal contact disturbances. In the neurological examination the slight hemiparesis on the right side was seen. The patient was anxious with motor restlessness and fear. Very severe problems with understanding of verbal sounds were recognized (identification of syllables was cancelled) in the neuropsychological examination. Verbal communication, ability to read and write were preserved.

MRI scans revealed a subacute ischaemic stroke with contrast enhancement in the left parieto-temporal region and recent ischemic lesion in the right parieto-temporal area.

**Conclusions:** In the literature we did not find descriptions of PWD with such severe disturbances of verbal sounds understanding and preserved spontaneous speech. We suggest that described above severe disturbances might depend on bilateral lesions in the area with MCA vascular supply.

### WSC-0439

#### Acute Stroke Management Efficacy and safety of thrombolytic therapy in acute stroke

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**Aim:** To evaluate efficacy and safety of thrombolytic therapy in acute ischemic stroke at our region.

**Subjects and methods:** Patients with ischemic stroke treated with rt-PA, admitted at the Department of Neurology Tuzla, Bosnia and Herzegovina, in the period between April 1<sup>st</sup> 2008 and December 31<sup>st</sup> 2012 were included.

**Results:** Between April 2008 and December 2012, intravenous rt-PA was given to 87 patients with acute ischemic stroke, which represents 3.2% of patients with acute ischemic stroke admitted to our Department in that period (2667 patients). The mean NIHSS score before thrombolysis was 12 (range 4–21). Large artery arteriosclerosis was the most common stroke etiology. The mean onset-to-needle time was 152 minutes. Half of patients (44/87) had a significant improvement within the first 24 hours. Symptomatic intracranial hemorrhage occurred in 5 patients (6%), and was fatal in two cases. The rate of asymptomatic intracranial hemorrhage was 11% and benign extracerebral bleeding complications occurred in 6 patients (7%). At 3-months follow-up, 45% of patients (39/87) had good outcome (mRS 0 or 1), and an analysis of independence (mRS 0–2) vs. disability (mRS 3–5) or death showed that 56% of patients treated in our center were independent in self-care. Sixteen patients were dead at 3-month, and mean baseline stroke severity was significantly higher in patients who died (NIHSS 16.5 vs. 11,  $p = 0.003$ ).

**Conclusion:** Thrombolytic therapy is effective and safe, and these results should encourage all physicians in our country to help its wider implementation in the treatment of acute ischemic stroke.

**WSC-0662****Acute Stroke Management  
NIH-time score predicts outcomes of patients with  
IV-TPA therapy in real world clinical practice: The  
Kawasaki Stroke Network Registry**Y Suzuki<sup>1</sup>, C Atsumi<sup>1</sup>, T Shimizu<sup>1</sup>, K O J I Yamada<sup>1</sup>, N Sasaki<sup>1</sup>, Y Hasegawa<sup>1</sup>, for the KSN Investigators<sup>1</sup><sup>1</sup>Neurology, St.Marianna University School of Medicine, Kawasaki, Japan

**Introduction:** The NIH-time score was proposed by Aoki et al. as a simple and easy assessment tool for the outcome of patients with intravenous tissue plasminogen activator (iv-tPA) therapy.

**Aims:** We aimed to confirm the validity of the NIH-time score in real world Japanese clinical practice.

**Methods:** All patients treated with iv-tPA between April 2009 and March 2013 in Kawasaki city were included. All of the transportation for acute thrombolysis was recorded and summarized by the Kawasaki City Fire Department every 6 months, and their clinical data were added to this file by 12 hospitals that accept stroke bypass transfers.

**Results:** A total of 2,049 patients were registered from April 2009 to March 2013. During this period, iv-tPA therapy was performed in 210 patients. Their mean age was 71.2 ± 11.5 (min-max: 40–96) years, and 64.4% of them were male. A discriminative ability for predicting favorable outcome (mRS 0–1) was calculated by receiver operating characteristic (ROC) curve analysis. Area under the curve (AUC) of ROC curves for NIH-time score, NIHSS score just before iv-tPA, and onset-to-needle time were 0.701, 0.692, and 0.587, respectively. Multivariate logistic regression analysis demonstrated that age (OR 0.969, 95% CI 0.941–0.998), and NIH-time score (OR 0.948, 95% CI 0.903–0.995) were significantly associated with favorable outcome (mRS < 2) after iv-tPA therapy.

**Conclusions:** NIH-time score predicts outcomes of patients with iv-tPA therapy in real world clinical practice.

**WSC-1268****Acute Stroke Management  
Simultaneous administration of edaravone and RT-PA  
in acute cerebral ischemic stroke patients**K Takenaka<sup>1</sup>, M Kato<sup>1</sup>, K Yamauchi<sup>1</sup>, Y Nonaka<sup>1</sup><sup>1</sup>Neurosurgery, Takayama Red Cross Hospital, Takayama, Japan

Among the 1,052 patients admitted to our hospital due to cerebral infarction between January 1, 2007 and December 31, 2010, we report the treatment outcomes of 48 patients (4.6% of all patients) who received recombinant tissue plasminogen activator (rt-PA) therapy (simultaneously combined with edaravone) within 3 hours after the onset of infarction. Twenty (41.7%) patients started receiving edaravone before rt-PA administration, and 28 (58.3%) started receiving rt-PA and edaravone simultaneously. The patients had an average age of 73.5 years (range, 55–93 years; male : female = 32:16). Medical histories included hypertension, diabetes mellitus, dyslipidemia, arterial fibrillation, and a smoking history in 23 (47.8%), 7 (14.6%), 8 (16.7%), 29 (60.4%), and 8 (16.7%) of patients, respectively. Regarding the treatment outcome of the therapy, the National Institutes of Health Stroke Scale (NIHSS) score, which was 15 points before rt-PA administration, showed a statistically significant improvement to 8 points after rt-PA administration ( $P < 0.001$ ). The modified Rankin Scale scores at the time of hospital discharge were as follows: 0 in 8 (16.7%) patients, 1 in 16 (33.3%) patients, 2 in 6 (12.5%) patients, 3 in 6 (12.5%) patients, 4 in 9 (18.8%) patients, 5 in 1 (2.1%) patient, and 6 in 2 (4.2%) patients. The occluded blood vessel reopened completely in 30 (62.5%) patients and partially in 5 (10.4%) patients. Asymptomatic hemorrhage over the entire brain developed in 2 (4.2%) patients. Thus, rt-PA therapy in combination with edaravone improved

the recanalization rate, reduced the incidence of intracranial hemorrhage, and improved functional prognosis.

**WSC-1420****Acute Stroke Management  
Effect of oral antithrombic agents taken before onset  
in acute brain infarction patients without atrial  
fibrillation**T Terasaki<sup>1</sup><sup>1</sup>Neurology, Japanese Red Cross Kumamoto Hospital, Kumamoto, Japan

**Aims:** To clarify effect of antithrombic agents which are taken orally before onset of stroke on severity and outcome in acute brain infarction patients without atrial fibrillation.

**Methods:** From 1170 acute brain infarction patients who got hospitalized from March 2013 to March 2014, we excluded patients with daily activity of modified Rankin scale  $3 \leq$  before onset and history of atrial fibrillation. Remaining 774 patients were divided to two groups, patients who had taken oral antithrombic agents before onset of stroke and patients who had not. We compared severity (NIHSS score on admission and discharge) and outcome (modified Rankin scale on discharge) between two groups.

**Results:** 195 patients took oral antithrombic agents (aspirin 110 patients, clopidogrel 24, cilostazol 22, warfarin 12, others or combination 27) before stroke onset and 543 patients did not. We did not find significant difference between NIHSS scores (mean 5.23) of the patients who had orally taken antithrombic agents and had not (mean 5.17) at the time of admission. NIHSS scores on discharge of two groups did not differ significantly, either (mean 3.52 vs. 3.56). The proportions of the patients with daily activity of modified Rankin scale  $\leq 2$  on discharge were not different between the groups (61.7% vs. 65.6%).

**Conclusion:** We did not find effect of oral antithrombic agents taken before onset of stroke on severity and outcome in acute brain infarction patients without atrial fibrillation.

**WSC-0283****Acute Stroke Management  
Prognostic factors in patient with cerebellar stroke**S Trajkovic-Bezmarevic<sup>1</sup>, A Bezmarevic<sup>1</sup>, S Djokovic<sup>1</sup>, N Basurovic<sup>1</sup>, T Jaramaz-Ducic<sup>1</sup>, M Vukicevic<sup>1</sup>, L J Beslac-Bumbasirevic<sup>2</sup><sup>1</sup>Neurology, Hospital for Cerebrovascular Diseases Sveti Sava, Belgrade, Serbia<sup>2</sup>Emergency Neurology, Clinical Centre of Serbia, Belgrade, Serbia

**Introduction:** Cerebellum infarcts are rare and make 1,5–3% of total number of ischemic strokes.

**Aims:** The aim of our study was to determine clinical and neuroradiological characteristics of cerebellar infarcts, to define role of demographic factors and clinical parameters (TOAST classification of stroke, volume and localization of cerebellar infarcts) in prognosis and recovery of patients with cerebellar stroke.

**Methods:** We enrolled 40 patients in our study which were hospitalized in Hospital "Sveti Sava" with neuroradiologically (CT/MR) proven cerebellar infarct. Demographic parameters and vascular risk factors were followed at all patients as well as localization and volume of infarcts. Patients conditions were scored with known scales – NIHSS on admission and discharge and modified Rankin score on discharge.

**Results:** The women mostly got stroke much later than men. The most frequent risk factor was hypertension at even 90% patients. NIHSS at admission pointed to moderate and in discharge to lower stroke. The most

frequent symptom was vertigo. The localization of infarct was vascular territories of PICA in 60% patients. Atherosclerosis of big arteries was the most frequent cause of ischemic stroke. According to Modified Rankin score, 35% were completely dependant in activities of daily living, 25% had recovered completely and 17.5% patients died.

**Conclusions:** The results of this study showed that NIHSS is not always good parameter for stroke severity in cerebellum. The clinical symptoms and volume of infarcts are not predictive factors for stroke severity and recovery, but the older age is bad predictive factor in this case.

## WSC-0252

### Acute Stroke Management

#### Case report: Thrombolysis, acute carotid endarterectomy and endovascular treatment in a young stroke patient

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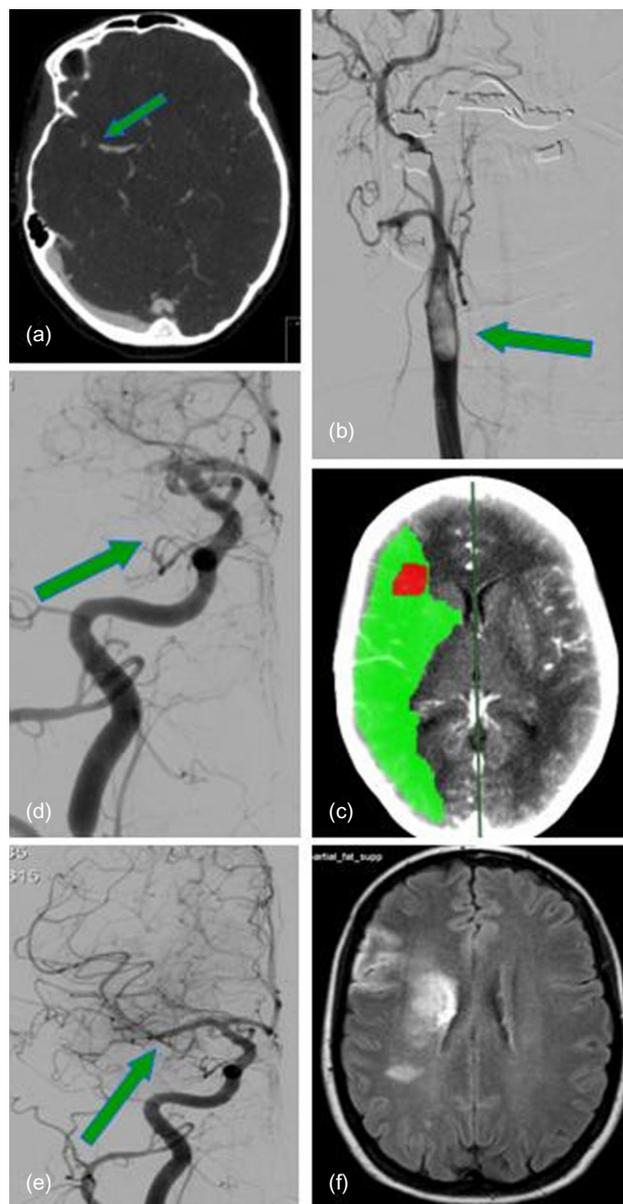
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**Introduction:** Thrombolysis IV is given to patients with an ischemic stroke within 4,5 hours after onset. Sometimes, for example in wake-up strokes, the exact time of onset is not precisely known. This hampers treatment with rTPA, because of the fear of an increased risk of hemorrhage. Even so, there still is some evidence that thrombolysis may be given safely in special circumstances.

**Case:** We present a patient, with a severe ischemic stroke of which the time of onset was in all probability within 4,5 hours. Our primary neuro-imaging didn't show signs of massive infarction. Secondly the brain-perfusion scan showed a very large penumbra. We decided to give the patient IV thrombolysis. Furthermore we did an acute carotid endarterectomy (CEA), because of an enormous thrombus in the right carotid bifurcation, which could not be removed by endovascular methods. Afterwards the carotid bifurcation was open. Subsequently we decided to remove another thrombus in the MCA endovascular by using a Penumbra-device. The MRI after 14 days showed only a small infarction. After 3 months she noted a score of 1 on the Modified Rankin Scale.

**Discussion:** In our opinion there are certain situations in the setting of acute stroke in which you may decide not to treat following the standard procedures.

In this patient, we performed an acute CEA followed by an endovascular procedure after thrombolysis. This case may provoke discussion about thrombolysis given in particular subgroups such as wake up strokes or young vital patients with specific findings on neuro-radiologic imaging.



**Fig.** (a) Primary CTA occlusion in the M1 segment of the right MCA. (b) DSA showing a big thrombus in right carotid artery bifurcation. (c) CT-brain-perfusion after acute CEA shows a big penumbra area of the right MCA. (d) DSA showing the right MCA with occlusion of the M1-segment. (e) Recanalized right MCA. (f) FLAIR-sequence MRI at 14 days: just a small infarction on the right side.

## WSC-0437

### Acute Stroke Management

#### Stroke dilemma: Too many and too few platelets

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**Introduction:** Ischemic stroke is the initial manifestation in 1.27% of patients with underlying hematological disorders. Two case reports, with extremes of platelet counts will be discussed; essential thrombocythemia and chronic idiopathic thrombocytopenic purpura (ITP).

**Aims:** To highlight the underlying mechanisms mediating thrombosis and how this impacts management.

**Method – Case description:** A 71-year old female, with a JAK2 V617F essential thrombocythemia and transfusion dependent anemia, presented with left-sided hemiparesis. MRI imaging confirmed an acute infarct of right internal capsule. Platelet count was  $420 \times 10^9/l$  on admission. Prior to admission, the patient was on hydroxyurea.

An 85-year old male, with chronic ITP, presented with slurred speech and left arm weakness, which resolved within 20-minutes. MRI confirmed right frontal and posterior lacunar infarcts. Platelet count was  $46 \times 10^9/l$  on admission.

**Results and discussion:** In essential thrombocythemia, activation and aggregation of hypersensitive platelets leads to a hyperviscosity state. In the acute phase, thrombolysis can be considered. Aspirin is recommended to be used, in combination with chemotherapeutic agents, to reduce the long term risk of a thrombotic event.

Thrombotic states in chronic ITP result from an increase production of platelet microparticles. Thrombolysis is relatively contraindicated at platelet counts  $<100 \times 10^9/l$ . Evidence suggests antiplatelet and anticoagulation therapy do not reduce platelet microparticle activity. Initiation of secondary stroke prevention is based upon platelet stability and patient risk factors.

**Conclusion:** In the absence of clear guidelines, we recommend the creation of a stroke registry of patients with underlying hematological disorders. A multi-center randomized-control trial would enable definitive guidance on management.

**WSC-1152**  
**Acute Stroke Management**  
**Safety of intraprocedural heparin in endovascular stroke treatment**

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**Background:** Heparin is thought to provide an anticoagulant effect preventing catheter related thrombosis during acute intra-arterial

thrombolytics in acute ischemic stroke patients undergoing endovascular procedures.

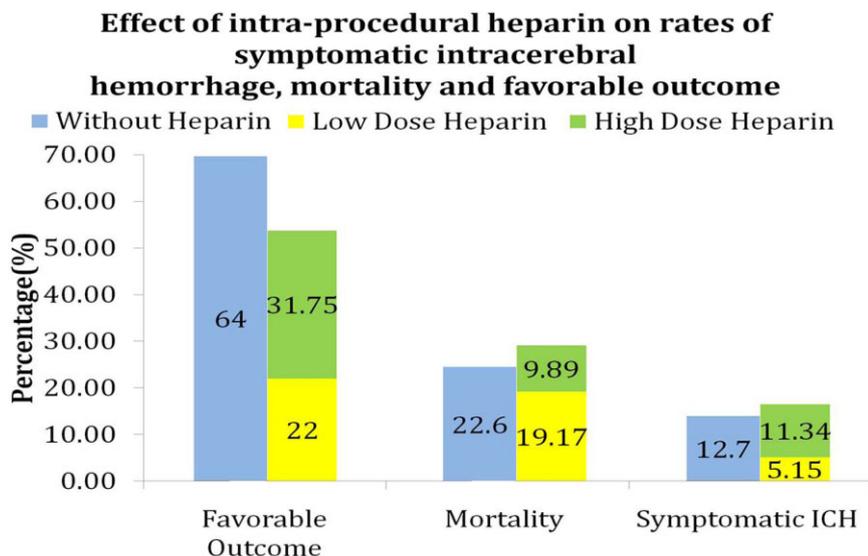
**Objective:** To perform a systematic review to determine the effect of intraprocedural heparin (and intensity) on rates of symptomatic intracerebral hemorrhage (ICH), mortality, and favorable outcome (mRS of 0–2) at 1–3 months.

**Methods:** All published trials until 2012 evaluating endovascular treatment were identified from Pubmed using searches with keywords ‘Catheter based therapy AND Stroke,’ ‘Intra-arterial acute stroke,’ ‘Intra-arterial thrombolysis.’ Studies that reported their treatment time window, baseline median NIH Stroke Scale (NIHSS) score, mean age, and 3-month outcomes were selected. The studies were divided into two groups; endovascular treatment performed with or without intraprocedural heparin. Among those who received heparin, patients were divided into high and low dose heparin. Low dose of heparin was defined as less than 2500 U/hr, and high dose heparin was defined as more than 2500 U/hr.

**Results:** A total of 957 (patients in both arms were analyzed) from 33 trials. Intraprocedural heparin was used in 485 of 957 patients (51%); 228 and 257 patients were treated with low dose and high dose heparin, respectively. The rate of symptomatic ICH was not different in patients who received or did not receive intraprocedural heparin (80 of 485 versus 60 of 472,  $p = 0.09$ ).

However, trial defined mortality was significantly lower in those who did not receive heparin (107 of 472 versus 141 of 485,  $p = 0.02$ ). There was a significantly higher rate of favorable outcomes at 1 to 3 months in patients who did not receive heparin compared with those who received heparin (305 of 472 versus 264 of 485,  $p = 0.001$ ). Among patients who received intraprocedural heparin, the rate of symptomatic ICH was significantly higher in those who received high dose heparin as compared to low (dose (55 of 257 versus 25 of 228,  $p = 0.001$ ).

**Conclusion:** Intraprocedural use of heparin during endovascular treatment among acute ischemic stroke patients was associated with higher rates of mortality and lower rates of favorable outcomes at 1–3 months.



**WSC-0986****Acute Stroke Management  
Decompressive hemicraniectomy in a South American population: Morbidities and outcome analysis focusing on age differences**

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Ischemic strokes of the middle cerebral artery can lead to malignant infarction, leaving decompressive hemicraniectomy as the only effective treatment. European trials demonstrated reduction of mortality rates without an increase in severely disabled patients. This research aims to discuss Hemicraniectomy comparatively below and above 60 yrs. Between 2010 and 2013, a retrospective cohort was made by reviewing electronic medical charts, dividing patients into two groups according to age. The outcomes were measured as mRS. Statistical analysis was made by simple logistic regression models. Sixty patients were submitted to surgical decompression. The mean age was 63 yrs (32 to 83 yrs). The variables sex, race, preexisting comorbidities, stroke side, time to surgery and NIHSS did not differ statistically. Eleven patients (18%) received r-TPA before surgery. Overall mortality was 55%, while patients  $\leq 60$  yrs had 40.7% vs. 66.7% in the  $>60$  yrs group ( $p = 0.045$ ). Thirty-eight developed Pneumonia, while 97% were in the subgroup of mRS 4–6 ( $p = 0.056$ ). Overall, sepsis appeared in all cases with mRS 5–6 ( $p = 0.01$ ). This represents the largest series from a South American population so far. The baseline characteristics presented correspond with the current literature, differing on the outcomes, which were worse in both of our groups. As expected and reported previously, we also found that the elderly group had a worse prognosis with an OR of 3.91 for an mRS 5–6 ( $p = 0.015$  IC 95% 1.30–11.74). Trials involving Latin American populations are required. Outcomes and survival of older patients were worse whereas the high incidence of sepsis could be a contributing factor.

**WSC-0172****Acute Stroke Management  
HbA1c versus OGTT as a method to detect abnormal glycometabolism in acute strokes**

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**Introduction:** The investigation on HbA1c as a method for detecting abnormal glycometabolism in acute stroke is rare.

**Objective:** To compare glycated hemoglobin (HbA1c) as a method for abnormal glycometabolism diagnosis with oral glucose tolerance test (OGTT) in acute stroke.

**Methods:** Patients were excluded successively from ACROSS study as: subarachnoid hemorrhage ( $n = 162$ ), those with a history of abnormal glycometabolism ( $n = 1708$ ), those without HbA1c values ( $n = 7$ ). 1708 patients were eligible for the present analysis. The OGTT results were categorized according to the WHO 1999 criteria. HbA1c  $\geq 6.5\%$ , HbA1c 5.7–6.4% and HbA1c  $< 5.7\%$  were used as the criteria for diabetes, prediabetes and normoglycemia.

**Results:** Ischemic ( $n = 1310$ ) and hemorrhagic ( $n = 398$ ) stroke were analyzed. The prevalence of abnormal glycometabolism with HbA1c  $\geq 5.7\%$  were 58.9% in ischemic stroke and 45.5% in hemorrhagic stroke which were both lower than that with OGTT (59.3% in ischemic stroke and 61.5% in hemorrhagic stroke). Compared to OGTT, 1) an HbA1c value  $\geq 6.5\%$  detected diabetes with a 52.8% sensitivity and 85.4% specificity ( $P < 0.001$ ) and prediabetes with a 41.6% sensitivity and 69.8% specificity ( $P = 0.001$ )

in ischemic stroke; 2) an HbA1c value  $\geq 6.5\%$  detected diabetes with a 32.3% sensitivity and 89.1% specificity ( $P = 0.002$ ) and prediabetes with a 34.2% sensitivity and 73.5% specificity ( $P = 0.197$ ) in hemorrhagic stroke. **Conclusions:** The prevalence of abnormal glycometabolism with HbA1c was lower than that with OGTT. HbA1c  $\geq 6.5\%$  for diabetes diagnosis in acute stroke and HbA1c 5.7–6.4% for prediabetes diagnosis in ischemic stroke were in a medium accordance with OGTT.

**WSC-0676****Acute Stroke Management  
Gender comparisons in the management of acute ischemic stroke patients – Results from a population-based study**

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**Introduction and aims:** Women may have poorer outcomes after stroke than men because of differences in their acute stroke management. We conducted a prospective population-based study in Tyrol, a federal state of Austria, to determine whether gender-differences exist in regards to frequency of thrombolysis, stroke-unit admission and early mortality.

**Methods:** We used data from 3173 consecutive patients with acute ischemic stroke in Tyrol between 2010 and 2012, after implementation of a Stroke Pathway in 2009. The Stroke Pathway covers all aspects of stroke care from symptom onset to posthospital rehabilitation. In the survey area, hospitalization rates for stroke patients were near complete (98.8%). **Results:** Among 3173 stroke patients, 1547 were women (48.8%). Women were older than men and had more severe strokes. In contrast to women, men were more likely to be admitted to stroke-units. In-hospital mortality was higher among women than men. However, the observed associations lost significance after adjustment for age and sex. The frequency of thrombolysis did not differ between men and women and we did not find any disadvantage of women versus men regarding the delay between stroke onset and hospital admission or frequency of first cerebral imaging.

**Conclusions:** No gender differences were observed in the acute management of ischemic stroke patients in Tyrol.

**WSC-1524****Acute Stroke Management  
Early recurrent ischemic stroke during IV thrombolysis – A case report**

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**Introduction:** New neurological symptoms during IV thrombolysis alerts the managing physician to the possibility of symptomatic intracranial hemorrhage. Early recurrent ischemic stroke is however a possibility. We present a case of new ischemic stroke during IV thrombolysis with a good outcome.

**Case:** A 67 year old man with paroxysmal atrial fibrillation, presented with isolated right hemianopia (NIHSS-2). His cranial CT scan did not show an infarct or bleed and he was thrombolysed with IV alteplase according to standard guidelines 235 minutes following the onset of his symptom. He developed new onset slurred speech and left facial droop 13 minutes after commencing IV thrombolysis with his NIHSS increasing to 5. His alteplase infusion was stopped immediately. A repeat cranial CT scan did not show any new changes and his alteplase infusion was recommenced. His post thrombolysis CT scan 24 hours after thrombolysis and MRI DWI 4 days later showed left occipital and right frontal infarcts with no significant vascular abnormalities on his MRA. He was discharged 6 days later with an mRS of 1.

**Conclusion:** There are no clear guidelines on the management of recurrent ischemic strokes during IV thrombolysis. We believe stopping IV alteplase and repeating cranial CT scan in our patient was justified as his new symptoms were related to a different vascular territory, though his NIHSS increased by only 3. More evidence is needed to determine subsequent reperfusion strategies but recommending IV alteplase in this case was not associated with complications and our patient had a favorable outcome.

### WSC-1376

#### Acute Stroke Management Recognizing the reversible cardiac manifestations associated with subarachnoid hemorrhage

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Elevation of cardiac troponins are the cornerstone to the diagnosis of acute coronary syndromes and initiation of their treatment. However, it is important to appreciate that there are other disease processes that can cause a rise in troponin.

In this case report we discuss and give an example of how intracranial pathology, namely subarachnoid hemorrhage (SAH), can be associated with electrocardiographic changes and elevations in cardiac troponins, which if not considered can be further exacerbated with initiation of anticoagulant therapy. The cardiac phenomenon associated with intracranial pathology is described by some as the “catecholamine hypothesis” and can be associated with reversible cardiac wall abnormalities and can be prognostic of the patients functional outcomes. (1) This case report describes the an SAH presentation which was initially managed as an ST elevation myocardial infarction and that was later found to have a SAH secondary to a posterior communicating artery aneurysm. We highlight the importance of recognizing that intracranial pathology can mimic acute myocardial infarctions and how clinicians need to correlate clinical signs with underlying pathology, as there can be limitations in the reassurance that neuroimaging can provide.

- [i] Miketic JK, Hrvanek M, Sereika SM, Crago EA. Elevated cardiac troponin I and functional recovery and disability in patients after aneurysmal subarachnoid hemorrhage. *Am J Crit Care* 2010; 19:522–8; quiz 529. doi: 10.4037/ajcc2010156.

### WSC-0642

#### Acute Stroke Management Feasibility and accuracy of fusion TCCD in acute stroke treatment

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**Introduction:** CT-ultrasound fusion technology can co-register real-time ultrasound imaging to an earlier acquired CT image. It has the potential to accurately and in real-time, determine large vessel recanalization in acute stroke.

**Aim:** To examine the feasibility and accuracy of transcranial color coded duplex (TCCD) ‘fused’ to CT angiography in acute stroke due to middle cerebral artery occlusion.

**Methods:** Selected acute stroke patients undergoing evaluation of thrombolysis eligibility were recruited at John Hunter Hospital, Newcastle.

Inclusion criteria was occlusion (partial or complete) of the MCA and exclusion criteria, inadequate acoustic windows for image analysis. 3D CT angiography datasets were obtained using Toshiba Aquilion 1 and transferred to the Aplio 500 ultrasound instrument equipped with prototype TCCD fusion technology. Color-flow imaging and Doppler signal analysis (TIBI flow grades) was performed to determine the TCCD vessel status.

**Results:** Recruitment is in progress. 14 patients analyzed had an average age of 68.2 yrs (44–89 years), 4 patients had inadequate windows for image analysis, and 7 patients received thrombolysis. There was concordance between CTA and fusion TCCD for either total occlusion or no occlusion in seven of ten patients with adequate acoustic windows for analysis.

**Conclusions:** Fusion TCCD appears feasible in acute stroke patients and preliminary results of the initial accuracy study suggest acceptable overall accuracy for determining ‘occluded or open’ arterial status. The technique has potential for noninvasive real-time recanalization monitoring in acute stroke patients and may be a useful in identifying patients who require neurointervention after intravenous thrombolysis.

### WSC-0448

#### Acute Stroke: New Treatments Concepts Dual antiplatelet therapy with aspirin and clopidogrel after carotid endarterectomy in restenosis prevention: A single center experience

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**Introduction:** The prevalence of restenosis after carotid endarterectomy (CEA) varies from 1–37%, and literature reports 0–8% restenosis-related symptoms. Safety of short-time (30 days) dual antiplatelet therapy (DAT) after CEA has not been established.

**Aims:** To investigate the efficacy of dual antiplatelet therapy after carotid endarterectomy to prevent restenosis.

**Methods:** We retrospectively identified all the patients that underwent CEA (symptomatic or asymptomatic) in our center between July 2010 and July 2013 according to local protocols. All patients received a dose 100 mg of aspirin daily immediately after CEA, with subsequent 100 mg of aspirin daily for the rest of the study period, and the other group of patients received in addition to aspirin, daily doses of 75 mg of Clopidogrel for 30 days starting immediately after CEA (DAT group), according to medical criteria. Duplex carotid ultrasound and clinical assessment were performed at 1 month and 1 year after the procedure.

**Results:** A total of 44 patients (71.2 ± 7.9 years old; 77,2% symptomatic) underwent to CEA and 35 patients were treated with DAT (79.54%). At first month only 2 patients in the aspirin group developed restenosis (22,2%), compared to none in DAT group (p = 0.04). At one year follow up only one patient from the dual group showed restenosis (p = 0.10). No deaths or new strokes were reported in both groups.

**Conclusions:** Short-term DAT appears to be a safe option in patient after CEA and it might be associated with a lower incidence of restenosis, but this observation must be validated in a prospective trial.

**WSC-0910****Acute Stroke: New Treatments Concepts  
Electrical pharyngeal stimulation for post stroke  
dysphagia: A meta-analysis of individual patient data  
from randomized controlled trials**P M W Bath<sup>1</sup>, P Scutt<sup>1</sup>, S Hamdy<sup>2</sup><sup>1</sup>Stroke – Division of Clinical Neuroscience, University of Nottingham, Nottingham, United Kingdom<sup>2</sup>Neuroscience Research Institute, University of Manchester, Manchester, United Kingdom

**Background:** Dysphagia is common (~50%) in patients with acute stroke and is associated with a poor outcome. Current treatment options are limited. Electrical Pharyngeal Stimulation (EPS) is a novel treatment for poststroke dysphagia.

**Methods:** We searched for randomized controlled trials of EPS in dysphagic patients within 3 months of stroke in the Cochrane Stroke Group trials register (January 2014), citation databases, and reference lists of published trials and review articles. Individual patient data were analyzed using binary or ordinal logistic regression, or multiple regression, with adjustment for trial, age, severity and baseline score. Data are number (%), median [interquartile range] or mean (standard deviation). **Results:** Three completed trials of EPS were identified, these including 66 patients: age 72 (12) years, male 61%, severity (NIHSS) 10 (6), dysphagia severity rating scale (DSRS) 7.1 (4.3), penetration aspiration scale (PAS, using videofluoroscopy) cumulative score 27 [12]. At baseline, patients randomized to EPS had more severe dysphagia and dependency. In comparison with no EPS, EPS was associated, at 2 weeks, with a lower PAS: 20.0 (10.2) vs 24.8 (10.1); DSRS > 3: 10 (33%) vs 15 (58%); modified Rankin Scale: 3.5 [2] vs 3.5 [2]; and length of stay in hospital: 47.4 (22.8) vs 72.0 (62.1) days.

**Conclusions:** Across 3 small trials, EPS was associated with less clinical and radiological evidence of dysphagia, less dependency, and a shorter of length of stay in hospital.

**WSC-0720****Acute Stroke: New Treatments Concepts  
Endovascular cooling catheter system for selective  
cerebral hypothermia in acute stroke therapy: An  
animal feasibility study**S Meckel<sup>1</sup>, M Schumacher<sup>1</sup>, A Keuler<sup>1</sup>, L Boos<sup>1</sup>, M Shah<sup>2</sup>, K Foerster<sup>3</sup>, W Niesen<sup>4</sup>, G Cattaneo<sup>5</sup><sup>1</sup>Department of Neuroradiology, University Hospital Freiburg, Freiburg, Germany<sup>2</sup>Department of Neurosurgery, University Hospital Freiburg, Freiburg, Germany<sup>3</sup>University Heart Center, University Hospital Freiburg, Freiburg, Germany<sup>4</sup>Department of Neurology, University Hospital Freiburg, Freiburg, Germany<sup>5</sup>R&D, Acandis GmbH & Co.KG, Pforzheim, Germany

**Introduction:** In acute ischemic stroke, systemic mild hypothermia after recanalization therapy has been shown to lead to improved clinical outcomes. Selective cerebral hypothermia applied prior and/or during endovascular stroke recanalization may enable early neuroprotection in the critical phase of reperfusion and decrease systemic side-effects.

**Aim:** In this study, we aimed to establish an animal model for and assess the feasibility of the intracarotid cooling catheter.

**Methods:** Animal experiments with 9 sheep were approved by the institutional ethics committee and performed in accordance to the European Community animal care guidelines. Temperature probes were introduced into the frontal and temporal brain cortex bilaterally. Via transfemoral access the cooling catheter system was introduced successively in both common carotid arteries (CCA). Selective intracarotid blood cooling was

applied without direct blood contact with cooling fluid. Systemic (venous and nasal) temperatures and brain temperatures were measured simultaneously during cooling. CCA diameters and flow were measured angiographically and by Doppler ultrasound. The correct positioning of brain temperature probes was verified by CT.

**Results:** The CCA diameter was between 6.3–8 mm with good flow conditions under cooling through the catheter. Maximum cooling in the ipsilateral, contralateral temporal cortex, and systemic were –2.8°C, –1.7°C and –1.4°C, respectively.

**Conclusions:** The sheep represents a feasible animal model to test the intracarotid cooling catheter. Selective mild hypothermia was achieved within the ipsilateral cerebral hemisphere. Systemic cooling was considerably lower compared to the ipsilateral brain.

Sponsored by Federal Ministry of Education and Research, Germany (BMBF grant 13GW0015B).

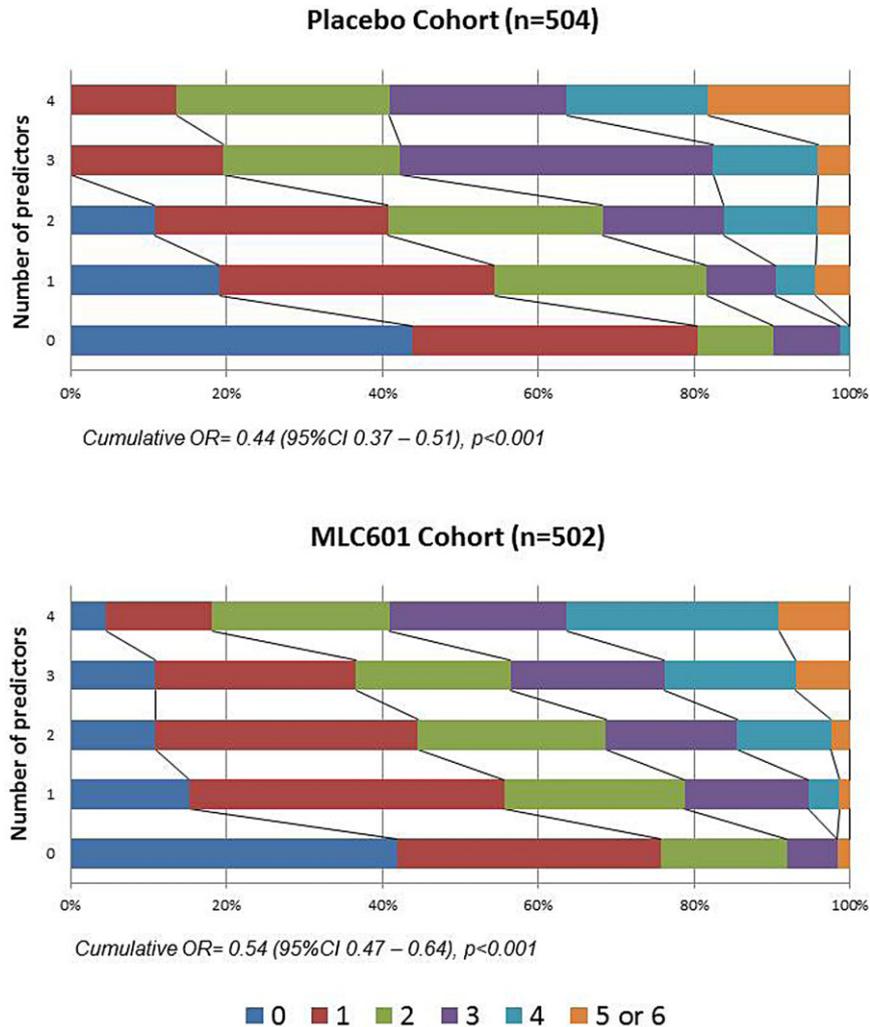
**WSC-0591****Acute Stroke: New Treatments Concepts  
Prognostic factors and treatment effect in the CHIMES  
Study**S Chankrachang<sup>1</sup>, J C Navarro<sup>2</sup>, D A De Silva<sup>3</sup>, S Towanabut<sup>4</sup>, C L Chua<sup>5</sup>, C F Lee<sup>6</sup>, N Venketasubramanian<sup>7</sup>, K S L Wong<sup>8</sup>, M G Bousser<sup>9</sup>, C Chen<sup>10</sup><sup>1</sup>Neurology, Chiang Mai University, Chiang Mai, Thailand<sup>2</sup>Neurology and Psychiatry, University of Santo Tomas Hospital, Manila, Philippines<sup>3</sup>Neurology, National Neuroscience Institute-Singapore General Hospital Campus, Singapore, Singapore<sup>4</sup>Neurology, Prasat Neurological Institute, Bangkok, Thailand<sup>5</sup>Neurosciences, Philippine General Hospital, University of the Philippines Manila, Manila, Philippines<sup>6</sup>Statistics, Singapore Clinical Research Institute, Singapore, Singapore<sup>7</sup>Neurology, Raffles Neuroscience Centre, Singapore, Singapore<sup>8</sup>Neurology, Chinese University of Hong Kong Prince of Wales Hospital, Shatin NT, Hong Kong, China<sup>9</sup>Neurology, Lariboisière University Hospital, Paris, France<sup>10</sup>Pharmacology, National University of Singapore, Singapore, Singapore

**Introduction and aim:** Patients with varying prognosis are likely to respond differently to treatment. We aimed to evaluate the treatment effects of MLC601 among patients stratified by prognosis in the CHIMES Medicine NeuroAid Efficacy on Stroke Recovery (CHIMES) Study.

**Methods:** Analyses were performed using data from the CHIMES Study, an international, randomized, placebo-controlled, double-blind trial comparing MLC601 to placebo in patients with ischemic stroke of intermediate severity in the preceding 72 hours. All subjects with baseline data and month 3 modified Rankin score (mRS) were included.

**Results:** Data from 1006 subjects were analyzed. The predictive variables for mRS > 1 at month 3 were age > 60 years ( $p < 0.001$ ), baseline NIHSS 10–14 ( $p < 0.001$ ), stroke onset to initiation of study treatment >48 hours ( $p < 0.001$ ), and female sex ( $p = 0.026$ ). A higher number of predictors was associated with poorer mRS at month 3 for both placebo ( $p < 0.001$ ) and treatment ( $p < 0.001$ ) groups. The odds ratio for achieving a good outcome increased with the number of predictors and reached statistical significance in favor of MLC601 among patients with 2 to 4 predictors combined (unadjusted OR = 1.44, 95% CI 1.02–2.03; adjusted OR = 1.60, 95% CI 1.10–2.34).

**Conclusions:** Age, sex, baseline NIHSS, and time to first dose are predictors of functional outcome in the CHIMES study. Stratification of patients by prognosis showed that patients with two or more predictors of poorer outcome have statistically better treatment effect with MLC601 than patients with a single or no prognostic factor. This finding may be considered in designing future studies.



**WSC-0598**  
**Acute Stroke: New Treatments Concepts**  
**Baseline characteristics and treatment responses of patients included from the Philippines in the CHIMES Study**

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*Introduction and aim:* The CHIMES Study compared MLC601 to placebo in patients with ischemic stroke of intermediate severity in the preceding 72 hours. Sites from the Philippines (PH) randomized 504 of 1099 (46%) patients in the study. We aimed to define the patient characteristics and treatment responses in this subgroup to better plan future trials.

*Methods:* The CHIMES dataset was used to compare the baseline characteristics, time from stroke onset to study treatment initiation, and treatment responses to MLC601 between patients recruited from PH and the rest of the cohort. Treatment effect was analyzed using endpoints at month 3 as described in the primary publication, i.e. modified Rankin Score, National Institutes of Health Stroke Scale (NIHSS), and Barthel Index.

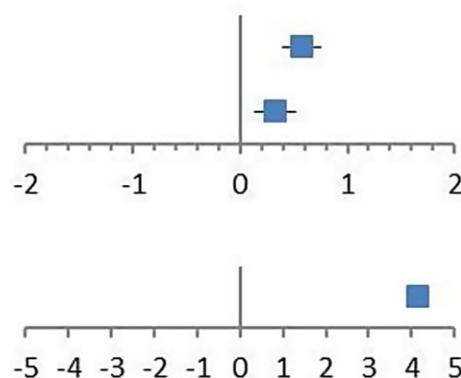
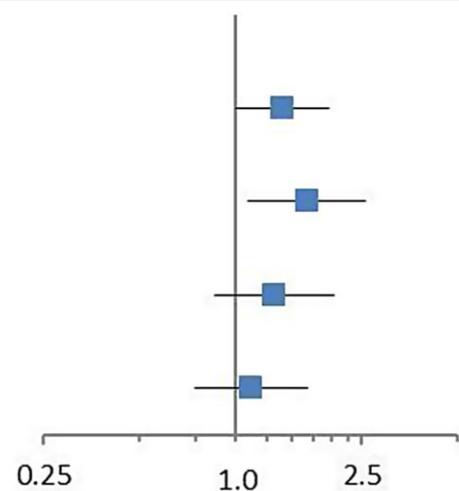
*Results:* The PH cohort were younger, had more women, worse baseline NIHSS, and longer time delay from stroke onset to study treatment compared to the rest of the cohort (Table). Age ( $p = 0.003$ ), baseline NIHSS ( $p < 0.001$ ), and stroke onset to study treatment initiation ( $p = 0.016$ ) were predictors of mRS at 3 months. Treatment effects of MLC601 as analyzed by mRS (shift and dichotomy 0-1), improvement in NIHSS (total and motor scores), and BI were statistically significant in the PH cohort (Figure).

*Conclusions:* The efficacy of MLC601 is statistically significant in the PH cohort. This may be due to inclusion of more patients with predictors of poorer outcome.

Table

	Philippines (n = 504)	Other Countries (n = 595)	OR (95% CI) *statistically significant
Age (>60 y)	239 (47%)	328 (55%)	0.73 (0.58–0.93)*
Sex (female)	228 (45%)	178 (30%)	1.94 (1.51–2.48)*
Baseline NIHSS score $\geq$ 10	226 (45%)	137 (23%)	2.72 (2.10–3.52)*
Stroke onset to first dose ( $\geq$ 48 h)	269 (54%)	261 (44%)	1.49 (1.17–1.89)*
Previous history of:			
TIA	16 (3%)	15 (3%)	1.27 (0.62–2.59)
Ischemic stroke	32 (6%)	67 (11%)	0.53 (0.34–0.83)*
Hemorrhagic stroke	3 (1%)	5 (1%)	0.71 (0.17–2.97)
Myocardial infarction or angina	18 (4%)	52 (9%)	0.39 (0.22–0.67)*
Hypertension	460 (91%)	432 (73%)	3.95 (2.76–5.65)*
Diabetes mellitus	120 (24%)	231 (39%)	0.49 (0.38–0.64)*
Hyperlipidemia	38 (8%)	493 (83%)	0.02 (0.01–0.03)*
Smoking	218 (43%)	284 (48%)	0.84 (0.66–1.06)
Habitual alcohol intake	166 (33%)	149 (25%)	1.49 (1.15–1.93)*

Outcomes	Odds ratio (95% CI)*
mRS shift	1.41 (1.01, 1.96)
mRS 0-1 dichotomy	1.68 (1.10, 2.57)
mRS 0-2 dichotomy	1.32 (0.86, 2.04)
NIHSS improvement $\geq$ 5 points from baseline	1.12 (0.75, 1.68)
	Mean difference (95% CI)*
NIHSS total score improvement from baseline	0.58 (0.40, 0.77)
NIHSS motor score improvement from baseline	0.33 (0.14, 0.52)
Barthel Index at Month 3	4.16 (3.97, 4.35)



\*Adjusted for age, sex, baseline NIHSS, baseline mRS, time from onset to first dose.

## WSC-0877

### Acute Stroke: New Treatments Concepts Gender and treatment effect in the Chinese Medicine Neuroaid Efficacy on Stroke Recovery (CHIMES) Trial

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**Introduction and aim:** Women have poorer outcome than men following stroke due to unclear reasons. The response to some stroke treatments may be affected by gender. We aimed to evaluate if gender influenced the treatment effect of NeuroAiD (MLC601, a combination of natural extracts) in the CHIMES trial, a multicenter, randomized, double-blind, placebo-controlled study.

**Methods:** The CHIMES trial included Asian ischemic stroke patients with National Institutes of Health Stroke Scale (NIHSS) score of 6–14. Informed consent was obtained from study participants. The primary measure was good functional outcome at 3 months defined as modified Rankin Scale (mRS) score of 0–1. Statistical testing included interaction analyses between treatment effect with NeuroAiD and gender.

**Results:** There were 1,007 participants (637 men, 370 women) with complete baseline and actual month 3 mRS data. Women were older (mean age 63 vs. 60 years,  $p < 0.0001$ ) and were less likely to have good functional outcome (41% vs. 51%,  $p = 0.002$ ) than men. A higher proportion of women had good functional outcome with NeuroAiD versus placebo (46% vs. 35%,  $p = 0.029$ ), but there was no difference among men (51% vs. 51%,  $p = 0.986$ ). The treatment effect by gender interaction was statistically significant and independent of age, prestroke mRS, and baseline NIHSS ( $p = 0.018$ ).

**Conclusion:** In the CHIMES trial, NeuroAiD effect in improving functional outcome versus placebo was better seen in women than in men. These data suggest that NeuroAiD may be particularly beneficial in certain populations with poorer prognoses. Further studies are needed to verify these post-hoc findings. For the CHIMES Study Investigators.

## WSC-0458

### Acute Stroke: New Treatments Concepts Development of a practical and evidence-based framework for clinical rehabilitation management regarding arm and hand paresis in sub acute stroke

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**Objectives:** The sheer volume of information on new treatment techniques/ technologies that may enhance restoration of arm-hand function (AHF) and arm-hand skill performance (AHSP) in stroke survivors may overwhelm therapists in every day clinical practice when choosing the appropriate therapy for their patient. The aim is to present a concise,

modular and clinically manageable framework that can be used by paramedical staff to structure and implement training of AHF and AHSP in stroke survivors.

**Methods:** The framework is based on four constructs, i.e. a) stratification according to the severity of arm-hand impairment (using the Utrechtse-Arm-Test (UAT)), b) the individual's rehabilitation goals and concomitant potential rehabilitation outcomes, c) principles of self-efficacy, d) possibilities to systematically incorporate (new) technology and new evidence-based training elements swiftly.

**Results:** The framework encompasses 3 programs aimed at treating either the severely (UAT 0–1), moderately (UAT 2–3) or mildly (UAT 4–7) impaired arm-hand. Program themes are: “taking care of the limb and prevention of complications” (program-1), “task-oriented gross motor grip performance” (program-2) and “functional AHSP training” (program-3). Each (group wise) (6-week) program is divided into multiple (goal-oriented) training modules, incorporating mastery experiences, vicarious experiences, verbal persuasion and physiological feedback. Each program is preceded and followed by an assessment. Program-2 and 3 may be extended by 6 weeks (max). Training modularity facilitates rapid interchange/adaptation of sub-elements.

**Conclusion:** Proof-of-principle as well as successful implementation in clinical rehabilitation have been established. The framework facilitates rapid structured design and provision of state-of-the-art AHF and AHSP treatment in stroke patients.

## WSC-0614

### Acute Stroke: New Treatments Concepts Is combination of repetitive transcranial magnetic stimulation (RTMS) with physiotherapy better than physiotherapy alone in stroke recovery?

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**Background:** Low frequency repetitive Transcranial magnetic stimulation (rTMS) enhances recovery potential in post stroke.

**Objective:** To study the role of low frequency (1 Hz) rTMS with physiotherapy compared to physiotherapy alone.

**Methods:** In this randomized, sham controlled, double blinded study patients diagnosed with acute ischemic stroke onset within 7–15 days, NIHSS score 4–20 & comprehensible were recruited. Physical therapy was administered from the day of recruitment for 3 months. Real rTMS & Sham rTMS was administered at 11<sup>th</sup> week of recruitment for 10 days. Resting motor threshold (RMT) and MEP (Motor evoked potential) were calculated at the start and at the end of rTMS. Low frequency rTMS 1 Hz, 750 pulses @ 110% MT (Motor threshold) for 45 minutes was administered to all patients. All patients were assessed with stroke recovery scales- NIHSS, mRS, mBI, HRSD, FMA upper & lower extremity at the baseline and at follow up.

**Results:** Thirty three patients were randomized into real group ( $n = 17$ ) and sham group ( $n = 15$ ). Mean age for all patients was 52.45±13.2 years & male: female ratio was 3.7:1. Baseline characteristics and clinical assessment with NIHSS, mRS, mBI, HRSD, FMA upper & lower extremity were comparable. In intergroup analysis, real group showed significant improvements in NIHSS, mRS & FMA lower extremity. No significant improvement in rTMS parameters was observed between the groups (Table 1). Real group showed statistically significant improvement in NIHSS, mRS, mBI post rTMS whereas FMA lower extremity could only show significant improvement post rTMS in Sham group (Table 2).

**Table 1** Intergroup analysis

Factors	Real rTMS group Mean + SD (n = 17)	Sham rTMS group Mean + SD (n = 15)	P value (<0.05)
Post rTMS NIHSS	3 ± 2.2	5.4 ± 3.68	<b>0.03</b>
Post rTMS mRS	1.17 ± 0.63	2.06 ± 1.03	<b>0.00</b>
Post rTMS mBI	94.64 ± 88.4	86.8 ± 18.65	<b>0.16</b>
Post rTMS HDRS	4 ± 1.90	5.06 ± 3.59	<b>0.29</b>
Post rTMS FMA upper extremity	50.93 ± 15.41	45.33 ± 18.23	<b>0.36</b>
Post rTMS FMA lower Extremity	32.3 ± 1.89	28.91 ± 6.41	<b>0.05</b>
Post rTMS MT affected hand	63.23 ± 6.05 (n = 13)	68 ± 10.04 (n = 13)	0.15
Post rTMS latency affected hand	7.09 ± 1.39 (n = 13)	8.41 ± 2.32 (n = 11)	0.11
Post rTMS amplitude affected hand	145.78 ± 31.67 (n = 13)	146.36 ± 53.13 (n = 13)	0.9

**Table 2** Analysis within group

Variable	Real group (n = 17)			Sham group (n = 15)		
	Baseline Mean ± SD	Post rTMS (90 days) Mean ± SD	P < 0.001	Baseline Mean ± SD	Post rTMS(90 days) Mean ± SD	P < 0.001
NIHSS	9.76 ± 4.8	3.0 ± 2.2	<b>0.00</b>	10.87 ± 5.1	5.4 ± 3.6	<b>0.24</b>
mRS	3.12 ± 1.2	1.18 ± 0.63	<b>0.00</b>	3.6 ± 0.9	2.07 ± 1.0	<b>0.49</b>
mBI	51.65 ± 37.24	94.65 ± 12.1	<b>0.00</b>	41.07 ± 32.96	86.8 ± 18.7	<b>0.109</b>
HRSD	8.82 ± 5.4	4.00 ± 1.9	<b>0.00</b>	12.47 ± 5.7	2.07 ± 1.0	<b>0.49</b>
FMA upper extremity	34.19 ± 19.5	50.94 ± 15.4	<b>1.00</b>	23.93 ± 19.5	45.33 ± 18.2	<b>0.035</b>
FMA lower extremity	22.69 ± 9.7	32.38 ± 1.89	<b>0.01</b>	19.17 ± 9.2	28.92 ± 6.4	<b>0.01</b>

**Conclusion:** Real rTMS with physiotherapy showed a trend of improvement in acute ischemic stroke. Physiotherapy regime for 3 months also led to clinical and functional recovery. Conclusive evidence of rTMS cannot be emphasized due to small sample size.

**Abbreviations:** NIHSS (National Institute of Health Stroke Scale), mRS (modified ranking scale), mBI (modified Barthel Index), HRSD (Hamilton rating scale for depression), FMA (Fugl Meyer Assessment).

## WSC-1318

### Acute Stroke: New Treatments Concepts High level of serum pentosidine indicates poor outcomes after acute ischemic stroke

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**Introduction & aims:** An advanced glycation end product has been implicated in a wide range of pathologic conditions including diabetes mellitus, chronic kidney diseases, cardiovascular diseases, or arteriosclerosis. Little is known about its relationship with cerebral ischemia. The authors investigated serum levels of pentosidine and outcomes of patients with acute ischemic stroke.

**Methods:** Serum pentosidine levels were measured in 83 patients with acute ischemic stroke at initial hospitalization as well as other risk factors of stroke. Outcomes of patients at 30 days from hospitalization were assessed by using modified Rankin Scale score (mRS). Univariate and multivariate logistic regression analyses were performed to analyze relationship between pentosidine and patient outcomes.

**Results:** In the univariate logistic regression analyses, poor outcomes, defined as mRS more than 2, at 30 days were significantly related to high

serum pentosidine ( $p = 0.001$ ), type of stroke ( $p = 0.045$ ), old age ( $p = 0.02$ ), male sex ( $p = 0.042$ ), and the absence of dyslipidemia ( $p = 0.02$ ). Deterioration of mRS was significantly correlated with high serum pentosidine ( $p = 0.003$ ) and creatinine ( $p = 0.02$ ). Multivariate logistic regression analysis showed that high level of serum pentosidine was the only independent risk factor for poor outcomes ( $p = 0.004$ ) and deterioration of mRS ( $p = 0.01$ ) at 30 days.

**Conclusions:** High level of serum pentosidine indicates poor and worse outcomes 30 days after acute ischemic stroke. This new biomarker is useful for risk stratification of patients with acute ischemic stroke.

## WSC-1030

### Acute Stroke: New Treatments Concepts Effects of cerebrolysin on motor recovery in patients with subacute stroke

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**Introduction:** Cerebrolysin is a peptide preparation derived from purified, lipid-free brain proteins which have demonstrated neurotrophic and neuroprotective properties.

**Aims:** This study aimed to investigate the effect of Cerebrolysin on motor recovery of patients with subacute stroke.

**Methods:** This study is a multicenter, randomized, double-blind, placebo-controlled trial. Inclusion criteria were the first-ever unilateral cerebral infarction with moderate to severe motor involvement (FMA scores  $\leq 84$ ). Participants were divided into two groups: Cerebrolysin group received daily IV injection of 30 ml Cerebrolysin for 3 weeks started from 8 days after stroke onset. Placebo group received saline solution. Assessment of motor function was performed using the FMA score before and after 3 weeks of treatment, 2 and 3 months after stroke onset.

**Results:** None of participants showed severe adverse effect. Sixty-one participants (32 cerebrolysin/29 control) completed the study protocols. There was no significant difference in general characteristics and FMA score at baseline between two groups. RMANOVA showed no significant interaction between time and group for the FMA score in total participants. However, in the participants who suffered from severe motor involvement at baseline (FMA  $< 50$ ), RMANOVA showed a significant interaction between time and group for the FMA score ( $p < 0.05$ ). In addition, improvement ratio of the FMA score at 3 months was significantly higher in Cerebrolysin group than control group ( $p < 0.05$ ).

**Conclusions:** Administration of Cerebrolysin in subacute stage of stroke was safe and effective for enhancing motor recovery in patients with severe motor involvement (This study is funded by EBEWE Neuro Pharma GmbH).

**Key words:** cerebrolysin, stroke, motor recovery, FMA.

## WSC-1025

### Acute Stroke: New Treatments Concepts Level of circulating endothelial progenitor cells in the peripheral blood of patients with ischemic stroke

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**Introduction:** Endothelial progenitor cells (EPC) are involved in the processes of vasculogenesis and reperfusion by activating angiogenesis. Therefore, it is interesting to study their dynamics in ischemic stroke (IS).

**Materials and methods:** we examined 3 IS patients with using the method of multi-color laser flow cytometry and set of monoclonal antibodies (CD34, CD117, CD133 and CD309) and investigated the phenotype of circulating EPC. CD34-positive cells of peripheral blood were isolated in the analysis of more than 2 million events, evaluation of expression of markers of early EPC (CD117 + CD133 +) and cells positive for receptor vascular endothelial growth factor (CD117 + VEGFR- 2 +) was carried out within gate CD34 + cells. Patients got citicoline 2000 mg daily.

**Results:** There was a reduction of early EPC (CD117+CD133+) – 8,6% and CD117+CD309+ – 19,6% in IS compared with donors (16.6% and 23.7% respectively). We got the significant increase in EPC expressing VEGFR-2+ to 50,1%, while the number of early EPC (CD117+CD133+) was 5,6% after 7 days after citicoline administration. After 14 days of therapy it was the increase of early and EPC (CD117+CD133+), as compared with the donors.

**Conclusion:** In samples of peripheral blood of IS patients we got a decrease of EPC. Citicoline 2000 mg daily enhances content of earliest EPC, this may indicate the increasing of vasculogenesis and angiogenesis. There was get positive trend in the neurologic status and functional status of the IS patients.

## WSC-0211

### Acute Stroke: New Treatments Concepts The efficacy of erythropoietin in acute ischemic stroke: A meta-analysis

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**Introduction:** Stroke remains the major cause of disability and death worldwide. Thrombolysis is the only acceptable treatment for nonhemorrhagic stroke shown to be effectively limiting the neurologic damage but only restricted to patients presented within 3 hours of onset of symptoms. **Objective:** To evaluate the clinical outcome of acute ischemic stroke patients after administration of erythropoietin within eight hours of onset of symptoms

**Design:** Meta-analysis of 3 randomized trials identified through Medline/Pubmed and Cochrane Library (as of 2002). Prior to performing meta-analysis, the homogeneity of the study outcomes was evaluated using the Cochran Q test and no significant variation was found among included trials. All statistical tests were assessed using 95% confidence interval. The results were analyzed using PASW Version 18 or SPSS.

**Results:** Sample size of the trials included in the study ranged from 15 to 40 and the mean age of participants was 68 to 72. The main endpoints namely NIHSS, Barthel Index, Modified Rankin Scale and infarct size were extracted. Results showed that effect of erythropoietin has no difference with the effect of the placebo.

**Conclusion:** Erythropoietin given with 8 hours of ictus cannot be recommended and treatment did not significantly hasten improvement on neurologic function, ameliorate stroke-related recovery or decrease the infarct size.

## WSC-0790

### Acute Stroke: New Treatments Concepts Influence of the neutrophils count on the outcome of patients treated by intravenous rt-PA for cerebral ischemia

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**Introduction:** In experimental models neutrophils play a role on hemorrhagic transformation (HT) after intravenous recombinant tissue plasminogen activator (rt-PA) administration for ischemic stroke (IS).

**Aims:** To examine if a higher neutrophils count before rt-PA administration is associated with worse outcome at 3 months in patients with IS.

**Methods:** This study was conducted retrospectively in the stroke units of Lille and Helsinki University Hospitals. The outcome at 3 months was assessed by the modified Rankin Scale (mRS). The primary end point was a mRS of 2 to 6 (or different than the prestroke mRS) at 3 months. Secondary endpoints were a mRS 3 to 6 (or different than the prestroke mRS) and death at 3 months, and symptomatic HT (sHT) according to the ECASS2 definition.

**Results:** We included 846 patients in the study. Neutrophils count was significantly higher in patients with mRS 2 to 6 or 3 to 6, in patients who died or developed sHT (all p values  $< 0.001$ ). After adjustment on confounders, neutrophils count was an independent predictor of mRS 2–6 (OR: 1.149; 95% CI: 1.078–1.225), mRS 3–6 (OR: 1.168; 95% CI: 1.096–1.244), death (OR: 1.160; 95% CI: 1.081–1.244) and sHT (OR: 1.163; 95%

CI: 1.073–1.261) (all overall p values < 0.001; results given for an increase of 1,000 neutrophils per mm<sup>3</sup>).

**Conclusions:** A higher neutrophils count before rt-PA is independently associated with an increased risk of poor outcome, sHT and death within 3 months, opening the way to the identification of new targets for neuroprotection.

## WSC-1596

### Acute Stroke: New Treatments Concepts

#### Flow diversion to posterior circulation (PCA) in TCD studies may predict good outcome in patients with middle cerebral artery occlusion

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**Introduction:** One of the most important factors for good outcome in patients with Middle Cerebral Artery (MCA) ischemic stroke relies in collateral circulation.

**Aims:** To determine the main TCD markers for collaterals in patients with MCA occlusion that may be related to good outcome after acute stroke.

**Methods:** Patients with acute ischemic stroke who received IV thrombolysis and had intra arterial occlusion had an assessment of collaterals using TCD Doppler. Mean flow velocities, pulsatility index and flow diversion were measured. The ratio of mean flow velocity (mfv) flow diversion to Anterior Cerebral Artery (ACA) and Posterior Cerebral Artery (PCA) over affected MCA were calculated. Modified Rankin Score (mRS) was done in all patients, and was considered good outcome when it was 0–2 at 3 months.

Statistical analysis included Chi square Fisher's exact test.

**Results:** Ninety six patients were included in our analysis. The ratio mfv ACA / mfv MCA  $\geq 1.25$  did not correlate with good outcome in 50% of the patients, when  $< 1.25$  correlated with good outcome in 72% of cases (Fisher's exact test = 0.202). On the other hand, the ratio mfv PCA / mfv MCA  $\geq 1.25$  predicted good outcome in 75% of the patients (Fisher's exact test = 0.145).

**Conclusions:** TCD Doppler might have a role in defining collateral blood flow in acute stroke setting. The ratio (mfv) PCA / (mfv) MCA is a more robust collateral predictor than the ratio ACA/MCA for good outcome in patients with MCA occlusion. Further studies are needed.

## WSC-0875

### Acute Stroke: New Treatments Concepts

#### Development of a laser thrombolysis system and its efficacy, safety and mechanism in animal thrombosis models

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**Introduction:** For treating acute cerebral infarction, the thrombolytic agent recombinant tissue plasminogen activator (rt-PA) is currently used in the world. However, the risks of cerebral bleeding and other side effects result in the limited application. Meanwhile, rapid advances are being

made for endovascular interventions, e.g., the Merci retriever and the Penumbra system, which are administered in patients contraindicated for, or unresponsive to, rt-PA therapy. Yet, these devices are not completely free from clinical problems, e.g., risk of vessel injury, indicating the need for safer, quicker, and more reliable recanalization approaches.

**Aims:** We developed a laser thrombolysis system with the second harmonic generation of microsecond Nd:YAG laser, and investigated its effectiveness, safety and mechanisms in animal thrombosis models.

**Methods & results:** The dynamics of laser-induced thrombolysis in a gelatin phantom model was investigated with a high speed camera. The observation revealed that laser irradiation generated a bubble in the gelatin phantom. In vivo thrombolytic efficacy was investigated using animal thrombosis models. Thrombi in the vena cava inferior of rats or in the carotid artery of rabbits were induced by an application of ferric chloride (FeCl<sub>3</sub>). Laser irradiation was then carried out through an optical fiber inserted from the femoral artery. Laser irradiation induced significant thrombolysis in the rat thrombosis model. Laser irradiation also resulted in recanalization in the rabbit thrombosis model. No vascular endothelial damage evaluated by Evans blue staining after laser irradiation was observed.

**Conclusions:** The irradiation of the pulsed green laser can induce a bubble that fragments thrombi without vessel damage.

## WSC-1077

### Acute Stroke: New Treatments Concepts

#### Transcutaneous combined dual-frequency ultrasonication accompanied by high-dose atorvastatin administration reduce the atherosclerotic stenosis in rabbit carotid artery

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**Introduction:** The management of advanced carotid atherosclerosis with severe stenosis (>70%) reduces the risk of stroke and its related deaths. Management options include carotid endarterectomy and carotid artery stenting. In response to the risk of invasive procedures and the challenges of percutaneous interventions, there is a continuous search for an effective, easy to perform and safe noninvasive treatment option in patients with advanced atherosclerosis.

**Aims:** The aim of this study was to develop a noninvasive treatment option for the carotid fibro-lipid plaque using transcutaneous ultrasonication.

**Methods:** Carotid fibro-lipid plaque with severe stenosis (>70%) and neovascularization was induced at the right common carotid artery of New Zealand white rabbits. The animals treated by transcutaneous combined dual-frequency ultrasonication accompanied by high-dose atorvastatin administration (5 mg/kg/day). Blood volume flow and blood mean velocity were measured by color Doppler ultrasonography at the stenosis region. Moreover, wall mean thickness and percentage of luminal cross-sectional area of stenosis were measured by B-mode ultrasound and histology.

**Results:** Results showed a significant reduction in the mean value for serum lipid parameters, blood mean velocity, wall mean thickness and the percentage of luminal cross-sectional area of stenosis and a significant increase in the mean value for blood volume flow in the treatment group compared with the other groups ( $P < 0.05$ ).

**Conclusion:** The Cavitation effect of ultrasonication and the pleiotropic and lipophilic effects of high-dose atorvastatin can cause to destroy the plaque microvessels, reduce the lesion lipid content and significantly dilate the luminal cross-sectional area of stenosis.

**WSC-0228****Acute Stroke: New Treatments Concepts  
Usefulness of transcranial Doppler (TCD) as a  
diagnostic tool to evaluate hemodynamic status for  
neurovascular disorders**P Methil<sup>1</sup>, C Ramakrishnan<sup>1</sup>, M Muhammed<sup>1</sup><sup>1</sup>Neurology & Stroke, KG Hospital & Postgraduate Institute, Coimbatore, India

*Aim:* To evaluate the usefulness of Transcranial doppler (TCD) as a diagnostic tool in suspected vascular disorders of the central nervous system.

TCD performed since 2004 were analyzed.

*Methods:* 3400 cases were analyzed. Several parameters including age, presumptive diagnosis, sex, whether insonation was complete or incomplete were analyzed. The mean flow velocity & Pulsatility indices of all the insonated vessels were noted. A complete TCD was performed in all the cases including both anterior & posterior circulation. The presence or absence of intracranial stenosis, flow diversion, micro emboli signals were noted.

*Results:* Incomplete insonation was more common in the anterior circulation and in the elderly patients. Incomplete insonation was more common in women (68%) compared with men (32%). In the posterior circulation not insonated vessels were less (<2%). Remarkable hemodynamic alterations were observed in 18% of the patients. Hemodynamic alterations were higher in patients with stroke.

*Conclusion:* TCD is a highly useful tool to evaluate intracranial hemodynamic status. TCD shows significant blood flow changes especially in patients with stroke & intracranial stenosis.

**WSC-1260****Acute Stroke: New Treatments Concepts  
Mechanical thrombectomy with stent retrievers in the  
M2 segment of the middle cerebral artery: Efficacy  
and outcome**P Mordasini<sup>1</sup>, C Del Giudice<sup>2</sup>, K Hsieh<sup>1</sup>, U Fischer<sup>3</sup>, M Arnold<sup>3</sup>, H P Mattle<sup>3</sup>, J Gralla<sup>1</sup><sup>1</sup>Diagnostic and Interventional Neuroradiology, University of Bern, Bern, Switzerland<sup>2</sup>Interventional Radiology and Radiation Therapy, Fondazione Policlinico Tor Vergata, Rome, Italy<sup>3</sup>Neurology, University of Bern, Bern, Switzerland

*Introduction and aims:* Mechanical thrombectomy (MT) using stent retrievers (SR) demonstrated improved outcomes for stroke treatment in large artery occlusion in the anterior circulation. However, only limited data is available about technical aspects and clinical outcome of MT in occlusions of the M2 segment of the MCA. We evaluated the technical feasibility, safety and efficacy of MT using SR in M2 occlusions with special regard on MCA bifurcation anatomy.

*Methods:* All patients treated with MT using SR for occlusion of a M2 branch were retrospectively analyzed. Recanalization rate (TICI), anatomical MCA branching pattern, procedure-related complications, ICH were and clinical outcome at 3 months were evaluated.

*Results:* Thirty-seven consecutive patients were included. Twenty-two patients (58%) had an isolated M2 occlusion, 16 patients (42%) a residual M2 occlusion after successful treatment of a more proximal occlusion. Median baseline NIHSS score at admission was 15 (range 2–26). Successful recanalization (TICI 2b-3) was achieved in 26 patients (70.3%). There was no device-related procedural complication, especially no vessel perforation. Sixteen patients (43.2%) had good clinical outcome (mRS ≤ 2). Eleven patients (29.7%) died at 3 months follow-up. Age, anatomical pattern of MCA bifurcation and distance of thrombus from MCA bifurcation were found as independent predictors for good clinical outcome.

*Conclusions:* MT using SR in M2 occlusions is able to achieve high recanalization rates with low complication rates. Recanalization success, especially in case of proximal trunk occlusion and the MCA bifurcation pattern are associated with better clinical outcome.

**WSC-0527****Acute Stroke: New Treatments Concepts  
Development of a laser thrombolysis system and its  
efficacy, safety and mechanism in a cynomolgus  
monkey cerebral embolism model**T Nakayama<sup>1</sup>, K Hokamura<sup>2</sup>, U Matsumoto<sup>2</sup>, K Umemura<sup>2</sup>, T Kosugi<sup>3</sup>, D Yamashita<sup>3</sup>, Y Shimizu<sup>3</sup>, Y Tamaoki<sup>4</sup>, Y Yamashita<sup>3</sup>, H Okada<sup>3</sup><sup>1</sup>Neurosurgery, Hamamatsu Medical Center Hospital, Hamamatsu, Japan<sup>2</sup>Pharmacology, Hamamatsu University School of Medicine, Hamamatsu, Japan<sup>3</sup>Central Research Laboratory, Hamamatsu Photonics K.K., Hamamatsu, Japan<sup>4</sup>Power Laser Development Section R&D Group, Hamamatsu Photonics K.K., Hamamatsu, Japan

Patients with acute stroke are usually treated with a recombinant tissue-type plasminogen activator (rt-PA) until 4.5 hours after onset. Mechanical thrombectomy is employed if recanalization is not achieved with rt-PA or after 4.5 hours from onset. However, mechanical thrombectomy has the potential risk of vessel damage and can cause hemorrhagic complications. Moreover, the available devices for thrombectomy are usually difficult to use. We developed a laser thrombolysis system using a 532 nm wave pulse laser. Safety and effectiveness was evaluated. The laser irradiation equipment specifications are 532 nm of center wavelength, repeated 1–10 Hz, 100 mW of average output for optical fiber laser edge, and 50–200 μs of pulse width. The fiber integrated catheter has an outer diameter of 0.8 mm and double-lumen dedicated fiber lumens. The guide wire of outer diameter 0.26–0.3 mm can pass the lumen. We made a cerebral embolism model of cynomolgus monkeys as follows: under general anesthesia the common carotid artery of a cynomolgus monkey was explored and cut down, then a 2.5 cm length of clot was inserted into cerebral arteries. To perform laser thrombolysis, a microcatheter with optic fiber was inserted via the femoral artery into the internal carotid artery and then the tip of it was placed in the immediate vicinity of the embolus. After thrombolysis, we evaluated efficacy and safety using MRI scans and pathological observations.

*Conclusion:* We were able to successfully reopen the occluded vessel of a cynomolgus monkey using the laser thrombolysis system without damage to the vessel.

**WSC-0409****Acute Stroke: New Treatments Concepts  
Poststroke rehabilitation with holistic home based  
therapy: A neuropsychological perspective**H Kaur<sup>1</sup>, A Nehra<sup>1</sup>, R Bhatia<sup>2</sup><sup>1</sup>Clinical Neuropsychology, All India Institute of Medical Sciences, New Delhi, India<sup>2</sup>Neurology, All India Institute of Medical Sciences, New Delhi, India

*Introduction:* It is estimated that the number of strokes in India will increase from 1,081,480 in 2000 to 1,667,372 in 2015 (Shah & Mathur 2006). Aphasia is the most striking cognitive sequels of strokes & attempts to rehabilitate patients have been undertaken for many years. Neuropsychological rehabilitation (NR) reduces the cognitive, emotional, psychosocial & behavioral deficits caused by an insult to the brain.

*Aim:* Therefore, a Comprehensive NR (CNR) with aphasia therapy was designed to improve the language as well as the neuropsychological functioning of patients suffering from stroke.

**Method:** On an OPD level, 7 cases after 1 month to 3 years of stroke with education >5 years, age 37 to 65 years having language problems were included. ABA design was used where neuropsychological assessment with Indian Aphasia Battery (IAB) assessing 5 domains was done. The CNR comprised of NR along with Aphasia Therapy. NR Sessions lasted for 4–8 weeks.

**Results:** Wilcoxon sign rank test reveals that the neuropsychological assessment post CNR shows a marked improvement in all the domains

along with overall IAB scores. The results reveal statistically significant results for 4 domains along with total IAB scores which show the effectiveness of the CNR with aphasia therapy. Only Visual & Reading Problems reveals clinically significant results, but not statistically significant due to the small sample.

**Conclusion:** A CNR with aphasia therapy can help in improving the language & QoL of patients suffering from stroke. A larger sample size is needed to prove the effectiveness of this program.

**Table 1** Statistical analysis showing change of median scores pre CNR to post CNR

Domains	Pre CNR	Post CNR	p value
Acoustic Problems (AP)	16.98 (1.9–90.5)	12.00 (.0–52.8)	0.01*
Speech & Language Problems (SLD)	73.00 (.0–100.0)	51.40 (.0–77.7)	0.04*
Simple Mathematical Problems (SMP)	28.00 (0–100)	.00 (0–64)	0.04*
Perceptuo Motor & Writing Problems (PMWP)	38.00 (.0–51.1)	11.00 (.0–31.1)	0.02*
Visual & Reading Problems (VRD)	61.36 (2–100)	50.00 (.0–90.9)	0.12
Global Aphasia Quotient i.e, Total IAB Scores (GAQ)	54.81 (.7–7.0)	44.00 (0–52)	0.01*

### WSC-1540

#### Acute Stroke: New Treatments Concepts Minocycline treatment in acute stroke: A meta-analysis of randomized controlled trials

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**Introduction:** Clinical trials on minocycline in patients with acute stroke have shown promising results in improving clinical and functional outcomes. We believed that aggregation of data of published studies will provide a unique opportunity to examine the 'effect size' of this intervention.

**Aim:** The aim of this study was to summarize results of randomized controlled trials comparing add on minocycline treatment to standard care after acute stroke.

**Methods:** We searched databases including MEDLINE, EMBASE, CENTRAL, Cochrane Stroke Group Register. The outcome of interest was modified Rankin Scale (mRS), dichotomized at  $\leq 2$  (good outcome), activities of daily living (Barthel Index), and National Institute of Health Stroke Scale (NIHSS). Random effect model was used.

**Results:** A total of three randomized controlled trials consisting of 144 patients and 152 control subjects met the inclusion criteria. Patients treated with minocycline showed no statistically significant improvement on the modified Rankin scale (OR, 3.48; 95% confidence interval: 0.58 to 20.95,  $P=0.17$ ) or Barthel Index (standardized mean difference: 0.47, 95% confidence interval:  $-0.15$  to 1.09,  $P=0.14$ ) when compared with controls. A trend in improvement on NIHSS stroke scale (standardized mean difference:  $-1.29$ , 95% confidence interval:  $-2.67$  to 0.10,  $P=0.07$ ) was observed when compared with controls.

**Conclusion:** This data analysis suggests, that add on minocycline therapy after acute stroke is not superior to standard medical management. Since results are derived from only three randomized controlled studies with a small number of patients, more studies may be needed to confirm these observations.

### WSC-0566

#### Acute Stroke: New Treatments Concepts Study of low-dose tissue plasminogen activator in acute ischemic stroke in a tertiary care center in South India

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**Introduction:** Low-dose recombinant tissue plasminogen activator (tPA) for intravenous thrombolysis has been shown to be beneficial upto 4.5 hours of acute ischemic stroke.

**Aim:** The study aims to analyze clinical experience of low dose intravenous thrombolysis (0.7 mg/Kg) with tPA in the 0 to 4.5 hours window period in acute ischemic stroke.

**Methods:** Observational study of 25 patients with acute ischemic stroke thrombolysed between 0 and 4.5 hours after onset; from Jan 2013 to Dec 2013 at a tertiary care center in South India. The dose of tPA used was 40 mg in all patients. Inclusion and exclusion criteria were similar to European Co-operative Acute Stroke Study – 3 criteria. Good outcome was defined as a 3 month modified Rankin score of 2 or less.

**Results:** Twenty five patients (median age 60 yrs, range (35 to 79 yrs) and median National Institute of Health Stroke Scale (NIHSS) 12 (range 5 to 24) were thrombolysed in the 4.5 hours window period after stroke onset during study period. In the first 24 hours, 11 patients (44%) improved in NIHSS score by 4. At the 3 month follow-up 12 patients (48%) were functionally independent (modified Rankin Score  $\leq 2$ ). None had symptomatic intracerebral hemorrhage. There was no significant difference in outcome between the various ischemic stroke subtypes.

**Conclusion:** Our initial experience confirms that low dose thrombolysis for acute ischemic stroke even in the extended window period is beneficial and safe.

### WSC-0880

#### Acute Stroke: New Treatments Concepts The effect of nafamostat mesilate (NM) on ischemic stroke in rat middle cerebral artery occlusion model

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**Introduction:** Nafamostat mesilate (NM), a serine protease inhibitor, has a broad range of clinical use such as an anticoagulant during hemodialysis for cerebral hemorrhage patients, an agent to improve acute pancreatitis, and a hemoperfusion anticoagulant for patients with intravascular coagulation, hemorrhagic lesion, and hemorrhagic tendency. However, the effect of NM on acute cerebral infarction has not been studied.

**Aims:** In this study, we made a middle cerebral artery occlusion-reperfusion model in the rats, and investigated the effect of NM on infarct volume and histological and biological changes.

**Methods:** Before and after occlusion of middle cerebral artery (MCAO) of the rats, nafamostat mesilate was administered intraperitoneally. After MCAO, we scored the motor neurological behavior. Sacrifice was done

after 24 hours, the brain of the rats were dissected and used in morphological and immunohistochemical analysis. We measured the size of the infarct and edema. And we investigated the effect of nafamostat mesilate on biological changes by immunohistochemical stain and immunoblotting.

*Results:* NM has favorable effects on motor neurological scoring induced by MCAO. NM decreased the size of infarct and brain edema after MCAO, compared to control. In MCAO group, there are neuronal degeneration, activation of glial cells and astrocytes, increase of GRP78, and CHOP and p-eIF2 $\alpha$  in cerebral cortex. These changes were decreased in NM treated group.

*Conclusion:* NM reduces cerebral injury after MCAO via inhibiting neuron degeneration and endoplasmic reticulum stress. These finding suggest that NM has a neuroprotective effect in ischemic-reperfusion injury.

## **WSC-1161**

### **Acute Stroke: New Treatments Concepts Are current lipid profile measurements reliable for monitoring carotid plaque?**

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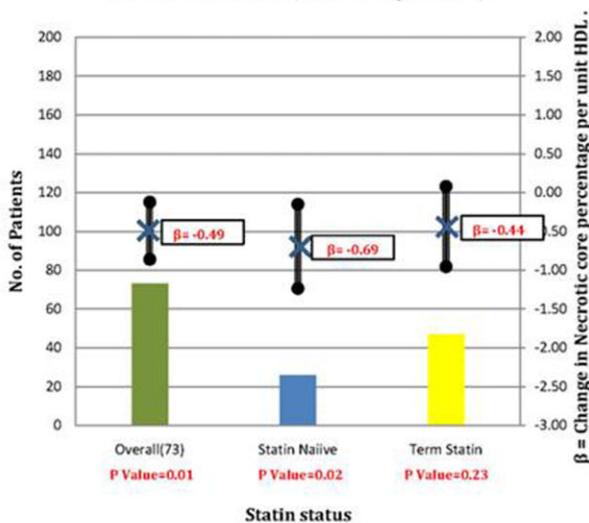
*Objective:* To test the hypothesis that lipid indices have a role in monitoring lipid-rich necrotic core (LRNC) burden and to see if this varies with statin exposure.

*Methods:* Cohort of 73 symptomatic carotid stenosis patients were identified with MR angiogram imaging to assess their carotid LRNC percentage determined by 2 independent radiologists and corresponding lipid profiles. Patients were further stratified into two groups as statin naïve (<30 day exposure to statin) and term statin group (>1 month exposure to statin). Simple linear regression was performed between with the dependent variable of LRNC size and independent variables of LDL: HDL ratio, TG :HDL ratio and HDL alone.

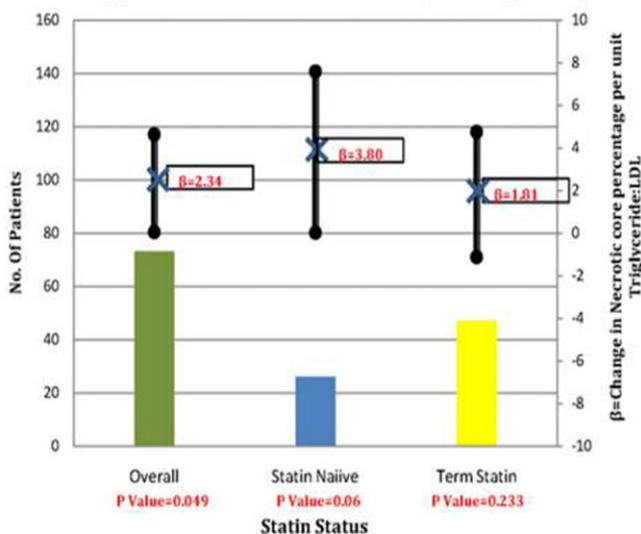
*Results:* Of 73 patients with LRNC percentage reported 26 were statin naïve and 47 were term statin users. Overall LDL:HDL, TG:HDL-C and HDL-C were associated (r,P) {moderately (0.37, 0.049)}, {weakly (0.23,0.049)}, {Moderately (-0.30,0.01)} LRNC size respectively. Patients with statin naïve status, LDL:HDL, TG:HDL-C and HDL-C were associated (r,P) {strongly (0.6,0.001)}, {not(0.37,0.06)}, {Strongly (-0.45,0.02)} with LRNC size respectively. After Stratifying with statin status (Term Statin), LDL:HDL, TG:HDL-C and HDL-C were not associated (r,P) {0.18,0.2},{0.17,0.2},{-0.24,0.1} with LRNC size respectively. Furthermore, longer duration of statin exposure did not reveal a greater reduction in the size of necrotic core (r = -0.004, P = 0.96) (see Figure).

*Conclusions:* Lipid indices correlate better with carotid plaque morphology in statin naïve patients. After starting statin the same indices correlate poorly with LRNC. Poorly controlled hyperlipidemia is a riskfactor for atherosclerosis, but lack of correlation between LRNC size and lipid levels after patients have been placed on statin therapy suggests the individual patient response to clearing LRNC with statin therapy is heterogenous. Persistent large LRNC with statin may improve lipid but, not the future risk of stroke.

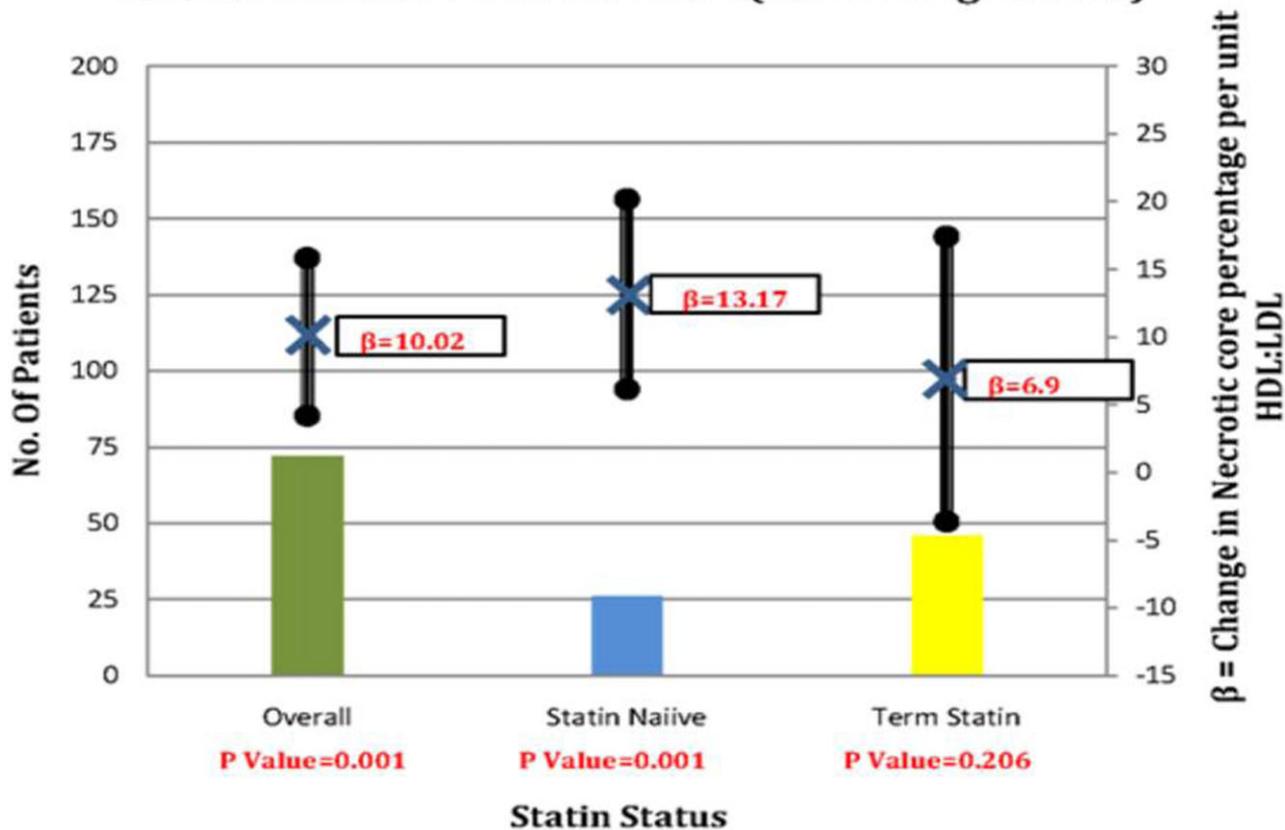
**HDL Necrotic Core(Linear Regression)**



**Triglyceride:HDL Ratio to Necrotic Core (Linear Regression)**



**LDL:HDL Ratio to Necrotic Core(Linear Regression)**



## WSC-0615

### Acute Stroke: New Treatments Concepts Prospective observational cohort study on treatment of acute ischemic stroke using edaravone, a free radical scavenger and neuroprotective agent, with and without rt-PA (PROTECT4.5)

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**Background/Objective:** Edaravone, a free radical scavenger and neuroprotective agent, has contributed to the treatment of acute ischemic stroke (AIS) in Japan since 2001, while none of this class of agents has been approved in the western countries. PROTECT4.5 (Post-marketing Registry On Treatment with Edaravone in acute Cerebral infarction by the Time window of 4.5 hours) is a nation-wide prospective observational cohort study to evaluate efficacy and safety of edaravone treatment in patients with AIS. We report here an analysis of PROTECT4.5 in comparison with other studies on AIS.

**Methods:** Patients who received edaravone with or without rt-PA up to 4.5 hours after onset of AIS were enrolled in this study. Primary endpoints were the proportion of patients with mRS 0–1 at 3 months after onset and incidence of symptomatic intracranial hemorrhage (sICH) within 36 hours after initiating treatment.

**Result/Discussion:** 11,385 patients were enrolled; 6,108 were treated with rt-PA and 5,277 patients without. The mean age was 72.1 years old and 62.9% were male. The median of baseline NIHSS treated with and without rt-PA were 13 and 6, respectively. The proportion of mRS 0–1 was 39.2% (95% CI 37.6–40.7%) with rt-PA and 51.7% (50.0–53.3) without rt-PA. The incidence of sICH was 1.6% (1.3–2.0) with rt-PA and 0.5% (0.3–0.7) without rt-PA. In comparison with results from other prospective observational cohort studies (STARS, CASES, SITS-MOST, J-MARS), edaravone appeared to reduce sICH in rt-PA treated patients. We'll present the final analysis.

## WSC-0930

### Aneurysm and Vascular Malformations Balloon test occlusion in the endovascular management of dissecting distal anterior cerebral artery pseudo-aneurysm: A case report

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**Introduction:** Endovascular treatment by parent artery occlusion (PAO) remains a method of choice in cases of peripheral aneurysm of cerebral arteries. To assess adequacy of collateral circulation, balloon test occlusion (BTO) is an established procedure prior to PAO. However it is rarely performed in small peripheral vessels. We report a case of dissecting DACA pseudo-aneurysm that was treated with PAO following a BTO of peri-callosal system which, to best of our knowledge, is first case of BTO of A4 segment of distal anterior cerebral artery (DACA).

**Case Illustration:** A 39 year old male without any vascular risk factors presented with sudden onset severe headache. Brain CT scan showed diffuse subarachnoid hemorrhage (Fisher grade 3). Patient was fully conscious, Hunt & Hess 2. Cerebral DSA revealed a 6 × 5 mm dissecting pseudo-aneurysm at right DACA in distal A4 segment. BTO and PAO were done.

**Discussion:** BTO provides useful information about the adequacy of collateral in a treatment strategy of PAO. There was intraprocedural aneurysm rupture due to technical difficulty in introducing coils in small and distally located aneurysm with small caliber parent artery. It was managed by glue embolization. No new neurological deficit post procedure was seen and patient discharged with good clinical and radiology outcome. A follow up cerebral DSA 4 months later confirmed stable angiographic results.

**Conclusion:** BTO and PAO of A4 segment has high technical difficulty; however, if the procedure is performed carefully and managed properly, it can be done successfully.

## WSC-0929

### Aneurysm and Vascular Malformations Endovascular management of distal anterior cerebral artery (DACA) ANEURYSMS: A retrospective review study

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**Introduction:** Distal anterior cerebral artery (DACA) aneurysms are rare and their treatment by surgical clipping poses technical difficulties and carries higher surgical risk. Endovascular treatment is a preferred method. Earlier studies have reported higher complication rates in DACA aneurysms compared with other aneurysms in the circle of Willis. Therefore, endovascular management of DACA aneurysms still remains as a challenge in their management.

**Aims:** To review clinical presentation, angiographic presentation of DACA aneurysms, complication and outcome of their endovascular treatment in our institutional experience.

**Methods:** Retrospective review study among 185 patients with intracranial aneurysms treated with endovascular management from September 2009 to December 2013 in Max Superspecialty Hospital, New Delhi, India, 11 patients (5.9%) with 12 DACA aneurysms were studied retrospectively.

We reported clinical presentations, cerebral angiographic findings, endovascular treatment, complications and outcomes. The clinical and angiographic outcomes were assessed using modified Rankin scales and Raymond scale, respectively.

**Results:** Of 11 patients, 54.5% were female and 45.5% were male with mean age was 48.4 years. All patients had subarachnoid hemorrhage that indicated ruptured DACA aneurysm. All of DACA aneurysms were small size. Postcoiling angiograms showed complete occlusion in all patients. Two patients had intraprocedural aneurysm rupture but without any clinical sequelae and 1 patient had thrombus formation which was thrombolysed at the end of coiling. All patients had good outcome.

**Conclusion:** Our experience with 11 patients showed endovascular management of small DACA aneurysms is safe with good outcome.

## WSC-1125

### Aneurysm and Vascular Malformations Endovascular treatment of mycotic intracranial aneurysms in a patient with rheumatic heart disease

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**Introduction:** Mycotic intracranial aneurysms (MIA) are uncommon causes of intracranial aneurysms that develop in the presence of infections. Pathology consists of inflammation leading to arterial wall weakening and subsequent aneurysm formation. It usually develops as a complication of subacute bacterial endocarditis.

**Case:** A 24-year-old female patient with a history of rheumatic heart disease presented with headache, vomiting and weakness of the left arm. Neurological examination revealed left hemiparesis (upper limb 3/5, lower limb 4/5). A right fronto-parietal hematoma was detected on cranial CT. Digital subtraction angiography examination (DSA) showed a fronto-parietal mycotic aneurysm sized approximately 4 mm at the distal branch of right middle cerebral artery. Under general anesthesia a guiding catheter was placed into the right internal carotid artery and advanced with micro catheter and micro guide wire to the level of aneurysm. The aneurysm sac was totally embolized using 50% glue mixture of *histoacryl*. Control angiography confirmed the total occlusion of the aneurysm. After DSA, transthoracic echocardiography was performed and a vegetation on the mitral valve was detected. After confirming the infective endocarditis diagnosis, patient was started on antibiotic treatment.

**Conclusion:** We presented this fully recovered MIA due to bacterial endocarditis case to remind the diagnostic as well as therapeutic role of endovascular approach.

## WSC-1250

### Aneurysm and Vascular Malformations Prophylactic topical antibiotics and delayed cerebral ischemia in patients with aneurysmal subarachnoid hemorrhage

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**Introduction:** Delayed cerebral ischemia (DCI) after aneurysmal subarachnoid hemorrhage (aSAH) worsens outcome. Inflammation with or

without infection may be a contributing factor. In intensive-care-unit (ICU) patients, selective digestive tract decontamination (SDD; 4 days intravenous cefotaxime plus topical application of tobramycin/colistin/amphotericin-B in oropharynx and stomach) and selective oropharyngeal decontamination (SOD; oropharyngeal application only) reduce respiratory tract colonization with Gram-negative bacteria and improve survival. **Aims:** To investigate the effects of SDD and SOD on the occurrence of DCI and survival after aSAH.

**Methods:** Patients admitted at least 72 hours at an ICU within 72 hours after aSAH who received SDD or SOD were compared to patients without such treatment. DCI was defined as a new hypodensity on CT not explained by edema or ischemia from coiling or clipping. We calculated hazard ratios (HR) for the effect of SDD/SOD compared to controls on DCI and odds ratios (OR) for mortality at day 28, adjusted for age, sex, clinical condition on admission (WFNS-score), recurrent bleeding, length-of-ICU-stay and amount of subarachnoid blood on admission CT. **Results:** We included 62 controls and 277 patients receiving SDD or SOD. DCI occurred in 90 (27%) patients. Compared to controls, the adjusted HR for DCI was 0.8 (95% CI 0.5–1.4) for SDD/SOD, and the adjusted OR for death at 28 days was 1.3 (95% CI 0.5–3.1) for SDD/SOD.

**Conclusions:** Our results do not support a preventive role of SDD/SOD on development of DCI and survival after aSAH. The small number of controls might explain these findings.

## WSC-1055

### Aneurysm and Vascular Malformations Long-term outcome of the belly-band wrap-clipping with polytetrafluoroethylene (PTFE) for ruptured blood blister-like aneurysms of the internal carotid artery

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**Introduction:** Blood blister-like aneurysms (BBAs) of the internal carotid artery (ICA) are not true aneurysms and should not be treated by simple neck clipping. Belly-band wrap-clipping (WC) is one of the recommended treatments, however, long-term outcome of this method has not been reported.

**Aims:** The aim of this study is to clarify long-term efficacy of WC for BBA. **Methods:** Six patients with ruptured BBAs treated with WC between 2000 and 2011 at our institute were included in this study. Polytetrafluoroethylene (PTFE) membrane with 0.1-mm-thickness was used as a wrapping material. All patients but one underwent follow-up three-dimensional computed tomographic angiography (3D-CTA) to detect the aneurysmal regrowth and patency of the ICA.

**Results:** Surgery was performed in an acute stage (within 6 days) in 5 patients and in chronic stage (on 25 days) in a patient. Preoperative Hunt & Kosnik grade was II in 3 patients, III in 3 patients. No postoperative aneurysmal rupture or ischemic complication occurred, and no neurological deficit was found at discharge. In the mean radiological follow-up period of 27 months, regrowth of aneurysm, progression of ICA stenosis or change of the clip position was not detected on 3D-CTA. Any aneurysmal rupture and ischemic complication were not observed in the final follow-up period of 47 months.

**Conclusions:** WC for ruptured BBAs of ICA is a useful and acceptable procedure promising long-term effectiveness.

## WSC-0506

### Aneurysm and Vascular Malformations Utility of 320-detector row CT for diagnosis and surgery for paraclinoid and intracavernous aneurysms

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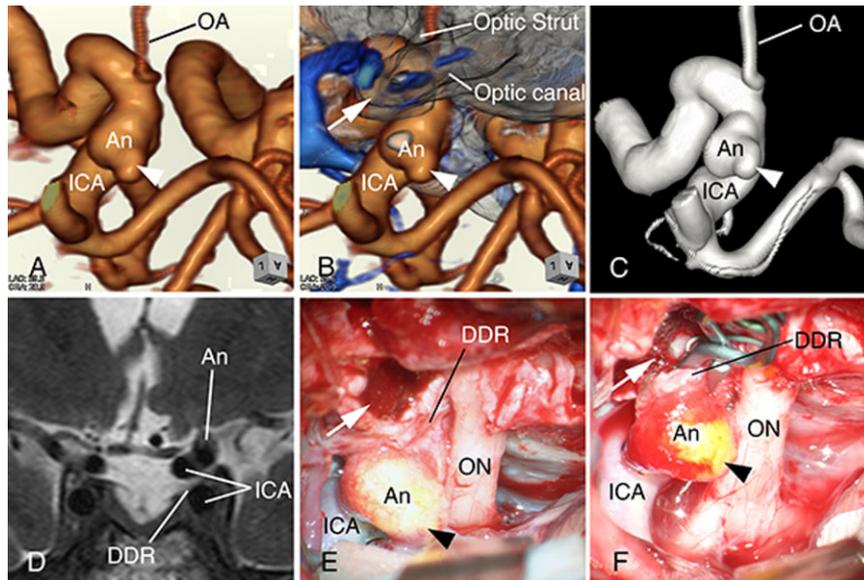
**Aims:** The aim of this study was (1) to assess the diagnostic accuracy of 320-detector row CT for paraclinoid and intracavernous aneurysms, and (2) to investigate whether this method provides sufficient information for surgery.

**Methods:** A total of 14 patients with 16 unruptured proximal ICA aneurysms underwent 3D-CTA fusion imaging, which was created by

superimposing 3D-CT venography and/or 3D-bone data onto 3D-CTA using 320-detector row CT, MRI, and 3D-DSA. Images of each modality were assessed using intraoperative findings as the reference standard.

**Results:** On 3D-CTA fusion images, 11 aneurysms were diagnosed as 'extracavernous' and five as 'intracavernous'. No discordance in aneurysm location between the 3D-CTA fusion images and the intraoperative findings was found. In contrast, discordance between MRI and intraoperative findings were found in five of the 16 cases (31%), which was significantly more frequent than with 3D-CTA ( $p = 0.043$ ). The findings DSA were also in excellent agreement with the intraoperative findings. However, 3D-CTA fusion imaging provided more comprehensive information, including venous and osseous structures. The 3D-CTA after surgery demonstrated a clear relationship between the clip and aneurysmal neck with notably few artifacts.

**Conclusions:** The 320-detector row CT provided high accuracy for the diagnosis of paraclinoid and intracavernous aneurysms. This technique also provided comprehensive depiction of the aneurysms and surrounding structures, therefore, might be useful for developing a surgical treatment plan.



## WSC-1322

### Aneurysm and Vascular Malformations Prognostic factors in patients with ruptured internal cerebral artery aneurysm: A single comprehensive stroke center experience

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**Introduction & aims:** The aim of this study was to analyze the trend on therapeutic decision-making and outcome in patients with ruptured internal cerebral artery (ICA) aneurysm treated in our comprehensive stroke center, where two therapeutic modalities (clipping and coiling) were available in independent department service.

**Methods:** Medical records of 100 consecutive patients who underwent ruptured ICA aneurysm repair during the past 3 years were retrospectively reviewed. All patients were evaluated by cerebrovascular surgeons and endovascular interventionists before treatment. The treatment modality was selected on the basis of aneurysm topography and patients' condition.

**Results:** The ruptured ICA aneurysms were repaired by surgical clipping in 47 patients and by endovascular coiling in 53. In multivariate analysis, independent predictors of poor patient outcome at discharge (mRS4-6) were age of the patients and poor clinical grade (H&K III-V) at admission, and wider aneurysmal neck. The treatment modality didn't influence on the outcome.

**Conclusions:** The considered selection of surgical or endovascular repair of ruptured aneurysm achieved excellent radiographic efficacy with low morbidity. Proper treatment of elderly patients and patients with wider aneurysmal neck remains to be elucidated.

## WSC-1324

### Aneurysm and Vascular Malformations

#### Effect of cisternal irrigation therapy for cerebral vasospasm after aneurysmal subarachnoid hemorrhage: A single comprehensive stroke center experience

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**Introduction & aims:** Cerebral vasospasm (CVS) after subarachnoid hemorrhage (SAH) remains as a major cause of morbidity. Cisternal irrigation is one of therapeutic options after surgical intervention, and has been reported to be effective to prevent cerebral vasospasm. The purpose of this study was to access our therapeutic results of cisternal irrigation therapy after surgical repair for aneurysmal SAH.

**Methods:** The medical chart of 246 patients with subarachnoid hemorrhage who underwent both acute craniotomy for ruptured aneurysm repair and cisternal irrigation with mock CSF containing ascorbic acid and Mg<sup>++</sup> in our stroke center between April 2007 and March 2012 were retrospectively reviewed.

**Results:** Of the 246 patients with SAH, cerebral infarction due to CVS occurred in only 18 patients (7.3%). There was no significant difference between primary clinical conditions (severity of SAH) or locations of aneurysms. Most patients with cerebral infarction after CVS were accompanied by complications such as hyponatremia, meningitis and hypovolemia.

**Conclusions:** These data suggest that cisternal irrigation with mock CSF containing ascorbic acid and Mg<sup>++</sup> could be an effective treatment for prevention of CVS. More strict intensive care and monitoring is needed for better outcome.

## WSC-0272

### Aneurysm and Vascular Malformations

#### Surgical treatment for recurrent aneurysms after initial endovascular coil embolization

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**Introduction:** The surgical treatment of recurrent lesions of embolized aneurysms is difficult and challenging for many neurosurgeons.

**Aims:** To assess the efficacy and safety of surgical treatment for recurrent aneurysms after previous embolization, the authors retrospectively studied angiographic results, clinical results, and complications in patients treated with additional surgery.

**Results:**

Test	Sensitivity		Specificity	
HSS	= 70.00%	95% CI: 45.73% to 88.03%	= 84.62%	95% CI: 69.46% to 94.10%
≥23				
Fisher	= 90.48%	95% CI: 69.58% to 98.55%	= 33.33%	95% CI: 20.77% to 47.92%
= 4				
wFNS	= 65.22%	95% CI: 42.74% to 83.58%	= 85.96%	95% CI: 74.20% to 93.72%
≥3				
mFisher	= 85.00%	95% CI: 62.08% to 96.62%	= 23.81%	95% CI: 12.07% to 39.45%
≥3				
mFisher	= 85.00%	95% CI: 62.08% to 96.62%	= 54.76%	95% CI: 38.68% to 70.15%
2 and 4				

Sensitivity = TP/(TP + FN); specificity = TN/(TN + FP); CI = Confidence Interval.

**Conclusions:** HSS and wFNS grading system have highest Specificity for predicting bad outcomes. Other systems have moderately higher Sensitivity, though considerably not as specific as HSS and wFNS.

**Methods:** Seven patients with recurrent aneurysms were treated with microsurgical treatment.

**Results:** This series included one man and six women received endovascular coiling as the first-line treatment. One was unruptured and six were ruptured. The aneurysm locations were posterior communicating (n = 3), anterior communicating (n = 2), ophthalmic (n = 1), posterior inferior cerebellar (n = 1). The initial size ranged 2.2 to 6.7 mm in greatest diameter (mean, 4.5 mm), and aspect ratio was 1.2 to 3.4 (mean, 1.9). In these aneurysms, the initial coiling result was complete occlusion in five patients, neck remnants in two patients. The mechanism underlying aneurysm recurrence was coil compaction in four aneurysms, aneurysm regrowth in two aneurysms, and fundal migration in one aneurysm. The median recurrence latency was 28.8 months (0.7 to 115 months). Microsurgical clipping without coil removal were used in five patients, trapping under bypass protection was done in one case of posterior inferior cerebellar aneurysm. No operative morbidity was observed, and postoperative angiography revealed complete aneurysms occlusion in all cases.

**Conclusions:** The microsurgical clipping of recurrent lesions of embolized aneurysms is effective and safe when it is technically feasible. For unclipable lesions, trapping under bypass protection should be taken into consideration.

## WSC-1559

### Aneurysm and Vascular Malformations

#### Aneurysmal subarachnoid hemorrhage: Sensitivity and specificity of scoring systems in predicting bad early outcome

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**Introduction:** Cerebral vasospasm is a frequent complication after aneurysmal subarachnoid hemorrhage (SAH) and is a preventable cause of death and disability. The ability to predict bad outcome could warrant a more aggressive therapeutic approach.

**Aims:** The aim of this study is to compare sensitivity and specificity of main scoring systems in predicting bad early outcome.

**Methods:** We reviewed the clinical and radiological information on all adult patients (>18 yo) with aneurysmal SAH treated from January 2012 to December 2013 (n = 81) in Hospital of Lithuanian University of Health Sciences. Volume of SAH was quantified using the Hijdra sum scoring system (HSS) as well as Fisher and Modified Fisher (mFisher) scoring systems. Neurological status upon arrival was quantified using wFNS grading system. Early outcomes were assessed using Glasgow outcome scale (GOS). GOS scores of 1 and 2 were defined as bad outcome.

## WSC-0557

### Aneurysm and Vascular Malformations

#### Numerical analysis of cerebral aneurysm using discriminant analysis

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To decide for surgical indication of unruptured cerebral aneurysms, numerical analysis using discriminant analysis with cerebral aneurysms were attempted retrospectively.

A number of 1090 aneurysms were analyzed retrospectively; 307 cases of close observation, 300 cases through surgical clipping and 483 cases through endovascular treatment. Five parameters were measured; three diameters of an aneurysm, neck size, and parent artery diameter. These parameters were measured under the rule. All aneurysms were divided into rupture and unruptured by discriminant function, and it was examined whether the function was significant or not. Furthermore, it was considered whether to treat the aneurysms classified ruptured statistically was appropriate or not.

The statistically significant discriminant function was obtained ( $p < 0.001$ ). Maximum aneurysm diameter and dome neck ratio were statistically significant. Statistically ruptured aneurysms had characteristics of unruptured aneurysm to treat than statistically unruptured aneurysms had; over 5 mm in maximum diameter, multiple aneurysms in one patient and irregular formation (Logistic analysis).

The obtained discriminant function may be useful to predict aneurysm rupture. In consideration of surgical indication for unruptured cerebral aneurysm, the function may be an option.

Aneurysm measurement: neck size, the depth of aneurysm and the wide of the aneurysm were measured in "working angle" on 3D workstation. Another angle is obtained by rotation of the angle in 90 degree automatically. Another wide is measured in the angle. Parent artery diameter is measured in either angle. Various parameters; such as the volume, dome neck ratio, are acquired from these five basic parameters.

prevent recurrence of hemorrhage. The carbamazepine was discontinued and recently 18 months after the treatment she still does not have pain.

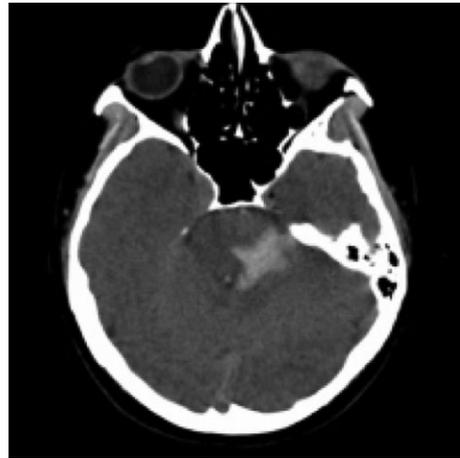


Fig. 1

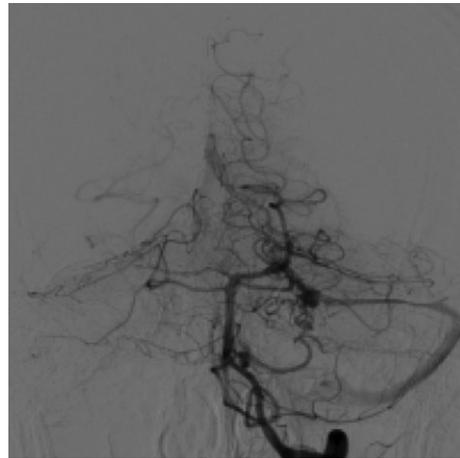


Fig. 2

## WSC-1134

### Aneurysm and Vascular Malformations

#### Trigeminal neuralgia: The first sign of the arteriovenous malformation

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**Introduction:** Arteriovenous malformations (AVMs) are a rare cause of trigeminal neuralgia.

**Case report:** A 45-year-old female admitted to emergency room with acute-onset right sided hemiparesis and left sided abducens palsy. She had a history of trigeminal neuralgia and she was pain-free with carbamazepine treatment. Brain computed tomography demonstrated left pontocerebellar hemorrhage (Fig. 1). The digital subtraction angiography showed an arteriovenous malformation (AVM) located in the cerebellopontine angle fed by left superior cerebellar, anterior inferior cerebellar arteries and draining into the transverse sinus (Fig. 2). Brain magnetic resonance imaging (MRI) that was performed five months ago when she was diagnosed with trigeminal neuralgia, actually demonstrated vascular loops of the AVM at the root of the trigeminal nerve which was not recognized earlier (Fig. 3). The patient was referred to endovascular treatment to

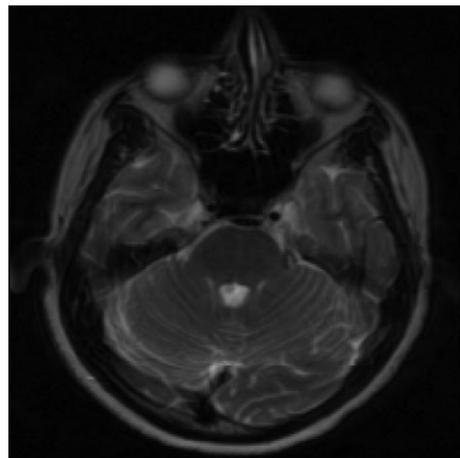


Fig. 3

**Conclusions:** Trigeminal neuralgia caused by the compression of an AVM is rare, and should be treated for both to prevent recurrence of hemorrhage and trigeminal neuralgia.

**WSC-1562****Aneurysm and Vascular Malformations  
Micro emboli detection on TCD during subarachnoid hemorrhage and its relevance**C Derksen<sup>1</sup>, M Saqur<sup>1</sup>, C O'Kelly<sup>2</sup>, M Chow<sup>2</sup>, M Findley<sup>2</sup>, T Darsaut<sup>2</sup>, K Khan<sup>1</sup><sup>1</sup>Neurology, University of Alberta Hospital, Edmonton, Canada<sup>2</sup>Neurosurgery, University of Alberta Hospital, Edmonton, Canada

**Background:** Microembolic signals (MES) may be seen during subarachnoid hemorrhage (SAH) monitoring with Transcranial Doppler (TCD) for diagnosis of vasospasm. The relationship of MES with vasospasm and risk of stroke is not well known.

**Method:** Patients presenting with aneurysmal SAH were assessed with TCD from days 1–3 through 21 or until indicated. Bilateral anterior and posterior circulations were assessed daily. Confirmation of vasospasm and microemboli was based on previously described protocols.

**Results:** Since Sept 2006 to present, 394 patients were admitted with SAH. Of these 340 were aneurysmal SAH and were analyzed. Of these 87 (25.6%) experienced moderate to severe vasospasm (m-sVSP) and 253 (74.4%) had mild or no VSP. Seventeen (5%) showed microembolic signals on TCD. Seven (41%) of these had m-sVSP and 10 (59%) mild or no VSP. (P = 0.11) Of the 17 with MES 8 (47%) had at least one alternate cause for MES (atrial fib/heart failure, aortic aneurysm or thrombosed coil). Five of 7 with m-sVSP experienced multiple strokes and 2 of 10 with mild or no VSP with stroke. (P < 0.001)

**Interpretation:** Microemboli detection in routine SAH monitoring is rare. Vasospasm did not significantly influence the rate of microemboli detection. However, it is associated with high rate of stroke. Further studies are needed to study this interesting phenomenon.

**WSC-0344****Aneurysm and Vascular Malformations  
Clinical outcome of paraclinoid ICA aneurysms after microsurgical neck clipping in comparison with endovascular embolization**J Kim<sup>1</sup>, J Cheong<sup>1</sup>, C Kim<sup>1</sup><sup>1</sup>Neurosurgery, Hanyang University Guri Hospital, Guri Gyeonggido, Korea

**Introduction:** Paraclinoid aneurysms are mainly intradural and therefore have a potential risk of subarachnoid hemorrhage (SAH). They are frequently large or giant and have a common close relationship with the bone of the skull base and with the dural folds around the ICA. Because of the complex anatomical relationship among neurovascular, dural, and bony structures, the management of paraclinoid aneurysms is more challenging than intracranial aneurysms at other locations.

**Aims:** We studied the clinical outcomes of 61 paraclinoid ICA aneurysms after microsurgical clipping in comparison with endovascular coiling.

**Methods:** Between January 2008 and December 2012, we treated 61 paraclinoid ICA aneurysms created by surgical clipping or endovascular coiling. Preoperative neurologic status and postoperative outcome were evaluated by the Glasgow Coma Scale (GCS) and the modified Rankin Scale (mRS). Postoperative hydrocephalus and vasospasm were reviewed using the patients' medical charts.

**Results:** Most patients were in good clinical condition before the operations and had good treatment outcomes. Clinical vasospasm was observed in 5 patients after operation, and hydrocephalus occurred in 6 patients. There was no statistically significant difference between the surgical clipping group and endovascular coiling group regarding aneurysm size, sex, GCS score, H-H grade, or mRS.

**Conclusions:** Paraclinoid ICA aneurysms are difficult to occlude surgically; however, there were no significant differences in the treatment results or complications when compared with coil embolization. In par-

ticular, an adequate surgical technique may lead to better outcomes than coil embolization in the treatment of large and/or wide-neck paraclinoid ICA aneurysms.

**WSC-0347****Aneurysm and Vascular Malformations  
Surgical strategy for the vertebral artery dissecting aneurysms involving the PICA origin site**T Kim<sup>1</sup>, S Joo<sup>1</sup>, T Kim<sup>1</sup><sup>1</sup>Neurosurgery, Chonnam National University Hospital, Gwangju, Korea

**Aims:** To propose the surgical strategy for vertebral artery (VA) dissecting aneurysms involving the posterior inferior cerebellar artery (PICA) origin site.

**Methods:** From March 2012 to December 2013, we had treated eleven patients diagnosed with PICA-involved VA dissecting aneurysms. Our surgical strategy applied to them including only surgery group (5 cases, proximal clipping of the VA and PICA with occipital artery (OA)-PICA bypass), stent assisted coiling group (4 cases, 3 cases: stent was deployed on dissected VA, 1 case: stent was deployed on PICA), and combined surgery group (2 cases). In combined surgery group, one patient with a giant VA dissecting had a proximal clipping of the VA and PICA with OA-PICA bypass first, and then underwent an internal trapping through contra-lateral VA for embolization of the remnant aneurysm. The other presented with SAH underwent an emergent partial coiling at ruptured site first, and then underwent a proximal clipping of the VA and PICA with OA-PICA bypass.

**Results:** 10 patients showed good recovery and one patient who underwent combined surgery showed moderate disabled due to low cranial nerve palsy according to GOS (Glasgow outcome scale). In radiologic outcome, only surgery and combined surgery group showed their all lesions were completely obliterated with the good patency of OA-PICA bypass. In stent assisted coiling group, there were no recurrence and regrowth lesions among two patient who had a follow-up angiography

**Conclusions:** We would say that our strategy for the treating VA dissecting aneurysm involving PICA is an effective and feasible.

**WSC-0915****Aneurysm and Vascular Malformations  
Endoscopic fluorescence video angiography in aneurysm surgery**H Kinouchi<sup>1</sup>, K Kanemaru<sup>1</sup>, H Yoshioka<sup>1</sup>, M Ogiwara<sup>1</sup>, T Yagi<sup>1</sup>, Y Fukumoto<sup>1</sup>, K Hashimoto<sup>1</sup><sup>1</sup>Department of Neurosurgery, Yamanashi University, Chuo, Japan

**Introduction:** Intraoperative fluorescence video angiography using indocyanine green (ICG) or fluorescein has been widely used in aneurysm surgery. This is a simple and useful method to confirm complete occlusion of the aneurysm lumen and preservation of blood flow in the arteries around the aneurysm. However, the observation field of fluorescence video angiography is limited under a microscope, making it difficult to confirm the flow in the arteries behind the parent arteries or aneurysm.

**Methods:** The authors developed a new technique of intraoperative endoscopic fluorescence video angiography using both ICG and fluorescein to assess the blood flow in perforating arteries hidden by the parent arteries or aneurysm, and assessed the usefulness of these systems.

**Results:** We applied these systems in 20 aneurysm surgeries. Complete clipping and the preservation of blood flow in the parent and perforating arteries were confirmed in all cases in combination with microscopic fluorescence video angiography. There was a case in which incomplete clipping of the left IC-PC aneurysm and occlusion of perforating arteries after clip placement were detected only by endoscopic video angiography.

Repositioning of aneurysm clips under endoscopic monitoring fixed these problems, and this was confirmed with repeated endoscopic fluorescence video angiography. There were no complications related to the procedures in all cases.

**Conclusion:** Endoscopic fluorescence video angiography is quite useful in aneurysm surgery since it could facilitate intraoperative real-time assessment of the aneurysm occlusion and the patency of perforating arteries behind parent arteries or aneurysms.

#### WSC-0884

### Aneurysm and Vascular Malformations Spontaneous disappearance of a cerebral arteriovenous malformation (AVM): Case report

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A case of spontaneous disappearance of a cerebral arteriovenous malformation (AVM) is reported. A 32-year-old woman, who had been diagnosed as having a AVM in the left occipital lobe, incidentally found by health checkup. She complained no symptom. Brain MRI and CT angiography revealed a AVM in the left occipital lobe with no hemorrhage or infarction. We confirmed the AVM by transfemoral cerebral angiograms (TFCA) one month later. Follow-up CT angiography performed four months after initial CT angiography demonstrated disappearance of a cerebral AVM. Repeated cerebral angiograms performed about eight months later confirmed complete disappearance of the AVM. Spontaneous regression of cerebral AVMs is rare and poorly understood. We report this rare case with review of the literature and several possible mechanisms for spontaneous disappearance of AVMs are discussed.

#### WSC-0646

### Aneurysm and Vascular Malformations A case of nonaneurysmatic perimesencephalic hemorrhage which caused to intranuclear ophthalmoplegia

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**Introduction:** Nonaneurysmatic perimesencephalic subarachnoid hemorrhages (N-APMSAH) which are a rare form of subarachnoid hemorrhages are leakage hemorrhages which occur as a result of decreased venous pressure. The center of hemorrhage is localized in the perimesencephalic cisterns and in the cisterns immediately in front of the mesencephalon. The risk of re-hemorrhage is very low compared to aneurysmatic hemorrhages and they have a very good prognosis. Good detection of N-APMSAH cases which occur rarely is important in terms of preventing unnecessary investigations and surgical interventions which may increase complications.

**Case:** A 48-year old male patient presented with complaints of headache and diplopia which developed suddenly. In his personal history, he had hypertension, coronary artery disease and smoking. On neurological examination, he had adduction limitation in the left eye, abduction nistagmus in the right eye and skew deviation in the left eye. On cranial CT, appearance compatible with hyperdense hemorrhage was present at the level of the right crus of the mesencephalon and in the prepontine cisterns. The areas of hemorrhage were observed to be isointense lesions on T1-weighted sections and lesions hyperintense in the center and hypointense in the periphery on T2 and T2 Flair-weighted sections.

Cranial MR angiography was found to be normal. The case was accepted to be nonaneurysmatic mesencephalic hemorrhage and symptomatic treatment was started.

**Discussion:** Here, we aimed to draw attention to presence of INO (internuclear ophthalmoplegia) as the only finding in a rare case of N-APMSAH who presented with complaints of headache and diplopia.

#### WSC-0847

### Aneurysm and Vascular Malformations Neutrophil/lymphocyte ratio in cerebral aneurysm

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**Introduction:** Blood neutrophil/lymphocyte ratio (NLR) is a simple marker of subclinical inflammation that can be easily obtained. This marker is not yet been studied in cerebral aneurysm.

**Aim:** The aim of this study is to determine the association between NLR and cerebral aneurysm.

**Methods:** A total of 148 patients with cerebral aneurysm, and 137 control subjects were included in this study. No patient had a recent history of an acute infection or an inflammatory disease. The baseline NLR was calculated as the ratio of neutrophil count to lymphocyte count. WBC count >12,000 cells per  $\mu$ L or <4,000 cells per  $\mu$ L and high body temperature >38 ° are excluded from the study.

**Results:** The Mean NLR was significantly higher among persons with cerebral aneurysm compared with controls ( $4.2 \pm 1.3$  vs  $1.9 \pm 0.78$ ,  $P < 0.001$ ). Other comorbid conditions were balanced between these two groups.

**Conclusions:** Higher NLR is associated with cerebral aneurysm. Unlike many other inflammatory markers and bioassays, NLR are inexpensive and readily available biomarkers that may be useful for risk stratification in patients with cerebral aneurysm.

#### WSC-1300

### Aneurysm and Vascular Malformations Surgical timing of aneurysmal subarachnoid hemorrhage – Impact on clinical outcome

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<sup>1</sup>Neurosurgery, Korea University Ansan Hospital, Ansan-si, Korea

Early surgery, treatment within 3 days after the onset of symptoms is usual for ruptured intracranial aneurysms. We assessed the impact of surgical timing to the clinical outcome of the patients with aneurysmal SAH.

241 patients were candidates for this study. The mean age is 52 years and the sex ratio is 113: 128 (M:F). Clippings were performed in 198 people (82.2%) and 43 underwent endovascular coiling.

The mean surgical timing after the onset of symptom was 1.2 days on average. 88 patients (36.5%) underwent surgery on the day of symptom, 86 patients (35.7%) on one day after symptom, 33 patients (13.7%) on two days, 24 patients (10.0%) on three days, and 10 patients (4.1%) on more than four days, respectively. Three patients showed preoperative bleedings and those all happened on the day of symptoms. The incidence of delayed cerebral ischemia showed no significant difference in groups and there was no significant difference in treatment outcome. ( $P < 0.05$ ) In patients admitted on weekends, including Friday, surgery was delayed compared to that of ones admitted on weekdays, especially admitted on Saturday (2.2 days). But clinical outcome was not significantly different. ( $P < 0.05$ )

Surgical timing is affected by the status of the patients, the condition of hospital, and surgeon factors. Preoperative rebleeding is one of the most important factors for clinical outcome and can even cause legal problems. We think this study may be helpful for cerebrovascular surgeons to decide the surgical timing of aneurysmal SAH.

### WSC-1301

#### Aneurysm and Vascular Malformations Combined treatment for the intracranial aneurysms of the same patients using microsurgical and endovascular therapies

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<sup>1</sup>Neurosurgery, Korea University Ansan Hospital, Ansan-si, Korea

A combined neurovascular approach that uses both surgical and endovascular therapies for the intracranial aneurysms could maximize efficacy and outcomes while minimizing risks. We retrospectively reviewed our experience of combined therapy for the same patients with intracranial aneurysm.

Between July 2008 and December 2012, twenty-three patients with intracranial aneurysms were treated using both microsurgical and endovascular therapies. Fourteen patients (66.7%) had multiple aneurysms, one of which was treated with microsurgical technique and the other was with endovascular one. Two patients had remnant aneurysms after clipping and another two patients showed regrowing ones after clipping. These four patients were managed with endovascular coil embolization. Two patients failed microsurgery and they underwent endovascular coiling. One patient failed endovascular coil embolization, so microsurgical clipping was performed. Two patients needed surgical decompression after coiling of the ruptured aneurysms.

Overall management outcome was favorable. In cases of multiple aneurysms, aneurysms located at proximal internal carotid artery or the posterior circulation prefer endovascular therapy and ruptured ones at anterior circulation prefer surgical clipping. Remnant or regrowing aneurysms after surgical clipping were treated successfully using endovascular technique without procedural morbidity. Very small aneurysm less than 3 mm in diameter was difficult to treat with coils and it was treated with clipping without difficulty.

Microsurgical clipping and endovascular coiling has its own pros and cons respectively. We can achieve favorable outcome with combined approach using both treatment modalities for the complicated patients with some tricky intracranial aneurysms.

### WSC-1307

#### Aneurysm and Vascular Malformations CT perfusion predicts early outcome of aneurysmal subarachnoid hemorrhage

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<sup>1</sup>Capital Medical University, Beijing Tian Tan Hospital, Beijing, China

**Introduction:** Patient with subarachnoid hemorrhage (SAH) always has poor outcome, affecting by one of the complications which is delayed cerebral ischemia (DCI).

**Aims:** Evaluate the diagnostic accuracy of CT perfusion (CTP) for the prediction of DCI and early outcome of aneurysmal subarachnoid hemorrhage.

**Methods:** 28 consecutive patients with aneurysmal SAH within 3 days after onset were enrolled in the study in Beijing Tian Tan Hospital, after the aneurysm clipping or coiling, 14 patients completed CTP, other 14 patients matched with the age, Fisher grade, Hunt-Hess grade as the conventional monitoring group (TCD monitoring). Compare the incidence of poor early outcome and DCI of different perfusion result. The sensitivity and specificity of CTP to TCD in predicting DCI was compared.

**Results:** 60.7% patients developed DCI in this study, most of them had a higher modified Fisher scale ( $\geq 3$ ). The later DCI were found higher incidence in those with abnormal perfusion variable (87.5% vs. 12.5%,  $P = 0.005$ ), and also related with poor early outcome. MTT is the best variable for the prediction of DCI and poor outcome. TCD predicted the DCI with 64.7% sensitivity and 36.4% specificity, CTP predicted with 87.5% sensitivity and 100% specificity.

**Conclusions:** CT perfusion is a sensitive and accurate predictor for early poor outcome and delayed cerebral ischemia.

### WSC-0275

#### Aneurysm and Vascular Malformations Predictors of neurological deficit after endovascular treatment of cerebral arteriovenous malformations and functional repercussion in prospective follow-up

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**Introduction:** Endovascular therapy is a well established approach to treatment of cerebral arteriovenous malformations (AVMs).

**Aims:** The objective of this study was to determine predictive factors of neurological deficit following its application. **Materials and Methods:** 71 patients with cerebral AVMs, having undergone 147 embolization sessions from 2006 to 2011 were followed up prospectively (average of 31, 1  $\pm$  17, 5 months). Functional neurological condition was documented by means of the modified Rankin scale.

**Results:** Factors found to be predictors of neurological deficit were the partial obstruction of drainage veins (OR = 197,6; IC = 2,76–1416,0;  $P = 0,015$ ), a positive result in the Propofol test (OR = 50,2; IC = 6,18–566,5;  $P = 0,000$ ), AVM diameter under 3 cm (OR = 21,3; IC:1,71–265,6;  $P = 0,018$ ), the presence of intranidal aneurysms (OR = 11,2; IC = 1,09–114,2;  $P = 0,042$ ), the absence of postprocedure hypotension (OR = 10,2; IC = 1,35–77,7;  $P = 0,003$ ), deep venous drainage (OR = 7,14; IC = 1,15–44,4;  $P = 0,035$ ), and devascularization in excess of 40% per session (OR = 3,3; IC = 1,11–16,8;  $P = 0,056$ ). 56 patients (78,9%) did not experience changes in their neurological condition after the treatment and 13 patients (18,3%) showed a new neurological deficit related to the treatment. 95,8% of the patients did not show significant long term incapacity.

**Conclusions:** Partial obstruction of drainage veins, small AVMs, intranidal aneurysms, faulty hemodynamic control and extensive devascularization were found to be predictors of neurological deficit. A significant number of patients with neurological deficit improved in the long term.

### WSC-0516

#### Aneurysm and Vascular Malformations Serial imaging of mouse cerebral arteries using a conventional 3T MR – A feasibility study using a mouse model of intracranial aneurysm

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We report the feasibility of using a readily available, conventional 3T MRI to serially image cerebrovascular in mice. We used a mouse model of

intracranial aneurysm (IA) as a mouse model of dynamic, pathological remodeling of cerebral arteries and demonstrate the feasibility of detecting the formation, growth and rupture of aneurysms.

*Methods:*

*MR imager and animal settings*

For mouse brain vessel imaging, 3.0T MR imager (Signa HDxt; General electric, USA) and a 40 mm-inner-diameter saddle coil (Takashima Seisakusho, Japan) were used. Mice were anesthetized and fixed inside the coil.

*Mouse model of intracranial aneurysm*

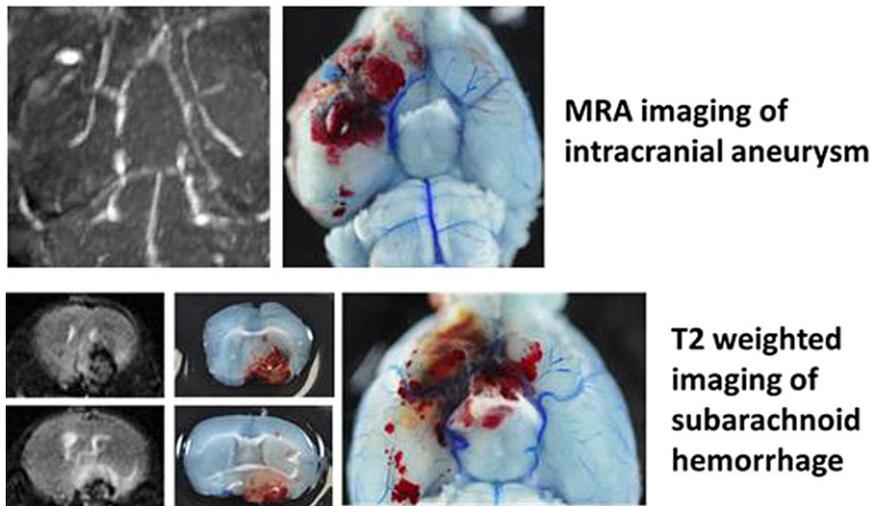
C57BL/6 male mice were used. IA was induced using a combination of a single injection of elastase into the cerebrospinal fluid and deoxycorticosterone acetate salt hypertension.

We used nonenhanced MR angiography (MRA) for IA observation and T2-weighted imaging for subarachnoid hemorrhage (SAH) detection.

*Result:* Imaging time for MRA and T2-weighted imaging were 5 minutes. There was no mortality associated with imaging.

We could observe IA formation serially with MRA and diagnose SAH as a low density area on the T2-weighted imaging (Fig. 1).

*Conclusion:* We have shown the feasibility of serial imaging of mouse cerebral arteries including IA and SAH using a conventional 3T MRI. These imaging methods without using highly specialized imager will be a strong tool for many researchers in the field of stroke.



**WSC-1114**

**Aneurysm and Vascular Malformations  
Collaterals blood flow may predict the occurrence of cerebral vasospasm related ischemic stroke in patients with aneurysmal subarachnoid hemorrhage**

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*Introduction:* Approximately 50% of the patients with aneurysm related subarachnoid hemorrhage (ASAH) and angiographic proven vasospasm develop neurological deficits, some of them resulting in ischemic stroke.

*Aims:* To determine if the current classifications of collaterals may predict the occurrence of delayed neurological symptoms (symptomatic vasospasm), and ischemic stroke.

*Methods:* Consecutive patients with ASAH were studied from 2005 to 2013 at the University of Alberta. Angiograms were performed for the assessment of vasospasm. Collaterals were classified according to the Christoforidis, Higashida, modified Tan classification, and the newly developed MALEJ scale. The new scale evaluated the presence of leptomeningeal collaterals in the arterial territory affected by vasospasm. CT head and/or brain MRI was performed in all patients.

*Results:* From 196 patients with ASAH, 66 (33%) developed angiographic vasospasm. From these last patients, only 32 (48%) had delayed neurological deficits due to symptomatic vasospasm, and 19 (28%) finally developed an ischemic stroke.

Status of collaterals did not predict the presence of delayed neurological symptoms, but predicted the occurrence of ischemic stroke (Pearson Chi-

Square correlation 5.49, positive likelihood ratio of 7.05,  $p = 0.029$ ). The MALEJ scale showed an association between bad leptomeningeal collaterals and twice the risk for development of an ischemic stroke (odds ratio 2.8, CI 90% 1.01–8.21). Regression analysis showed a trend for this association.

*Conclusions:* Assessment of leptomeningeal collaterals may predict the occurrence of stroke, in patients with angiographic proven vasospasm. Future and larger studies are required.



**Fig. 1** MALEJ new classification. Vasospasm M1, A1 and poor leptomeningeal collaterals.

**WSC-1160****Aneurysm and Vascular Malformations  
A clinical, angiography and transcranial Doppler score  
for predicting vasospasm related stroke in aneurysmal  
subarachnoid hemorrhage**

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C Dekersen<sup>1</sup>, K Khan<sup>1</sup>, M Chow<sup>2</sup>, A Shuaib<sup>1</sup>, M Saqqur<sup>1</sup>  
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Canada

**Introduction:** Approximately half to 1/3 of patients with aneurysm subarachnoid hemorrhage (SAH) develop vasospasm related ischemic stroke (VSPST)

**Aims:** To determine which baseline clinical, radiological and transcranial doppler (TCD) parameters are predictive of ischemic stroke after SAH.

**Methods:** We prospectively evaluated 220 SAH patients. CT Fisher grade, aneurysmal location in the first cerebral angiography, first of serial TCD studies and clinical parameters on day of the TCD were included. The primary outcome was VSPST. Univariate and multivariate logistic regression analysis were performed.

**Results:** Fisher grade score was correlated with VSPST (Pearson correlation 0.561). Logistic regression analysis showed that patients with higher diastolic blood pressure had a higher risk for developing VSPST ( $p = 0.006$ ) (odds ratio 1.026 CI 95% 1.003–1.051). Moreover, patients with baseline TCD showing mean flow velocity (MFV) > 120 cm/sec in middle cerebral artery (MCA) had twice risk for developing ischemic stroke after vasospasm (odds ratio 2.4 CI 95% 1.005–6.11).

**Conclusion:** In aneurysmal SAH, the main predictor for vasospasm related ischemic stroke were baseline MCA mean flow velocity > 120 and Diastolic Blood Pressure. Future studies are necessary to confirm these findings.

**WSC-1178****Aneurysm and Vascular Malformations  
Intra-arterial injection fluorescence videoangiography  
in cerebral arteriovenous malformation surgery**

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**Background:** Fluorescence videoangiography has been reported to be effective in cerebral arteriovenous malformation (AVM) surgery. However, the image contrast of the procedure with intravenous injection is diminished by repeated study, which makes precise evaluation of blood flow in AVM difficult. To overcome this weak point, we performed intra-arterial fluorescence videoangiography (IA-FVAG) that can be repeated within a short time, and evaluated its effectiveness in AVM surgery.

**Methods:** In 14 AVM patients, fluorescein sodium solution was administered through the catheter for intraoperative digital subtraction angiography (DSA). IA-FVAG was achieved before, during, and after resection of AVM.

**Results:** DSA catheters were introduced into the internal carotid artery (ICA) in 10 patients, the vertebral artery (VA) in three, and both the ICA and VA in one. Intraoperative DSA was performed twice in a surgery, whereas IA-FVAG was carried out 3 to 15 (mean 7.0) times. The time required to obtain each IA-FVAG (1.4 minutes) was statistically shorter than that of intraoperative DSA (27.1 minutes). Since IA-FVAG provided excellent special and temporal contrast, it was useful in detecting feeders. In addition, decrease of blood flow in AVM during resection could be confirmed in all cases due to the quick clearance of dye. After resection of AVM, IA-FVAG disclosed no residual shunt into the drainers in all cases, which was compatible with the findings of intraoperative DSA.

**Conclusion:** IA-FVAG is effective in AVM surgery since this procedure allows us the precise identification of feeders and the real-time assessment of blood flow in AVM during resection.

**WSC-1330****Aneurysm and Vascular Malformations  
Transcranial electric motor-evoked potentials  
monitoring for intracranial aneurysm surgery**

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**Objective:** Intraoperative transcranial electric motor-evoked potentials (TC-MEPs) monitoring is widely used to protect the motor pathways during neurosurgical operation. Aim of this study was to investigate the usefulness of intraoperative TC-MEPs monitoring under sevoflurane and remifentanyl anesthesia to detect a compromise of motor pathways during the intracranial aneurysm surgery.

**Material and methods:** Consecutive 102 patients undergoing intracranial aneurysm surgery were examined from October 2010 to April 2014. Seventy-eight patients were performed TC-MEPs monitoring. Anesthesia was induced with/without fentanyl 100 µg, propofol 1.5 mg/kg and rocuronium 0.6 mg/kg. Anesthesia was maintained with 50% air in oxygen, sevoflurane at 0.25 or 0.5 MAC (minimum alveolar concentration) and remifentanyl. No additional muscle relaxant agents used. Success rate of the intraoperative TC-MEPs recording and surgical result were evaluated.

**Results:** MEP recording was successful in 74 of 78 patients (94.9%). Three patients who had motor weakness due to cervical disc hernia were failure to record TC-MEPs. One patient with anterior communicating artery aneurysm was insufficient recording from lower extremities. In three cases, MEPs was disappeared after the clipping or temporary clipping and improved with re-applying the clip. In one case, giant MEP wave was appeared after temporary clipping. There was transient hemiparesis in this case. In spite of no intraoperative change of MEPs, three patients had transient hemiparesis after surgery. These false-negative results were accounted for hydrocephalus, venous congestion and edema.

**Conclusions:** Transcranial electric motor-evoked potentials monitoring under sevoflurane and remifentanyl anesthesia without muscle relaxants is simple and safety method for the protection of the motor pathways during intracranial aneurysm surgery.

**WSC-1356****Aneurysm and Vascular Malformations  
Pain management in adult patients with unsecured  
acute aneurysmal subarachnoid hemorrhage in a  
tertiary hospital from 2009–2013: a descriptive study  
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**Objective:** The aim of this study is to identify the most commonly used and most effective pain reliever/s for headache among adult patients with unsecured aneurysmal subarachnoid hemorrhage during the first 48 hours from ictus.

**Methodology:** This is a retrospective descriptive study that included 18 patients admitted in the Acute Stroke Unit of a Tertiary Hospital from January 2009 to August 2013 with a diagnosis of Subarachnoid Hemorrhage secondary to ruptured aneurysm, Hunt & Hess 1–2, and Fisher grading 1–4. The pain medications given and the reported pain scale scores using the Numerical Rating Scale in the first 48 hours from the ictus or before any surgical intervention was given were recorded.

**Results:** Parecoxib 40 mg/IV, which was given to 14 out of the 18 patients (77.8%), was the most commonly used medication. After its initial administration, pain scores were reduced by an average of 50.3%. During the first 48 hours from ictus, it was able to reduce pain scores by  $\geq 50\%$  after an average of 2.8 hours; Ketorolac after 6 hours, and Tramadol after 8 hours. Paracetamol, when given with 1 or more NSAIDs or tramadol, was able to reduce pain scores by  $\geq 50\%$  after an average of 5.7 hours.

**Conclusion:** Parecoxib was the most commonly used intravenous medication. Parecoxib was able to reduce the pain scores of the patients by  $\geq 50\%$  after an average of 2.8 hours. A prospective study is recommended to determine the effectiveness of these medications in a bigger population.

### WSC-0307

#### Aneurysm and Vascular Malformations Radical treatment for bilateral vertebral artery dissecting aneurysms can be performed by reconstruction of the vertebral artery

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**Introduction:** Bilateral vertebral artery dissecting aneurysm (VADA) has a poor prognosis because progressing enlargement of the aneurysm compresses the brainstem or causes subarachnoid hemorrhage (SAH). Trapping of the vertebral artery (VA) causes increased hemodynamic stress in the contralateral VA and leads to enlargement and possibly rupture; therefore, management strategies are controversial.

This study describes radical treatment for bilateral VADAs using bypass surgery.

**Materials:** Four patients with bilateral VADAs were included. One case consisted of postcoil embolization after SAH and enlargement of the contralateral VA. The other three cases presented with progressing enlargement of aneurysms.

**Surgical intervention and results:** The postcoil embolization patient underwent V3-PCA bypass and trapping. The other three cases underwent VA reconstruction by V3-V4 or V4-V4 bypass, with contralateral trapping proceeding on a separate day. Perioperative complications included one case of liquorrhea, and one case of dysphagia and facial palsy due to sigmoid sinus occlusion. Long-term outcome of these cases were favorable.

**Conclusion:** Cases of bilateral VADAs require treatment on both sides. If VA trapping is performed first, the treatment option for the other side is limited to V3-PCA bypass and trapping. This procedure is effective; however, it is also more invasive and technically difficult. In the case of bilateral VADAs in which it is possible to reconstruct one side, we recommend VA reconstruction first (the side that is easiest for reconstruction should be chosen), followed by trapping of the contralateral VADA. This strategy allows enough time to suture vessels because contralateral reverse flow is maintained.

### WSC-0345

#### Aneurysm and Vascular Malformations Rupture and growth rate of unruptured intracranial aneurysms which were observed for a long term by serial magnetic resonance angiography

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**Objectives:** We report the natural history of unruptured intracranial aneurysms (UIA) which were observed for a long term by serial magnetic resonance angiography (MRA).

**Methods:** We included 164 patients who were diagnosed as having UIA with a size of 2 mm or more and then observed by MRA. The total number of UIAs was 184: 72 in the ICA, 62 in the MCA, 36 in the ACA, and 13 in the VA-BA. The size was less than 4.9 mm for 145 lesions and equal to or more than 5.0 mm for 39 lesions; the mean value was 3.7 mm. We investigated the rupture and growth rate of UIA during a follow-up period of 15 to 157 months (mean: 82.4 months).

**Results:** 1) Twenty-five UIAs (13.6%) showed the growth by 1 mm or above; nine patients showed the growth by 3 mm or above, five of whom underwent clipping surgery, and all were discharged at GR (good recovery). 2) Seven patients (3.8%) developed SAH, with an annual rupture rate of 0.64%. These patients were all female (mean age: 68 years). The size of UIA was 5.1 mm on average. During the follow-up, three patients showed the growth of UIA. In final, six patients were discharged at GR & MD (moderate disability) and one patient died.

**Conclusions:** The rupture rate of UIA during follow-up was relatively low. If the growth of UIA is identified, the therapeutic strategy should be reconsidered.

### WSC-0798

#### Aneurysm and Vascular Malformations Angiotensin-(1-7) protects against the development of aneurysmal subarachnoid hemorrhage in mice

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**Introduction:** Angiotensin (Ang) 1-7 is emerging as a new key player of the vascular renin-angiotensin system. Ang (1-7) acts to oppose the vasoconstrictor and proinflammatory actions of Ang II. However, which receptor Ang (1-7) activates still remains unclear. It has been suggested that Ang (1-7) mediates its effect via Mas receptor (MasR), although some suggest that it may also act at Ang II type 2 receptor (AT2R).

**Aims:** We hypothesized that Ang (1-7) has protective effect against aneurysmal rupture via MasR or AT2R. We tested this hypothesis by using our own established mouse model of intracranial aneurysm.

**Methods:** Intracranial aneurysms were induced in male mice using a combination of a single injection of elastase into the cerebrospinal fluid and the deoxycorticosterone acetate salt hypertension. Six days after aneurysm induction, we started 2-week treatment with vehicle or Ang (1-7). We induced aneurysms to AT2R knockout mice and treated them with vehicle or Ang (1-7) with the same protocol mentioned above. Aneurysmal rupture was detected by neurological symptoms and confirmed by the presence of intracranial aneurysms with subarachnoid hemorrhage.

**Results:** Ang (1-7) reduced the incidence of ruptured aneurysms and rupture rate. AT2R antagonist but not MasR antagonist reversed the reduced rupture rate by Ang (1-7). We administered Ang (1-7) to AT2R knockout mice and Ang (1-7) was not effective against aneurysmal rupture in AT2R knockout mice.

**Conclusion:** Our results indicate that Ang (1-7) is protective against intracranial aneurysmal rupture and that its protective effect is exerted via AT2R rather than MasR.

## WSC-0501

### Aneurysm and Vascular Malformations

#### Hair cortisol: a promising method for long range monitoring of stress including prehospital stage. A case report

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Hair cortisol (CORT) is a biomarker for stress via alterations in the hypothalamus-pituitary-adrenal axis activity. Hair grows at an average of 1 cm/month, so assessment of hair cortisol can be used to measure stress levels retrospectively.

We have studied changes in CORT in patients with Subarachnoid Hemorrhages (SAH). Hair samples were cut from the posterior vertex close to the scalp with an interval of one month with the first cut at admittance to the neurointensive care unit (NICU). Cortisol was measured using a competitive radioimmunoassay.

**Case history:** This patient had sudden onset of a severe headache. The general practitioner diagnosed it as migraine. Three weeks later there was another attack of severe headache, dizziness and nausea. A CT-scan showed a SAH arising from an aneurysm of the right distal vertebral artery which was coiled. The total hospital stay was 23 days with 12 days in the NICU, followed by outpatient rehabilitation for 3 months. Six months after the SAH the patient developed hydrocephalus (HP) which was successfully treated with a VP-shunt.

CORT (pg/mg)

NICU <sup>1</sup>	1 month <sup>2</sup>	2 months <sup>3</sup>	3 months	HP/VP-shunt <sup>4</sup>	9 months
108,9	386,2	140,1	15,6	70,0	9,7

In this case CORT was elevated during the prehospital month<sup>1</sup> (probably because of stress due to a 'warning headache'), during the intensive care period<sup>2</sup> and until 2 months<sup>3</sup> after the SAH. It was elevated again at the time for developing hydrocephalus<sup>4</sup>.

This case illustrates that hair cortisol measurement is a promising method for studying stress in patients suffering from SAH.

## WSC-0303

### Aneurysm and Vascular Malformations

#### Localized nonaneurysmal subarachnoid hemorrhage

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**Introduction:** Only 8 to 20% of all subarachnoid hemorrhages (SAHs) are not of aneurysmal origin. Among these, localized SAHs along the cortical convexity or around midbrain (perimesencephalic SAH) are relatively rare.

**Aims:** The purpose of this study was to investigate prevalence, clinical presentation and prognosis of the localized nonaneurysmal SAH in a cohort of hospitalized patients with nontraumatic SAH.

**Methods:** Localized aneurysmal SAHs within cortical convexity or perimesencephalic cisternae were identified from 197 patients with nontrau-

matic SAH evaluated at our hospital between May 1, 2006 and October 31, 2010. Retrospective review of patient medical records, neuroimaging studies, and follow-up data was performed.

**Results:** There were 4 patients (2%) with localized perimesencephalic SAH and 4 patients (2%) with localized convexal SAH. Patients with perimesencephalic SAH were 2 men and 2 women between the ages of 42 and 58 years. One patient had hypertension. Patients with convexal SAH were all women between 51 and 70 years. One patient had hypertension. No other stroke risk factors were found. All of 8 patients complained of mild to severe headache, but no other symptoms and signs were noted on admission. All patients were discharged in physically independent condition.

**Conclusions:** The present study suggests that the convexal and perimesencephalic SAHs are rare, but important subtypes of nonaneurysmal SAH that have unique hemorrhage localization and a common benign clinical course.

## WSC-1385

### Aneurysm and Vascular Malformations

#### Treatment of posterior inferior cerebellar artery aneurysms

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Posterior inferior cerebellar artery (PICA) aneurysms are very rare, accounting for 0.5–2% of total aneurysms in the brain. Their treatment is challenged by the various anatomy, and narrow space near the cranial nerves, brain stem.

Described here is a series of patients with PICA aneurysms. And we consider the treatment strategy of PICA aneurysms.

We retrospectively reviewed the 11 cases with a treated PICA aneurysm among 955 cases of intracranial aneurysm between January 2003 and March 2014. We collected data in terms of treatment method, clinical presentation, radiologic findings, location, etiology, and outcome of clinical and radiologic status.

Of the 11 patients (mean age: 58, mean Fisher grade: 3.5, mean Hunt Hess grade 3) studied, 10 (90.9%) were women. 4 patients were treated surgically, the rest were treated endovascularly. 4 saccular aneurysms were treated surgically in 3, and endovascularly in 1. 7 dissecting aneurysms were treated surgically in 1, and endovascularly in 6. Of 7 dissecting aneurysms, 3 were treated in a way of conserving PICA (stent assisted coil embolization: 1, simple coil embolization: 2).

All the dead of this study were dissecting aneurysms, and 2 of them were treated in a way of conserving PICA. 8 patients, exclusive of the dead, were good outcome.

We achieved the good outcome in 72.7% of PICA aneurysms using diverse method. However, we should learn a lesson from the patients with poor outcome. Complete resolution of disease segment in the dissecting aneurysms would be important factor in order to avoid poor outcome.

## WSC-0775

### Aneurysm and Vascular Malformations

#### Familial cavernous malformations of CNS

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Cerebral cavernous malformation (CCM), or cavernomas, are benign vascular hamartomas that consist of endothelium-lined vascular channels without intervening normal brain parenchyma. Cavernomas can cause neurological deficits in any area of the brain.

The prevalence of CCMs in the general population has been estimated at 0.1 to 0.5%.

Cavernous malformations can occur as sporadic or autosomal-dominant inherited conditions. To date, familial CMs have been attributed to mutations at three different loci: CCM1 on 7q21.2, CCM2 on 7p15-p13, or CCM3 on 3q25.2-q27.

We present to you a case of 74 year old female with a history of hypertension who came into our emergency room with sudden nausea, vomiting and walk insatibility. The imaging (CT, MRI) showed a multiple intracranial cavernomas bilaterally. Since there was a history of death from brain hemorrhage in her family we studied the family tree. We preformed MRI on family members who agreed, and also took blood for genetic testing. We discovered that, in fact, 3 generations were suffering from cerebral cavernous malformation, which the family was not aware of. The genetic testng is still in progress.

The exact mechanism of familial CM pathogenesis is still unknown. The management of patients with cavernous malformations, particularly those with the familial form of the disease, remains a challenge because little is known regarding the natural history. These findings suggest that patients with familial cavernous malformations require careful follow-up monitoring, and that significant changes in neurological symptoms warrant repeat MR imaging.

### WSC-0181

#### Cerebrovascular Occlusive Disease

#### Predictors of intracranial stenooclusive disease among patients with coronary artery syndrome

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**Introduction:** There is a limited data regarding prevalence of intracranial atherosclerotic disease (ICAD) in patients with coronary artery disease (CAD). The association between coronary and cerebral atherosclerosis indicate sever disease burden and needs aggressive medical managements. **Aim of the study:** To determine the prevalence and correlate of ICAD in CAD patients.

**Methods:** From January 1st 2012 to January 1st 2013 we recruited 118 patients who proved to have ischemic heart disease. All patients were assessed for vascular risk factors and existence of stroke or TIA. The patients screened for both extra and intracranial disease by color coded duplex sonography and for coronary artery disease by coronary angiography. Clinical, echocardiographic and angiographic variables were tested by univariate and multivariate analyses.

**Results:** Out of 118 patients with CAD, intracranial disease was detected in 14 patients (12%). Eight (7%) had stenosis  $\geq$  50% while 6 patients (5%) had stenosis < 50%. Multiple logistic regression analyses showed that moderate or sever extracranial stenosis and multiple coronary artery disease/left main coronary artery disease were the only variables independently associated with intracranial stenosis

**Conclusions:** Low prevalence of (ICAD) among CAD patients. Sever extracranial atherosclerosis and multiple coronary artery disease were the strongest predictors for existance of ICAD among CAD patients.

### WSC-0674

#### Cerebrovascular Occlusive Disease

#### Cerebral venous thrombosis in Saudi Arabia: A retrospective study

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**Introduction:** Cerebral venous thrombosis (CVT) is an uncommon type of stroke in many countries (1–2%). This is not the case in many arid hot climate countries such as Saudi Arabia.

**Aims:** We sought to examine the extremely varied clinical features, predisposing factors, brain imaging findings and outcomes in a consequence series of CVT patients admitted to one tertiary care center in Saudi Arabia.

**Methods:** Records of 105 patients with confirmed CVT were reviewed.

**Results:** Females outnumbered males 1.7:1. Age range: 13–58 years median 27. The most common presenting symptoms were headache (83.9%), nausea and/or vomiting (43.4%), blurred vision (18.8%), seizures (8.4%) and stupor/coma (8.4%).The most common predisposing conditions were pregnancy- or pueprium-related (22.6%), Behcet disease (15%), oral contraceptives (10.3%), protein S deficiency (4.7%)and anti-cardiolipin antibodies (4.7%). Patients were treated with heparin followed by coumadin unless contraindicated. Intravenous thrombolysis was administered in two patients and was complicated in one by a minor cerebellar hemorrhage.

**Conclusions:** CVT manifestation is variable and relates to the extent of venous occlusion. CVT has four distinct presentations: intracranial hypertension is the most common, while seizures or hemispheric symptoms are typical of cortical vein thrombosis with or without sinus thrombosis and central venous system occlusion manifested by stupor and coma and associated with increased morbidity. Complete recovery seen in 54%, partial recovery 37% and major disability or death in 9% of the patients. Anticoagulation for an average of six month is safe.

### WSC-0611

#### Cerebrovascular Occlusive Disease

#### The effect of cilostazol on preventing angiographic restenosis following elective percutaneous transluminal cerebral balloon angioplasty, serial angiographic investigation of 30 cases

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**Background:** Previous studies have reported that cilostazol may have effects on preventing restenosis following coronary or carotid artery stenting. The purpose of our study was to investigate the effect of cilostazol on reducing restenosis following elective percutaneous transluminal cerebral balloon angioplasty (PTCBA) for a high-grade symptomatic stenosis of intracranial arteries.

**Methods:** Included were patients 1) who underwent elective PTCBA for a symptomatic stenosis between Feb 2005 and Apr 2013, 2) who started to take dual antiplatelet agents before PTCBA and continued at least for 3 months following PTCBA, 3) who continued to take some antiplatelet agents between 3 and 12 months after PTCBA and 4) who underwent angiographic investigation to assess restenosis at 3 and 12 months after PTCBA. Aspirin or cilostazol coupled with thienopyridine agents was used as dual antiplatelet therapy (DAPT). Evaluated were patient's characteristics, antiplatelet agents, binary restenosis at 3 and 12 months after PTCBA and repeat PTCA for restenosis within 12 months. Restenosis was defined as a 50% or more stenosis of the intracranial artery. According to antiplatelet agents, patients were classified into two groups as follows; patients who started to take cilostazol as one of DAPT and continued for 12 months or until restenosis (group CI), and patients who started to take antiplatelet agents except cilostazol as DAPT (group ACr). Binary restenosis was compared between two groups.

**Results:** During the study period, here were 12 patients in group CI and 18 in group ACr. Overall cumulative restenosis rate was 26.6% (8/30) at 3 months and 50% (15/30) at 12 months. No ischemic strokes occurred with 12 months. In group CI, angiographic restenosis rate was 33.3% (4/12) at 3 months and 41.7% (5/12) at 12 months and 3 patients (25%; 3/12) underwent repeat PTCBA. In group ACr, angiographic restenosis rate was 22.2% (4/18) and 55.6% (10/18) at 12 months and 4 patients (22.2%; 4/18) underwent repeat PTCBA.

**Conclusion:** Cilostazol may have no effects on prevention of restenosis following elective PTCBA.

**WSC-1417****Cerebrovascular Occlusive Disease  
Relationship between localizations and etiologies in  
patients with brainstem infarctions**G Baran<sup>1</sup>, T Ozturk<sup>1</sup>, M Kolukisa<sup>1</sup>, A Aralasmak<sup>2</sup>, E Bohloul<sup>2</sup>,  
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**Objective:** Posterior circulation infarcts represents a heterogeneous group of strokes that differ in etiology, clinical presentation, and prognosis. In this study, we evaluated whether the localization of brainstem infarctions have an effect on clinical presentation and etiologies.

**Material and methods:** Patients were identified retrospectively from Bezmialem University Stroke Registry. Clinical details were ascertained by chart review, and radiologic data were reviewed by two neuro-radiologists. We assessed the location of the infarct and its etiology using magnetic resonance imaging, which included DWI, MR angiography or BT angiography, and noninvasive cardiac tests. We recorded mesencephalon, pons and bulber involvement. According to DWI, we classified brainstem infarction in four groups, anteromedial, anterolateral, lateral and posterior involvement. We evaluated their relation to etiology and infarct distribution.

**Results:** In a database analysis of 826 patients with stroke between January 1st 2012 and April 30th 2013, 101 patients (12%) were detected to have brainstem infarction through imaging and clinical criteria. We detected 35 bulber infarctions, 55 pontin infarctions, and 8 mesencephalic infarctions. In patients with bulber infarctions, posterior and lateral involvement was more frequent, but in patients with pontin infarction, anterior involvements were more common. Large artery disease was a more frequent etiology (48%). There was no significant relationship between infarct distributions and stroke etiologies in all patients.

**Conclusion:** Our findings emphasized that the frequency of intracranial and extracranial large-artery disease in brainstem infarcts was higher than was previously acknowledged.

**WSC-1144****Cerebrovascular Occlusive Disease  
Stroke outcome in carotid occlusions**B Bastan<sup>1</sup>, S Ince<sup>1</sup>, B Petek Balci<sup>1</sup>, H Acar<sup>1</sup>, S Gunaydin<sup>1</sup><sup>1</sup>Neurology, Haseki Research and Training Hospital, Istanbul,  
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**Introduction:** Carotid artery occlusion is responsible in 15% of large-vessel strokes. In some instances, it may not be the etiology underlying the presenting stroke.

**Aims:** To evaluate total carotid occlusion in the presenting ischemic strokes of our in-patient clinics.

**Methods:** We retrospectively reviewed the medical records of acute ischemic stroke patients in Haseki Research and Training Hospital and searched for total carotid occlusions. The demographic and clinical features of the patients were noted.

**Results:** Out of 794 cases 27 (3,4%) had a documented carotid occlusion. Two of the patients had unilateral common carotid artery (CCA) occlusions, while the others had unilateral internal carotid artery (ICA) occlusions. The mean age was  $72,5 \pm 3,5$ . Majority (88,9%) of the patients had hypertension. Not all but 70,4% (n = 19) of the presenting strokes occurred in ipsilateral ICA occlusion. Others had ischemia either in contralateral anterior circulation or posterior circulation or multiple arterial territories. Only 2 of 27 patients were dead, while 9 (33,3%) of them were able to live independently.

**Conclusions:** Carotid occlusions have a benign natural course and are not always the underlying pathology of the presenting stroke.

**WSC-1169****Cerebrovascular Occlusive Disease  
Reproducibility and accuracy of semiautomatic  
assessment of carotid artery stenosis on CTA**J Borst<sup>1</sup>, H A Marquering<sup>1</sup>, M Kappelhof<sup>1</sup>, T Zadi<sup>2</sup>, A van Dijk<sup>2</sup>,  
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**Introduction:** Many commercial solutions for semiautomatic assessment of internal carotid artery (ICA) stenosis have been introduced in the market with a potential high reproducibility and ease of use.

**Aims:** To investigate the accuracy and reproducibility of semiautomatic ICA stenosis measurements of five different semiautomatic commercial solutions available in the market.

**Methods:** We selected thin slice CTA image data of 91 consecutive patients with recent neurological symptoms and ultrasound proven ICA stenosis. Two experienced blinded neuroradiologists manually measured the degree of stenosis of both internal carotid arteries according to NASCET. The semiautomatic stenosis grading was performed with five software packages (TeraRecon, Siemens, Philips, 3Mensio, Vitrea Vital Images). Interobserver agreement and accuracy was assessed by Bland-Altman analysis and the calculation of the intraclass correlation coefficient (ICC).

**Results:** For all but one software packages, the interobserver agreement outperformed the manual interobserver agreement. The worst performing software package had an ICC very close to the manual ICC. The reliability between the manual and semiautomatic measurements was high as well, with ICC between 0.75 and 0.88. Semiautomatic measurements slightly underestimated the degree of stenosis compared to manual measurements with an average difference of 2.1 to 3.9%. Bland-Altman limits of agreement were still large varying from 29 to 61 percent for interobserver agreement.

**Conclusions:** Reproducibility and agreement of commercially available automated ICA stenosis measurements software is high, despite a considerable spread, making these packages suitable for introduction in clinical practice.

**WSC-1131****Cerebrovascular Occlusive Disease  
Concomitance of JAK-2 mutation with essential  
thrombocytosis, migraine and stroke**A Bulut<sup>1</sup>, S Çağırıcı<sup>1</sup>, H A Erdogan<sup>1</sup>, M Çabalar<sup>1</sup>, V Yayla<sup>1</sup><sup>1</sup>Neurology, Bakirkoy Dr Sadi Konuk Research & Training  
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Essential thrombocytosis (ET) is a clonal stem cell disease among the group of myeloproliferative diseases indicating increase in the number of platelet. It may cause migraine, transient ischemic attacks and stroke over 60 years but rare in young adults. Janus kinaz 2 (JAK 2) gene mutation is determined 50% positive in ET patients and occurrence of the thrombosis is more frequent in these patients.

A 36 years old female patient admitted with the complaints of headache and speech disorder. In her medical history there were migraine, ET and oral contraceptive drug (OCS) for polycystic over treatment. She had given up her treatment of ET for a week. In her neurological examination slight dysarthria and monoparesis of right arm were detected. Laboratory findings showed increased platelet ( $462.000/\text{mm}^3$ ) but otherwise normal hemogram and biochemistry. Vasculitis, coagulation parameters and tumor markers were negative. Jak-2 mutation was positive. Multiple cortical infarct areas are determined in diffusion MRI. ECG, echocardiography, carotid and vertebral Doppler ultrasonography, brain and neck MRA

were normal. The treatment was planned as acetylsalicylic acid 300mg/day, topiramate 50 mg/day, anagrelid 2 mg/day. Her complaints recovered within 24 hours.

This young Jak-2 positive ET case was presented due to rare occurrence and comorbid risk factors like migraine and OCS use. We want to emphasize the importance of the treatment continuation in addition to drug selection for the accompanying illnesses.

**WSC-0341**

**Cerebrovascular Occlusive Disease  
Subclinical cerebrovascular diseases in chronic kidney disease patients**

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*Introduction:* Chronic kidney disease (CKD) is an established risk factor for atherosclerosis causing large vessel disease of brain. In addition, cerebral small vessel disease is associated with impaired kidney function because there are hemodynamic similarities between kidney and brain.

*Aims:* We aimed to investigate the subclinical small vessel disease and large vessel disease of brain in CKD patients.

*Methods:* CKD patients aged between 45 and 90 and without clinical history of stroke were prospectively enrolled. Patients with contraindication of MRI were excluded. Demographics, risk factors, creatinine level and blood pressure were obtained. T2-weighted MRI, gradient-echo MRI and MR angiography were performed. Lacunar infarction, territorial infarction, white matter change, and cerebral arterial stenosis were analyzed masked to clinical data. Modified Fazeka scale was applied to interpret white matter change.

*Results:* Total number of patients was 19. Their mean age was 73.11 ± 5.97 years. 11 (57.9%) were male. Mean creatinine level was 1.82 ± 0.79 mg/dl. Mean glomerular filtration rate was 42.60 ± 19.22. Asymptomatic lacunar infarction was observed in 6 (31.6%) patients and territorial infarction in 2. White matter change was observed in 17 (89.5%). Moderate white matter change was observed in 6. Gradient-echo MRI revealed cerebral microbleeds in 4 (21.1%) patients. Ten (52.6%) patients had intracranial or extracranial arterial stenosis on MR angiography. There were no statistically significant characteristics in patients with subclinical small or large vessel disease of brain in this study.

*Conclusion:* Subclinical small vessel disease as well as large vessel disease was commonly observed in chronic kidney disease patients.

**WSC-1285**

**Cerebrovascular Occlusive Disease  
Endovascular stenting for treatment of carotid artery stenosis: A series of 40 patients**

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*Introduction:* Carotid stenting is less invasive percutaneous procedure than carotid endarterectomy for the treatment of carotid stenosis. It may provide an alternative to endarterectomy, especially in those patients deemed to be at higher risk for endarterectomy. Although guidelines specify indications for this procedure and our patients are a small group, we want to evaluate its efficacy in our cases.

*Material-Method:* Our study involved patients who applied our clinic with a stroke episode, transient ischemic attack or nonspecific complaints but carotid stenosis was detected at neuroimaging. All data (demographics, clinical status, neuroimaging findings before stenting, rate of carotid stenosis, indication for procedure, restenosis after stenting, any complications after stenting) were obtained from hospital records retrospectively.

*Results:* Total number of patients were 40 (30 male/10 female). Mean age of the patients was 65 (min 55, max 90 years). Majority of patients were in symptomatic group. In the light of existing guidelines, features of our cases, complications and efficacy of carotid stenting were discussed.

*Conclusion:* Although endarterectomy is a more effective procedure than carotid stenting in stroke risk reduction, carotid stenting can be considered in the treatment of carotid stenosis in suitable cases.

**WSC-0321**

**Cerebrovascular Occlusive Disease  
Ischemia/Reperfusion enhances endothelium dependent relaxation in rat mesenteric arteries**

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*Introduction:* We previously showed that ischemia/reperfusion impairs vascular reactivity in both ischemic and nonischemic hemispheres via increased peroxynitrite generation. However, little is known about the impact of ischemia/reperfusion on vascular reactivity on other vascular beds.

*Aim:* To determine whether ischemia/reperfusion could alter vascular function away from the site of injury.

*Methods:* Male-Wistar rats were subjected to sham or 30 min ischemia/45 min reperfusion. Aorta and mesenteric arteries were mounted on a wire myograph. Dose response curves to serotonin (1 nM–0.2 mM) and acetylcholine (1 nM–5 mM) were obtained. Sensitivity and maximum-response values were calculated from the respective dose-response equations obtained by nonlinear regression analysis.

*Results:* Ischemia/reperfusion caused a leftward shift and enhanced relaxation following precontraction with serotonin in mesenteric arteries only. Maximum-response and sensitivity to acetylcholine were augmented in mesenteric arteries only compared to sham. Sensitivity and the contractile response to serotonin were similar among the two groups in aorta and mesenteric arteries.

*Conclusion:* Our results provide novel evidence that ischemia/reperfusion injury has a global effect influencing reactivity of vasculature other than the brain. Endothelium dependent relaxation was improved after stroke, suggesting that endothelial-nitric-oxide-synthase could be upregulated by ischemia/reperfusion. Further studies are required to confirm the role of endothelial-nitric-oxide-synthase in mediating mesenteric vasorelaxation after stroke and to identify the circulating factors contributing to ischemia/reperfusion global effect.

(\*p < 0.05, \*\*p < 0.01 and #p < 0.001 vs sham n = 6)

Acetylcholine doses(mM)	% Relaxation of Mesenteric Arteries		
	0.5*	5#	50**
Sham	12.4 ± 5.8	35.2 ± 11.1	68.6 ± 6.9
Stroke	31.4 ± 8.3	63.2 ± 14.8	83.2 ± 14.8

**WSC-1346****Cerebrovascular Occlusive Disease Lipoprotein-associated phospholipase A2 (LP-PLA2) may ascertain plaque instability and predict ischemic stroke**L Danihel<sup>1</sup>, S Madarasz<sup>2</sup>, P Blazicek<sup>3</sup><sup>1</sup>Central Military Hospital – Faculty Hospital Ruzomberok, Radiology Department, Ruzomberok, Slovakia<sup>2</sup>Central Military Hospital – Faculty Hospital Ruzomberok, Neurology Department, Ruzomberok, Slovakia<sup>3</sup>Clinical Biochemistry and Hematology Laboratory, Alpha Medical Ltd., Bratislava, Slovakia

**Introduction:** New specific vascular inflammatory marker LP-PLA<sub>2</sub> may ascertain plaque instability and imminent rupture of the plaque and predict future ischemic stroke (IS). During last years discussion starts regarding its relationship with intima-media thickness (IMT), arterial stiffness and plaque morphology.

**Aims:** To assess the changes in LP-PLA<sub>2</sub>, IMT and arterial stiffness and their mutual relationships. Prospective, multidisciplinary, multicentric study

**Methods:** Material consists of 436 subjects divided in four subgroups 1. IS (n = 171), mean age 69 ± 11 years, men 52%, 2. Coronary artery disease (CAD) (n = 87), mean age 70 ± 9 years, men 32%, 3. Arterial hypertension (AH) (n = 124), mean age 60 ± 10 years, men 46%, healthy controls (C) (n = 56), mean age 47 ± 13 years, men 55%. In all subjects: Neurological and cardiological examinations, IS confirmed by CT/MRI, SPECT, battery of biochemical/hematological investigations, LP-PLA<sub>2</sub> using ELISA, intima-media thickness (IMT) using ultrasonography by radio-frequency data analysis, augmentation index (Alx) and pulse wave velocity (PWV) using aplanation tonometry. Alx and PWV are indices of arterial stiffness. Statistical software STATISTICA Base Cz Version 10, Kruskal-Wallis test, linear regression and Pearson correlation coefficient

**Results:** The study showed statistically higher values of LP-PLA in IS, CAD, AH comparing to C (p < 0.01–0.0001). Close correlation between LP-PLA<sub>2</sub>, IMT and arterial stiffness was documented in IS, CAD and AH.

**Conclusions:** Our results documented significant changes in LP-PLA<sub>2</sub> in all followed groups (IS, CAD, AH) comparing to C. The measurement of LP-PLA<sub>2</sub> is very useful parameters for assessing cerebrovascular risk. It represents significant prognostic power to ascertain subjects with increased risk for onset of ischemic stroke.

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**WSC-1585****Cerebrovascular Occlusive Disease White matter hyper-intensities on brain MRI are common in patients with carotid stenosis**O Fartushna<sup>1</sup>, K Dani<sup>2</sup>, R A Lees<sup>1</sup>, F McGrane<sup>3</sup>, A Vusirikala<sup>4</sup>, N M Broomfield<sup>3</sup>, T J Quinn<sup>1</sup>, M R Walters<sup>1</sup>, K Forbes<sup>4</sup>, J Dawson<sup>1</sup><sup>1</sup>ICAMS, University of Glasgow, Glasgow, United Kingdom<sup>2</sup>INP, University of Glasgow, Glasgow, United Kingdom<sup>3</sup>Stroke Unit, Western Infirmary, Glasgow, United Kingdom<sup>4</sup>School of Medicine, University of Glasgow, Glasgow, United Kingdom

**Introduction:** Carotid artery stenosis is a common cause of ischemic stroke but may also cause cerebral small vessel disease and neuronal damage through chronic cerebral ischemia.

**Aim:** To explore prevalence of white matter hyper-intensities (WMH) on brain MRI and to explore whether these are related to brain ischemia measured using MR spectroscopy.

**Methods:** Patients >50-years-old with >50% carotid artery stenosis detected on Doppler ultrasonography underwent brain MRI. 3D-T1, T2, FLAIR and spectroscopy (TE times of 135 and 270 seconds) sequences were performed. Voxels for spectroscopy were placed in the anterior

watershed region or nearest adjacent area where this was involved by a stroke lesion. WMH were measured using the Fazeka's scale and the presence of cerebral ischemia was defined according to detectable lactate on MR spectroscopy.

**Results:** Forty eight participants were included: 14 females; mean age 69.8-years (SD 9.1). In 16 the carotid stenosis was left sided, in 15 the stenosis was right sided and in 17 it was bilateral. In 27 the stenosis was symptomatic.

The Fazeka's deep WMH score was 0 in 3 participants (6.3%), 1 in 27 (56.3%), 2 in 12 (25%) and 3 in 6 (12.5%) participants. The Fazeka's periventricular WMH score was 0 in 6 participants (12.5%), 1 in 26 (54.1%) and 2 in 16 (33.3%) participants. Lactate was not present in any patient.

**Conclusion:** White matter hyper-intensities are common in patients with carotid artery stenosis but are not explained by chronic cerebral ischemia defined according to presence of lactate on MR spectroscopy.

**WSC-0920****Cerebrovascular Occlusive Disease Ischemic stroke in elderly people. Etiology by gender. Single center register 2003 to 2013**V Diaz<sup>1</sup>, V Olavarria<sup>1</sup>, A Prat<sup>1</sup>, A Valdivia<sup>1</sup>, M Guzman<sup>1</sup>, J M Fernandez<sup>1</sup>, A Brunser<sup>1</sup>, P Lavados<sup>1</sup><sup>1</sup>Neurology, Clinica Alemana Universidad del Desarrollo Instituto de Neurociencias, Santiago, Chile

**Background:** Stroke by gender differ. The incidence is high in men than women and decrease at 75 years old in men and increase in women. The mean age for men is at list 5 years before and the case fatality rate is higher in women. The cardiovascular risk factors (CVRF) are different by gender, the women have systolic blood pressure and blood cholesterol higher than the men but Tabaco and alcohol intake is higher in men.

**Objectives:** To compare cardiovascular risk factors (CVRF), treatment and time to consult by gender, in adults that are 80 years age and older. To analyze age, NIHSS at admission, localization, etiology, treatment, complications, discharge condition and recurrence.

**Methodology:** A descriptive study comparing elderly over 80 years old with ischemic stroke by gender. We analyzed (infarction and transitory ischemic attack) from 2003 to 2013. CVRF were compared, aspirin use or oral anticoagulation treatment (ACO) and time to attend. In infarction subgroup it was compared localization, NIHSS, thrombolysis, etiology, treatment, complications, impatient time, mRanking scale and recurrence.

**Results:** from 1787 patients in RECCA register, 386 patients were elderly (21.6%), 60,4% women. Blood hypertension (BH), diabetes mellitus (DM) and alcoholism (OH) were frequent in men (p = 0,02; 0,0002; 0,007). NIHSS was higher in women (p = 0,02). The infarction subgroup (n = 332), cardio embolic etiology frequent in women (p = 0,05) and higher-ranking scores (p = 0,03 at discharge).

**Conclusion:** In elderly patients with IS, HTA, DM, OH are more frequent in men. The women present more cardio embolic etiology and worse prognosis at discharge.

**WSC-0562****Cerebrovascular Occlusive Disease Risk of stroke and cardiac events in medically treated asymptomatic carotid stenosis**K P Divya<sup>1</sup>, S Nayani<sup>1</sup>, S Sarma<sup>2</sup>, P N Sylaja<sup>1</sup><sup>1</sup>Department of Neurology, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram, India<sup>2</sup>Achutha Menon Centre for Health Science Studies, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram, India

**Introduction:** Risk of stroke in patients with ≥ 50% asymptomatic carotid stenosis (ACS) on intensive medical treatment is low. The optimal treatment of ACS remains controversial currently.

**Aim:** We assessed the risk of stroke/TIA and cardiac events in patients with  $\geq 50\%$  ACS on intensive medical treatment.

**Methods:** All patients with TIA/minor stroke (NIHSS  $\leq 5$ ) who had undergone vessel imaging as part of stroke evaluation and patients with coronary artery disease who had undergone vessel imaging before cardiac intervention were screened for ACS with approval from Institutional Review Board and informed consent. All were on intensive medical treatment. The risk of TIA/stroke, cardiac events and vascular deaths on follow-up were evaluated.

**Results:** Of 1800 patients, we identified 92 patients (0.05%) with ACS having 50–99% stenosis. 63 patients had TIA/minor stroke and 29 patients had CAD, of whom 7 patients had bilateral ACS, thus constituting 99 study units of ACS. The mean follow up was 34.7 months (3–120 months). Two patients developed ischemic events on the side ipsilateral to the ACS and 9 patients developed cardiac events during the follow up. The average annual event rate for cerebral ischemic events was 0.93% (95% CI, 0.11–3.37), 4.21% (95% CI, 1.92–7.98) for cardiac events and 3.27% (95% CI, 1.31–6.74) for death.

**Conclusions:** Though the risk of stroke in patients with ACS is low, acute coronary events and vascular deaths were significant. This highlights the importance of intensive risk factor modification to reduce adverse cardiovascular events in ACS rather than treatment of carotid stenosis.

### WSC-0819

#### Cerebrovascular Occlusive Disease Hyperperfusion syndrome following vascular reconstruction surgeries in patients with moyamoya and quasi-moyamoya diseases

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**Introduction:** Vascular reconstruction surgeries are believed to improve clinical symptoms in patients with moyamoya disease. However, some of them suffered from clinical deterioration caused by hyperperfusion after surgeries.

**Aim:** We performed this study to elucidate the possible factors and mechanisms for postoperative hyperperfusion.

**Methods:** From 2005 to the present, we encountered 18 patients with moyamoya and quasi-moyamoya diseases. Of these, 10 patients underwent vascular reconstruction surgeries. They were retrospectively analyzed.

**Results:** Three out of 10 patients who underwent surgeries temporarily deteriorated neurological status due to hyperperfusion. Neurological deterioration including aphasia, sensory disturbance, motor weakness and generalized convulsion began from 2 days after surgeries and lasted for over 14 days. Preoperative single photon emission computed tomography (SPECT) disclosed reduction of CBF in the resting state. In all patients, the cerebral perfusion reserve estimated by acetazolamide infusion was severely disturbed in the affected lesion. After surgeries, SPECT demonstrated focal intense accumulation of the tracer on the side of the surgery. Magnetic resonance (MR) imaging did not show any abnormalities except for the postoperative change. MR digital subtraction angiography in 2 patients and three dimensional computed tomographic angiography in 1 patient revealed hyperperfusion on the side of the surgery where the cerebral perfusion reserve was severely disturbed preoperatively.

**Conclusions:** Hyperperfusion following vascular reconstruction surgeries could occur in the poor perfusion reserve area preoperatively and could cause temporary neurological deterioration in moyamoya and quasi-moyamoya diseases. We should pay attention to this epiphenomenon because otherwise we might provide the patients with contraindicated therapies.

### WSC-0266

#### Cerebrovascular Occlusive Disease Early clinical signs, lesion localization and prognostic factors in unilateral symptomatic internal carotid artery occlusion

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**Purpose:** To assess infarct localization, clinical signs and prognostic factors in cases with unilateral symptomatic total internal carotid occlusion.

**Materials and methods:** 101 patients who had a diagnosis of symptomatic unilateral carotid occlusion in Trakya University Faculty of Medicine, Department of Neurology between January 2008 and May 2012 were included in this study. The relationship between infarct localizations and prognosis of patients was evaluated by cranial MRG and diffusion weighted MRG. The condition of ipsilateral middle cerebral artery and posterior communicating arteries were assessed by Cranial and cervical MRG angio besides opposite carotid. Patients were evaluated by mrs in terms of prognosis at discharge and three months after. Furthermore, they were evaluated in terms of risk factors such as cigarette and alcohol use, presence of temporary ischemic attack and stroke history, hypertension, diabetes mellitus, coronary artery disease, previous myocardial infarction, hyperlipidemia and peripheral vascular disease.

**Results:** Territorial infarct was commonly seen as acute ischemic stroke pattern especially in cases with a poor middle cerebral artery circulation and insufficient collateral circulation. Development of territorial stroke, occlusion of middle cerebral artery and nonvisualization of posterior communicating artery were found to be associated with poor prognosis.

**Discussion:** In unilateral symptomatic ICA occlusion, poor prognosis and high mortality-associated territorial stroke pattern is frequently observed. Besides, presence of severe stenosis or occlusion and absence of collateral circulation in middle cerebral artery are associated with poor prognosis.

### WSC-1011

#### Cerebrovascular Occlusive Disease Preoperative coronary stenosis is a determinant of early outcome after carotid endarterectomy

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**Introduction:** Individualized risks and benefits are very important in patients undergoing carotid endarterectomy (CEA). Although clinical practice guidelines recommend CEA by specific cutoffs for the degree and recent ( $<6$  months) symptoms of stenosis, but patient-level risks and predictors including coronary atherosclerosis, are rarely evaluated in Asian patients.

**Aims:** Our study aimed to investigate whether preoperative coronary stenosis can influence on early vascular outcome after CEA and which factors affect major adverse events (MAEs).

**Methods:** We initially included 160 consecutive patients who underwent CEA procedures from Jul 2007 to Dec 2013, then excluded 12 patients who did not undergo coronary vessel study (cardiac angio CT or coronary angiography). We dichotomized our patients into two groups, mild to moderate (0–70%) vs. severe ( $>70\%$ ) coronary stenosis. Early ( $\leq 30$  days) outcome (stroke, myocardial infarction, or death) were obtained.

**Results:** A total of 148 patients ( $68.7 \pm 6.9$  years old) were included for analysis. The 30-day rate of composite outcome was 4.7%. Early MAEs were significantly associated with higher risk group of coronary artery stenosis ( $p = 0.047$ ), not in patients with SAPHIRE high risk and symptomatic ischemic heart disease. In logistic regression analysis adjusting important variables, coronary artery stenosis (HR 5.63, 95% CI, 1.08–29.36) and atrial fibrillation (HR 17.13, 95% CI, 1.34–219.39) were significant predictors of MAEs.

**Conclusions:** In this study, bad outcome in early stage was observed in patients with severe coronary artery stenosis, not in patients with traditional high risk or symptomatic ischemic heart disease. Therefore, coronary stenosis is a determinant of early outcome after CEA.

### WSC-1470

#### Cerebrovascular Occlusive Disease Progression of responsible intracranial artery stenosis prior to ischemic stroke onset – Fukuyama Intracranial Artery Stenosis (FICAS) Study–

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**Introduction:** Around two third of acute coronary syndrome was onset at the coronary artery where no significant stenosis was observed in former coronary angiography.

**Aims:** In the present study, we assessed the hypothesis that ischemic stroke due to intracranial artery (ICA) atherosclerosis may also onset due to ICA where no significant stenosis was exist. And also, this study was aimed to define responsible ICA atherosclerosis progression prior to their onset.

**Methods:** To evaluate nature of responsible ICA atherosclerosis, the patients with ischemic stroke due to ICA atherosclerosis according to the Causative Classification System for Acute Ischemic Stroke classification criteria and ASCOD phenotyping who had a premorbid ICA evaluation with MRA within 1 year prior to their ischemic stroke event. Responsible artery stenosis causing ischemic stroke was classified into 5 grades by consensus: normal, mild (signal reduction 30–50%), moderate (signal reduction  $\geq 50\%$ ), severe (focal signal loss with the presence of distal signal), and occlusion.

**Results:** There were 54 ischemic stroke patients due to ICA atherosclerosis (20 female, median age 73.5 (range 48 to 92)) who were evaluated premorbid ICA using MRA within 1 year prior to their admission. There were 8 patients (14.8%) who had normal artery in the premorbid evaluation and 26 patients (48.1%) who had progressed responsible ICA atherosclerosis.

**Conclusion:** There are a substantial number of ischemic stroke patients due to ICA atherosclerosis who had no significant stenosis at premorbid evaluation on responsible ICA.

### WSC-1441

#### Cerebrovascular Occlusive Disease Clinico-radiological features of a symptomatic subocclusive carotid stenosis: Guadiana river sign

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**Introduction:** Radiological appearances of critical stenosis are reminiscent of the Spanish river Guadiana. Characterized by porous limestones producing intermittent streams that disappear underground, the Guadiana subsequently reappears before reaching the Atlantic Ocean.

**Aims:** To describe the clinico-radiological features of a symptomatic subocclusive carotid stenosis and to propose the term Guadiana river sign.

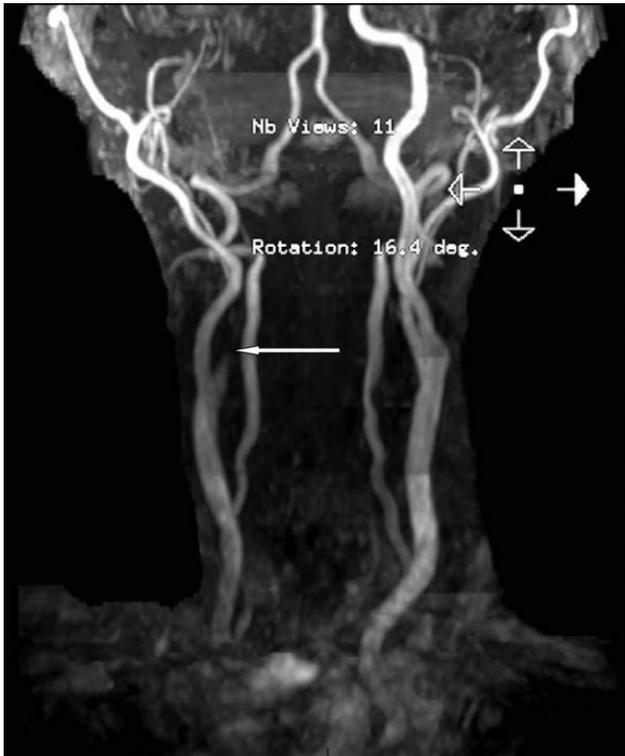
**Methods:** A 64-year-old man was suddenly awoken at 4 am with severe frontal headache followed by dysarthria and left sided weakness resolving in just under 1 hour. He had known hypertension and used to smoke until aged 40. CT brain, routine bloods and ECG on admission were all normal and was given antiplatelet treatment.

**Results:** Brain MRA showed an apparent occlusion of the right internal carotid artery (ICA), with a patent anterior communicating artery, normal anterior cerebral arteries and secondary filling of the right middle cerebral artery (MCA) with a central luminal flow disturbance caused by an endoluminal thrombotic extension from the M1 segment through the MCA trifurcation (Fig. 1). Cervical MRA showed an occlusion of the right ICA at the level of the carotid bulb 5mm from its origin (Fig. 2). Subsequent CTAngiogram confirmed the presence of critical  $>95\%$  stenosis of the distal portion of the right carotid bulb associated with a calcified atheromatous plaque, with the endoluminal filling defect having disappeared (Fig. 3). He successfully underwent carotid endarterectomy.

**Conclusions:** We present the clinico-radiological features of a subocclusive right carotid stenosis presenting as TIA 'plus' and propose the term Guadiana river sign to describe its radiological appearances.



**Fig. 1** Cerebral MR Angiogram showing an apparently occluded distal Right Internal Carotid Artery, with cross filling.



**Fig. 2** MR Angiogram of the neck vessels showing an apparent proximal occlusion of right Internal Carotid Artery.



**Fig. 3** CT Angiogram showing a high grade stenosis at the level of the proximal Right Internal Carotid Artery.

#### WSC-0483

##### Cerebrovascular Occlusive Disease

##### The effect of early recanalization on clinical outcome in patients with vertebral artery dissection

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*Introduction:* Vertebral artery dissection occurs as a result of the split of the vessel wall with the formation of intramural hematoma that leads to narrowing of the lumen and is usually localized in the extracranial segment (V3) of the vertebral artery (VA).

*Objective:* To determine the impact of early recanalization on clinical outcome in patients with vertebral artery dissection.

*Materials and methods:* We retrospectively studied total of 17 patients with unilateral VA dissection, 8 men and 9 women, age 33–75 y (mean age 53 y) who were hospitalized in our institution during period from 2009 to 2013. All patients got ultrasonography of the neck arteries on admission and on the 10th day of hospitalization, MRI with MR angiography of the head and neck and NIHSS at patients' admission and discharge.

*Results:* The ultrasonographic examination of the neck arteries that has been done at admission showed stenosis of AV in the long segment in 5 patients, occlusion in 4 patients, reduced flow in 7 patients and normal findings in 1 patient. MR angiography showed stenosis in the longer segment in 12 patients, and occlusion in 5 patients. Dissection was in extracranial segment in 11 patients. Control ultrasonography showed signs of recanalization in 7 (41%) patients. NIHSS values at discharge in patient with signs of recanalization had been 0–1, while the second group had value 1–7.

*Conclusion:* Early recanalization was more frequent in patients with dissection of vertebral artery in extracranial segment and was followed with better clinical recovery.

#### WSC-0484

##### Cerebrovascular Occlusive Disease

##### The impact of arterial hypertension in clinical outcomes in patients with dissection of the craniocervical arteries who are less than 50 years old

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*Introduction:* Dissection of craniocervical arteries occurs as a result of the split of the vessel wall with the formation of intramural hematoma that leads to narrowing of the lumen.

*Objective:* To determine the impact of arterial hypertension on clinical outcomes in patients with dissection of the craniocervical arteries who are less than 50 year old.

*Materials and methods:* We retrospectively studied a total of 27 patients, 15 men and 12 women between ages of 27–50 (mean age 43.7 y), who were hospitalized in our institution during the period from 2009 to 2013. All patients were analyzed with the presence of arterial hypertension, got made their MRI with MR angiography of the head and neck and NIHSS, both in admission and discharge.

*Results:* Out of 27 patients, arterial hypertension as a risk factor was found in 13 patients. MR angiography has shown in 18 patients dissection of internal carotid artery and in 9 patients dissection of vertebral artery. 12 patients (44%) had occlusion of the vessel, while 15 patients (56%)

stenosis of blood vessels in the long segment. Out of 13 patients with arterial hypertension, 9 patients had occlusion of a blood vessel, while 4 patients had stenosis in the long segments. Average NIHSS at discharge in patients with hypertension was 8. For the patients without arterial hypertension it was 3.

**Conclusion:** Patients younger than 50 years with the dissection of the craniocervical arteries and arterial hypertension have more frequent occlusion of blood vessels and poor clinical recovery.

## WSC-1299

### Cerebrovascular Occlusive Disease

#### Platelet derived growth factor (PDGF) level can predict progression of intracranial large artery atherosclerosis

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**Background and purpose:** Serum markers of the progression of intracranial large artery atherosclerosis are rare. We aimed to study the relationship between biomarkers and the risk of progression of symptomatic intracranial large artery atherosclerosis.

**Methods:** Of 409 patients in Trial of cilostazol in symptomatic intracranial stenosis-2 (TOSS-2) study, 52 patients showed progression of symptomatic intracranial large artery atherosclerosis on MRA after 7 months. We selected 20 patients with progression and 40 age- and sex- matched control patients. We collected blood sample initially, one month and 7 month after infarction, and multiplex analysis of biomarkers including interleukin-1, 2, 6, 8, 10, soluble CD40 ligand, TNF alpha, PDGF, soluble ICAM, E-selectin and VCAM, MMP-2, 3, 9, SOD 1, 2, 3 and adipokines, were performed.

**Results:** Demographic features such as age, sex, hypertension, diabetes and smoking history were comparable between both groups. On univariate analysis, 7 month PDGF-AA (1638.6 (762.7–4567.6) pg/ml; median (interquartile range) vs 769.2 (506.9–1714.5) pg/ml), PDGF-AB/BB (10314.9 (2608.3–25904.9) pg/ml vs 2345.3 (735.2–6702.3) pg/ml) level were higher in progression group. On multivariable analysis using logistic model, PDGF AB/BB levels at 7-month are independent prognostic factor for progression of intracranial large artery atherosclerosis ( $p = 0.012$ ). Cut point at 11495.4 pg/ml of PDGF AB/BB levels showed low sensitivity (0.5) but high specificity (0.88).

**Conclusion:** PDGF-AB/BB level can predict progression of symptomatic intracranial large artery atherosclerosis.

## WSC-0280

### Cerebrovascular Occlusive Disease

#### Basilar artery angulation in advanced age and pontine lacunar infarction: A multicenter observational study

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**Aims:** Deep pontine lacunar infarction (DPLI) is known to be a small vessel disease in the territory of the basilar artery (BA). In the present study, we examined whether morphological features of the BA changed in advanced age and could be associated with DPLI.

**Methods:** This study included 338 healthy population and 78 patients with DPLI at the stroke centers of 3 university hospitals in Korea. For a quantitative analysis, the BA was projected 2-dimensionally to anteroposterior and lateral views using Time-Of-Flight magnetic resonance angiographic images, and perceived as triangles of vertebrobasilar junction – angulation point – BA division. The angles and triangular areas

were summated into angulation indexes and used to quantify BA tortuosity.

**Results:** The BA showed more acute angles at the angulation point in advanced age in the healthy population. Compared to the healthy population, the DPLI patients showed significantly larger angles at the vertebrobasilar junction, in addition to the acute angles at the angulation point. A unit increase of the BA angle indexes at the vertebrobasilar junction and angulation points for DPLI showed an odds ratio of 1.15 (95% confidence intervals, 1.05–1.26) and 0.95 (95% CI, 0.91–0.99), even after adjusting for potential confounders, respectively.

**Conclusion:** In advanced age, the angulation point of the BA becomes more acute. In the patients with DPLI, the vertebrobasilar junction showed the larger angles than the controls. More studies are needed to examine whether the present findings can be generalized into various populations and other types of brainstem infarctions.

## WSC-0559

### Cerebrovascular Occlusive Disease

#### An investigation of factors affecting post operative renal function insufficiency after carotid artery stenting

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Chronic kidney disease (CKD) is frequently observed in patients of carotid artery stenosis. Post operative renal function disturbance is also appeared after carotid artery stenting (CAS). In this study, the factors affecting post operative renal disturbance were investigated.

135 patients being experienced CAS were chosen. All procedures were carried out under general anesthesia and with undiluted contrast. The factors, pre and post operative BUN, creatinine, and eGFR, the ratio of intra- and postoperative average of systolic blood pressure in comparison with preoperative average, intra- and postoperative urine per hour and body weight, the amount of used contrast media, and anesthesia and operation time, were statistically analyzed in multi variable analysis. The definition of renal disturbance was as the following; an elevation of SCr of 0.5 mg/dL or 25% in CKD group (pre operative SCr >1.1 mg/dL) and a deviation of SCr from normal range (<1.1 mg/dL) in non CKD group (pre operative SCr ?1.1 mg/dL).

Intraoperative average of systolic blood pressure was a predictive factor of post operative renal function disturbance ( $p < 0.05$ ). Over 20% reduction was statistically correlated with post operative renal disturbance (odds ratio = 5.668).

Intraoperative hypotension may result in post operative renal function disturbance. In carotid artery stenosis patients, we should pay attention to intraoperative blood pressure, because they may have occult renal function insufficiency.

## WSC-0744

### Cerebrovascular Occlusive Disease Hyoid bone proximity and symptomatic carotid artery atherosclerosis

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**Background:** Repetitive micro-trauma and compression of arteries is considered as a contributing factor for initiation and progression of atherosclerosis. In this respect, elongated greater horn of hyoid bone can compress carotid arteries during certain provoking movements.

**Aims:** To determine whether hyoid bone proximity contributes to development and severity of carotid artery atherosclerosis.

**Methods:** We retrospectively examined the relationship between symptomatic stenosis, degree of stenosis, and hyoid proximity (as determined by nearest distance between common/internal carotid artery and hyoid bone) on axial CTA-source images in consecutive patients admitted with a diagnosis of ischemic stroke secondary to carotid artery disease.

**Results:** The study population comprised of 87 patients with symptomatic carotid stenosis (left in 45, right in 42 patients). There was a trend for hyoid bone to be in closer proximity with carotid artery on the right side ( $79 \pm 32$  mm vs.  $90 \pm 49$  mm;  $p = 0.072$ ). The distance between hyoid bone and symptomatic carotid artery was significantly shorter in comparison to asymptomatic side ( $p = 0.035$ ). When each side was analyzed separately, hyoid proximity was significantly associated with symptomatic disease on the left side ( $p = 0.010$ ), while no such relationship existed on the right (Table).

**Conclusion:** This study shows a significant association between hyoid proximity and carotid artery disease on the left side. Further studies in larger datasets including both symptomatic and asymptomatic plaques are needed to elucidate whether hyoid proximity confers a risk for symptomatic carotid artery stenosis.

	Hyoid proximity (mm)		p
	Symptomatic	Asymptomatic	
Overall	$80 \pm 39$	$90 \pm 44$	0.035
Right	$80 \pm 36$	$77 \pm 29$	0.939
Left	$79 \pm 41$	$103 \pm 54$	0.010

## WSC-1232

### Cerebrovascular Occlusive Disease The frequency of simultaneous intra- and extra-cranial artery stenosis and related factors in patients admitted to neurology center

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**Background:** To investigate the distribution of atherosclerotic stenosis of cerebral arteries in Iranian patients and to determine if there are factors related to the simultaneous intra and extra cranial atherosclerosis.

**Methods:** For this study we enrolled 113 consecutive patients admitted to neurology center. All patients were examined with conventional angiography to determined location and severity of atherosclerotic lesions in

intracranial and extracranial cerebral arteries. Potential vascular risk factors for each patient were obtained from medical records. We compared the vascular risk factors between patients with combined intracranial atherosclerosis and extracranial or intracranial stenosis.

**Results:** In anterior circulation, 29 cases (25/7%) had only intracranial artery stenosis, 70 cases (61/9%) had only extracranial artery stenosis.

In posterior circulation, 15 cases (13.3%) had only intracranial artery stenosis, 34 cases (30.1%) had only extracranial artery stenosis.

31 cases (27.4%) had both intracranial and extracranial stenosis.

Compared within two groups, diabetes mellitus was the only risk factor associated with simultaneous intra and extracranial atherosclerosis in anterior circulation ( $p = 0.001$ )

**Conclusion:** The occurrence of stenosis in extracranial arteries is more frequent than that in intracranial arteries in Iranian patients. Diabetes mellitus is associated with simultaneous intra- and extracranial artery stenosis in anterior circulation.

## WSC-0794

### Cerebrovascular Occlusive Disease Cerebral blood flow and oxygen metabolism measurements using positron emission tomography on the first day after carotid artery stenting

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**Introduction:** The aim of the present study is the characterization of hemodynamics to predict hyperperfusion syndrome (HPS) after carotid artery stenting (CAS) with positron emission tomography (PET) obtained before and on the first day after the treatment.

**Methods:** Cerebral perfusion and oxygen metabolism were evaluated by <sup>15</sup>O-gas PET in 25 patients with symptomatic ICA stenosis before and on the first day after CAS. Regional cerebral blood flow (CBF), oxygen extraction fraction (OEF), cerebral metabolic rate of oxygen (CMRO<sub>2</sub>), and cerebral blood volume (CBV) were measured in the ipsilateral and contralateral MCA territories and compared between before and after CAS.

**Results:** CBF increased in 22/25 patients on the first day after CAS and postoperative CBF was significantly higher than preoperative CBF bilaterally. OEF decreased in 19/25 patients on the first day after CAS and postoperative OEF was significantly lower than preoperative OEF in the ipsilateral hemisphere. CMRO<sub>2</sub> and CBV did not change significantly. None of the patients showed HPS after CAS. All patients who had preoperative OEF  $\geq 53\%$  (misery perfusion) in the ipsilateral hemisphere showed  $\geq 50\%$  increase in CBF postoperatively. The preoperative OEF value significantly correlated with the rate of postoperative increase in CBF bilaterally.

**Conclusion:** A high preoperative OEF is related to postoperative marked CBF increase and might be used as a predictor of HPS. Patients with greater hemodynamic compromise with a high preoperative OEF should be managed carefully to prevent HPS, but they have a greater chance of CBF increase after CAS.

## WSC-0603

### Cerebrovascular Occlusive Disease Lateral thalamic infarction is associated with the vascular geometry of posterior cerebral artery

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**Background:** One-fourth of isolated lateral thalamic infarction (LTI) demonstrates a concomitant atherosclerosis of posterior cerebral artery (PCA). The geometrical properties and hemodynamic alterations are associated with atherosclerosis prone sites.

**Aim:** To investigate the association between vascular geometry of PCA and the occurrence of LTI.

**Methods:** Patients with LTI without an embolic cause were enrolled. The geometrical properties – distal basilar artery (BA) diameter, proximal PCA diameter, BA-PCA angle, P1-P2 angle and the presence of posterior communicating artery (Pcom) – were investigated. These parameters were compared among ipsilesional PCA, contralateral PCA and the corresponding PCA of age and sex matched control.

**Results:** Comparing the 45 LTI patients to the age and sex matched healthy controls, the incidence of hypertension and hyperlipidemia was higher in LTI patients. Ipsilesional PCA of LTI demonstrated a higher P1-P2 angle and a higher incidence of concomitant Pcom. Comparing to the contralateral normal PCA, the ipsilesional PCA demonstrated a smaller PCA diameter ( $1.83 \pm 0.47$  mm vs.  $2.01 \pm 0.45$  mm,  $p = 0.002$ ), larger P1-P2 angle ( $81.4 \pm 22.6^\circ$  vs.  $70.1 \pm 21.8^\circ$ ,  $p = 0.02$ ), and a higher incidence of Pcom (42.2% vs. 17.8%,  $p = 0.01$ ). The presence of Pcom independently predicted the lesion side of LTI (OR = 3.029 [1.125–8.154],  $p = 0.03$ ).

**Conclusion:** Local hemodynamics of PCA altered by P1-P2 angle and the presence of Pcom seems to be associated with the occurrence of LTI.

### WSC-0459

#### Cerebrovascular Occlusive Disease

#### Clinical significance of thyroid function status and thyroid autoantibodies in adult moyamoya disease: Case-control study

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**Background and purpose:** The purpose of this study was to compare the prevalence of thyroid autoantibodies and thyroid function status in adult moyamoya disease (MMD) with normal controls, and to investigate the clinical significance of thyroid autoantibodies and thyroid function status with regard to stroke.

**Methods:** We compared thyroid function status and prevalence of positive anti-thyroperoxidase antibody (TPOAb) between MMD and control groups. We divided MMD patients into 3 groups as ischemic, hemorrhagic, nonstroke group, and analyzed the correlation between stroke and thyroid function status and thyroid autoantibodies.

**Results:** A total of 169 patients with MMD and 3399 healthy control subjects were included in the study. The prevalence of positive TPOAb and hyperthyroid status were more common in 116 matched MMD cases compared with 464 matched controls ( $P < 0.01$  in both cases). Multivariate analysis among subgroups in MMD revealed significant correlation of TPOAb with ischemic stroke (OR, 2.99; 95% CI, 1.18 to 7.92;  $P = 0.019$ ). Hyperthyroid status was associated with ischemic stroke with borderline level of statistical significance (OR, 2.53; 95% CI, 0.97 to 6.82;  $P = 0.055$ ).

**Conclusions:** Thyroid function status and thyroid autoimmunity may play important roles in the pathogenesis of ischemic infarct in adult patients with MMD. Screening test and treatment targeted for thyroid hormone and thyroid autoantibodies might be helpful for the management of MMD presented with ischemic stroke.

### WSC-0449

#### Cerebrovascular Occlusive Disease

#### <sup>1</sup>H-NMR-based metabolomic analysis of cerebrospinal fluid from adult bilateral moyamoya disease: Comparison to unilateral moyamoya disease and atherosclerotic stenosis: A pilot study

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**Background and purpose:** Metabolomics has recently emerged as a promising new area to understand the pathogenesis and determine disease-specific metabolites; however, metabolite profiling for typical bilateral moyamoya disease (MMD) has not yet been conducted in adults. Although proteomics approach has shown several candidate proteins, still MMD pathogenesis is not fully understood. This pilot study was undertaken to reveal cerebrospinal fluid (CSF) metabolites which were specific to bilateral MMD with comparison to unilateral MMD or atherosclerotic stenosis in adults using a <sup>1</sup>H-NMR spectroscopy.

**Methods:** CSF samples of bilateral MMD ( $n = 29$ ), unilateral MMD ( $n = 10$ ) and atherosclerotic cerebrovascular disease (ACVD) ( $n = 9$ ) were recruited. Principal components analysis (PCA), PLS-Discriminant Analysis (PLS-DA) and orthogonal projections to latent structure discriminant analysis (OPLS-DA) were conducted for comparison. Diagnostic performance was acquired by prediction of one left-out sample from the distinction model constructed with the rest of the samples.

**Results:** Bilateral MMD revealed an increase in glutamine ( $p < 0.001$ ) and taurine ( $p = 0.004$ ), and a decrease in glucose ( $p < 0.001$ ), citrate ( $p = 0.002$ ) and myo-inositol ( $p = 0.006$ ) than ACVD. Unilateral MMD showed a higher level of glutamine ( $p = 0.012$ ) and a lower level of glutamate ( $p < 0.001$ ) than ACVD. Regarding bilateral and unilateral MMD, no difference at the metabolite level was observed. In addition, cross-validation with an OPLS-DA model showed a high accuracy for prediction of MMD. **Conclusions:** Our study suggests a novel approach to understand the MMD pathogenesis in adults at the metabolite level, especially of glutamine, which could be used for prognosis prediction and treatment planning in the future.

### WSC-0686

#### Cerebrovascular Occlusive Disease

#### Comparison of proximal balloon occlusion and distal filter protection during carotid artery stenting in Korean – Preliminary study

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**Introduction:** The use of cerebral protection device is essential during carotid artery stenting (CAS). Although good outcomes of CAS using proximal balloon occlusion have been reported in Western countries, few reports are available in East Asian countries.

**Aims:** We sought to compare the cerebral embolic load of proximal balloon occlusion (PBO) versus distal filter protection (DFP) during CAS using diffusion-weighted magnetic resonance imaging (DW-MRI).

**Methods:** From July 2012 to March 2014, 23 patients undergoing CAS were enrolled.

All patients underwent DW-MRI before and after CAS. An independent neuroradiologist blinded to the cerebral protection used analyzed the images.

**Results:** New cerebral ischemic lesions detected on DW-MRI were present in 6 patients (75.0%) of the PBO group versus 11 patients (73.3%) of the DFP group. The number of ischemic cerebral lesions per patient, when present, was lower in the PBO group (a median of 2 lesions per patient vs. a median of 4,  $p = 0.281$ ). There was no embolic complication after CAS in both groups.

**Conclusions:** In our study there is no difference between PBO and DFP during CAS in terms of the cerebral embolic load.

## WSC-1580

### Cerebrovascular Occlusive Disease

#### A case of Wallenberg syndrome

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**Introduction:** Wallenberg's syndrome is a well known brain stem vascular syndrome. Main clinical features of this syndrome are dizziness, nausea, difficulties with swallowing, Horner's syndrome and superficial sensory loss on the same side of the infarct and lack of pain and temperature sensation on the opposite side.

**Case:** An 63 years old, female patient presented with dizziness, difficulty swallowing and numbness in the right half of her face. In history, she had blood pressure disease and diabetes. On examination, a right sided miosis, semipitotoz, enophthalmos of artificial eye, anhidrosis (Horner's syndrome), right central facial paralysis, slurred speech and disphonic, uvula reflex was diminished. Cerebellar tests incompetent and decreased muscle tone on right, bilateral plantar reflex was extensor, facial hypoesthesia on the right side, a lack of pain and temperature sensation on the left side of the body. On diffusion MRI lesion viewed right half of the bulb is hyperintense on B1000, hypointense on ADC map. Patient is diagnosed Wallenberg syndrome and she was suddenly ex caused by possible vagal inhibition on the fifth day of hospitalization.

**Discussion:** The most common neurological findings of Wallenberg syndrome are Horner's syndrome, ataxia, cross-sensory defects, palatal weakness. In addition glossofarengeal and vagal nucleus of cranial nerves impairment were lead to dysphagia, hoarseness, a reduction of swallowing reflex and vagal inhibition. Sudden cardiac side effects can occur after vagal inhibition due to vagus directly impact sinoatrial node. We present a case of Wallenberg syndrome occurs sudden arrest, due to draw attention to the vagal complications.

## WSC-1340

### Cerebrovascular Occlusive Disease

#### Cavernous sinus thrombosis in an older patient

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**Introduction:** Cavernous sinus thrombosis is encountered among rare causes of ischemic stroke (1–2%). Clinically it may manifest itself with headache, nausea and vomiting, changes in consciousness, cranial nerve involvement, vision loss and epileptic seizures.

**Case:** An 85 years old, female patient applied with complaints of ptosis of the right eyelid, double vision, half-cranial headache on the right side like a flash of lightning, and numbness in the right half of the face. Her personal history revealed that she had hypertension and hyperthyroidism for 20 years. In neurological examination, the findings were ptosis below

the pupil in the right side; edematous right eyelid; limitation of right eye in every directions; hemihypoesthesia on the right half of the face. Laboratory results were normal other than CRP = 8.54 mg/L (N: 0–5). In MRI examination, a lesion with 36 × 30 mm size in the right cavernous sinus, which was hyperintense in Flair and T2 sequences, and peripherally hyperintense and centrally isointense thrombosis in T1 sequence. ENT examination was within normal limits. Paranasal CT and vasculitis markers were all normal. Patient was coumadinized with the diagnosis of cavernous sinus thrombosis. The symptoms were partially recovered.

**Discussion:** Cavernous sinus thrombosis may be encountered as a result of infectious or noninfectious etiology. It is more commonly encountered in young or middle-aged individuals with female predominance, and it has high mortality. The present case is presented, because well-progressed, noninfectious, advanced age cavernous sinus thrombosis in a female patient is rarely encountered.

## WSC-0256

### Cerebrovascular Occlusive Disease

#### Prevalence and predictors of asymptomatic intracranial stenosis and role of hs-CRP as a surrogate biomarker amongst diabetics in a Malaysian teaching hospital

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**Introduction:** Diabetes predisposes to the development of micro and macrovascular pathology, and is associated with increased stroke incidence. In the Asian population, the incidence of intracranial stenosis (ICS) is significant.

**Aims:** We studied the prevalence and predictors of ICS in a population of stroke-free diabetic patients.

**Methods:** Diabetic patients without history of stroke or transient ischemic attack were recruited. Baseline clinical data were obtained. All patients underwent a MR angiogram. We evaluated the degree of ICS, in which more than 25% were considered significant. Logistic regression was used to evaluate potential risk factors of ICS in patients.

**Results:** 78 patients (46.2% male, 53.3% female, mean age 55.94 years) were included. One or more ICS were detected at baseline in 15 subjects (19%). Multiple logistic regression showed that significant and independent predictors of asymptomatic ICS were Chinese ethnicity [OR 4.632; 95% CI (1.394–15.390);  $p = 0.012$ ], eGFR [OR 2.347; 95% CI (1.162–4.738);  $p = 0.017$ ] and hs-CRP [OR 59.500 95% CI (7.114–497.680);  $p =$

**Conclusion:** We found a significant association between Chinese ethnicity and the presence of ICS. This reflects the findings of previous researchers who reported high prevalence of ICS in East-Asians. Duration and control of diabetes were not associated with ICS.

**WSC-0911****Cerebrovascular Occlusive Disease****Long term outcome of patients with symptomatic severe carotid stenosis who received carotid artery angioplasty and stenting: A comparison between prior and no irradiation**M P Lee<sup>1</sup>, H Y Gan<sup>1</sup>, W E H Lim<sup>2</sup>, D A De Silva<sup>3</sup>, H M Chang<sup>3</sup><sup>1</sup>Neurology, Singapore General Hospital, Singapore, Singapore<sup>2</sup>Diagnostic Radiology, Singapore General Hospital, Singapore, Singapore<sup>3</sup>Neurology, National Neuroscience Institute (Singapore General Hospital Campus), Singapore, Singapore

**Introduction:** Radiation-induced atherosclerosis (RIA) is similar to spontaneous atherosclerosis, though differences have been described. Patients are usually offered Carotid Angioplasty and Stenting (CAS) because of anticipated difficulties with surgical resection/healing.

**Aim:** To compare the baseline and longer-term clinical and ultrasound features between patients with prior neck irradiation versus those without, who had received CAS.

**Methods:** A retrospective review of all patients who had CAS performed. Demographics, risk factors, malignancies and carotid plaque ultrasound features were collected. Ultrasound features of plaque-ulceration and hypochoic cores were considered high risk features.

**Results:** Of 59 patients (median age 75 years, 83% males), 16 (27%) had prior irradiation to the head and neck for malignancies (15 Nasopharyngeal and 1 Thyroid cancer). Irradiated patients were more likely to be Chinese (100% vs 81%) and less likely to have traditional risk factors like Hypertension (69% vs 98%), Diabetes (31% vs 47%), Ischemic Heart Disease (31% vs 61%), Hyperlipidemia (88% vs 93%) and Smoked (19% vs 44%). At baseline, irradiated plaques were more likely to have high risk ultrasound features (44% vs 25%). During follow up, stent re-stenosis was more common in irradiated necks (58% vs 3%). On multivariate analysis, younger age ( $p=0.013$ ) and stent re-stenosis ( $p=0.002$ ) were significantly associated with RIA.

**Conclusions:** RIA patients were younger. This may be explained by the fact that most of these patients had Nasopharyngeal cancer, which is a common malignancy affecting Singaporean males from the third decade onwards. RIA patients were also more likely to have stent re-stenosis during follow up.

**WSC-0310****Cerebrovascular Occlusive Disease****Impact of intracranial atherosclerotic stenosis on the prognosis in acute ischemic stroke patients with cardioembolic source**S Lee<sup>1</sup>, D Lee<sup>1</sup>, D Shim<sup>2</sup>, T Chung<sup>3</sup><sup>1</sup>Department of Neurology, Sejong General Hospital, Bucheon, Korea<sup>2</sup>Department of Neurology, St. Mary's Hospital, Bucheon, Korea<sup>3</sup>Department of Neurology, Dong-In Hospital, Gangneung, Korea

**Introduction:** Although intracranial atherosclerotic stenosis (IAS) has been reported to be related to a high rate of recurrent stroke and mortality in total patient population with acute ischemic stroke, its impact on the prognosis of the patients with cardioembolic source is not yet established.

**Aims:** This study attempts to investigate whether IAS is associated with stroke recurrence and mortality in stroke patients with cardioembolic source.

**Methods:** 223 patients with acute ischemic stroke and cardioembolic source were included in this study. IAS was defined as the presence

of  $\geq 50\%$  stenosis of brain vessels on enhanced MRA, and cardioembolic sources were detected by transthoracic or transesophageal echocardiography. Follow-up data on the clinical events (including mortality and stroke recurrence) were obtained by outpatient medical records and/or telephone interviews.

**Results:** The two most frequent sources of cardioembolism were atrial fibrillation (142 patients, 63.7%) and congestive heart failure (47 patients, 21.2%). IAS was present in 72 patients (32.3%). 60 major clinical events occurred in 58 patients (26.0%); 18 recurrent ischemic strokes and 42 deaths from any cause. Patient with IAS had significantly higher rates of death and stroke recurrence than those without IAS ( $P=0.015$  and  $0.046$  each by log rank test). The multivariate Cox proportional hazards regression analysis showed that IAS is significantly related to the major clinical events (hazard ratio 1.725, 95% confidence interval 1.020–2.920,  $P=0.042$ ).

**Conclusions:** In acute ischemic stroke patients with cardioembolic source, IAS may be a marker of a high risk of stroke recurrence or death.

**WSC-1074****Cerebrovascular Occlusive Disease****Angiographic steno-occlusive lesions and collateral patterns according to cerebral vascular reservoir of acute ischemic stroke and TIA**S B Lee<sup>1</sup>, K S Kim<sup>2</sup>, Y D Won<sup>3</sup>, D Yoo<sup>4</sup><sup>1</sup>Neurology, Uijeongbu St Mary's Hospital, Catholic University Medical College, Uijeongbu-si Gyeonggi-do, Korea<sup>2</sup>Neurology, Pohang SM Christianity Hospital, Pohang-si Gyeongbuk-do, Korea<sup>3</sup>Radiology, Uijeongbu St Mary's Hospital, Catholic University Medical College, Uijeongbu-si Gyeonggi-do, Korea<sup>4</sup>Neurosurgery, Uijeongbu St Mary's Hospital, Catholic University Medical College, Uijeongbu-si Gyeonggi-do, Korea

**Introduction:** Atherosclerotic large arterial steno-occlusive disease is one of the risk factors of ischemic stroke. Despite best medical treatment, some patients with these lesions still have hypoperfusion and may need an intervention.

**Aims:** We selected patients who undergone digital subtraction angiography (DSA), MR perfusion, SPECT with Diamox challenging for assessment of perfusion status and cerebral vascular reservoir (CVR) and evaluated the association between the collateral pattern, perfusion status, clinical manifestation and short term clinical outcome.

**Methods:** From a cohort of patients consecutively admitted for stroke or TIA, we selected patients with symptomatic large artery steno-occlusive lesion confirmed by DSA. Cerebral angiogram was graded systematically in a blinded fashion for collateral flow, using ASITN/SIR grading. We also evaluated DWI-PWI mismatch and CVR by Diamox SPECT. Demographic and clinical variables, initial NIHSS score and mRS scores at discharge were collected. We divided patients in two according to CVR pattern and compared clinical and imaging status.

**Results:** A total of 21 patients were selected. Men was 14(67%) and mean age was 64.3 (range of 40 to 84). Eleven patients had ICA steno-occlusive, 8 had MCA steno-occlusive lesions and remaining 2 had tandem lesions. In Diamox SPECT, 5 patients showed preserved CVR. Patients with preserved CVR more had stenotic lesion while those with reduced CVR had occlusive lesion ( $p=0.001$ ) and collateral grading was differently distributed between two groups ( $p=0.046$ ).

**Conclusions:** DSA is still the most important in evaluating steno-occlusive lesion and collateral status. The status of the steno-occlusive lesion may have an effect on CVR.

**WSC-0486****Cerebrovascular Occlusive Disease  
nBCA embolization of a ruptured thalamoperforator  
artery aneurysm in a patient associated moyamoya  
disease**J Lim<sup>1</sup><sup>1</sup>Neurosurgery Department, Sun Hospital, Daejeon city, Korea

**Introduction:** Unusually an aneurysm is the cause of hemorrhage in patients with moyamoya disease (MMD). We present a case of a ruptured thalamoperforator artery aneurysm treated with n-butyl cyanoacrylic acid (nBCA) embolization in a patient with MMD.

**Methods and results:** A 51-year-old female presented with suddenly decreased mentality and left side 3rd cranial nerve palsy. Initial brain computed tomography and angiography showed subarachnoid hemorrhage, both distal internal carotid arterial occlusion and strong enhancing nodule at left side posterior communicating artery. Digital subtraction angiography reveals occlusion at the terminal portion of the both internal carotid artery with development of moyamoya vessels and aneurysm like vascular pouch at left side P1 portion. A 50% solution of nBCA and ethiodol was injected into the aneurysm. Postembolization angiography demonstrated no evidence of residual aneurysm. There were no procedural complications and at 1 year follow-up she remained neurologically normal. One year follow-up magnetic resonance angiography showed no residual aneurysm.

**Conclusions:** In MMD associated with intracranial aneurysms, coil embolization was performed for saccular aneurysms whereas endovascular parent artery occlusion with glu was conducted for pseudoaneurysms. The endovascular occlusion of aneurysms on the collateral vessel in MMD with nBCA might be an effective treatment option.

**WSC-0502****Cerebrovascular Occlusive Disease  
Cerebrovascular occlusive disorders during ischemic  
stroke**I Maksimovich<sup>1</sup><sup>1</sup>Interventional Neuroangiology, Clinic of Cardiovascular Diseases named after Most Holy John Tobolsky, Moscow, Russia

**Introduction and aims:** The research investigates the localization of occlusive disorders in cerebrovascular system during ischemic stroke.

**Methods:** We examined 1238 patients aged 29–81 (average age 74) with various types of atherosclerotic disorders of cerebral vessels: 916 male (73.99%), 322 female (26.01%).

The examination plan included: CT, MRI, scintigraphy (SG), rheoencephalography (REG), cerebral MUGA; CDR, MMSE, IB assessment.

Ischemic stroke clinical presentation was diagnosed in 486 (39.26%) patients, signs of previous transient cerebral circulatory disorders were found in 248 (20.03%) patients.

**Results:**

Of these groups according to CT and MRI:

- Macro- and mediofocal postischemic brain cysts – 205 (27.93%) patients;
- microfocal postischemic brain cysts – 88 (11.99%) patients;
- single and multiple microcysts – 245 (33.38%) patients;
- absence of postischemic cysts with atherosclerotic disorders – 192 (26.16%) patients, which does not exclude the presence of multiple extremely small cysts, much smaller than the resolution of the equipment used.

According to MUGA, patients were divided by the type of brachiocephalic arterial branches atherosclerotic disorders into:

- intracranial type – 326 (44.41%);
- mixed type – 339 (46.19%);
- extracranial type – 69 (9.40%).

Of these, occlusive disorders:

- main extracranial arteries – 21 (2.86%);
- main intracranial arteries – 96 (13.08%);
- distal intracranial branches – 302 (41.14%);
- peripheral intracranial branches – 171 (23.30%);
- capillary occlusive disorders – 144 (19.62%).

**Conclusions:** Ischemic stroke is mostly accompanied by intracranial arterial branches occlusions. Multiple occlusions of the capillary bed are identified by hypovascular areas in the cerebral tissue.

**WSC-1258****Cerebrovascular Occlusive Disease  
Discrepancy between CT and conventional  
angiography in determining degree of carotid artery  
stenosis**E McFadden<sup>1</sup>, S U Ahmed<sup>2</sup>, L Peeling<sup>2</sup>, P Szkup<sup>3</sup>, M Kelly<sup>2</sup><sup>1</sup>College of Medicine, University of Saskatchewan, Saskatoon, Canada<sup>2</sup>Neurosurgery, University of Saskatchewan, Saskatoon, Canada<sup>3</sup>Neuroradiology, University of Saskatchewan, Saskatoon, Canada

**Introduction:** Computerized tomography angiography (CTA) is commonly used to define the degree of carotid stenosis prior to carotid endarterectomy or stenting. However, cerebral angiography is considered the gold standard for assessing the degree of carotid stenosis.

**Aims:** In this study, we attempted to analyze the discrepancy rates between CTA and cerebral angiography in patients undergoing carotid stenting with only a baseline CTA.

**Methods:** Retrospectively reviewed our patient database for patients treated with carotid stenting at Royal University Hospital from 09/2008 to 06/2013. 58 patients were identified. The criteria for carotid stenting were symptomatic disease and greater than 69% stenosis on CTA, confirmed by a stroke neurologist and independent radiologist respectively. Patients then underwent control cerebral angiography at the time of the stenting procedure.

**Results:** 5/58 (8.6%) had stenosis greater than 70% on initial CTA, but showed < 70% stenosis on angiography. The rate of angiographic stenosis was 59%, 50%, 44%, 31% and 46% in these patients.

**Conclusions:** In this single center experience, a high degree of discrepancy was noted between diagnostic CTA and cerebral angiography at the time of the carotid stenting procedure, which led to the procedure being aborted due to the presence of a low or moderate grade stenosis. While the overall standard deviation between the two modalities was not statistically significant ( $p < 0.05$ ) in this sample size, care must be taken to ensure that patients undergoing carotid endarterectomy do not have an overestimation of the degree of stenosis, and do not consequently undergo unnecessary treatment.

**WSC-1405****Cerebrovascular Occlusive Disease  
Development of an atherosclerotic fibro-lipid plaque  
with neovascularization and severe stenosis in rabbit  
carotid artery, monitored by ultrasonography and  
histopathology**H Mehrad<sup>1</sup>, M Mokhtari-Dizaji<sup>2</sup>, H Ghanaati<sup>3</sup><sup>1</sup>Medical Physics, School of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran<sup>2</sup>Medical Physics, School of of Medical Sciences, Tarbiat Modares University, Tehran, Iran<sup>3</sup>Radiology, Imam Khomeini Hospital, Tehran University of Medical Sciences, Tehran, Iran

**Introduction:** A precise understanding of the mechanism of atherosclerotic soft plaque neovascularization in human carotid artery, which give

rise to plaque progression, lumen stenosis, plaque rupture, thrombosis, emboli and stroke, requires a suitable animal model that would mimic the same characteristics well.

**Aims:** The aim of this study was to develop an atherosclerotic fibro-lipid plaque with neovascularization and severe stenosis (>70%) in the rabbit carotid artery.

**Methods:** Atherosclerotic fibro-lipid plaque was induced via perivascular cold injury using liquid nitrogen at the right common carotid artery of New Zealand white rabbits, before being fed a 1.5% cholesterol-rich diet for eight weeks. Blood volume flow, blood mean velocity, wall mean thickness and percentage of luminal cross-sectional area of stenosis in the all of the rabbits' arteries were measured by color Doppler and B-mode ultrasonography weekly, after which the rabbits were sacrificed, and their vessels were processed for histopathology.

**Results:** Histopathology results showed progressive changes, from the lipid-laden cells and fibrous connective tissue proliferation, up to fibro-lipid plaque formation, resulting in vessel wall thickening, remodeling, neovascularization and lumen narrowing. The color Doppler and B-mode ultrasonography measurements showed a significant reduction in the luminal cross-sectional area at the stenotic region within eight weeks ( $P < 0.05$ ).

**Conclusion:** We successfully developed a new rabbit carotid artery model of atherosclerotic plaque neovascularization, which is not only quickly and easily reproducible and inexpensive but also without mortality. The merits of our model render the evaluation of carotid artery stenosis and its treatment strategies more feasible in humans.

### WSC-0223

#### Cerebrovascular Occlusive Disease Screening for intracranial stenosis: Comparison of transcranial Doppler with MR angiogram

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**Introduction:** Magnetic resonance angiography (MRA) and Transcranial Doppler (TCD) are both screening tests for intracranial stenosis.

MRA findings and TCD findings were compared in patients with Transient ischemic attack (TIA), stroke or suspected cerebro vascular disease. **Materials and methods:** 280 patients were studied over a 3 year period between 2009 & 2012. There were 192 male & 88 female patients with in the age group 32 to 78 years. A complete TCD examination & MRA was performed in all the patients.

**Results:** In the 280 patients studied, there was significant agreement between TCD & MRA. The results were discordant in only 7% of cases. In the discordant cases MRA showed greater stenosis & TCD showed insignificant stenosis.

**Conclusion:** In our study we found a 93% concordance between MRA & TCD for evaluation of intracranial stenosis. In cases where there is no concordance, MRA showed higher degree of stenosis in 90% of the cases.

### WSC-0494

#### Cerebrovascular Occlusive Disease The association between preoperative clinical risk factors and in-hospital stroke and death following carotid endarterectomy in South African patients

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**Introduction:** Current surgical management for carotid artery disease includes carotid endarterectomy (CEA). In-hospital stroke and death fol-

lowing CEA might be associated with preinduction blood pressure measurements and other clinical risk factors.

**Aims:** The aim of this study was to determine whether there is an association between preinduction blood pressure, other clinical risk factors, and in-hospital stroke or death following CEA in a cohort of South African patients.

**Methods:** We collected data related to clinical risk factors, preinduction blood pressure measurements, and in-hospital stroke and death following CEA from patient medical records. The association between clinical risk factors, preinduction blood pressure measurements, and postoperative in-hospital neurological morbidity and mortality were analyzed using univariate statistical methods.

**Results:** Our cohort consisted of 76 patients who underwent CEA, with eight of these patients suffering in-hospital stroke or death following their surgeries. Univariate analysis did not identify any associations between a history of hypertension or other clinical risk factors and in-hospital stroke and death in these 76 CEA patients. However, patients who had a preinduction systolic blood pressure <145 mmHg or >195 mmHg had a significantly increased risk of in-hospital stroke and death following their surgeries ( $p = 0.003$ ). A sub-analysis of hypertensive patients also showed this univariate association ( $p = 0.003$ ).

**Conclusions:** It is possible that extremes of preinduction systolic blood pressure might be associated with in-hospital stroke and death in CEA patients following their surgeries, although further research is required to confirm this.

### WSC-0496

#### Cerebrovascular Occlusive Disease Risk factors for postoperative in-hospital cerebrovascular accident or death following carotid endarterectomy in the elderly

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**Introduction:** Data related to poor in-hospital and 30-day outcomes in elderly patients undergoing carotid endarterectomy (CEA) are based primarily on findings in patients  $\geq 80$  years old, although younger elderly patients ( $\geq 65$  years old) may also possess comorbidities associated with cerebrovascular accident (CVA) or death post-CEA.

**Aims:** This study sought to determine the role of common comorbid conditions in the development of in-hospital CVA or combined in-hospital CVA and Death (CVA/Death) post-CEA in cases  $\geq 65$  years old.

**Methods:** We analyzed data from the National Hospital Discharge Survey. Our final study cohort consisted of 2023 cases  $\geq 65$  years undergoing CEA between 2005 and 2008. We determined comorbidities and CVA or CVA/Death from standard ICD-9-CM codes recorded on the NHDS database for each case. Independent predictors of CVA and CVA/Death were identified using binary logistic regression. Receiver operator characteristic (ROC) curve analyses were used to determine the predictive accuracy of independent predictors of CVA or CVA/Death.

**Results:** Only a prior history of symptomatic cerebrovascular disease was identified as an independent predictor of CVA (Odds Ratio, 95% CI: 47.71, 18.65–122.1) or CVA/Death in this study (Odds Ratio, 95% CI: 51.32, 21.15–124.6). Prior symptomatic cerebrovascular disease was a fair predictor of CVA or CVA/Death post-CEA (ROC area under curve: 0.786 and 0.791, respectively).

**Conclusions:** Prior symptomatic cerebrovascular disease is a risk factor for poor outcomes post-CEA in younger elderly patients. Patients at risk should be optimized medically prior to their surgeries.

**WSC-1303****Cerebrovascular Occlusive Disease  
Treatment of adult patients with moyamoya disease  
based on hemodynamic measurement with perfusion  
MRI and PET and indirect bypass procedures**T Nariai<sup>1</sup>, M Inaji<sup>1</sup>, Y Tanaka<sup>1</sup>, Y Ishii<sup>1</sup>, M Mukawa<sup>1</sup>, S Hayashi<sup>1</sup>, K Oda<sup>2</sup>, K Ishiwata<sup>2</sup>, K Ishii<sup>2</sup><sup>1</sup>Department of Neurosurgery, Tokyo Medical and Dental University, Tokyo, Japan<sup>2</sup>Research Team for Neuroimaging, Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan

**Introduction:** We have started to measure cerebral hemodynamics of all adult patients with moyamoya disease (MMD) with dynamic susceptible contrast magnetic resonance imaging (DSC-MRI) and/or positron emission tomography (PET) after 2001. We reported how the treatment method and its result changed in comparison to the treatment before 2000.

**Methods:** From 1979 to the present, 311 adult patients with MMD (19–58 y/o) were treated in our institute. All of patients treated after 2001 (N = 248) were evaluated with DSC-MRI and/or PET to prospectively determine the surgical indication and the site of craniotomy for indirect bypass surgery. Surgical method and result of these patients were compared with patients treated before 2000 (N = 63) who were treated by EDAS around sensorimotor area.

**Results:** 1) In the earlier period, 40 of 63 (63%) patients were operated based on clinical symptom. In the latter period, 43 of 248 (17%) patients were operated using hemodynamic data as determinant. 2) Pre- and Post-operative hemodynamic data of patients treated before 2001 indicted that CBF significantly increased among frontal lobe, but CMRO<sub>2</sub> significantly decreased in parieto-occipital lobe. In the recent patients, CBF and CMRO<sub>2</sub> significantly increased among frontal, temporal, parietal and occipital lobe together with significantly decreased OEF. 5) Permanent deficit caused by perioperative infarction decreased in recently treated cases (3 out of 40 (6.6%) in earlier and 0 in recent cases).

**Conclusions:** Quantitative measurement of cerebral hemodynamic parameter of MMD with DSC-MRI or PET and surgical treatment using indirect bypass technique based on hemodynamic parameters was highly effective in selecting surgical candidates and to perform an effective surgery to ameliorate cerebral blood flow and metabolism.

**WSC-0542****Cerebrovascular Occlusive Disease  
Increased prevalence of coronary artery calcification in  
subjects with intracranial atherosclerosis detected in  
transcranial Doppler ultrasound**H Oh<sup>1</sup>, E Rhee<sup>2</sup>, H Park<sup>1</sup>, M Ahn<sup>3</sup><sup>1</sup>Department of Neurology, Soonchunhyang University College of Medicine, Cheonan, Korea<sup>2</sup>Department of Endocrinology and Metabolism, Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Seoul, Korea<sup>3</sup>Department of Neurology, Soonchunhyang University College of Medicine, Seoul, Korea

**Introduction:** Intracranial atherosclerosis (ICAS) is associated with incident stroke. Similarly, coronary artery calcification has been associated with incident coronary artery disease events. Although atherogenesis in both vascular beds may share some common mechanisms, the extent to which coronary artery calcification (CAC) is associated with ICAS in apparently healthy subjects remains unknown. Transcranial Doppler ultrasound (TCD) is a diagnostic modality that could be noninvasively used for the diagnosis of ICAS.

**Aims:** To know the association of CAC and ICAS

**Methods:** TCD and coronary artery calcium scores (CACS) were measured in 10,051 healthy subjects who underwent detailed medical health screening. Stroke Outcomes and Neuroimaging of Intracranial Atherosclerosis trial methods was used to diagnose ICAS with TCD. The presence of CACS was assessed by the Agatston method using multi-detector computed tomography. We analyzed the relationship between CACS and ICAS assessed by TCD in apparently healthy Korean adults.

**Results:** Analyses were performed in 191 subjects with ICAS and 9860 subjects without ICAS. When the proportion of subjects with CAC was compared between the groups, the subjects with ICAS showed significantly higher proportion of subjects with CAC compared with that in subjects without ICAS (23.0 vs. 16.6%,  $p = 0.011$ ). In reverse, the proportion of subjects with ICAS was higher in group with CAC compared with subjects without CAC (2.6 vs. 1.8%,  $p = 0.011$ ).

**Conclusions:** Subjects with ICAS detected by TCD showed significantly higher proportion for CAC in this apparently healthy subjects, suggesting the association of CAC and ICAS.

**WSC-1323****Cerebrovascular Occlusive Disease  
Circulating matrix metalloproteinase-9 level is  
associated with cerebral white matter hyperintensities  
in nonstroke individuals**S Oh<sup>1</sup>, Y Kim<sup>1</sup>, Y Kim<sup>2</sup>, N Kim<sup>2</sup><sup>1</sup>Neurology, CHA Bundang Medical Center, Seongnam, Korea<sup>2</sup>Institute for Clinical Research, CHA Bundang Medical Center, Seongnam, Korea

**Backgrounds:** The pathogenesis of cerebral white matter hyperintensities (WMH) has been poorly understood. Our aim was to investigate the association of circulating proteins, the biomarkers of inflammation, blood-brain barrier (BBB) dysfunction, and thrombosis with WMH in nonstroke individuals.

**Methods:** Demographic, laboratory, and brain magnetic resonance imaging (MRI) parameters were prospectively analyzed in 137 subjects. The severity of WMH was measured using Fazekas grade score, and WMH volume was semi-quantitatively measured on FLAIR image. The circulating levels of interleukin-6 (IL-6), tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), matrix-metalloproteinase-9 (MMP-9), plasminogen activator inhibitor-1 (PAI-1) were measured on plasma using enzyme-linked immunosorbent assay.

**Results:** In univariate analysis, old age, high blood pressure, and history of hypertension were associated with overt WMH (Fazekas grade  $\geq 2$ ). Among the examined circulating proteins, only MMP-9 was found to be significantly elevated in the overt WMH group (median: 46.80 ng/ml, IQR: 23.50 to 98.7) compared to the no WMH group (median: 35.10 ng/ml, IQR: 15.69 to 60.80,  $p = 0.025$ ). In multivariate analysis after adjusting for age and hypertension, plasma MMP-9 still maintained a significant association with WMH (OR: 1.09 [per 10 ng/ml increase], 95% CI: 1.00–1.18,  $p = 0.047$ ). In correlation analysis, plasma MMP-9 level was weakly but significantly associated with WMH volume ( $r = 0.232$ ,  $p = 0.006$ ). Circulating IL-6, TNF- $\alpha$ , and PAI-1 failed to demonstrate a significant relationship with WMH.

**Conclusions:** Plasma MMP-9 is associated with overt WMH. This result suggests that altered extracellular matrix and BBB permeability may contribute to development of WMH.

**WSC-1579****Cerebrovascular Occlusive Disease  
Stenting in patients with innominate, subclavian and proximal vertebral artery stenosis**E Timer<sup>1</sup>, S Mumcu<sup>1</sup>, Z Tanriverdi<sup>1</sup>, B Aydin Islamoglu<sup>1</sup>, E Uysal<sup>2</sup>, D Orken<sup>1</sup><sup>1</sup>Neurology, Sisli Hamidiye Etfal Education and Research Hospital, Istanbul, Turkey<sup>2</sup>Radiology, Sisli Hamidiye Etfal Education and Research Hospital, Istanbul, Turkey

**Introduction:** Although subclavian steal syndrome remains characteristically asymptomatic, atherosclerotic occlusive disease of the proximal vertebral and innominate artery is an important cause of cerebrovascular ischemic events. Endovascular therapy is an accepted treatment method in occlusive disease of these arteries.

**Aims:** The purpose of this study was to evaluate the clinical long-term outcome following stenting.

**Methods:** We retrospectively analyzed 5 interventions of atherosclerotic lesions of 3 subclavian arteries, 1 brachiocephalic trunk and 1 proximal vertebral artery. Mean follow-up was 2.6 years. Follow-up was based on duplex ultrasound at 1, 4, 12 and every 24 weeks and digital subtraction angiography at 1 year.

**Results:** The mean age ( $\pm$ SD) of patients were  $60,8 \pm 5,9$  years and two of them were female. There was no catheter-related stroke. All patients had hypertension, 1 patient had diabetes mellitus, 1 patient had atrial fibrillation and 2 patients were smoking. Two patients were symptomatic in the time of intervention. On follow-up patients didn't have any vascular event. Only 1 patient had asymptomatic 40% intrastent stenosis.

**Conclusions:** Minimally invasive endovascular techniques were safe and feasible for symptomatic stenotic disease of subclavian, proximal vertebral and innominate artery. Stenting is a viable therapeutic option, producing good technical success and durability.

**WSC-1112****Cerebrovascular Occlusive Disease  
Risk factors and short term prognosis for elderly stroke patients**S Mumcu<sup>1</sup>, E Timer<sup>1</sup>, D Orken<sup>1</sup>, Z Tanriverdi<sup>1</sup><sup>1</sup>Neurology, Sisli Hamidiye Etfal Education and Research Hospital, Istanbul, Turkey

**Introduction:** The Turkish population is still relatively young but if the current trends of demographic indicators persist, the population will continue ageing. Therefore elderly are expected to become a growing part of the stroke population.

**Aims:** The aims of this study were to evaluate clinical characteristics and short-term prognosis of patients aged 80 years or more.

**Methods:** A total of consecutive 352 patients who were admitted to Sisli Hamidiye Etfal Education and Research Hospital, Department of Neurology, between January 2013 and March 2014, with a diagnosis of first ever ischemic stroke. After exclusion of 158 patients under 55 year of age 294 patients were enrolled for the study. Patients were divided into two groups according their age. Patients aged 55–79 years were accepted as control.

**Results:** The mean age ( $\pm$ SD) of patients and controls were  $84,6 \pm 4,29$  and  $68,1 \pm 6,96$  years, respectively. Sixty five of patients (69%) and 83 of controls (41%) were female ( $p = 0,000$ ). Patients had significantly more hypertension and atrial fibrillation than controls ( $p = 0,04$  and  $0,000$ ). Controls had more diabetes mellitus, smoked more cigarette and consumed more alcohol than patients ( $p = 0,01$ ,  $0,000$  and  $0,000$ ). Mean NIHSS of patients and controls were  $7,5 \pm 5,7$  and  $4,5 \pm 4,2$  respectively ( $p = 0,000$ ). And elderly patients Rankin scale were grader than controls ( $p = 0,000$ ).

**Conclusions:** Elderly patients tend to have more cardioembolic strokes. And prognosis was poorer than younger aged patients.

**WSC-0436****Cerebrovascular Occlusive Disease  
Intracranial artery dissections: Report of 83 cases in a single institution**D E Dossi<sup>1</sup>, M F Farez<sup>1</sup>, J E Arena<sup>1</sup>, V Pujol Lereis<sup>1</sup>, F Rodriguez Lucci<sup>1</sup>, G Povedano<sup>1</sup>, S F Ameriso<sup>1</sup><sup>1</sup>Neurology, Institute for Neurological Research (FLENI), Ciudad Autónoma de Buenos Aires, Argentina

**Introduction:** Cerebral artery dissections (CAD) represent one of the leading causes of stroke in the young and middle aged population. Approximately one third of CAD are purely intracranial or extend from the neck to intracranial vessels. There is scant data on intracranial arterial dissections (IAD) in Latin-America.

**Aims:** We report a single institution series of IAD from Buenos Aires, Argentina. **METHODS:** Data was retrospectively obtained from the FLENI Stroke Data Bank between 1994 and 2013. We assessed demographic characteristics, clinical presentation, diagnostic tests, acute treatment, and outcome at six months.

**Results:** Out of 300 patients with CAD, 117 (39%) were extracranial artery dissections, 97 (33%) were combined, and 83 (28%) were pure IAD. Mean age for IAD was  $44 \pm 12$  years, and 63% were men. Clinical presentation was: ischemic stroke (71%), pain/Horner/tinnitus (21%), transient ischemic attack (4%), and hemorrhagic stroke (4%). The causes of IAD were: mayor trauma (6%), minor or trivial trauma (29%), and spontaneous dissections (65%). The most frequent patterns were: stenosis (71%), occlusion (13%), dissection flap (7%), and dissecting aneurysm (8%). Patients were treated with antiplatelet therapy (50%), anticoagulants (46%), r-TPA (2%), surgery (1%) or nontreatment (1%). At six-months follow up, 63% of the patients had a mRS 0/1, 32% of 2/3, and 4% of 4/5. One patient died during follow up (1%).

**Conclusions:** IAD represent a substantial proportion of CAD and may be a frequently underdiagnosed cause of stroke. Intraparenchymal hemorrhage seemed to occur less frequently in our series than previously reported.

**WSC-0896****Cerebrovascular Occlusive Disease  
Vertebral artery revascularization in vertebrobasilar ischemia cases the Hillel Yaffe Medical Center experience**S Sabetay<sup>1</sup>, O Galili<sup>2</sup>, A Kantarovski<sup>2</sup>, Z Kovzantsev<sup>2</sup>, I Portnoi<sup>2</sup><sup>1</sup>Neurology, Hillel Yaffe Medical Center, Hadera, Israel<sup>2</sup>Vascular Surgery Unit, Hillel Yaffe Medical Center, Hadera, Israel

**Introduction:** Symptoms of vertebrobasilar ischemia (VBI) can be caused both by flow limiting lesions and embolic phenomena of the vertebral arteries. VBI is often under-diagnosed and under-treated since the optimal management of vertebral artery (VA) stenosis until now received limited attention with controversial results.

**Methods:** We present a retrospective review of our medical center's experience in VA reconstruction. Between February 2006 and November 2013, 9 patients underwent 12 VA reconstructions, including transposition of external carotid artery to VA (V3) at the C1–2 level ( $n = 7$ ), bypass from common carotid artery to VA (V3) with great saphenous vein ( $n = 3$ ), and relocation of VA origin ( $n = 2$ ). The presenting symptoms were attributed to flow limiting lesions in 8 cases (66%), embolization in 2 cases (17%), and ischemia after penetrating trauma in 2 cases (17%).

**Results:** All the procedures were performed under general anesthesia with no intraoperative complications. One patient required re-exploration for bleeding. There were no perioperative death or strokes and no cranial nerve injuries. During follow up, two bypass procedures required endovascular treatment of stenosis in the distal anastomosis and return of VBI symptoms. The symptoms resolved in all patients but one (92%) with no late strokes.

**Conclusions:** Although our experience includes a small number of patients, our results are in line with the reported in the literature and suggest that VA reconstruction provides good symptomatic relief with acceptable risk in selected patients. Based on the above elements we developed a comprehensive protocol for decision-making in patients with suspected VBI.

### WSC-0742

#### Cerebrovascular Occlusive Disease Limb-shaking transient ischemic attacks – Treatment pitfalls

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**Background:** Limb-shaking transient ischemic attacks (TIAs) are a hallmark of hemodynamic compromise underlying a severe internal carotid artery (ICA) stenosis/occlusion. Although it is estimated to increase the stroke risk, the best treatment is unknown.

**Case report:** 79 year-old male, refers multiple episodes of involuntary and irregular wavering movements involving right limbs simultaneously that started three months ago and became more frequent in the last week. These episodes are invariably triggered by rising from sitting/lying position, usually lasting five minutes and are often accompanied by ipsilateral weakness. Medical history: arterial hypertension, diabetes and coronary/peripheral arterial diseases. Neurologic examination: right spastic hemiparesis (grade 4+), osteotendinous hyperreflexia and Babinski sign. Brain CT-scan: left-hemispheric borderzone-shaped recent parietal and frontal infarcts. Doppler ultrasonography: left postbulbar ICA occlusion and <50% right ICA stenosis. CT-angiography confirms the occlusion, revealing patency of the distal ICA upstream the ophthalmic segment; suggests the absence of anterior and left posterior communicating arteries and defines a 65–70% right proximal ICA stenosis. MRI-perfusion study discloses reduced cerebral blood flow and increased mean transit time in left hemisphere, suggesting inadequate collateral compensation.

**Discussion:** Limb-shaking TIAs/ICA occlusion increases significantly stroke risk. The recent Carotid Occlusion Surgery Study failed to prove ECA-ICA (superficial temporal-middle cerebral arteries) bypass surgery superiority over medical therapy on stroke recurrence. So, when approaching an ICA occlusion with signs of perfusion failure the medical treatment remains our only option, despite a dreadful stroke recurrence rate of 22%. ICA occlusion is a serious condition with limited/ineffective treatment options, demanding new clinical research.

### WSC-0990

#### Cerebrovascular Occlusive Disease Morphological analysis of cerebral infarction (CI)

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**Introduction:** Cerebral tissue damage is a usual cause of death in patients with nonhemorrhagic infarcts.

**Aims:** We undertook analysis of causes of death of patients with cerebral infarction (CI). The analysis has included cases of CI for 2013 from the morphological department of the emergency clinic at the city of Almaty.

**Methods:** Out of 258 autopsies in 2013, the pathologist reported CI in 76 cases. All patients died in the stroke unit of the clinic.

**Results:** In 76 cases we analyzed, there were 50 women and 26 men. In 53 cases patients belonged to the age group from 70 to 84. The acute CI was reported in 55 cases, while the rest of patients had recurrent CI. The duration of hospitalization varied from 0 to 3 days (29 cases), from 4 to 7 days (23 cases), and from 14 to 15 days (8 cases). In the autopsy report, the pathologist reported atherosclerosis of the vessels of the Willis' circle, and signs of arterial hypertension in all cases. In 15 cases the autopsy showed diseases that were not diagnosed in the clinic but that worsened the condition of the patients, and became the cause of death, including MI, gangrenous bowel, and colon cancer

**Conclusion:** The analysis of autopsy demonstrated, that CI became the cause of death for 28 percent of all patients accepted by the clinic. Conditions that were the fundamental cause were not diagnosed in 20 percent of cases, so CI was considered the major cause of death.

### WSC-1278

#### Cerebrovascular Occlusive Disease Prognosis of severe vertebral artery involvement in giant cell arteritis

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Giant cell arteritis (GCA) of the vertebral artery (VA) is a rare but serious cause of ischemic stroke. Little is known about the long-term clinical outcome and medical therapy of GCA with VA involvement, particularly in case of high grade stenosis or occlusion of VA.

**Methods:** We analyzed 559 consecutive patients referred to our ultrasound (US) lab between 1/2002 and 2/2011 with suspected GCA. 160 patients showed typical US-findings, 32 with VA-involvement (20%), 8 with (5%) high grade VA-stenosis or occlusion. The latter patients were investigated regarding treatment, course of VA occlusive disease and clinical outcome based on routine follow-up.

**Results:** 3/8 patients presented with ischemic stroke in the vertebrobasilar territory. All patients had at least one-sided severe VA-stenosis. 6/8 patients had follow-up US examination after 10 months. 7/8 patients had clinical follow-up after of 33 months (median). Follow-up US showed persistent wall-thickening in 5/6 patients with persistent severe stenosis or occlusion. All patients received platelet inhibitors and cortisone, 2/8 patients additionally methotrexate, 1/8 pulsatile i.v.-cyclophosphamide, 2/8 azathioprine. The different treatment strategies had no impact on ultrasound findings. One patient died of unknown cause 2 months after deliberate discontinuation of all medical therapy while the other 6 patients did not experience further cerebrovascular events.

**Conclusion:** Severe VA involvement with GCA bears a high risk of stroke. Recurrent stroke after initiation of immunosuppressive and antiplatelet treatment is rare and long-term outcome good. VA stenoses persist in the majority of cases. We did not identify a clear of superiority of one immunotherapeutic approach.

### WSC-1391

#### Cerebrovascular Occlusive Disease An unusual fatal case of adult onset moyamoya syndrome

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Moya Moya disease is a chronic, progressive occlusion of the intracranial blood vessels leading upto the characteristic collateral vessels seen on

cerebral angiography. This is predominantly a disease occurring in Japanese populations and it is underrecognized cause of stroke in western population.

The presentation differs substantially between children and adults. Ischemic events are commoner in children and hemorrhagic events are commoner in adults.

There are no large European population study available to inform about the presentation and prognosis in caucasian populations.

We report a case of rapidly progressive moyama syndrome in a young caucasian woman who presented as ischemic stroke and this rapidly progressed with multiple episodes of hemodynamic TIA. She was emotionally labile and crying precipitated her symptoms.

She has past history of recurrent migraine with visual aura and her initial presentation was consistent with typical migraine aura with hemisensory symptoms. However she later on developed persistent focal motor deficits which warranted cranial imaging.

Her cranial imaging shows characteristic angiographic features of generalized Moyamoya in the carotid and dependent territory on both sides of various degrees of severity.

Vasculitic process, sickle cell disease and other secondary causes of moyama syndrome were excluded.

She was treated with Encephaloduroarteriosynangiosis (EDAS) as an emergency procedure but unfortunately she had a relentless progression with fresh infarction and malignant cerebral edema.

Our case highlights the need for registry study of Moyamoya disease in United Kingdom. This would help to understand the natural history and the effective revascularisation procedure in adult Caucasian population.

#### WSC-0432

##### Cerebrovascular Occlusive Disease Histopathological analysis of thrombi retrieved by endovascular mechanical extraction during acute ischemic stroke

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**Introduction:** Examination of freshly retrieved thrombi during acute ischemic stroke could help to improve our knowledge of stroke pathophysiology, may forecast response to treatment and soon might be expected to play a role in shaping success of treatment approaches after patient selection.

**Aim:** The purpose of this study is to provide information regarding histopathological structure of fresh thrombi retrieved by endovascular mechanical extraction during acute ischemic stroke.

**Methods:** This study describes the histopathological analysis of thrombi retrieved by endovascular mechanical extraction from anterior and posterior circulation arteries of 49 consecutive patients with acute stroke.

**Results:** Among 49 patients, mean age was 67 years with 47% females. Of retrieved clots, 19 (38.8%) were mixed, 16 (32.6%) RBC dominant and 14 (28.6%) fibrin dominant. Despite the presence of common components of fibrin-platelets, nucleated cells (neutrophil/monocyte) and RBC's in all the cases, there was a large diversity of histological pattern as well as in quantitative proportion of different components both within each thrombus and across the various thrombi. There was no association of thrombus histology with presumed stroke aetiology, site of occlusion and reperfusion status.

**Conclusions:** The histopathologic assessment of fresh thrombi with light microscopy permits new understanding of the pathogenesis of and treatment for large-vessel ischemic stroke.

#### WSC-0570

##### Cerebrovascular Occlusive Disease Comparison of risk of brain infarction between carotid endarterectomy and stenting: A prospective randomized study

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**Introduction:** Silent brain infarctions can be detected in up to 34% of patients after carotid endarterectomy (CEA) and in up to 54% of patients after carotid stenting (CAS).

**Aims:** The aim of the study was to compare the risk of new brain infarctions in patients with internal carotid artery (ICA) stenosis >70% undergoing CEA or CAS.

**Methods:** All consecutive patients with ICA stenosis >70% indicated to carotid intervention were screened to the prospective study. Patients eligible for both methods were allocated randomly to CEA or CAS. Neurological examination, cognitive function tests and brain magnetic resonance imaging (MRI) were performed before and 24 h after intervention in all patients.

**Results:** Out of 150 randomized patients, 73 patients (47 males, mean age 64.9 ± 7.0 years) underwent CEA and 77 patients (58 males, mean age 66.4 ± 7.5 years) underwent CAS. New brain infarctions on control MRI were found more frequently in patients after CAS (49.4% vs. 24.7%,  $P < 0.001$ ). Volume of lesions was also significantly higher in CAS group ( $P = 0.01$ ). Multiple logistic regression analysis showed only right ICA intervention as the independent predictor of brain infarction (OR = 2.09, 95% CI: 1.033–4.250,  $P = 0.04$ ). Stroke or TIA occurred in 1 patient after CEA and in 2 patients after CAS ( $P > 0.05$ ). No significant differences were found in cognitive tests between groups ( $P > 0.05$ ).

**Conclusions:** The study results confirm higher risk of the occurrence of silent brain infarctions on MRI after CAS in comparison with CEA. Trial registration: www.clinicaltrials.gov, No. NCT 01591005.

#### WSC-1595

##### Cerebrovascular Occlusive Disease Prognostic significance of monocyte chemotactic protein -1 in screening of early postoperative carotid restenosis

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**Introduction:** Early screening of patients with carotid artery stenosis as well as postoperative ultrasound follow up of thrombendarterectomy

(CEA) treatment is paramount in primary and secondary prevention of stroke.

**Research aim:** Monocyte chemotactic protein (MCP-1) are of great significance in this process, therefore we can put MCP-1 as one of the earliest signs of endothelial dysfunction. We attempted to ascertain the prognostic value of determining MCP-1 in system circulation with the purpose of early screening and discovery of patients with a high risk of carotid restenosis.

**Patients and methods:** In our study we included 75 patients with carotid artery stenosis. After CEA we scheduled an ultrasonographic follow up according to a 7, 30 and 90 day after CEA, in order to early discover developing carotid artery restenosis. MCP-1 serum levels have been determined using ELISA method and a procedure where we implemented follow up according to a 0, 2 and 90 day after CEA algorithm.

**Results:** A statistically significant difference between stenosis and restenosis groups has been determined. The groups were divided into subgroups according to MCP-1 plasma levels found on day 0 (before CEA)  $\chi^2 = 4,66$ ;  $p = 0,031$  and on day 90 after CEA  $\chi^2 = 4,66$ ;  $p = 0,031$ .

**Conclusion:** With these results we verified a key hypothesis of this study in confirming a prognostic value of determining serum MCP-1 levels in patients prior and after CEA. Now we can recognize potential for restenosis in patients with carotid artery stenosis and implement intensive combined follow up both before and after CEA.

## WSC-1554

### Cerebrovascular Occlusive Disease

#### Lacunar infarcts: Correlation of clinical syndrome with imaging lesion, angiographic findings, and cognitive function

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**Introduction:** Correlation of cerebral lacunes with intracranial angiopathy and with resultant cognitive dysfunction is incompletely delineated.

**Aims:** To correlate acute lacunar syndrome with imaging (MRI), angiography and cognitive dysfunction.

**Methodology:** Prospective, serial recruitment -82 patients, over 1.5 years, in tertiary municipal hospital.

MMSE, Addenbrooke's examination (ACER) -46 patients.

Angiography -every 8th patient (12).

Stat.- W-SPSS – v11.

**Results:** Average age 49.2 years.  
12 females.

1] Clinical syndromes -

A) -Pure motor 58/82 -

31 internal capsule,

8 gangliocapsular,

6 brain stem,

5 corona radiata,

5 gangliocapsular plus cortical,

3 multiple lacunes.

B) Sensory motor 12/82. -Thalamic 6, gangliocapsular plus cortical 3, Internal capsule 2, corona radiata 1.

C) Ataxia- hemiparesis 5/82. 3 gangliocapsular & cortical, 2 brain stem.

D) Dysarthria clumsy hand (DCH) 3/82, all internal capsule.

E) Pure Dysarthria, lateral medullary and Foville's syndrome- 1 patient each, all in brainstem.

F) Overall, PMS was the commonest syndrome.

G) Brain-stem lacunes accounted for 18.3% cases.

H) Multiple lacunes were seen in 14/82 patients (11 were cortical), raising question of embolic etiology.

2] Angiographies – 8/12 abnormal- distal intracranial stenosis 4/8 (50%), proximal stenosis 3/8 (37.5%), both in 1/8 patients (12.5%). Arterial stenosis & lesion concordant in 7/8 patients.

3] Echo-hypertensive heart – 43.4%, Ischemic – 5.6%, both 30.2%.

4) Prior TIA in concordant territory seen in 24.5%, prior stroke in 13.2% patients.

5) ACER < 87 in 32/46 (69.5%). Poor scores correlated with Pure motor syndrome (localization IC), and multiplicity of lacunes.

**Recommendations:** Co-relation of lacunar strokes with intracranial stenosis and executive dysfunction merits further study.

## WSC-0889

### Cerebrovascular Occlusive Disease

#### Metabolic changes in symptomatic atherosclerotic large-artery occlusive disease evaluated by proton magnetic resonance spectroscopy

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**Introduction:** Proton MR spectroscopy (MRS) is valuable for identifying metabolic changes occurring during brain ischemia. Although N-acetylaspartate (NAA) measurement by MRS is shown to be useful to detect neuronal damage in acute stage of cerebral ischemia, clinical significance and the availability of the NAA measurement in chronic stage of cerebral ischemia are still obscure[1–3]. We examined a serial change of NAA/Creatinin (Cr) ratio in patients who underwent EC-IC bypass in chronic stage of ischemia and investigated the influence of revascularization surgery on the brain metabolism.

**Material and methods:** Between October 2009 and December 2010, 14 patients with symptomatic atherosclerotic large-artery occlusive disease were treated in our institute. Nine patients who underwent EC-IC bypass, five patients who received conservative treatment, and three healthy volunteers were studied. <sup>1</sup>H-MRS was obtained using Philips Achieva 3.0T. Multi-voxel spectra were recorded using a SE-2D-CSI sequence (TR/TE = 2000/288 ms). The volume of interest was placed in the frontal white matter of both hemispheres axially above the lateral ventricles. Surgery was done on average 45 days after the onset. <sup>1</sup>H-MRS was performed before and 1week, 1 and 3 months after surgery. In the conservative treatment group, <sup>1</sup>H-MRS was performed 1, 2 and 4 months after the onset of cerebral infarction. Serial change of ischemia/contralateral side ratio (I/C ratio) of NAA/Cr between bypass group and conservative treatment group was compared.

**Results:** In the healthy volunteer group, laterality of NAA/Cr and the serial change were not seen. Six patients in bypass group had significant lower NAA/Cr on the affected side compared to the contralateral side at 1 month after onset. In these patients, I/C ratio of NAA/Cr was increased 11 percentage point after 3months from surgery. All patients in the conservative treatment group also had significant lower NAA/Cr on the affected side, but I/C ratio of NAA/Cr was increased 3 percentage point in duration of 3 months after onset. The improvement range of I/C ratio of NAA/Cr was significantly higher in bypass surgery group.

**Conclusions:** The present study demonstrated that decreased NAA/Cr shown in the chronic stage of cerebral ischemia is reversible. MRS may provide useful information of impaired metabolic state in patients with chronic stage of cerebral ischemia.

**WSC-0411****Cerebrovascular Occlusive Disease  
The association between congestive heart failure and  
occlusion of internal carotid artery in acute ischemic  
stroke with atrial fibrillation: The SAMURAI-NVAF  
Study**J Takasugi<sup>1</sup>, H Yamagami<sup>1</sup>, K Toyoda<sup>2</sup>, The SAMURAI Investigators<sup>3</sup><sup>1</sup>Department of Neurology, National Cerebral and Cardiovascular Center, Suita Osaka, Japan<sup>2</sup>Department of Cerebrovascular Medicine, National Cerebral and Cardiovascular Center, Suita Osaka, Japan<sup>3</sup>Japan

**Introduction and aims:** As congestive heart failure (CHF) is related to poor anticoagulation control, it may cause larger clots formation. We sought to clarify the association between CHF and occlusion of internal carotid artery (ICAO) in patients with acute ischemic stroke and nonvalvular atrial fibrillation (NVAF).

**Methods:** Between Sep 2011 and Mar 2014, 1058 acute ischemic stroke/TIA patients with NVAF were registered from a multicenter prospective registry (the SAMURAI-NVAF study, NCT01581502). Of those, patients who were evaluated with cerebrovascular images on admission were assessed. CHF was defined as any symptomatic heart failure or left ventricular ejection fraction < 40%.

**Results:** Of a total of 974 patients (442 women, 78 ± 10 years), 114 (12%) had ICAO on admission. CHF was more frequent in patients with ICAO than those without (32% vs. 19%,  $p=0.02$ ). After multivariate analysis, CHF was independently associated with ICAO (OR, 1.67; 95% CI, 1.06–2.58). In patients treated with warfarin ( $n = 277$ , 78 ± 9 years), CHF prevalence was higher (52% vs. 22%,  $p < 0.001$ ) and median PT-INR levels were lower (1.21 vs. 1.36,  $p = 0.071$ ) in patients with ICAO than those without, and CHF was independently associated with ICAO (OR, 3.50; 95% CI, 1.50–8.23). However, in patients without receiving anticoagulants, prevalence of CHF was similar between patients with and without ICAO (22% vs. 18%,  $p = 0.28$ ).

**Conclusions:** In acute ischemic stroke patients with NVAF, CHF was associated with ICAO especially in patients taking warfarin. Strict control of PT-INR is required in NVAF patients with CHF.

**WSC-1141****Cerebrovascular Occlusive Disease  
Juxtaluminal echodensity as an index of the unstable  
carotid plaque**T Tegos<sup>1</sup>, G Stefanou<sup>2</sup>, A Petrakis<sup>3</sup>, A Valavanis<sup>3</sup>, A Safouris<sup>3</sup>, K Notas<sup>3</sup>, A Papadimitriou<sup>3</sup>, A Delopoulos<sup>2</sup>, A Orologas<sup>3</sup><sup>1</sup>A Neurology Department, AHEPA University Hospital Aristotelian University, Thessaloniki, Greece<sup>2</sup>Division of Electronics & Computer Engineering, Aristotelian University, Thessaloniki, Greece<sup>3</sup>A Neurology Department, AHEPA University Hospital Aristotelian University, Thessaloniki, Greece

**Introduction:** Previous studies concluded that carotid plaque echodensity on ultrasound determines cerebrovascular symptomatology.

**Aims:** The aim of this study was to determine whether juxtaluminal plaque echodensity constitutes a better discriminator of the symptomatic and asymptomatic status, as compared to global plaque echodensity, in various degrees of stenosis.

**Methods:** Analysis performed on ultrasound images of 154 carotid plaques of more than 50% stenosis (65 symptomatic, 89 asymptomatic), in a computer. The global plaque Gray Scale Median ( $GSM_{global}$ ) and the juxtaluminal 25% plaque area  $GSM$  ( $GSM_{j125\%}$ ) were evaluated in the same software.

**Results:** In the group of plaques with 50–70% stenosis ( $n = 71$ ), the symptomatic ones were associated with median  $GSM_{global}$  of 14 whereas the asymptomatic of 35.5 ( $p = 0.01$ ). The corresponding values for median  $GSM_{j125\%}$  were: 5 for symptomatic plaques and 41 for asymptomatic ones ( $p = 0.0001$ ). ROC curves demonstrated a better ability of  $GSM_{j125\%}$  over  $GSM_{global}$  in separating symptomatic from asymptomatic plaques ( $p = 0.014$ ). In the group of plaques with 71–99% stenosis ( $n = 83$ ) the corresponding values were: median  $GSM_{global}$  (symptomatic: 3.5, asymptomatic: 22), median  $GSM_{j125\%}$  (symptomatic: 0, asymptomatic: 36). ROC curves failed to demonstrate an adequate ability of  $GSM_{j125\%}$  over  $GSM_{global}$  in separating symptomatic from asymptomatic plaques ( $p = 0.074$ ).

**Conclusions:** Our results suggested that  $GSM_{j125\%}$  might have a more adequate ability over  $GSM_{global}$  in separating symptomatic and asymptomatic plaques, only in the range of 50–70% stenosis. This position should be addressed in larger, properly conducted studies of plaques with less severe stenosis, a group that, at present, is managed conservatively.

**WSC-0764****Cerebrovascular Occlusive Disease  
Microembolic signals and stroke recurrence in  
symptomatic carotid artery stenosis**G Tekgol Uzuner<sup>1</sup>, A O Ozdemir<sup>1</sup>, N Uzuner<sup>1</sup><sup>1</sup>Neurology, Eskisehir Osmangazi University, Eskisehir, Turkey

**Introduction:** Relationship with microembolic signal occurrence and symptomatic carotid artery stenosis and concomitance for stroke recurrence still needs to be investigated.

**Aim:** We aimed to evaluate the prevalence of microembolic signals (MES) in patients with symptomatic carotid artery stenosis (CAS), and the relationship between the presence of MES and stroke recurrence.

**Methods:** We performed transcranial Doppler ultrasound in patients with symptomatic CAS within 7 days of symptom onset after ischemic stroke. All patients underwent carotid Doppler ultrasound and cerebral CT or MRI as indicated. Clinical evaluation was done 1 and 6 month after the baseline event.

**Results:** Six hundred stroke patients underwent carotid and vertebral ultrasound. Only 75 patients have symptomatic CAS underwent TCD examination. The prevalence of MES was 15% (11 patients). Among them, only 5 patients had recurrent stroke or TIA. We did not detect any relationship between the presence of MES and the occurrence of recurrent cerebrovascular events ( $p = 1.153$ ). More patients with MES had intraluminal thrombus compared with patients without MES ( $p < 0.001$ ). MES positive patients had more unstable plaques in carotid ultrasound compared with MES negative patients.

**Conclusions:** The prevalence of MES in patients with symptomatic CAS is found lower than the previous reports. The lower prevalence of MES in our current study may be due to aggressive medical therapy. However, symptomatic CAS patients with unstable carotid plaques may have higher recurrent stroke risk, and aggressive medical therapy would reduce recurrent stroke risk.

**WSC-0326****Cerebrovascular Occlusive Disease  
Cerebrovascular reactivity in patients with obstructive  
sleep apnea**G Tekgol Uzuner<sup>1</sup>, N Uzuner<sup>1</sup>, O Erdinc<sup>1</sup><sup>1</sup>Neurology, Eskisehir Osmangazi University, Eskisehir, Turkey

**Introduction:** Endothelial dysfunction has been shown in patients with obstructive sleep apnea syndrome (OSAS). Cerebrovascular reactivity is partly related to endothelial function.

**Aims:** We investigated cerebral vascular reactivity using breath holding in patients with OSAS by means of transcranial Doppler (TCD).

**Methods:** Data were collected 49 patients who have moderate to severe OSAS (an apnea hypopnea index of >15/hour), and compared with those of 15 healthy subjects matched for age and vascular risk factors.

**Results:** Since there is no significant side differences, the Doppler data of the left and right sides were pooled both in patients and controls. Thus, 98 vessels in patients and 30 vessels in controls were analyzed. OSAS patients showed significantly lower reactivity to breath holding with respect to controls (36.9% vs. 46.6%;  $p < 0.02$ ).

**Conclusion:** These data demonstrate a diminished vasodilator reserve in OSAS patients. OSA has been implicated in the pathogenesis stroke, which are associated with impaired endothelial responses. Lower cerebrovascular reactivity as shown by TCD may be used a predictor.

## WSC-0759

### Cerebrovascular Occlusive Disease Is cerebral ischemia on diffusion-weighted imaging after revascularization of carotid stenosis a surrogate outcome measure for peri-procedural stroke? A systematic review and meta-analysis

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**Aim:** To investigate if DWI lesions after carotid artery stenting (CAS) or endarterectomy (CEA) provide a surrogate outcome measure for peri-procedural stroke.

**Methods:** We selected all studies where DWI scans were obtained before and within 7 days after CAS or CEA for symptomatic or asymptomatic carotid stenosis. The clinical outcome was ischemic hemispheric stroke up to 30 days after treatment. The surrogate outcome was the presence of  $\geq 1$  new DWI lesion after treatment (DWI+). The correlation between the log odds of stroke and DWI+ was estimated in a bivariate random effects logistic regression model across studies and subgroups for CAS and CEA separately. Relative risks of DWI+ and stroke in studies comparing CAS vs. CEA were estimated using fixed-effect Mantel-Haenszel models.

**Results:** 54 studies, reporting 53 separate CAS subgroups (2754 procedures) and 20 separate CEA subgroups (1144 procedures) were included. The average risks of DWI+ and stroke were 35.8% and 3.5% in CAS patients and 11.5% and 1.8% in CEA patients, respectively. Across CAS subgroups, the log odds of DWI+ correlated significantly with the log odds of stroke (correlation coefficient 0.65,  $p = 0.032$ ). Correlation was not significant across CEA subgroups. In 13 studies comparing CAS vs. CEA, the relative risks (95% confidence intervals) of DWI+ and stroke were 4.09 (3.24–5.17) and 2.50 (1.42–4.40), respectively.

**Conclusion:** These findings support the use of DWI as a surrogate outcome measure for peri-procedural stroke in CAS. Randomized studies comparing treatment effects on DWI lesions and clinical stroke are needed to further validate surrogacy.

## WSC-0778

### Cerebrovascular Occlusive Disease Cervical artery dissection in patients aged > or = 60 years

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**Aim:** Cervical Artery Dissection (CeAD) is a major cause of stroke in the young. Little is known about CeAD in the elderly. We aimed at determining the frequency of patients aged  $\geq 60$  among CeAD patients and at identifying characteristics of CeAD patients in this age group.

**Methods:** In two large CeAD cohorts (Cervical Artery Dissection and Ischemic Stroke Patients [CADISP] and the Paris-Bern-Zurich-CeAD Registry [PBZ]) we compared clinical characteristics, risk factors and vascular findings in patients  $\geq 60$  vs.  $< 60$  years of age. For each variable, we performed univariate statistical analysis (Mantel-Haenszel) with calculation of unadjusted odds ratios (OR, [CI 95%]) with 95% confidence intervals across both cohorts.

**Results:** We identified 128 patients aged  $\geq 60$  years out of 2115 CeAD patients [6% total; 5.7% (CADISP); 6.3% (PBZ)]. Across both cohorts, prior trauma (OR 0.44 [0.27–0.72]) and cervical pain (OR 0.46 [0.31–0.68]) were less common in patients  $\geq 60$  years. Hypertension (OR 2.59 [1.8–3.74]), and internal carotid artery as site of dissection (OR 1.85 [1.21–2.83]) were more common in the older age group. Diabetes mellitus, hypercholesterolemia, occlusion of the dissected artery, stroke or TIA as presenting symptom and presence of Horner syndrome did not differ between the age groups.

**Conclusion:** This analysis suggests that about every twentieth CeAD patient is aged  $\geq 60$  years. Due to the lower frequency of prior trauma and cervical pain, the diagnosis of CeAD can be more challenging in elderly patients than in the young, and the risk of missed diagnosis might be higher.

## WSC-0371

### Cerebrovascular Occlusive Disease Indication for surgical treatment of carotid arterial stenosis in high-risk patients using plaque diagnosis

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**Introduction and aims:** The indication for carotid endarterectomy (CEA) or carotid artery stenting (CAS) has not been established. CEA is more appropriate than CAS if soft atherosclerotic plaques are included in the stenotic lesion. We report our clinical results of CEA and CAS and suggest an appropriate treatment strategy using plaque diagnosis, especially for high-risk patients.

**Methods:** CEA was considered the first choice of the surgical treatment for severe carotid stenosis, especially with eccentric or tortuous lesion, and

a narrow residual lumen with massive soft plaque. CAS was chosen when CEA was considered to be high risk with: 1) a contra lateral ICA lesion, 2) distal carotid lesion, 3) medical risk factors, such as untreated coronary heart disease. From January 2001 to December 2013, we surgically treated carotid stenosis in 241 lesions by CEA and 309 lesions by CAS. Symptomatic stenosis was 67% and the average stenotic rate was 82% in CEA group, and symptomatic stenosis was 61% and the average stenotic rate was 66% in CAS group.

**Results:** Stenosis of carotid arteries was relieved in all cases after CEA or CAS. Perioperative mortality with CEA and CAS was 0.4% (1/241) and 0.3% (1/309), respectively. Morbidity by ischemic stroke with CEA and CAS was 2.9% (7/241) and 1.6% (5/309), respectively. Surgical morbidity and the long-term outcome after CAS is not inferior to that after CEA even in high risk patients.

**Conclusion:** Carotid stenotic lesions can be treated with comparably low morbidity and mortality rates using CEA and/or CAS even for high risk patients, when appropriate surgical methods are selected considering each characteristic of carotid stenosis using plaque diagnosis.

### WSC-0813

#### Cerebrovascular Occlusive Disease

##### The efficacy of rosuvastatin on carotid intima media thickness

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**Purpose:** Lipid-lowering therapy with statin has been shown to reduce cardiovascular events and progression of intima-media thickness (IMT) in a large number of studies. However, the progression of IMT in ischemic stroke patients remains unclear. We investigated the effect of rosuvastatin on carotid IMT progression.

**Methods:** Twenty-three outpatients with ischemic stroke (13 males and 10 females) were enrolled. All had hypercholesterolemia and were treated with rosuvastatin. Maximum common carotid IMT (C-IMT) was measured by B-mode ultrasonography before and after treatment with rosuvastatin.

**Results:** The average dosage of rosuvastatin was 3.1 mg/day, and the mean observation period was 11.2 months. The reduction of mean LDL cholesterol level was 38.6%, and that of C-IMT was 9.05%.

**Conclusion:** Carotid IMT progression strongly correlated with LDL-C reduction. Furthermore, it was possible that the reduction rate of C-IMT with rosuvastatin treatment was better in Japanese patients than in Caucasian.

### WSC-0262

#### Cerebrovascular Occlusive Disease

##### Time course of depression and correlated factors in patients with ischemic stroke in China

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**Introduction:** Post stroke depression (PSD) generally runs a chronic course and is related to adverse outcomes, especially PSD with recurrent or persistent course.

**Aims:** To determine the correlated factors for different categories of the course of PSD in patients with ischemic stroke in China.

**Methods:** A total of 1383 patients, who were diagnosed with ischemic stroke and attended 4 follow-up visits at 14 ± 2 days, 3-month, 6-month and 1-year after stroke, were enrolled in the study. PSD was diagnosed according to DSM-IV. The course of PSD was divided into 3 categories: no depression, transient depression, and recurrent/persistent depression. Poor prognosis was defined as modified Rankin Score ≥2 at 1-year.

**Results:** 834 (60.3%), 389 (28.1%), 160 (11.6%) patients were categorized into no depression, transient depression and recurrent/persistent depression, respectively. In the multinomial logistic regression analyses, model 1 (no depression as reference) showed that HAMD score on 14 ± 2 days and stroke recurrence were both associated with transient and persistent/recurrent depression. Besides that, NIHSS score on admission were also found to be associated with persistent/recurrent depression. In model 2 (transient depression as reference), NIHSS score on admission, ischemic lesions on frontal lobe, history of dyslipidemia and stroke recurrence were considered to be correlated factors for persistent/recurrent depression.

**Conclusions:** Stroke recurrence increases the risk for PSD. Ischemic stroke survivors who have severe neurologic impairment, lesions on frontal lobe, history of dyslipidemia, once diagnosed of PSD, they might have higher risk for experiencing persistent or recurrent depression and should be provided long-term and periodical screening, evaluation and treatment.

### WSC-0466

#### Cerebrovascular Occlusive Disease

##### Angioplasty and stenting for extracranial vertebral artery stenosis: CISR

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**Introduction:** Large sample registry on angioplasty and/or stenting in extracranial vertebral artery stenosis (ECVAS) is lacking.

**Objective:** To evaluate the technical success, periprocedural events, long-term clinical outcomes on consecutive patients who underwent angioplasty and/or stenting in ECVAS in China.

**Methods:** Seven medical centers in China prospectively enrolled consecutive patients undergone angioplasty and/or stenting in ECVAS between Jan 2004 and Jan 2013. We collected patients' clinical histories, symptoms, technical success and clinical outcomes of transient ischemic attack (TIA), stroke or death.

**Results:** Six-hundred and ninety-five patients with 760 treated ECVAS were included, and 452 patients were followed-up. The technical success rate, periprocedural events rate and 6-month in-stent restenosis rate was 94.7% (658/695), 2.6% (18/695) and 13.8% (18/130), respectively. With a median follow-up duration of 17 months, the composite events rate of TIA, stroke or death was 10.6% (48/452). Systolic blood pressure at admission (hazard ratio [HR] 1.016, 95% confidence interval [CI]: 1.002–1.030), chronic heart failure (HR 7.690, 95% CI: 1.761–33.582), NIHSS ≥4 (HR 2.859, 95% CI: 1.499–5.451) and extracranial vertebral artery (VA) with concomitant intracranial vertebral artery and basilar artery (VBA) angioplasty and stenting (HR 4.674, 95% CI: 1.922–11.368) contributed independently to the composite events.

**Conclusions:** Angioplasty and stenting has high rate of technical success and low periprocedural events rate for ECVAS in China. Systolic blood

pressure at admission, chronic heart failure, NIHSS $\geq$ 4 and extracranial VA with concomitant intracranial VBA angioplasty and stenting increased the risk for composite events of TIA, stroke and/or death.

### WSC-1486

#### Cerebrovascular Occlusive Disease Stroke risk of combined coronary artery bypass graft surgery and carotid endarterectomy in asymptomatic carotid artery disease

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**Introduction:** Atherosclerosis is a systemic disorder and co-existence of coronary artery disease (CAD) with carotid artery disease (CAD) is quite frequent. With an advancing age spectrum among CAD patients even an asymptomatic carotid artery disease can be the cause of serious morbidity during coronary revascularization. Therefore surgery combining both arterial territories is increasingly performed.

**Aims:** To assess perioperative and postoperative neurological outcome in patients undergoing combined coronary artery bypass graft surgery (CABG) and carotid endarterectomy (CEA).

**Methods:** Patients with severe asymptomatic CAD undergoing combined CABG and CEA have been assessed for neurological complications both during and one year following surgery. All patients receiving indication of CABG underwent carotid Doppler US and angiography. All patients were assessed for possible previous neurological symptoms and signs.

**Results:** A total 22 patients, aged 52–89 (mean 64 yr), 16 men and 6 women have been included in the study. Two out of 22 patients (9%) experienced a transient neurological deficit during the early postoperative period. No long-term stroke or mortalities were observed.

**Conclusions:** The 9% rate of early postoperative TIA is comparable to the literature. This small series helps in demonstrating the feasibility of combined CABG and CEA in patients with severe asymptomatic carotid artery disease.

### WSC-0789

#### Cerebrovascular Occlusive Disease Hypothalamic proline-rich peptide-1 new therapeutic agent for treatment of cerebrovascular disorders

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**Background:** The aim of the study was to investigate the effectiveness of new discovered hypothalamic proline-rich peptide-1 (PRP-1) on local cerebral blood flow (LCBF) of rats during cerebrovascular disorders.

**Methods:** Experiments were carried out on adult, male, albino rats weighting 200–240g (n = 18). Rats were anesthetized by Nembutal and cerebrovascular disorders were induced by right common carotid artery occlusion (rCCAO). A continuous Laser-Doppler-Flowmeter (Transonic Systems Inc.BLF-21 U.S.A) was used to monitor (LCBF) (during 140 minutes) the right hemisphere. Animal were divided into 2 groups:

control and PRP-1 treated (20  $\mu$ g/kg). For both groups cerebral blood flow (CBF) was measured during normal conditions, and after rCCAO. LCBF data were expressed as percentages of the respective basal values. Multiple comparisons were indicated by Student *t* test. Differences were considered significant at  $p < 0.01$  level.

**Results:** Data indicates that due to rCCAO normal cerebral blood flow is reduced by 36–37% ( $p < 0.01$ ) from its basal value. After 40 minutes of PRP-1 i/p injection it was noticeable the confidential improvement of reduced CBF, that achieves its beneficial value after 90 minutes by 47–48% ( $p < 0.01$ ), which even exceeds its basal value.

**Conclusions:** Obtained data evident that PRP-1 could be investigated as a new source for new component as a treatment tool for cerebrovascular blood flow disorders, based on the ability of PRP-1 to recover damaged cerebral blood supply.

Taking into consideration wide action spectrum of PRP-1 and our experimental results it could be concluded that PRP-1 can be used for the treatment of cerebrovascular disorders.

### WSC-0876

#### Cerebrovascular Occlusive Disease Arterial stiffness is associated with white matter hyperintensities of supratentorial lesions in patients with acute ischemic stroke

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**Introduction:** White matter hyperintensities (WMH) are common manifestations of small vessel disease. Pulse wave velocity (PWV), which is a measure of arterial stiffness, was found to be one of the predictors of stroke in population-based study.

**Aims:** We investigated the association between PWV and WMH in patients with acute ischemic stroke.

**Methods:** We included 171 patients with acute cerebral infarctions or transient ischemic attacks who underwent PWV and brain MRI. Severity of WMH on FLAIR images was assessed using Scheltens visual rating scale which was calculated by summation of the periventricular, lobar, basal ganglia and infratentorial lesions. Arterial stiffness was assessed by measuring brachial-ankle PWV (baPWV).

**Results:** Patients with higher baPWV tended to have a higher Scheltens score, age, systolic or diastolic blood pressure, pulse pressure and heart rate, and lower hemoglobin and glomerular filtration rate ( $p < 0.05$ ). Multiple linear regression analysis revealed that Scheltens score ( $\beta = 0.236$ ,  $p = 0.001$ ), age ( $\beta = 0.259$ ,  $p < 0.001$ ), pulse pressure ( $\beta = 0.306$ ,  $p < 0.001$ ) and heart rate ( $\beta = 0.228$ ,  $p < 0.001$ ) were independent determinants of baPWV. Patients with higher baPWV had significantly more severe WMH in the periventricular, lobar and basal ganglia lesions ( $p < 0.001$ ), but not in the infratentorial lesions ( $p = 0.321$ ).

**Conclusions:** Arterial stiffness is associated with periventricular, lobar or basal ganglia WMH but not infratentorial lesions. These findings suggest that increased peripheral arterial stiffness results in increased pulsatility with transmission to the cerebral small vessels resulting WMH in acute ischemic stroke.

### WSC-1615

#### Diagnosis Spontaneous exaggerated postural reflex in acute in acute ischemic stroke

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**Introduction:** Involuntary movements are known in the hemorrhagic stroke. It is attempt that a suddenly lesion of the basal ganglia of the brain to produce an unexpected movements.

**Aims:** In this work we want to present any involuntary movements which appears in the initial phase of the ischemic stroke.

**Methods:** For the approach we studied all patients with acute ischemic stroke in the anterior circulation who involve the basal ganglia. All the patients were submitted to physical and neurological examination, blood exam and CT scans and/or MRI exams. The patients who survive was follow up periodically. Involuntary movements were video recorded.

**Results:** At the 87 patients with affected basal ganglia in the ischemic stroke had has appeared stereotypes movements, which were observed periodically at every 1–2 minutes. The movements had 2 components: the rapid one who last for 8–10 seconds and who consist in the dorsal clonoid flexion of the foot and sometimes the flexion of the shank near the knee articulation. This movement was followed by a relaxation phase, when the foot came back to the initial position. On the part with involuntary movements the patients present hemiparesis and spasticity. The patients were sleepy or comatous. The initial brain CT scans were normally in the first 24 hours. After 24 hours the CT scans revealed a low density area present in the lenticular nucleus, on the opposite side of the involuntary movements. At all patients who were explored with MRI exams, these were modified from the first 24 hours they were admitted in the hospital. From all 87 patients, only 82 survived. The prognosis is good if the patient is treat in a short time from the initial symptoms. Neither one of these patients had received thrombolysis therapy.

**Conclusions:** The aim of this work was only to describe the new involuntary movements with diagnosis value in acute ischemic stroke who affect the basal ganglia.

## WSC-0712

### Epidemiology of Stroke

#### The Bahrain National Stroke Care Audit: From acute event to hospital discharge

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**Introduction:** Data on management of stroke in the Arab world is relatively scarce.

**Aims:** To determine national risk factors and outcomes for stroke in Bahrain and compare this with the UK National Sentinel Stroke Audit 2006 and the Irish National Audit of Stroke Care (INASC).

**Methods:** The hospital records of all patients with stroke admitted to government hospitals in Bahrain in 2011 (n = 521) were examined, using the Sentinel Stroke Audit proforma.

**Results:** Incidence of stroke was 60/100,000 population. However, there was a high prevalence of risk factors for stroke (diabetes in 54%; hypertension 75%; hyperlipidemia 34%). Bahrain scored 30/100 for the 12 UK 2006 Sentinel Stroke Audit indicators of stroke care, compared to 65 in the UK and 30 in INASC. 88% of patients were scanned within 24 hours and 86% with nonhemorrhagic strokes were commenced on aspirin within 48 hours. Standards of care between Bahraini and non-Bahraini patients were comparable.

**Conclusion:** The low incidence of stroke in Bahrain is a reflection of the young population, but the high prevalence of risk factors suggests a 'ticking time bomb' as the population ages, with a likelihood that this incidence will rise considerably in the coming years. The quality of stroke care is therefore important to this population. Bahrain scored similarly to Ireland in the audit indicators developed by the UK Sentinel study, but this masks a lack of stroke units and a total absence of availability for thrombolysis. Stroke care in Bahrain could be improved through implementation of evidence based measures.

## WSC-1266

### Epidemiology of Stroke

#### Periodical study of stroke incidence and its mortality in hospitals of Ulaanbaatar

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**Background:** We have studied the incidence of stroke and its mortality since 1960s however few studies have been done with its specific time periods. The purpose of our study is to determine the trend of stroke incidence

**Methods:** We analyzed secondary data consisted with the incidence of stroke, its mortality and autopsy analysis integrated from the nine hospitals and four time periodically in 1994–2012. We explored and identified types of stroke, weight of demographic inputs (gender) and per rate of stroke cases in population of a thousand people. It was investigated and compared the rate of mortality cases from autopsy data in accordance to gender and per average in a year. Stroke registration has been started at the Shastin Central Hospital (SCH), State 1st Central Hospital and Bayangol District Hospital for 4 months since 1<sup>st</sup> November 2012. Every stroke case was registered by validating the diagnoses. HBSR was developed according to the methodology of the WHO/Stroke STEPS Surveillance System

**Results:** The mortality from stroke in 1994–1996, 2002–2004, 2008–2009 were 299, 421 and 336 means that the death rate is being increased gradually. The average rate of per year it was increased by 45.8 percent in 2004 than 1996, by 69.1 percent in 2009 than 1996, and by 23.3 percent than 2004. The incidence of stroke has being increased from 2455 to 4365 within 1998, 1999–2008, 2009, the frequency of illness in per population of 1000 people from 2.96 to 5.26. The ratio between ischemic and hemorrhagic stroke was changed from 1:1.44 into 1:1.76. Gender ratio was changed from 1:1 (male:female) to 1:1.2 (t=3.83, p < 0.001) during 2008–2009. During the registration period/ WHO/Stroke STEPS Surveillance System/, a total of 367 stroke cases have been registered from the three hospitals. 198 of them were male and 169 female cases respectively. The ratio of hemorrhagic vs ischemic stroke was 2.3 : 1. There were 38 (10.3%) deaths registered during the registration period and 32 (84.2%) of them were caused by hemorrhagic stroke. Autopsy was done on 76.3% of the stroke deaths.

**Conclusions:** The gradual increase incidence or mortality of stroke in 1994–2012 mean poor stroke prevention among Mongolian population, lack of organized stroke care and need for "stroke unit" in hospitals of city Ulaanbaatar and need continue regular registration of stroke.

## WSC-0190

### Epidemiology of Stroke

#### Peculiarities of risk factors for patients with posterior circulation strokes in different intracranial territories

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Posterior circulation (PC) strokes are different in etiology, heterogeneous in pathogenesis. Huge epidemiologic studies (Framingham, INTERSTROKE) indicated main stroke risk factors, but for more effective primary and secondary prophylaxis of PC strokes is still important to specify them.

**Objective:** To investigate peculiarities of risk factors among patients with different affected vascular territories of PC.

**Patients and methods:** We evaluated prospectively 145 consecutive patients (85 men and 60 women) aged 32 to 85 years in acute period of ischemic PC strokes. Comprehensive examination included analysis of baseline characteristics, risk factors, attentive clinical study. Localization and size of the ischemic lesion were verified with the DWI.

**Results:** 21% of ischemic lesions were located within the proximal PC territory, 28% – middle and 51% – distal territory; 73,1% of them were isolated and 26,9% – combined. Atrial fibrillation (AF) was predominant risk factor for PC stroke in distal territory ( $p < 0,001$ ), smoking – for ischemic lesion of middle vascular territory ( $p = 0,022$ ). AF was frequent risk factor for combined ischemic PC strokes in comparison with isolated ( $p = 0,015$ ). AF and also coronary heart disease prevail among patients of elderly and senile age in comparison with patients of young and middle age (42,4% versus 6,9%; 52,1% versus 19,4%, respectively). Among proximal lesion of PC atherothrombotic subtype of ischemic strokes predominated, middle – lacunar and distal – cardioembolic ( $p = 0,03$ ).

**Conclusions:** Our study highlights the etiological heterogeneity of PC different intracranial vascular territories. Awareness of these peculiarities will help to enhance quality of prophylaxis, choose appropriate treatment.

### WSC-0673

#### Epidemiology of Stroke

#### Similarities and differences in risk factors of ischemic stroke between Turkish and Iranian patients

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**Background:** High rates of vascular morbidity and mortality due to ischemic stroke clarify the need to detect and treat vascular risk factors. Although risk factors of stroke are well-demonstrated in western countries, there is still lack of data in eastern world. Here we aimed to investigate the similarities and differences in risk factors ischemic stroke patients between Turkish and Iranian patients.

**Methods:** We reviewed the files of ischemic stroke patients followed-up between years 1996 and 2011 from Istanbul, Turkey, and those followed-up between years 2008 and 2013 from Tabriz, Iran.

**Results:** A total of 2534 Turkish patients and 2314 Iranian patients with ischemic stroke have been evaluated. The majority of patients were males (53.9%) in Turkey, while 51.4% were females in Iran. The mean age at onset of disease was  $61.7 \pm 13.4$  and  $68.3 \pm 13.8$  years, in Turkish and Iranian patients respectively. In regard to etiology, the largest group was ischemic stroke of unknown etiology, followed by cardioembolism in both groups. The most common risk factors were found as hypertension and cardiac diseases in both groups. This was followed by hyperlipidemia in Turkish patients while diabetes is the second most common risk factor in Iranian patients. Smoking and alcohol intake were considerably higher in Turkish patients.

**Conclusions:** Even in geographically and culturally similar countries, two neighboring countries may display different risk factors, which underlines the importance of national documentation.

### WSC-0442

#### Epidemiology of Stroke

#### Hyperlipidemia in stroke subtypes

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**Introduction:** In spite of recent vast developments, stroke still constitutes the second most common cause of morbidity and mortality. Better delin-

ation of risk factors in different subtypes would help clinicians to better classify and manage stroke patients in regard to primary and secondary prevention.

**Methods:** A total of 2590 patients followed in our stroke unit were analyzed; stroke subtypes were diagnosed according to TOAST criteria. In definition of hyperlipidemia were used NCEP criteria. All other risk factors were also noted, including age, gender, hypertension, diabetes mellitus, heart diseases, smoking and alcohol consumption.

**Results:** The mean age of study population was  $61.8 \pm 13.2$  years, and 54.1% were males. Hyperlipidemia was found strikingly high in patients with parenchymal hemorrhage (82.0%) in compared to patients with ischemic stroke. Of patients with ischemic stroke, hyperlipidemia was highest in patients with stroke of unknown etiology (74.4%) and those with cardioembolic stroke (72.0%), followed by patients with stroke related to small vessel disease (63.3%), and then those with atherothrombotic stroke (56.2%) ( $p = 0.009$ ). Hyperlipidemia was more common in elderly ( $p = 0.006$ ) and in males (72.4% vs 68.5%,  $p = 0.017$ ). The presence of hypertension and diabetes mellitus were more common in association with hyperlipidemia ( $p < 0.001$ ); heart diseases, smoking and alcohol consumption were also more common but not significant.

**Discussion:** Treatable causes of stroke is of crucial important to be diagnosed and handled properly in order for better risk analysis in different subtypes of stroke, as well as in designing more comprehensive treatment approaches.

### WSC-0774

#### Epidemiology of Stroke

#### Large vessel stenosis in the patients with ischemic stroke in Iran: Prevalence, pattern and risk factors

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**Introduction:** Large artery disease (LAD) is a common cause of stroke, but little is known regarding its role in Iranian stroke patients.

**Aims:** The current study investigates the prevalence and risk factors for cervicocephalic arterial stenosis in the patients with ischemic stroke using digital subtraction angiography.

**Methods:** This was a prospective cross-sectional study performed in hospitals affiliated to Shiraz University of Medical Sciences from March 2011 to March 2013. Patients with ischemic stroke underwent noninvasive vascular and cardiac investigations to find the etiology of the stroke. Patients suspected of having large artery stenosis underwent digital subtraction angiography. The severity of the stenosis was calculated according to the North American Symptomatic Carotid Endarterectomy (NASCET) and Warfarin-Aspirin Symptomatic Intracranial Disease (WASID) Trial criteria. The presence of cigarette smoking, hyperlipidemia, hypertension, and diabetes mellitus were documented for all subjects.

**Results:** 3703 stroke patients were identified. 342 Patients (62.3%, male) underwent digital subtraction angiography for large artery disease. The mean age at the time of angiography was  $66.7 \pm 10.3$  years. Extra-cranial and intracranial arteries were involved in 305 (89.2%) and 162 (47.4%) respectively. 301 patients (88%) had anterior circulation and 128 patients (37.4%) had posterior circulation involvement. Diabetes mellitus but not age, sex, hypertension, hyperlipidemia, or smoking was significantly associated with intracranial involvement. ( $P = 0.002$ )

**Conclusion:** It can be concluded that the distribution of the large arterial atherosclerotic disease in Iran is similar to that seen in North America and Europe. Intracranial stenosis was more prevalent in diabetic patients.

**WSC-1379****Epidemiology of Stroke  
Ischemic stroke rate in patients with the complaint of dizziness**T Güler<sup>1</sup>, S Kibaroglu<sup>1</sup>, E Derle Çiftçi<sup>1</sup>, R Öcal<sup>1</sup>, C Çelikkol Tanoglu<sup>1</sup>, U Can<sup>1</sup><sup>1</sup>Neurology, Baskent University Hospital, Ankara, Turkey

**Background and purpose:** Dizziness is one of the most common presenting symptom of patients in emergency services and outpatient clinics. Our objective was determining the symptomatological properties of dizziness patients who has finally diagnosed as ischemic stroke.

**Methods:** A total of 794 patients (n = 491, 61.8% women and n = 303, 38.2% men) who presented with vertigo to the Department of Neurology, Baskent University Ankara Hospital, Turkey, between August 2012 and August 2013 were retrospectively analyzed. Patients with dizziness were grouped based on the symptoms and final diagnosis.

**Results:** Based on the diagnosis 129 of 794 patients (%16,2) suffered from vertigo due to neurological etiologies. Of those ischemic stroke was 38%, migrainous vertigo was 13,2%, Parkinson's disease was 13,2%, transient ischemic attack was 7%, epilepsy was 5,4%, demyelinating diseases were 5,4%, vertebrobasilar insufficiency was 4,7%, mass lesions were 5,4%, and others were 7,8%. The infarct localizations of ischemic patients were cerebellar in 59,2%, brain stem in 28,6% and supratentorial in 12,2%. Besides vertigo, the other common symptoms of neurological etiology patients such as motor and sensorial deficits, eye movement abnormalities, dysphagia and dysarthria, fascial paralysis were seen in 38.8%, and ataxia was in 24%, nausea/vomiting were in 27,1% and headache was in 16,3%. Complaints about ear were seen only in 7.4% of patients whose final diagnosis were neurological.

**Conclusion:** Although peripheric causes are the most common underlying factor for dizziness and vertigo, other causes especially ischemic stroke must be kept in mind to prevent misdiagnosis and consequences of mortality and morbidity.

**WSC-1159****Epidemiology of Stroke  
Temporal trends in incidence of intracerebral hemorrhage in Tromsø, Norway, 1995–2010: A population-based study**M Carlsson<sup>1</sup>, T Wilsgaard<sup>2</sup>, S H Johnsen<sup>1</sup>, A M Vangen-Lønne<sup>1</sup>, E B Mathiesen<sup>1</sup><sup>1</sup>Department of Clinical Medicine, University of Tromsø, Tromsø, Norway<sup>2</sup>Department of Community Medicine, University of Tromsø, Tromsø, Norway

**Introduction:** Intracerebral hemorrhage (ICH) has high morbidity and mortality and limited treatment possibilities.

**Aims:** To explore temporal trends in incidence rates of ICH in a Norwegian community.

**Methods:** The Tromsø study, started in 1974, is an ongoing population-based study which has included 40 051 individuals. The participants have been followed up with registration of incident primary intracerebral hemorrhage through Desember 31, 2010. Incidence rates for first-ever ICH in participants aged  $\geq 30$  years were calculated. Age- and sex-adjusted trends in incidence rates over time were analyzed using Poisson regression. Because older birth cohorts were not enrolled in the earliest surveys, analyses were limited to the period 1995–2010. The study was approved by the regional ethics committee. All participants gave written informed consent.

**Results:** We identified 199 ICH events in the study-population in 1995–2010. The overall age- and sex-adjusted incidence rate was 0.43 (95% CI 0.37–0.49) per 1000 person-years. The crude and adjusted incidence rate

in women was 0.45 (95% CI 0.37–0.55) and 0.36 (95% CI 0.28–0.43) and in men 0.53 (95% CI 0.44–0.64) and 0.52 (95% CI 0.42–0.62) per 1000 person-years, respectively. In participants <75 years the crude and adjusted incidence rates were 0.28 (95% CI 0.24–0.34) and 0.27 (95% CI 0.22–0.32), and 2.56 (95% CI 2.09–3.13) and 2.55 (95% CI 2.03–3.07) per 1000 person-years in participants aged  $\geq 75$  years. There was no significant trend for time in any of the groups.

**Conclusion:** Overall, our study shows stable incidence rates of ICH in the observation period.

**WSC-0454****Epidemiology of Stroke  
Self-reported sleep problems and stroke risk among adult Taiwanese**W Chang<sup>1</sup>, C Wei<sup>1</sup>, S Lin<sup>2</sup>, P Lin<sup>3</sup>, C Sun<sup>4</sup>, T S A N Yang<sup>5</sup>, Y Chou<sup>6</sup><sup>1</sup>Neurology, Show-Chwan Memorial Hospital, Changhua County, Taiwan<sup>2</sup>Graduate Institute of Life Sciences, National Defense Medical Center, Taipei, Taiwan<sup>3</sup>School of Public Health, National Defense Medical Center, Taipei, Taiwan<sup>4</sup>Department of Public Health, Fu-Jen Catholic University, New Taipei City, Taiwan<sup>5</sup>Department of Health Business Administration, Mei-ho University, Pingtung County, Taiwan<sup>6</sup>School of Public Health, National Defense Medical Center, Taipei City, Taiwan

**Objective:** Sleep problems are associated with an increased risk of cardiovascular disease and prevalent among individuals with stroke. Our aim is to investigate the relationship between the sleep problems and stroke risk in adult Taiwanese.

**Material and methods:** We performed a case-control study among 175 patients who were newly diagnosed with stroke from the Chang-Bing Show-Chwan Memorial Hospital, frequency-matched for age and sex with controls from nonstroke patients. All subjects received a health checkup and completed a structured questionnaire, which gathered details of their demographic information, medical history, sleep assessment, smoking, alcohol drinking, and exercise habits. Descriptive analyses were used to determine the different gender patterns. Logistic regression was used to assess the association between stroke and each sleep problem.

**Results:** In our results, the current cigarette smoker and education were the same for stroke and nonstroke. However, our study shows that physical activity had a higher proportion of without stroke patients ( $p = 0.02$ ). The risk of stroke increased significantly with increasing body mass index, systolic blood pressure, diastolic blood pressure and neck circumference. There was a significant difference Epworth Sleepiness Scale between with and without stroke ( $p = 0.03$ ). The excessive daytime sleepiness was associated with 55% increases in stroke odds among men (odds ratio: 1.55, 95% confidence interval: 1.02–2.34).

**Conclusion:** Our reports indicated that people with daytime sleepiness are more likely to be elevated the risk of stroke. Moreover, our strategies for the prevention of cardiovascular events in patients with stroke should incorporate a consideration of sleep patterns.

**Key words:** stroke, sleep problems, excessive daytime sleepiness, case-control study.

## WSC-0905

**Epidemiology of Stroke****Risk factor, etiology and outcome of ischemic stroke in Korean young adults: A single center study**K Cho<sup>1</sup>, S Baek<sup>1</sup>, S Yu<sup>1</sup><sup>1</sup>Neurology, Korea University College of Medicine, Seoul, Korea

**Introduction:** The stroke in young adults has a big impact on their life because young adults are main agents of economic activity. However, there is limited information about clinical manifestations of stroke in Korean young adults.

**Aims:** We aimed to evaluate characteristics of young ischemic stroke patients.

**Methods:** We reviewed stroke registry of our center between September 2007 and March 2013, retrospectively. We enrolled patients aged 18 to 50 years with an ischemic stroke. We collected the data of demographics, risk factors, stroke mechanism, National Institutes of Health stroke scale (NIHSS) score at admission and modified Rankin Scale (mRS) score at 3 months. We divided into 2 groups; favorable (mRS 0–2) and poor outcome (mRS 3–6).

**Results:** We analyzed the clinical data of 108 patients. Most common risk factor was smoking (n = 72, 66.7%). Large artery atherosclerosis (n = 39, 36.1%) was most common stroke mechanism. Clinical outcome at 3 months was favorable in 97 patients (89.8%). The initial NIHSS score of poor outcome group had higher than the favorable outcome (median, 5 vs. 2, p=0.006). Multivariate analysis revealed that the previous stroke history (odds ratio (OR), 10.08, p = 0.010), the NIHSS score at admission (OR, 1.21, p = 0.008) were independent predictors of poor outcome.

**Conclusions:** Ischemic stroke was mainly caused by large artery atherosclerosis in young adults. Most of young stroke patients had good prognosis. The previous stroke history and high NIHSS score at admission could be independent predictors of poor clinical outcome in young stroke patients.

## WSC-0931

**Epidemiology of Stroke****The Brunei Epidemiological Study in Stroke and Multiple Sclerosis (BEST) -A door-to-door survey**U Meyding-Lamadé<sup>1</sup>, A Lupat<sup>2</sup>, E Craemer<sup>1</sup>, M Luissin<sup>2</sup>, P Ying<sup>2</sup>, M Fix<sup>3</sup>, R Wagner<sup>1</sup>, H Becher<sup>3</sup><sup>1</sup>Department of Neurology, Krankenhaus Nordwest, Frankfurt am Main, Germany<sup>2</sup>PARSB, Universiti Brunei Darussalam, JalanTulak, Brunei<sup>3</sup>Institut für Public Health, Universität Heidelberg, Heidelberg, Germany

**Background:** Stroke is a major public health problem, it's the 2<sup>nd</sup> common cause of death and the leading cause for permanent disability worldwide. Stroke has also enormous emotional and socioeconomic consequences in patients, their families and health services. The expected increase in the number of stroke patients will require substantial changes in health care services unless the incidence of stroke decreases in the future, e.g. as the result of improved primary prevention. The development of strategies to prevent stroke in elderly persons should be given a high priority from health-policy perspective.

Multiple Sclerosis (MS) is a chronic, inflammatory, demyelinating disease of the CNS. MS signs can range from relatively benign to disabling and devastating symptoms, as communication between the brain and other parts of the body is disrupted. The information on incidence, prevalence and mortality of stroke and multiple sclerosis is of utmost importance.

**Aim:** BEST will set a milestone in stroke and MS studies in South-East-Asia; the study aims to determine the prevalence of stroke risk factors. Those data are crucial for adapting treatment options and rehabilitation facilities in Brunei Darussalam.

**Methods:** This door-to-door survey will be a descriptive epidemiological investigation. Such studies require data on the population and its sub-groups, and statistical methods like the calculation of confidence intervals for prevalence.

**Results:** The preliminary findings from the 1<sup>st</sup> visited households showed that 30,5% are male and 69,5% are female with an age range from >20 to >70yrs.

**Conclusion:** BEST will provide a data basis for planning and establishing adequate resources to help patients and eventually be helpful for the development of treatment of stroke and multiple sclerosis in Brunei Darussalam.

## WSC-1070

**Epidemiology of Stroke****Stroke registries worldwide: A review**R Deljavan<sup>1</sup>, M Farhoudi<sup>2</sup>, H Sadeghi-Bazargani<sup>2</sup>, F Pour Asghar<sup>3</sup>, M Zamanlu<sup>2</sup><sup>1</sup>Tabriz University of Medical Sciences, Neuroscience Research Center (NSRC), Tabriz, Iran<sup>2</sup>Neuroscience Research Center (NSRC), Tabriz University of Medical Sciences, Tabriz, Iran<sup>3</sup>Faculty of Health, Tabriz University of Medical Sciences, Tabriz, Iran

**Introduction:** Stroke is the most common neurologic disorder in Asia, the main cause of disability worldwide and burdens considerable costs to all nations. Stroke registries have been developed for improving available information about stroke, which would be used for epidemiologic and etiologic research, qualifying treatment by assessing interventions and outcomes, designing preventive plans, surveying stroke care and for any other promotion to fight against stroke.

**Aims:** This paper is a review of the developed stroke registries worldwide. **Results:** Reports about stroke registries in various countries are available including Houston University in Texas of USA, China, Japan, Germany, Canada, Israel, Yonsei Stroke Registry in South Korea, registries of Mumbai and Trivandrum in India, registries of Dijon and Lausanne in France, Arcadia in Greece, Barcelona in Spain, Tartu in Estonia, Mexico, Malmö in Sweden, Ege in Turkey and Khorasan in Iran.

**Conclusion:** The reports of the mentioned stroke registries, their experiences, and suggestions for future stroke registry implementations are discussed.

## WSC-1291

**Epidemiology of Stroke****The prevalence of stroke in a Nigerian neurology clinic**F Dike<sup>1</sup>, B Ekeh<sup>1</sup>, U Ekrikpo<sup>1</sup><sup>1</sup>Department of Internal Medicine, University of Uyo, Uyo, Nigeria

**Introduction:** Stroke is a common neurological disorder, as common in the neurology outpatient clinic as it is among medical causes of morbidity in the emergency room. Its high mortality rate may mask its true prevalence in neurology clinics in developing nations where it is a major cause of unregistered deaths.

**Aim:** To determine the frequency of occurrence of cerebrovascular disease as a diagnosis in patients referred to, or, followed-up in the Neurology clinic of the University of Uyo Teaching hospital, Uyo.

**Methods:** This is a retrospective analysis of patients seen in the above specialist clinic within a period of two (2) years spanning January 2012–December 2013. Diagnosis was made in each case by a neurologist, and patients grouped into categories based on clinical diagnosis. Patient demographics and risk factors were also studied.

**Results:** A total of 406 patients were studied retrospectively. Stroke and poststroke follow-up cases made up 31.5% of all cases seen in the neuro-

ogy clinic within the period under review. 22.2% of patients had seizure disorder, mostly primary. Extra-pyramidal movement disorders, predominantly Parkinson's disease, made up 11.3%, while Headache was the diagnosis in 10.1%.

**Conclusion:** Stroke appears to be the most common neurological disorder in our clinic today. However it probably has a higher prevalence if neurology out-patient clinics are merged with all neurological admissions, into which all unregistered deaths due to stroke will be considered. Primary prevention of stroke through efficient general medical practice and health education measures may well aid to reduce this burden.

## WSC-0294

### Epidemiology of Stroke

#### Epidemiology of stroke in a rural community in Southeastern Nigeria

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**Introduction:** The prevalence and incidence of stroke vary from community to community worldwide. Nonetheless, not much is known about the current epidemiology of stroke in rural Nigeria and indeed Africa.

**Aims:** The aim was to determine the current epidemiology of stroke in a rural community in Southeastern Nigeria while the objective was to determine the prevalence of stroke in the different segments of the population.

**Methods:** We carried out a two-phase door-to-door survey in Ukpo- a rural predominantly low-income community in Anambra, Southeastern Nigeria. We used a modified World Health Organization (WHO) protocol for detecting neurological diseases in the first phase and a stroke-specific questionnaire and neurological examination in the second phase. An equal number of sex and age matched stroke-negative persons were examined.

**Results:** We identified 10 stroke subjects in the study. The crude prevalence of stroke in rural Nigeria was 1.63 (95% CI = 0.78–3.00) per 1000 population. The crude prevalence of stroke in males was 1.99 (95% CI = 0.73–4.33) per 1000 while that for females was 1.28 (95% CI = 0.35–3.28) per 1000 population. The peak age specific prevalence of stroke was 12.08 (95% CI = 3.92–28.19) per 1000 while after adjustment to WHO world population, the peak was 1.0 (95% CI = 0.33–2.33) per 1000.

**Conclusion:** The prevalence of stroke was found to be higher than previously documented in rural Nigeria with a slightly higher prevalence in males than females. This is however comparable to data from rural Africa.

## WSC-1270

### Epidemiology of Stroke

#### A prospective study of serum high-density lipoprotein cholesterol and recurrent stroke risk

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**Introduction:** Lipid plays a key role in stroke recurrence. Seldom research on exploring the relationship between high-density lipoprotein cholesterol (HDL-C) and stroke recurrence in China was done.

**Aims:** To investigate the association between HDL-C and ischemic stroke recurrence.

**Method:** A total of 1074 patients with ischemic stroke were enrolled from 5 community health centers and underwent baseline surveys during the period of Jan. 2003 to Dec. 2006. After baseline surveys, patients were

followed up every 6 months until December 31, 2008. The new stroke events were recorded as the study endpoint.

**Results:** The proportions of patients with high (>1.04mmol/L), appropriate (0.91–1.04mmol/L) and low.

**Conclusions:** HDL-C was an independent protective factor of recurrent stroke. HDL-C anomaly contributed to the greater effectiveness than non-HDL-C anomaly on stroke recurrence.

## WSC-0602

### Epidemiology of Stroke

#### Long-term trends in stroke incidence in New Zealand: 1981–2012

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**Background:** In the context of declining stroke mortality rates, reliable data on long-term trends of stroke incidence and case fatality is required to understand reasons for the decline and to plan long-term health care stroke services and to monitor the effects of stroke prevention in the community.

**Aim:** To determine long-term trends in stroke incidence and 28-day case-fatality in Auckland, New Zealand (NZ) over three decades from 1981 to 2012.

**Method:** Four population-based stroke incidence studies: 1981–1982, 1991–1992, 2002–2003, and 2011–2012. All four studies (one year recruitment period each) used multiple overlapping sources of information to ensure complete case ascertainment. The “hot-pursuit” method of case ascertainment was used across all studies to register all strokes in people ≥15 years, normally resident within the Greater Auckland Region.

**Results:** Overall, there was a 23% reduction in age-adjusted stroke incidence rates: from 156/100,000 person-years in 1981–1982 to 119/100,000 person-years in 2011–2012 (p for trend <0.0001). The mean age of patients at stroke onset did not significantly change (71.2 [SD 13.3] years in 1981–1982 and 71.6 [SD 14.9] years in 2011–2012). Case-fatality at 28 days declined by 42% – from 33% in 1981–1982 to 19% in 2011–2012 (p for trend <0.0001)

**Conclusions:** Over the last 3 decades in NZ, there has been a significant decline in both overall incidence and early case-fatality suggesting improvements in prevention as well as acute treatment.

## WSC-0477

## Epidemiology of Stroke

## Insomnia in cerebrovascular diseases

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The prevalence and incidence of insomnia are increasing. Risk factors are represented by psychological and psychiatric disturbs, incorrect behaviors, stressful events, diseases.

The aim of our study is to assess hematological parameters and cognitive dysfunction in patients affected with insomnia, admitted to our neurological unit.

So far we have recruited 11 patients with acute stroke (AS, age 71,09 sd 10,37; GCS 14,82 sd 0,4), 9 with chronic cerebrovascular disease (CCVD, age 75,22 sd 10,07; GCS 14,56 sd 0,53) and 3 with other neurological diseases (OND, age 55,33 sd 6,66; GCS 15). They underwent routine blood examination, echocardiogram and neuropsychological examination. We administered Mini-Mental State Examination (MMSE), Hamilton (HN) and/or Cornell (CS) scales, Hachinski scale (HS), Activity of Daily Living Questionnaire (ADLQ), Pittsburg Sleep Quality Index (PSQI).

Preliminary results show significant correlation of PSQI scores with Eritro-Sedimentation Rate ( $r$  0,42), White Blood Cells ( $r$  0,46), glycemia ( $r$  0,31), glycosilated hemoglobin ( $r$  0,51), urea ( $r$  0,45), reduced ejection fraction ( $r$  -0,36), urinary k ( $r$  0,35) and I chains ( $r$  0,34), CS ( $r$  0,63), HS ( $r$  0,90) in CCVD, C Reactive Protein ( $r$  0,46), fibrinogen ( $r$  0,53), troponin ths ( $r$  0,40), Pro-Brain Natriuretic Peptide ( $r$  0,76), left atrial dilatation ( $r$  0,35), urinary I chains ( $r$  0,43), CS ( $r$  0,43), HS ( $r$  0,76), ADLQ ( $r$  0,38) in AS.

Our study corroborates the link of insomnia with hematological and urinary dysfunctions in cerebrovascular diseases.

## WSC-1029

## Epidemiology of Stroke

## The effect of lunar cycles in the development of acute ischemic stroke

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**Introduction:** The number of hospital admissions for acute ischemic stroke (AIS) fluctuates extremely. Data that can predict increased patient load provide economic benefit in addition to patient safety. Previously we confirmed that meteorological factors could increase the risk of AIS. The correlation was significant, but the influence of meteorological factors was local and short term. In present work we examined the role of lunar cycles in the development of AIS. The few data from the literature reported, that the incidence of acute myocardial infarction is higher during the new moon and relatively rare during full moon.

**Methods:** We compared the moon cycles and the stroke onset dates of patients having thrombolysis treatment (TT) in the central region of Hungary. Because of the narrow therapeutic window, TT allowed exact determination of the onset of AIS. Anonymous data were downloaded from the database of the NHIF. Based on the lunar cycle, 8 periods were chosen: new moon (1), waxing moon (2), full moon (3), waning moon (4) and the 4 intermediate periods (5–8). We calculated the average number of TTs/day.

**Results:** 1.17 TTs were carried out during new moon, 1.08 during waxing moon, 0.58 during full moon and 0.92 during waning moon. During the intermediate periods (5–8), the frequency of TTs increased gradually after new moon: 0.7, 0.8, 1.42, 1.6 TTs/day.

**Conclusion:** The role of moon cycles in the development of AIS seems to be proved. The period of new moon is the highest, the full moon is the least risk for AIS.

## WSC-0480

## Epidemiology of Stroke

## The influence of poststroke depression on 1-year survival in the study of stroke mortality and morbidity (The EMMA Study), Brazil

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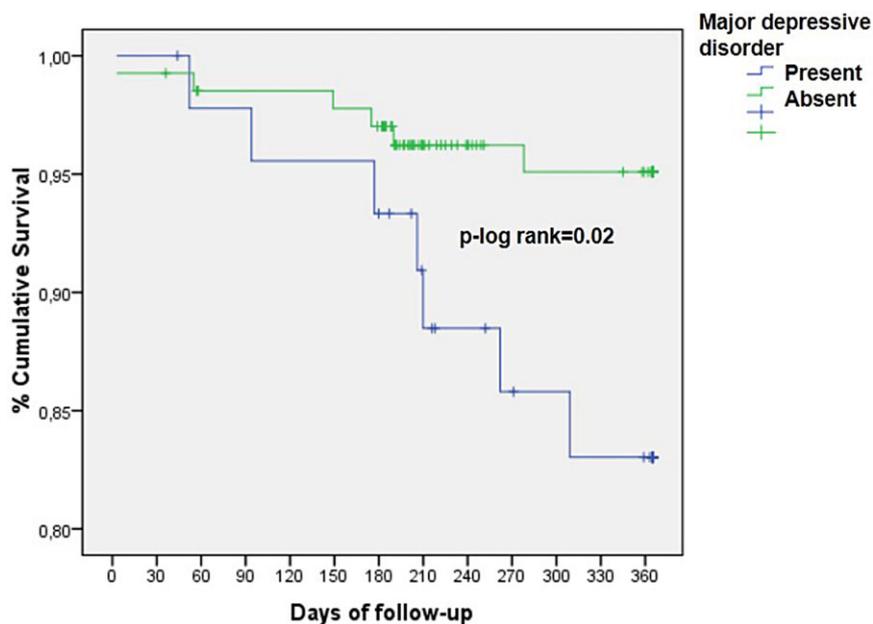
**Introduction:** The influence of poststroke depression on long-term survival is poorly investigated.

**Aims:** To investigate the influence of major depression disorder (MDD) on 1-year survival in the participants from The Study of Stroke Mortality and Morbidity” (The EMMA Study) São Paulo, Brazil.

**Methods:** We prospectively evaluated 182 individuals with ischemic or hemorrhagic stroke from “The Study of Stroke Mortality and Morbidity” (The EMMA Study). Beyond the assessment of baseline characteristics, cardiovascular risk factors, we evaluated MDD according to Patient Health Questionnaire (PHQ-9) 30 days after acute event. We performed Kaplan-Meier survival analysis, crude, and multivariate Cox-regression models, as well.

**Results:** Among 182 stroke patients, we found an incidence of 25.3% of MDD. Overall, MDD was detected four months after acute event. We found no association between MDD and baseline characteristics or cardiovascular risk factors. We observed a lower survival rate among individuals who developed poststroke depression compared to those who did not develop this condition after 1 year of follow-up (84.8% vs. 95.6%,  $p$ -log rank = 0.02) (Fig. 1). The risk of death was about 3 times higher among stroke people with MDD compared to those without MDD. After multivariate analysis, we kept a higher risk of death among those who developed MDD compared to those who did not develop this condition 1-year poststroke (Hazard Ratio=3.38; 95% CI = 1.10–10.44,  $p$  = 0.03) (Table 1).

**Conclusions:** Our findings suggest that MDD is a potential maker of poor prognosis 1-year after stroke.



**Fig. 1** One-year survival among stroke patients from the EMMA study according to major depressive disorder (MDD), 2011–2013.

**Table 1** Hazard ratio of death among 182 participants from the EMMA study, according to the presence of major depressive disorder (MDD) diagnosis during 1-year after stroke

Regression models	HR (95%CI)*	P value
<i>Model 1 (crude)</i>		
Absent	Reference (1.00)	0.03
Present	3.36 (1.13–10.01)	
<i>Model 2 (adjusted by age)</i>		
Absent	Reference (1.00)	0.04
Present	3.12 (1.04–9.36)	
<i>Model 3 (adjusted by age and gender)</i>		
Absent	Reference (1.00)	0.04
Present	3.20 (1.06–9.69)	
<i>Model 4 (adjusted by age, gender and educational level)</i>		
Absent	Reference (1.00)	0.04
Present	3.14 (1.02–9.61)	
<i>Model 5 (adjusted by age, gender and educational level, diabetes)</i>		
Absent	Reference (1.00)	0.03
Present	3.38 (1.10–10.44)	

HR – hazard ratio (95% CI- confidence intervals).

### WSC-0616

#### Epidemiology of Stroke

#### Epidemiological features of strokes in Kharkiv region of Ukraine

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**Introduction:** The problem of stroke in Ukraine remains extremely urgent. In Ukraine, yearly there are nearly 110–125 thousand strokes, the mortality from which is in 2.5 times higher, than in Western countries.

**Aim:** To study the epidemiological features of strokes in the Kharkiv region.

**Results.** In the structure of cerebrovascular disease in the Kharkiv region are dominated the chronic disorders (93%). The part of the strokes is 7%. Incidence of stroke in the Kharkiv region in 2013 was 342, and in Ukraine 297.8 cases per 100 thousand population. In developed countries, the data are the 290 cases per 100 thousand population. In a patient population of Kharkiv region the most frequent age of people with stroke is over 50–55 years is 78% of all cases. The frequency of deaths in Ukraine from cardiovascular diseases is nearly 60%. Mortality from stroke in the Kharkiv region is almost the same level as the Ukrainian number (83% and 86% respectively). In spite of the best efforts of emergency medical service of the Kharkiv region, only 31% of patients with ischemic stroke admitted to the hospital within 3 hours of the development of the disease in the first 6:00 – 6.8%. The main amount of patients (58.6%) are in the hospital after 6 hours of stroke.

**Conclusions:** Thus, the prevalence of strokes in the Kharkov region today remains at the high level compared with Ukrainian number and in 2013 amounted to 6433.8 compared 4600 respectively.

### WSC-1284

#### Epidemiology of Stroke

#### A cross-sectional study on relationship between stroke and risk factors in elderly in Beijing

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**Introduction:** Stroke is one of most popular reasons causing death and disability. It's urgent and vital to explore the risk factors corrected with stroke, especially in a community-based population in aged.

**Aims:** To explore the relationship between stroke and risk factors in eldly.

**Methods:** 2832 aged person in community in Beijing were investigated in 2000 by questionnaire. Demographic information, including age, gender, area, education level, smoking, drinking, exercising habit were collected. Stroke was identified by stroke history, which was recorded in county hospital or in city hospital. Chronic diseases histories, such as ischemic heart diseases (IHD), diabetes mellitus (DM), hypertension (Hp) were collected. Height, weight and blood pressure were measured. Blood sample including fasting glucose, uric acid and lipid files were checked.

**Results:** In 2832 aged person, male 1380 (48.7%), age (72.03 ± 8.13). Stroke 321 (11.3%), Hp 1758 (62.1%), DM 200 (7.1%), IHD 501 (17.7%).

After adjustment for age, area, education level, smoking, drinking, exercise habit, body mass level (BMI), lipid files, and uric acid level, stroke is associated with IHD (OR 1.527, 95% CI 1.045–2.232,  $p = 0.028$ ), HP (OR 2.655, 95% CI 1.789–3.938,  $p = 0.000$ ), DM (OR 1.686, 95% CI 1.022–2.784,  $p = 0.048$ ), HDL\_C (OR 0.504, 95% CI 0.275–0.922,  $p = 0.026$ ) and gender (OR 0.346, 95% CI 0.233–0.513,  $p = 0.000$ ).

**Conclusions:** Stroke was associated with IHD, Hp, DM, HDL\_C and gender in Beijing communicate-based elderly.

### WSC-0329

#### Epidemiology of Stroke

##### A comparison of ASCO1 and TOAST classification systems for stroke in young

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**Introduction:** Aetiology of young stroke differs from, and has a higher proportion of undetermined aetiology as compared to stroke in elderly. The recently introduced ASCO classification system is considered as an improvement over the TOAST system. Our study compares the agreement and differences between the two classification systems.

**Materials and methods:** 440 consecutive cases of ischemic strokes between the ages of 18–45 years presenting to our hospital, were classified according to ASCO and TOAST classification systems. The  $k$  statistic was used to evaluate similarities and McNemar's test was used to compare differences between ASCO1 and TOAST.

**Results:** ASCO1 showed significantly higher proportion of small vessel disease (10.4% vs. 6.8%;  $p = 0.02$ ) and a lower proportion of undetermined aetiology (59.3% vs. 57%;  $p < 0.001$ ) as compared to TOAST. There was no significant difference between ASCO1 and TOAST in proportions of large artery disease (4.3% vs. 4.7%;  $p = 0.77$ ), cardioembolic strokes (15.5% vs. 14%;  $p = 0.8$ ) and strokes of other definite origin (15.7% vs. 17.3%;  $p = 0.3$ ). Agreement between ASCO1 and TOAST ranged from fair for small vessel disease ( $k = 0.40$ ), to near perfect for cardioembolic stroke ( $k = 0.85$ ). There was moderate agreement between ASCO1 and TOAST for stroke of undetermined aetiology ( $k = 0.60$ ) and substantial agreement for large artery atherosclerosis ( $k = 0.69$ ) and stroke of other definite origin ( $k = 0.73$ ).

**Conclusion:** The agreement between ASCO1 and TOAST in young strokes ranges widely from fair to near perfect. ASCO1 identifies more cases of small vessel disease and decreases the proportion of strokes of undetermined aetiology as compared to TOAST.

### WSC-1228

#### Epidemiology of Stroke

##### The lifestyle in Ganzi Tibetan state and its association with cerebral stroke: A randomized cluster sampling study

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**Introduction:** The Ganzi Tibetan state is an underdeveloped area in China, systematical epidemiologic studies on cerebral stroke and its related influence factors in this area is rarely reported.

**Aim:** To describe the incidence of stroke, investigate the association between lifestyle and cerebral stroke in this area, in reducing the cerebral stroke incidence in Tibetan state.

**Method:** we conducted a randomized cluster sampling trail in Kangding, Dege, Ganzi, Litang and Batang county. 7038 peoples aged  $\geq 18$  years were included, data of lifestyle, living conditions and stroke status were collected by face-to-face interview. Stroke was defined by the World Health Organization diagnosis criteria, and the result was analyzed by statistical analysis using SPSS 19.0.

**Results:** The prevalence rate of stroke were 1923/100,000. Smoking, alcohol drinking, excess salt and overweight increase the risk of cerebral stroke. And there was an inverse correlation between physical exercise and stroke. The living conditions were not relevant for stroke.

**Conclusions:** The prevalence of cerebral stroke is high in Ganzi Tibetan state. The causes may be ascribed to special lifestyle. It is very important to pay more attention to prevent and control of stroke in this area.

### WSC-1065

#### Epidemiology of Stroke

##### The characteristics and impact of a diverse population of recent immigrants on an urban stroke center

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Due to geographic and economic factors, Ireland had an unusually small immigrant population until this century when the country experienced an influx of migrant workers and refugees due to an economic boom. A large proportion of these immigrants settled in central Dublin, census data indicating that 20–30% of the population are of non-Irish birth. We performed a study to determine the characteristics of stroke in this population and the impact on the local stroke service.

**Methods:** We reviewed admissions with primary or secondary diagnoses of stroke (ICD 9 or 10) over 4 years. Nationality of subjects were identified and those originating from outside Ireland / UK were compared to the indigenous population.

**Results:** 62 subjects from 30 different countries were identified representing 4% of all admissions. Mean age was younger (mean 52 years vs 71 years) and immigrants represented a higher proportion of those under 65 years (11.1%) vs those  $\geq 65$  years (1.6%) ( $p < 0.001$  chi square). 37.5% of our strokes under 40 years (18/48) were immigrants. Compared to a control group ( $n = 97$ ) matched for age and gender, subjects from the immigrant population were significantly more likely to suffer hemorrhagic stroke (18/62 (29%) vs 11/97 (11%)  $p = 0.005$  Chi square) and tended to have a shorter mean length of stay (20.9 days vs. 30.7 days,  $p = 0.18$ ).

**Conclusions:** Our immigrant population contributes a much smaller proportion of strokes than their overall proportion in the community. They are however, overrepresented amongst strokes in the young and are more likely to suffer hemorrhagic stroke.

### WSC-0482

#### Epidemiology of Stroke

##### Characteristic adverse events and their incidence among patients participating in acute ischemic stroke trials

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**Introduction:** Adverse events (AE) in trial populations present a major burden to researchers and patients, yet most events are unrelated to investigational treatment.

**Aims:** We aimed to develop a coherent list of “expected” AEs, whose incidence can be predicted by patient characteristics that will inform future trials and perhaps general poststroke care.

**Methods:** We analyzed raw AE data from patients participating in acute ischemic stroke trials. We identified events that occurred with a lower 99% confidence bound greater than nil. Among these we applied receiver operating characteristic principles to select the fewest types of event that together represented the greatest number of reports. Using ordinal logistic regression, we modeled the incidence of these events as a function of patient age, sex, baseline NIHSS and multi-morbidity status, defining  $p < 0.05$  as statistically significant.

**Results:** We analyzed 5,775 placebo-treated patients, reporting 21,217 AEs. Among 756 types of AE, 132 accounted for 82.7%, of which 80% began within 10 days poststroke. Right hemisphere (OR 1.67), increasing baseline NIHSS (OR 1.11), multi-morbidity status (OR 1.09 per disease), patient age (OR 1.01 per year), height (OR 1.01 per centimeter), diastolic BP (OR 0.99 per mmHg) and smoking (OR 0.82) were independently associated with developing more AEs, but together explained only 13% of the variation.

**Conclusions:** A list of 132 “expected” adverse events after acute ischemic stroke may be used to simplify interpretation and reporting of complications. Adverse events can be modestly predicted by patient characteristics, facilitating stratification of patients by risk for poststroke complications.

## WSC-0582

### Epidemiology of Stroke

#### Prevalence and factors associated with apparent treatment-resistant hypertension among individuals with history of stroke or TIA

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**Introduction:** Control of blood pressure (BP) is recognized as a paramount goal in secondary stroke prevention; however, the high prevalence of uncontrolled BP and use of multiple antihypertensive medication classes in stroke patients suggest this goal is not being met.

**Aim:** We sought to determine prevalence and factors associated with apparent treatment-resistant hypertension (aTRH) in persons with history of stroke or TIA.

**Methods:** These cross-sectional data came from REGARDS, a national (US), population-based cohort of 30,239 black and white adults > 45 years, enrolled in 2003–2007. The primary analysis was restricted to 11,719 participants with treated hypertension. aTRH was defined as: 1) uncontrolled BP (systolic BP  $\geq 140$  mmHg or diastolic BP  $\geq 90$  mmHg) with  $\geq 3$  antihypertensive medication classes, or 2) use of  $\geq 4$  antihypertensive medication classes, regardless of BP level. Poisson regression was used to calculate characteristics associated with aTRH.

**Results:** Among hypertensive participants, the prevalence of aTRH was 24.9% (422/1,694) and 17.0% (1,708/10,025) in individuals with and without a history of stroke/TIA, respectively. Relative to those stroke/TIA-free, after adjustment for demographics and cardiovascular risk factors, the multivariable adjusted prevalence ratios for aTRH was 1.14 (95% CI: 1.03–1.27) for those with stroke/TIA. After multivariable adjustment, men, black race, larger waist circumference, longer duration of hypertension, and reduced kidney function were associated with aTRH.

**Conclusions:** The high prevalence of aTRH among persons with stroke/TIA, particularly in specific subgroups, supports the need for more

individualized, intensive monitoring and management to achieve recommended BP reduction.

## WSC-0524

### Epidemiology of Stroke

#### Is blood pressure control the correct goal for stroke prevention? The lost opportunity of prevention

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**Introduction:** A clinical tendency is to focus on pharmacologic treatment of blood pressure (BP) in hypertensive patients, but sole focus on this approach fails to capture the opportunity for risk reduction through the prevention or delay hypertension development.

**Aims:** Assess stroke risk within strata defined by BP level and intensiveness of antihypertensive medication treatment.

**Methods:** Participants in the REasons for Geographic And Racial Differences in Stroke Study were stratified 16 strata by SBP level (normotensive: <120 mmHg; prehypertension: 120–139 mmHg; stage 1 hypertension: 140–159 mmHg; and stage 2 hypertension: 160+ mmHg) and intensiveness of pharmacotherapy to control BP (no, 1, 2 or 3 or more antihypertensive medications). Risk of stroke was estimated by proportional hazards analysis.

**Results:** 823 strokes occurred among 26,445 participants over 6.3 years of follow-up. Within each blood pressure stratum, there was strong evidence of increasing risk of stroke with higher levels of medication required to control blood pressure (hazard ratio [HR] = 1.33; 95% CI: 1.16 – 1.52 for normotensive, HR = 1.15; 95% CI: 1.05–1.26 for prehypertension, and HR = 1.22; 95% CI: 1.06–1.39 for stage 1 hypertension, for each antihypertensive drug). The stroke risk of a successfully treated (SBP <120 mmHg) hypertensive person was marginally larger than a person with untreated stage 1 hypertension (HR = 2.48 versus HR = 2.19).

**Conclusions:** While clinical trial data have clearly demonstrated the value of BP medications, even successful treatment fails to return individuals to risk levels similar to normotensive individuals. To reduce stroke risk, it is critical to focus on efforts to prevent or delay the development of hypertension.

**Table** Hazard ratio for incident stroke (95% CI) after adjustment for age, race, age-by-race interaction, sex and the deviation from the mean SBP level for the category. Tests for trend represent the estimated increase in the hazard ratio per category for number of medications and SBP category

		Blood Pressure Strata				
		Normotensive	Prehypertension	Stage 1	Stage 2	Trend
Number of antihypertensive medications	No Meds	1.00 (ref)	1.44 (1.04–2.01)	2.19 (1.45–3.31)	3.35 (1.78–6.28)	1.49 (1.26–1.76)
	1 Med	1.42 (0.94–2.15)	2.00 (1.44–2.77)	1.67 (1.09–2.54)	3.00 (1.71–5.26)	1.16 (0.98–1.37)
	2 Meds	1.60 (1.06–2.42)	1.88 (1.35–2.62)	2.84 (1.95–4.13)	1.42 (0.67–2.99)	1.16 (0.98–1.37)
	3 Meds	2.48 (1.63–3.77)	2.34 (1.16–3.32)	3.35 (2.28–4.92)	4.62 (2.84–7.51)	1.26 (1.07–1.48)
Trend		1.33 (1.16–1.52)	1.15 (1.05–1.26)	1.22 (1.06–1.39)	1.10 (0.86–1.40)	

**WSC-0812**

**Epidemiology of Stroke  
Association of sex and race with incident stroke: The Reasons for Geographic and Racial Differences in Stroke (REGARDS) Study**

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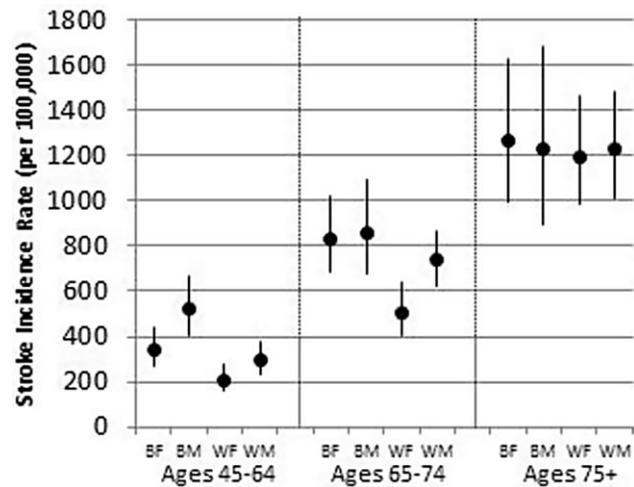
**Introduction:** Recent US guidelines for stroke in women confirm that there are strikingly few national data available to describe sex differences in age-specific stroke incidence.

**Aims:** Describe male-to-female differences in stroke incidence, and assess the black-white consistency of differences.

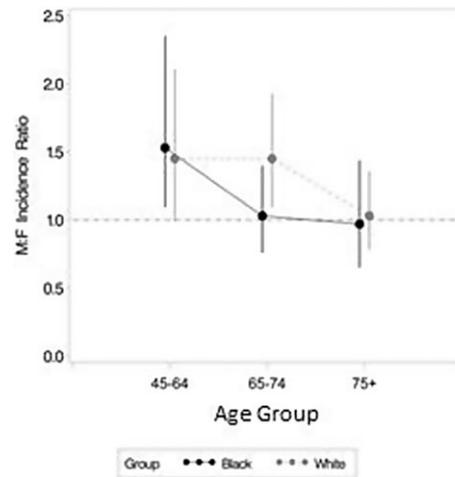
**Methods:** REGARDS is a national, US, population-based, longitudinal study of black and white participants aged > 45 years old. This analysis included 27,970 stroke-free participants followed for 6.3 years for incident stroke. Sex- and race-specific stroke incidence rates were calculated by age strata (<65, 65–74, and 75+).

**Results:** Based on 827 incident strokes, incidence rates increased with age, from 207/100,000 to 1269/100,000 (see Table). Among those <65 years, the male-to-female difference was similar for blacks and whites ( $p = 0.82$ ), with greater stroke risk in men for both races ( $RR_{blacks} = 1.53$ ,  $RR_{whites} = 1.45$ ). For those aged 65–74, stroke risk was greater in white men ( $RR_{whites} = 1.45$ ), with no sex difference for blacks ( $RR_{blacks} = 1.03$ ), marginally different by race ( $p = 0.11$ ). Above age 75, the sex difference in stroke risk was similarly absent ( $p = 0.81$ ) for blacks and whites ( $RR_{blacks} = 0.97$ ,  $RR_{whites} = 1.03$ ).

**Conclusions:** Below age 65, stroke risk is higher in men than women in both races. At ages 65–74, this sex difference dissolves for blacks, but persists for whites. Above age 75 there is little evidence of a sex difference in stroke risk.



**Fig. 1** Stroke incidence (with 95% confidence intervals) per 100,000 population by age and race-sex (BF: black females, BM: black males, WF: white females, WM: white males).



**Fig. 2** Male-to-Females incidence ratio (with 95% confidence limits) for blacks (black, solid line) and whites (gray, dashed line)

## WSC-0583

## Epidemiology of Stroke

## Differences in risk factors for first versus recurrent stroke

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**Introduction:** Risk factors for incident stroke are similar to risk factors for recurrent stroke, however, there has not a comparison of the magnitude of the impact of the risk factors on incident vs. recurrent stroke.

**Aims:** Assess differences in the impact of risk factors on first vs. recurrent stroke.

**Methods:** REGARDS recruited 30,239 participants between 2003 and 2007. Participants were stratified into those reporting and not reporting a physician-diagnosed stroke at baseline. Proportional hazards analysis was used to assess the role of risk factors for stroke.

**Results:** Over 6.2 years of follow-up, there were 825 strokes among 25,849 participants without stroke/TIA at baseline, and 310 strokes among 3,101 with stroke/TIA at baseline. For incident stroke, there was an age-by-race interaction ( $p = 0.0003$ ) with a higher risk among blacks than whites at age 45 (HR = 2.69; 95% CI: 1.85–3.91), but with increasing age, to age 85, this disparity disappeared (HR = 0.95; 95% CI: 0.74–1.23). For recurrent stroke, there was a constant 21% nonsignificantly higher risk among blacks over the entire age range. For both races, age had a substantially smaller impact on recurrent than incident stroke. The traditional risk factors had a generally smaller (but still significant) impact for recurrent vs. incident stroke (see Table).

**Conclusion:** The role of race and age differed for incident vs. recurrent stroke, while the traditional risk factors for incident stroke persisted as indicators of higher risk for secondary stroke.

			Hazard Ratio (95% CI)		p-value for difference in impact	
			Incident Stroke	Recurrent Stroke		
Age-Race Effects	p-value for age-race interaction		0.0003	0.98		
		Age (per 10-year difference)	For blacks	1.66 (1.49–1.85)	1.21 (1.03–1.42)	0.0017
	For whites		2.15 (1.96–2.36)	1.21 (1.03–1.42)	<0.0001	
	Black race		@ 45 Years	2.69 (1.85–3.91)	1.22 (0.67–1.53)	0.022
			@ 65 Years	1.60 (1.38–1.85)	1.21 (0.96–1.53)	0.049
		@ 85 Years	0.95 (0.74–1.23)	1.21 (0.79–1.83)	0.34	
Male sex		1.23 (1.08–1.41)	1.18 (0.96–1.45)	0.71		
Hypertension		1.98 (1.72–2.28)	1.68 (1.25–2.25)	0.32		
Diabetes		1.79 (1.54–2.09)	1.51 (1.21–1.88)	0.21		
Current Smoking		1.34 (1.12–1.61)	1.35 (1.04–1.74)	0.97		
Atrial Fibrillation		2.10 (1.74–2.52)	1.36 (1.02–1.82)	0.015		
Left ventricular hypertrophy		1.76 (1.47–2.09)	1.46 (1.12–1.91)	0.26		
Heart disease		2.15 (1.87–2.48)	1.35 (1.09–1.67)	0.0003		

Hazard ratio (with 95% confidence limits) on the univariate association of "Framingham" risk factors with first (incident) and recurrent stroke; with a test of whether the impact of the risk factor differs for incident versus recurrent (interaction test). Note that the significant age-by-race interaction implies that the impact of age must be reported separately by race, and that the black-white racial difference must be reported at specific ages.

## WSC-0305

### Epidemiology of Stroke Development of comprehensive stroke centers in Turkey in the last decade

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**Background:** Stroke is one of the major health problems in Turkey. According to the World Health Organization and Turkish Health Statistics, cerebrovascular disease is the second leading cause of death in Turkey. Institutional organizations are important to decrease the burden of stroke.

**Method:** We investigated the growth of comprehensive stroke centers in Turkey between 2004 and 2014. A survey including the presence of stroke unit, intensive care unit, imaging (CT, MRI, MRA, DSA, DUS), outpatient clinic, availability of thrombolysis, thrombectomy, decompressive surgery, carotid surgery/stenting was conducted in all stroke centers.

**Results:** Comprehensive stroke centers are present in 6 of 7 regions and 19 of 81 cities of Turkey. Despite the increasing number of centers from 23 to 34, the distribution is not homogenous according to geographical regions or population size. Ten years ago, thrombolysis was almost never applied, but it is now a routine procedure in all stroke centers. Outpatient clinic is present in 68%, and stroke unit and/or neurological intensive care unit in 93% of these centers. All centers are able to perform carotid surgery/stenting and decompressive surgery, while only 68% of them provide thrombectomy.

**Conclusion:** Although a considerable improvement in terms of diagnosis and management of patients with stroke has been made over the last decade, we still need more qualified stroke centers and more homogenous distribution in Turkey.

## WSC-0426

### Epidemiology of Stroke Elevated blood viscosity is associated with cerebral microbleeds in patients with ischemic stroke

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**Introduction:** The viscosity of blood involves complex functions of red blood cells, fibrinogen, and the shearing forces within the vessel lumen. Hyperviscosity increases microvascular flow resistance in capillary vessels. Recent studies suggest that hemostatic factors might play a role in the development of cerebral small vessel disease. We investigate the association between blood viscosity and these radiological findings.

**Method:** We prospective recruited consecutive acute ischemic stroke patients. Blood viscosity testing, using BVD viscometer, was performed immediately before any medication including normal saline hydration to preclude bias made by any medical intervention. Blood viscosity levels are tested together with lipids and blood pressure including other conventional vascular risk factors (e.g. smoking). Other inflammatory and hemostatic variables, including CRP, fibrinogen, and D-dimer, were measured. Radiological findings, indicating surrogate markers of cerebral small vessel disease, such as white matter changes, previous lacunes, and microbleeds were evaluated.

**Results:** Of 64 consecutive patients, patients were dichotomized into normal or hyperviscosity group, according to upper cut-off level (>260 mP in male and >210 mP in female). Severity of white matter changes, according to the Fazekas scale, presence or number of previous lacunes or microbleeds were not different between two groups. However, in patients with microbleeds (n = 28), number of microbleeds were correlated with blood viscosity (Pearson correlation coefficient = 0.384, p = 0.043).

**Conclusion:** Among radiological surrogate markers of cerebral small vessel disease, number of microbleeds might be associated with increased blood viscosity in patients with acute ischemic stroke. Future study focused on the pathomechanism of hyperviscosity induced microbleeds might be needed.

## WSC-0707

### Epidemiology of Stroke Association between weight change and clinical outcomes in acute ischemic stroke patients

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**Introduction:** Although mild obesity has been shown better prognosis in the 'obesity paradox', little is known about the effects of weight change during acute ischemic stroke (IS) on the clinical outcomes.

**Aims:** We sought to investigate the association between weight changes and clinical outcomes in IS patients.

**Methods:** A total of 686 patients from SNUH with IS were enrolled from October 2002 through May 2013. Weights were measured at admission and discharge from department of neurology. Weight change was pre-defined as weight-gain or weight-loss from baseline of > 0.05kg per baseline BMI-unit. Patients were divided into five groups with regard to weight-change: pronounced (>0.1kg/baseline BMI-unit), moderate (≥0.05–0.1kg/baseline BMI-unit), and stable group. In addition, we evaluated the clinical outcomes using modified Rankin Scale (mRS) 3 months after stroke onset.

**Results:** Among the 686 patients, a total of 431 patients (62.8%) were included in the stable weight-change group. Patients with stable or weight-gain were more likely to have better functional outcomes. We dichotomized 3-month mRS into favorable and unfavorable (3-month mRS 0–2 vs. 3–6) outcomes. After categorizing all patients into the 3 levels of initial stroke severity (0–1, 2–4, and ≥5), the pronounced weight-loss group had a higher risk of having unfavorable outcomes (OR 2.56; 95% CI 1.08–6.06) only in level of NIHSS at admission ≥5 compared to the stable weight-change group.

**Conclusions:** In our study, pronounced weight loss were associated with unfavorable outcomes. Therefore, initial fluid or nutritional support should be considered when managing acute stroke patients.

## WSC-1028

## Epidemiology of Stroke

## Influencing factors on functional outcomes at 6 months after first-ever stroke in Korea

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**Introduction:** This study is an interim result of the Korean Stroke Cohort for Functioning and Rehabilitation (KoSCo) designed for 10 years of follow-up for the first-ever stroke patients.

**Aims:** To analyze the factors influencing on the functional status of stroke survivors at 6 months after onset.

**Methods:** Patients were completed face-to-face assessments at discharge and 6 months after stroke onset using the Korean version of Modified Barthel Index (K-MBI). A complete enumeration survey of the medical records included demographic data, risk factors, stroke type, characteristics of treatment, and discharge functional status. Multiple regression analysis was done to delineate the factors influencing functional outcomes at 6 months after stroke.

**Results:** Among 1,493 participants, 76.6% suffered from ischemic stroke. The mean age was 64.2 years-old and a ratio of male to female was 1.4:1. Mean duration of hospitalization was 20.1 days. Factors influencing on K-MBI scores at discharge were age, initial NIHSS, and duration of hospitalization ( $p < 0.05$ ). Factors influencing on K-MBI at 6 months were age, education level, recurrence of stroke, duration of hospitalization, and functional status at discharge, respectively ( $p < 0.05$ ). Initial stroke severity showed no independent influencing factor to functional status at 6 months.

**Conclusions:** These results revealed that functional outcome at 6 months were affected by the functional gain during hospitalization rather than acute stroke severity. Implication of systematic stroke care is positively needed to decrease the residual disabilities and increase functional independence of stroke patients in Korea (Supported by Korea Centers for Disease Control and Prevention (2013E3301700)).

**Key words:** stroke, functional status, modified Barthel Index.

## WSC-1182

## Epidemiology of Stroke

## Long-term functional outcome in patients with very mild stroke (NIHSS 0–1)

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**Introduction:** This study is the interim results of the Korean Stroke Cohort for Functioning and Rehabilitation (KoSCo) designed as 10 years long-term follow-up study of stroke patients.

**Aims:** The purposes of this study were to explore the long-term functional outcome at 6 months in the stroke patients with very mild stroke scoring NIHSS 0–1 at 7 days after onset.

**Methods:** All patients who admitted to the representative hospitals in 9 distinct areas of Korea with acute first-ever stroke (Aug. 2012–Oct. 2013) were recruited. On 7 days after stroke, severity of stroke was reassessed using the NIHSS. Out of 3,069 patients, 1,065 patients completed face-to-face assessment of functional status at 6 months after stroke onset using the Korean Version of Modified Barthel Index (K-MBI), K-MMSE, FMA, FAC, and K-FAST. Functional outcomes at 6 months were analyzed in patients who showed NIHSS 0–1 at 7 days after stroke onset.

**Results:** Among 1,065 patients who were followed up at 6 months, the very mild stroke group with NIHSS 0–1 composed of 44.7%. Out of these patients, the proportion of patients who have any impairment at 6 months after stroke in cognitive function was 21.7%, motor impairment 8.2%, impairment in their mobility 10.3%, and language impairment 33.9%.

**Conclusion:** Many of acute stroke patients with mild stroke severity assessed by NIHSS had impairments in various functional domains but were easily neglected from proper rehabilitation opportunity. (Supported by Korea Centers for Disease Control and Prevention (2013E3301700))

## WSC-1498 Epidemiology of Stroke Relationship of seasonal variation with stroke occurrence in north India population: A hospital based study

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**Introduction:** The existence of a seasonal pattern in the occurrence of stroke remains controversial. There have been numerous investigations into the existence of an association between season of the year and stroke occurrence.

**Aim:** To investigate the relationship between seasonal variation and stroke occurrence in a North India population

**Methods:** Data from patients with both ischemic stroke (IS) or hemorrhagic stroke (HS) admitted in the Neurology ward of All India Institute of Medical sciences (AIIMS), New Delhi, India, were collected from the period of January 2009 to April 2014. Seasons were categorized into 4 categories, i.e Spring (March to May), Summer (June to August), Autumn (September to November) and Winter (December to February).

**Results:** Total 810 stroke patients [481 (59.4%) IS and 329 (40.6%) HS] comprising of 550 (67.9%) males and 260 (32.1%) females. The mean age of all patients was  $53.7 \pm 15.6$  years. Seasonal occurrence of IS in increasing order were 151/481 (31.4%) in spring, 124/481(25.8%) in winter, 120/481 (24.9%) in summer, 86/481 (17.9%) in autumn. The increasing order for a seasonal occurrence of HS were 128/329 (38.9%) in winter, 81/329 (24.6%) in spring, 69/329 (21%) in autumn and 51/329 (15.5%) in summer.

**Conclusion:** Seasonal variation of stroke occurrence in a North Indian population was observed. Our results suggest that there is a higher chance of developing IS in spring season and higher chance of developing HS in winter season.

## WSC-0581 Epidemiology of Stroke Stroke risk in patients with musculoskeletal pain: A multicenter prospective Turkish trial

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**Introduction:** Stroke risk calculators are helpful in screening people and warning them against their future risk of stroke.

**Aim:** To investigate the incidental and 10 year-stroke risk of the patients with musculoskeletal pain by using two stroke risk calculators.

**Methods:** NHS Stroke risk card and Cleveland 10-year stroke risk calculator were used.

**Results:** A total of 2383 patients from 17 centers were included. Pain (avg. 1.4 months) was mainly at the knee (18.3%). Females were more than males (74.9% vs 24.9%) and mean age was  $50.5 \pm 14.3$ . Mean weight and BMI were 76.6 kg and 28.7 respectively. Mean systolic and diastolic blood pressures were  $125.5 \pm 20.3$  and  $77 \pm 12$ . Mean total cholesterol level was  $199.6 \pm 43$ . 59.2% were living a sedentary life while 20.9% did regular physical exercise. 16.9% were smoking, 28.8% had hypertension, 15% were diabetic. 9.9% were taking antiaggregant drugs and 25% were using antihypertensives. Mean stroke risk card score was  $5.5 \pm 4$ . 10-year stroke probability was  $4.4 \pm 4.9$ .

**Conclusion:** In this cohort of patients with pain, risk of incidental stroke was at the caution level. Average of 10-year stroke probability was above the safe limit of 3% for females. Reduced amount of physical activity may be the most important factor for the moderately elevated stroke risk.

**Co-authors:** Çelebi G, Erhan B, Bardak A, Yilmaz F, Soy Bugdayci D, Gündüz B, Paker N, Önes P, Sezer N, Akkus S, Karaca G, Yilmaz H, Savas S, Kaya T, Atalay NS, Yildiz N, Baygatalp F, Salbas E, Yumusakhuylu Y, Durlanik G, Dogu B, Öncü J, Aksu N, Satir Ö, Yilmaz H, Sari A, Ogut E

## WSC-0514 Epidemiology of Stroke Long-term prognostic implications of visit-to-visit blood pressure variability in patients with ischemic stroke

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**Introduction:** Blood pressure variability (BPV) is a novel risk factor for the development of atherosclerotic diseases. The long-term implications of visit-to-visit BPV in patients with ischemic stroke remains uncertain.

**Aims:** To determine the long-term prognostic implications of visit-to-visit BPV in patients with ischemic stroke.

**Methods:** We prospectively followed up the clinical outcome of 632 consecutive ischemic stroke patients without atrial fibrillation. The average BP and BPV, as determined by the coefficient of variation (CV) of the systolic and diastolic BP, were recorded during a mean  $12 \pm 6$  outpatient clinic visits. Informed consent was obtained from all study subjects and the study was approved by the IRB.

**Results:** The average age of the population was  $71 \pm 11$  years. After a mean of  $76 \pm 18$  month's follow-up, 161 patients died, 35% were due to cardiovascular causes. 16% and 5% developed recurrent stroke and acute coronary syndrome (ACS). After adjusting for mean systolic BP and confounding variables, patients with a high systolic BPV were at significantly greater risk of cardiovascular mortality (hazards ratio (HR) 2.36, 95% confidence interval (CI) 1.02–5.49,  $P < 0.05$ ). A high systolic BPV also predicted all-cause mortality after adjusting for mean systolic BP (HR 1.79, 95% CI 1.16–2.75,  $P < 0.05$ ). There was no association between systolic BPV with nonfatal recurrent stroke nor nonfatal ACS. A raised diastolic BPV did not predict adverse clinical outcomes of interest.

**Conclusions:** Visit-to-visit systolic BPV predicts long-term all-cause and cardiovascular mortality in patients with ischemic stroke without atrial fibrillation, independent of other conventional risk factors including average BP control.

## WSC-0238

## Epidemiology of Stroke

## Lacunar infarction: A diabetic microvascular disease?

## Findings from a hospital-based registry

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**Introduction:** Diabetes increases the risk of microangiopathy, the most probable cause of lacunar stroke. There is a high prevalence of diabetes in Malaysia that is proportionally reflected in our stroke population.

**Aims:** We aimed to determine if lacunar stroke was significantly associated with diabetes in our population.

**Methods:** We retrospectively reviewed data of all ischemic stroke patients admitted to our hospital from 2004 to 2010. We classified stroke as lacunar or nonlacunar based on imaging studies and clinical examination. Multiple logistic regression was used to analyze the data.

**Results:** 858 patients were identified with ischemic stroke and 511 (59.6%) were diabetic. The most common stroke type was lacunar stroke (60.6%). In the diabetic group, 330 (64.6%) had lacunar strokes. Diabetes was the most significant and independent risk factor for lacunar stroke (OR 1.5, 95% CI 1.16–2.01,  $p = 0.003$ ), particularly in those aged  $\leq 55$  years (OR 2.29, 95% CI 1.12–4.67) and with a HbA1C  $\geq 6.5\%$  ( $\chi^2 = 8.77$ ,  $p = 0.003$ ). Hypertension, despite being the most prevalent risk factor (81.6%), contributed equally to both lacunar and nonlacunar stroke ( $\chi^2 = 0.91$ ,  $p = 0.763$ ). Leukoaraiosis was found in 21.8% ( $n=187$ ) and was significantly associated with lacunar infarction ( $p < 0.001$ ), diabetes ( $p = 0.015$ ) and older age ( $p < 0.001$ ).

**Conclusions:** Diabetes mellitus is highly prevalent among our patients, and is an independent risk factor for lacunar stroke and leukoaraiosis. The data suggests that in our population, stroke is a microvascular rather than macrovascular complication of diabetes. We have described an associative risk between diabetes and lacunar stroke which warrants further investigation.

## WSC-0579

## Epidemiology of Stroke

## Self-perceived stress and the risk of stroke: A meta-analysis of prospective studies

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**Introduction:** Several studies have indicated that self-perceived stress is associated with an increased risk of stroke; however, the results are not consistent.

**Aims:** We aimed to examine the association between self-perceived stress and risk of stroke by performing a meta-analysis of prospective cohort studies.

**Methods:** A search of MEDLINE, EMBASE, and PsycINFO databases (to Mar 2014) was supplemented by manual searches of bibliographies of key retrieved articles and relevant reviews. Prospective cohort studies that reported relative risk estimates with 95% confidence intervals for the association of self-perceived stress and incident stroke were selected.

**Results:** The search yielded 6 prospective cohort studies including 117482 participants and 3271 stroke cases during a follow-up period ranging from 8 to 30 years. The pooled adjusted relative risk was 1.24 (95% confidence interval, 1.11 to 1.39) for the magnitude of the relation between high self-perceived stress and risk of stroke.

**Conclusions:** High self-perceived stress is associated with a moderately increased risk of stroke.

## WSC-0273

## Epidemiology of Stroke

## Prevalence, incidence and associated risk factors of stroke in older adults in Havana and Matanzas provinces, Cuba

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**Background:** The few epidemiological studies of stroke in Latin America generally report lower prevalence and different patterns than developed countries.

**Aims:** To estimate the prevalence and incidence of stroke and associated risk factors in adults aged  $\geq 65$  years in Havana City and Matanzas provinces, Cuba.

**Methods:** A cross-sectional, door-to-door study of 3015 adults aged  $\geq 65$  years (97.6% response rate). An Incidence wave study was conducted in 4.1 years after cohort inception.

**Results:** Prevalence of stroke was 7.8% (95% CI 6.9–8.8). The risk profile for this population group included history of hypertension (OR 2.8; 95% CI 2.0–4.0), low HDL cholesterol (OR 2.6; 95% CI 1.7–3.9), male sex (OR 1.7; 95% CI 1.2–2.5), anemia (OR 1.6; 95% CI 1.1–2.5), history of ischemic heart disease (OR 1.5; 95% CI 1.0–2.3), carrier of one or two apolipoprotein E4 genotype (APOE  $\epsilon 4$ ) alleles (OR 1.4; 95% CI 1.0–2.0), and advanced age (OR 1.3; 95% CI 1.1–1.9).

Crude annual incidence rates was 786.2/100 000 person years (CI 95%: 672.3–906.4). Alcohol consumptions (HR 3.5; IC 95% 3.3–3.7), dementia antecedent (HR 3.0; IC 95% 1.6–5.5) and male sex (HR 1.8; IC 95% 1.2–2.8) were associated with dementia incident.

**Conclusions:** Prevalence and incidence of stroke in this study is similar to that reported for Europe and North America, and higher than that observed in other Latin American countries. The risk profile identified includes classic risk factors plus anemia and APOE  $\epsilon 4$  genotype.

## WSC-0698

## Epidemiology of Stroke

## Young stroke in Taiwan – What matters

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**Introduction and aims:** Many stroke risk factors have been identified, and some are particularly important in young stroke. In this project, we aimed to identify which risk factor(s) might play a significant role in affecting NIHSS and Barthel index in young stroke.

**Material and methods:** Medical records of patients admitted to Mackay Memorial Hospital, Taipei, Taiwan, due to cerebral vascular events (CVE) during 2008–2012, were reviewed. The CVE is defined as having had TIA, ischemic infarction, and nontraumatic intracranial hemorrhage. The age

spans were limited to 18–45 years old. From these medical records, information including age, sex, risk factors of stroke (including cigarette smoking, hypertension, hyperlipidemia, diabetes mellitus, and hyperuricemia), coagulopathies (including abnormal C3, C4, protein C, protein S, antiphospholipid antibody, rheumatic factor, and anti-thrombin-III level, etc), body mass index (BMI), education status, marital status, NIHSS and Barthel index were collected. Nonparametric T test, ordinary least square test and logistic regression were used to investigate our data.

**Results:** Altogether 575 records were reviewed, and 399 entered the analyses. DM was the main risk factor that significantly affected NIHSS and Barthel index in our patient population ( $P < 0.05$ ). For patients who had coagulopathies, C3, protein C, protein S and antiphospholipid antibody could significantly affect NIHSS ( $P < 0.05$ ).

**Conclusions:** DM as well as factors in coagulopathies might play a more significant role than other stroke risk factors in young stroke, which might be responsible in having higher NIHSS and lower Barthel index in our study population.

### WSC-1355

#### Epidemiology of Stroke

##### Risk factors of stroke subtypes in northwest of Iran

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**Background:** Stroke is the second leading cause of death and the most important cause of adult disability worldwide. Ischemic stroke, Intracerebral hemorrhage (ICH), and Subarachnoid hemorrhage (SAH) are the most common subtypes of stroke. Risk factors in each subtype are different and there are limited data in this regard in Iran. Thus, the present study was designed to fill this gap.

**Methods:** In a retrospective analytic study done at two university tertiary referral hospitals in the northwest of Iran, Imam-Reza and Razi hospitals, from March 2008 to April 2013, Patients with diagnosis of stroke were enrolled. Risk factors and stroke subtypes were recorded for all the patients. Risk Factors for each subtype were recorded separately.

**Results:** A total number of 2314 patients enrolled in the present study. Final diagnosis of ischemic stroke was made in 86.2% of the patients, as were intra cerebral with or without intra ventricular hemorrhage (ICH + IVH) and subarachnoid hemorrhage (SAH) in 8.3% and 7.2% of the patients, respectively. Risk factors for each subtype were as below: Ischemic Stroke: Hypertension: 72%, Diabetes mellitus: 26.8%, Smoking: 13%, Hyperlipidemia: 12.2%, AF: 6.1%. ICH (with or without IVH): Hypertension: 65.3%, Diabetes mellitus: 16.6%, Smoking: 11.4%, Hyperlipidemia: 7.3%, AF: 1.6%.SAH: Hypertension: 48.8%, Diabetes Mellitus: 10.7%, Smoking 13.1%, Hyperlipidemia:5.4%, AF:0.6%.

**Conclusions:** This study suggests similar rates of hypertension and diabetes mellitus in the ischemic stroke and ICH patients. Atrial fibrillation was significantly prevalent in the ischemic stroke patients.

**Key words:** stroke subtypes, risk factors.

### WSC-0728

#### Epidemiology of Stroke

##### Stroke subtypes, risk factors and mortality in northwest of Iran

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**Background:** Cerebrovascular disease is the second most common cause of death in the world. About 80% of all stroke deaths occur in developing

countries. Data on stroke epidemiology have so far been limited in Iran. To fill this gap, this study was focused on stroke demographic data, risk factors, types and mortality.

**Methods:** A retrospective study was done at Imam-Reza and Razi hospitals, two university tertiary referral hospitals in the Northwest of Iran, from March 2008 to April 2013. Patients with diagnosis of stroke were enrolled. Demographic data, type of stroke, length of hospitalization, stroke risk factors and hospital mortality were recorded for all the patients.

**Results:** A total number of 2314 patients enrolled in the present study. Mean age was  $68.3 \pm 13.8$  years in which 48.6% were male. Final diagnosis of ischemic stroke was made in 86.2% of the patients, as were intra cerebral with or without intra ventricular hemorrhage (ICH + IVH) and subarachnoid hemorrhage (SAH) in 8.3% and 7.2% of the patients, respectively. Stroke risk factors of the patients were found to be hypertension in 70.0%, diabetes mellitus in 24.9%, smoking in 12.7%, Hyperlipidemia in 11.4%, atrial fibrillation in 9.2%, ischemic heart diseases in 17.9% and Family history of CVA in 1.5%. Overall, in hospital mortality was seen to be 24.5%.

**Conclusions:** Compared to the other studies, SAH and hypertension among Iranian patients are common. Unlike developed countries, mortality rate in Iran remains high and needs special considerations.

**Key words:** stroke, epidemiology, Iran.

### WSC-1446

#### Epidemiology of Stroke

##### Hyperuricemia and risk of ischemic stroke in an urban area of Japan: The Suita Study

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**Introduction:** Hyperuricemia has been considered as the etiologic factor in gout and ischemic heart disease. Recently, prospective studies reported it to be associated with an increased risk of stroke.

**Aims:** Aim of this study is to investigate the association between hyperuricemia and the risk of stroke.

**Methods:** This study is a population-based prospective study in an urban area of Japan. Study subjects comprised 5355 initially healthy Japanese (2568 men and 2787 women) aged 30–83 years with no history of cardiovascular disease (CVD). At baseline (1989–1994), serum uric acid levels were measured after overnight fasting. The criterion of stroke was defined according to the US National Survey of Stroke. We stratified subjects by uric acid levels (5.0, 6.0 and 7.0 mg/dl in men, 4.0, 5.0 and 6.0 mg/dl in women). The Cox proportional hazard ratios for stroke according to uric acid levels were calculated after adjustment by age.

**Results:** During the follow-up period (13.0 years in average), 237 strokes (142 ischemic stroke) were observed. Uric acid levels in men were not associated with incidences of ischemic stroke ( $p$  for trend = 0.30) while those in women significantly were associated with incidences of ischemic stroke ( $p$  for trend = 0.02). Women of the highest uric acid group had significantly higher risk for ischemic stroke; the HRs (95% CIs) was 2.63 (1.04–6.68).

**Conclusions:** Hyperuricemia could be risk factor for ischemic stroke especially in women.

## WSC-0234

## Epidemiology of Stroke

## Stroke and obstructive sleep apnea: Is there a link?

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**Introduction:** Obstructive sleep apnea (OSA) has been established as a risk factor for stroke. Also, many stroke victims wake-up with the symptoms. Yet, the relationship between OSA and stroke during sleep has not been conclusively studied.

**Methods:** This is a case-control study conducted at King-Khalid specialty hospital in Riyadh Saudi Arabia. Acute stroke patients admitted to the hospital between January 2013 and December 2013 were asked whether they woke-up with the symptoms. Those who woke-up with the stroke symptoms were labeled as wake-up stroke. The presence of preceding OSA was determined in the two stroke groups utilizing the Berlin questionnaire.

**Results:** 92 patients (mean age: 63, males: 56%) admitted with acute stroke symptoms in one year. 32 (35%) patients woke-up with the stroke symptoms. 18 (56%) of the patients who woke-up with stroke has symptoms suggestive of OSA, compared to 25 (41%) in those whose stroke occurred while awake [OR 1.8; 95% CI 0.75–4.28; P = 0.18].

**Conclusion:** Stroke during sleep is probably induced by OSA. Further studies with a larger sample size, to ascertain this relationship, is warranted.

## WSC-1096

## Epidemiology of Stroke

Three fourths of South Indian, Tamilian, noncardiogenic, undetermined anterior circulation ischemic strokes have no ipsilateral carotid artery disease

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**Introduction:** Carotid artery disease is a major risk factor for anterior circulation ischemic stroke. However, carotid disease is less expected among strokes of cardiogenic and other determined aetiologies. Reports from India are notably scanty.

**Aim:** To study carotid disease patterns in stroke patients with noncardiogenic and undetermined TOAST subtypes in a South Indian Tamilian population.

**Methods:** 69 consecutive ischemic stroke patients underwent carotid colour and power duplex studies. Data including demographics, risk factors, stroke subtype and severity were documented as per a tertiary care stroke registry. Common carotid artery (CCA) intima medial thickness (CIMT) >1.2 mm was defined as significant and focal IMT >1.2 mm as plaque. Appropriate statistical analysis was done using SPSS19 software.

**Results:** Mean age 54 (SD 13.7). 59 (85%) Men. Complete occlusion (3[4.3%]); stenosis 70 – 99% (2[2.8%]), 50 – 70% (2[2.8%]), and < 50% (62[89%]) of the Carotid artery (ICA or CCA) were seen in this ischemic stroke sample. 27 (43.5%) had plaque, and/or significant CIMT/dissemination. 17 (24.6%) strokes had ipsilateral, 10 (14.4%) contralateral and 42 (60.%) no carotid artery disease. Carotid artery disease was significantly (P = 0.009) more commonly associated in the age group >50 (56.4%) compared to the younger age group (21.7%). Gender, hypertension, diabetes, hyperlipidemia, smoking or stroke subtypes (P = 0.77) did not differ significantly between the groups with and without carotid artery disease.

**Conclusion:** Among 69 consecutive Tamilian ischemic stroke patients, age was significantly associated with carotid artery disease. While only one fourths had ipsilateral disease, 56% had no carotid disease at all.

## WSC-0722

## Epidemiology of Stroke

Intracranial hemorrhage after ischemic stroke – Incidence, time-trends and predictors in a Swedish nationwide cohort of 196765 patients

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**Introduction:** Epidemiological data concerning the risk of intracranial hemorrhage (ICH) after ischemic stroke (IS) is sparse.

**Aims:** The aims of this study were to describe incidence rates, time-trends and predictors of ICH within one year after IS.

**Methods:** All patients registered in the Swedish stroke register Riks-Stroke 1998–2009 were included (n=196765) and data was combined with the National Patient Register to identify ICH occurrence. A matched reference population was obtained. Incidence rates and cumulative incidences were calculated. Logistic regression analysis was used to identify predictors. Analyses were performed separately for the first 30 days and day 31–365 after IS, respectively.

**Results:** The incidence rate was 1.97% per year at risk the first year after IS (0.13% in the reference population) and 0.85% excluding the first 30 days. The cumulative incidence increased the first 30 days during the study-period while it decreased day 31–365. Intravenous thrombolysis, prior ICH, atrial fibrillation and male sex were associated with an increased risk the first 30 days. Prior ICH, antithrombotic treatment and male sex were associated with an increased risk day 31 to 365. The use of statins and antithrombotic treatment increased during the study-period.

**Conclusions:** The risk of an ICH is increased after an IS, even if the acute phase is excluded. During the period 1998–2009 the ICH risk has increased within the first 30 days and is associated with thrombolysis and prior ICH. The ICH risk has decreased after the acute phase despite an increased use of antithrombotic treatment.

## WSC-1274

## Epidemiology of Stroke

Pattern of co-morbidities and socio-demographic variables in stroke survivors seen at the physiotherapy outpatient clinic in a Nigerian tertiary hospital

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**Introduction:** Stroke is a major public health problem in many countries. Co-morbidities and Socio-demographic factors often affect recovery outcomes in stroke rehabilitation.

**Aim:** The aim of the study was to assess the pattern and distribution of co-morbidities and socio-demographics of stroke survivors seen at outpatient physiotherapy clinic of a Nigerian tertiary hospital.

**Methods:** A five year retrospective review (January 2008–December 2012) of stroke survivors seen at the physiotherapy clinic of the Obafemi Awolowo University Teaching Hospital Complex (OAUTHC), Ile-Ife, Nigeria was carried out. Data were gleaned on patients' demographics (age and gender), side of affectation and clinical co-morbidities from the case notes.

**Results:** A total of 198 cases were reviewed out of which 55.5% were male and 44.5% were female with mean ages of 59.1 ± 9.3 years and 58.2 ± 10.8 years respectively. Hypertension (64.7%) and Diabetes Melli-

tus (11.11%) were the most common co-morbidities seen. Ischaemic stroke (65.6%) was the most common type of stroke reported in this study. Majority of the patient had left sided weakness (58.6%).

**Conclusions:** Hypertension was the most common co-morbidity seen in this study while majority of the survivors were male and middle-aged.

### WSC-1015

#### Epidemiology of Stroke

#### Distribution of NIHSS in a national register of patients with ischemic or hemorrhagic stroke

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**Introduction:** One recent study described the NIHSS distribution in ischemic stroke patients presenting at hospital by retrospectively scoring patient records.

**Aims:** We aimed to replicate these findings using a much larger stroke register (Sentinel Stroke National Audit Programme – SSNAP), and extend to include primary intracerebral hemorrhage (PIH) patients.

**Methods:** Data from adults admitted to 191 hospitals in England, Wales and Northern Ireland from Jan-Sep 2013. NIHSS upon arrival was compared between ischemic and PIH patients, excluding unknown stroke types.

**Results:** Of 44,005 adults, 39,376 (89.5%) were ischemic and 4,629 (10.5%) had PIH. 56.7% of PIH patients had fully completed NIHSS compared to 70.4% of ischemic patients. A higher proportion of PIH patients had moderate/severe (10.9%) or severe stroke (13.8%) compared to ischemic patients (6.4%, 6.5% respectively). A lower proportion of PIH patients were categorized as mild stroke (30.9%) than ischemic patients (45.9%). The distribution of NIHSS shows the same pattern across the whole range of scores.

**Conclusions:** It is feasible to collect NIHSS in a large unselected population. The distribution of NIHSS for ischemic patients was similar to a previous retrospective study, however, the proportion with NIHSS 0 or 1 was lower, and the median (IQR) was higher. The distribution of NIHSS for PIH patients demonstrated a profile of more severe strokes.

Completed NIHSS	Ischemic	PIH
Number of patients	27,731	2,626
Median (IQR)	4 (2–9)	7 (3–15)
Category		
0	6.3%	7.0%
1–4 minor	45.9%	30.9%
5–15 moderate	34.9%	37.4%
16–20 moderate/severe	6.4%	10.9%
21–42 severe	6.5%	13.8%

### WSC-1305

#### Epidemiology of Stroke

#### Family stress effects on 16-th years risk of arterial hypertension and stroke in female population 25–64 years in Russia: MONICA-Psychosocial Epidemiological Study

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**Aim:** We studied the influence of high family stress (HFS) on relative risk of an arterial hypertension (AH) and stroke in female population aged of 25–64 years in Russia.

**Methods:** Under the third screening of the WHO “MONICA-psychosocial” program (MOPSY) random representative sample of women aged 25–64 years (n = 870) were surveyed in Novosibirsk. Family stress levels were measured by questionnaire MOPSY. From 1995 to 2010 women were followed for the incidence of AH and stroke. Cox regression model was used for relative risk assessment (HR).

**Results:** The prevalence of HFS in women 25–64 years was 20.9%. HR of AH over 16 years of follow-up in women with HFS was 1.39-fold higher (95.0% CI: 1.99–15.70, p = 0.001) compared to those with lower levels of family stress. HR of stroke over 16 years was 3.53-fold higher (95.0% CI: 1.82–6.84, p < 0.001) for HFS.

There were tendencies of increasing AH and stroke rates in married women experienced stress in family. AH developed significantly higher in women with university and vocational education with HFS (p for all < 0.05, respectively). AH rates were higher in groups “first-line manager” (p < 0.05) and “physical worker” (p < 0.01) experienced stress in family. Higher stroke rates were more likely in “physical workers” with family stress compared to those without it (p = 0.055).

**Conclusions:** There is high prevalence of family stress in female population aged 25–64 in Russia. Women with HFS had significantly higher risk of AH/stroke over 16-th years of follow-up, especially in married women with higher educational level, in professional class “managers” and “physical workers”.

### WSC-0314

#### Epidemiology of Stroke

#### Job stress and 16-th years risk of stroke in female population aged 25–64 years in Russia: MONICA-Psychosocial Epidemiological Study

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**Aim:** To study the job stress effect on relative risk of stroke in female population of 25–64 years in Russia over 16 years of follow-up.

**Methods:** Under the third screening of the WHO “MONICA-psychosocial” program (MOPSY) random representative sample of women aged 25–64 years (n = 870) were surveyed in Novosibirsk. Questionnaire based on Karasek’s job demands-control model proposed by MOPSY protocol was used to estimate levels of job stress. From 1995 to 2010 women were followed for the incidence of stroke. Cox regression model was used for relative risk assessment (HR) of stroke.

**Results:** The prevalence of high job stress level in women aged 25–64 years was 31.6%.

HR of stroke was 1.96-fold higher (95.0% CI: 1.01–3.79, p < 0.05) in women with high job stress compared to those with lower levels of stress. There were tendencies of increasing stroke rates in married women experienced stress at work compared to unmarried, divorced and widowed with the same stress level. As the tendency there was a decline in stroke development in those with university education having job stress. With regard to occupational class stroke more likely developed in “physical workers” with stress at work.

**Conclusions:** There is high prevalence of stress at work in female population aged 25–64 years and high job stress level is 31.6% in Russia. Women with high job stress have significantly higher risk of stroke over 16-th years of follow-up. Rates of stroke development were more likely in married women with lower educational level and high job stress in professional class “physical workers”.

## WSC-0553

## Epidemiology of Stroke

## Cerebral artery calcification is associated with deep cerebral microbleeds

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**Introduction:** Cerebral arterial calcification has been reported to be associated with cerebral small vessel disease

**Aims:** Our aim was to determine the association between arterial calcification and cerebral microbleed (CMB) relative to their distribution pattern.

**Methods:** We identified 834 consecutive patients with acute ischemic stroke who visited a tertiary hospital within 7 days of symptom onset. Calcification in the intracranial internal carotid artery (ICA) was graded on CT angiography. CMB was counted relative to their location on susceptibility-weighted imaging. The association between ICA calcification and CMB was tested using logistic regression analysis.

**Results:** The patients ranged in age from 26 to 111 years ( $67 \pm 12.7$  years). ICA calcification and CMB were found in 660 patients (79.1%) and 335 patients (40.2%), respectively. On multivariate analysis, ICA calcification was associated with CMB of any location (odds ratio (OR) 1.76, 95% confidence interval (CI) 1.31–2.36 for mild calcification; OR 2.86, 95% CI 2.01–4.08 for severe calcification, respectively). The association between calcification and deep CMB was more robust (OR 1.76, 95% CI 1.27–2.44 for mild calcification; OR 3.51, 95% CI 2.39–5.14 for severe calcification, respectively). However, ICA calcification was not associated with CMB in a strictly lobar area.

**Conclusions:** ICA calcification is an independent predictor for deep CMB but not for a strictly lobar CMB. Our findings suggest that arterial calcification be used as an important risk-stratification tool in vascular brain injury and might contribute to the elucidation of the pathogenesis of SVD.

## WSC-0618

## Epidemiology of Stroke

## Heme oxygenase-1 gene promoter microsatellite polymorphism is associated with progressive atherosclerosis and incident cardiovascular disease

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**Introduction:** The enzyme heme oxygenase-1 (HO-1) exerts cytoprotective effects in response to various cellular stressors. A variable number

(GT)<sub>n</sub> tandem repeat (VNTR) polymorphism in the HO-1 gene promoter region has previously been linked to cardiovascular disease (CVD).

**Aims:** We sought to examine this association prospectively in the general population.

**Methods:** The Bruneck Study is a prospective population-based survey with near-complete participation and follow-up initiated in 1990. The first re-evaluation in 1995 served as the baseline for the present investigation with follow-up until 2010 for CVD (composed of stroke and myocardial infarction). HO-1 VNTR length was determined by polymerase chain reaction. Atherosclerosis progression at the carotid arteries was quantified by high-resolution ultrasound.

**Results:** The study population consisted of 812 subjects (age, mean [range] 63 [45, 84] years; 49.4% male). Subjects with  $\geq 32$  tandem repeats on both HO-1 alleles compared to the rest of the population (recessive trait) featured substantially increased CVD risk (hazard ratio [95% confidence interval], 5.45 (2.39, 12.42); P

**Conclusions:** This study found a strong association between the HO-1 VNTR polymorphism and CVD risk confined to subjects with a high number of (GT)<sub>n</sub> repeats on both HO-1 alleles, and provides evidence for accelerated atherogenesis and decreased anti-oxidant defence in this vascular high-risk group.

## WSC-0945

## Epidemiology of Stroke

## Relationship of serum homocysteine and other modifiable risk factors in ischemic and hemorrhagic strokes

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**Introduction:** Hyperhomocystinemia is a modifiable risk factor for stroke. Indian studies report high prevalence of hyperhomocystinemia. It is important to identify at-risk population to target stroke prevention.

**Objectives:** To study relationship of serum homocysteine and other modifiable risk factors in ischemic (IS) and hemorrhagic strokes (HS).

**Methods:** This study is based on data collected prospectively from 451 consecutive admissions at a JCI-accredited stroke center within 24 hours of stroke onset. All patients were evaluated with CT/MRI of brain. Risk factors ascertained: Diabetes, Hypertension, moderate-to-high alcohol consumption, cigarette smoking > 5/day, fasting blood lipid profile and homocysteine. For analysis patients were classified into age groups <44 years, 44–58 years, 58–72 years, >72 years, serum homocysteine <15  $\mu\text{mol/l}$  considered normal.

Contingency analysis and ANOVA were used to evaluate association of risk factors with homocysteine. Logistic regression model was derived to predict stroke type (IS/HS).

**Results:** 144 patients (32%) had hyperhomocystinemia (mean 30.47  $\mu\text{mol/l}$ ). Following observations achieved statistical significance ( $p < 0.05$ ):

- (i) Higher incidence of hyperhomocystinemia was observed in young (<44 years) patients, male gender, alcohol consumers, and dyslipidemics.
- (ii) Higher mean serum values in <44 age group, male gender, and high TC/HDL cholesterol Ratio
- (iii) Hyperhomocystinemia did not correlate with other stroke risk factors.

Logistic regression analysis revealed combination of TC/HDL Ratio and serum homocysteine as significant risk factors to determine stroke type (ischemic versus hemorrhagic).

**Conclusion:** Hyperhomocystinemia and dyslipidemia are significant contributory factors for stroke in young Indian men.

## WSC-1349

### Epidemiology of Stroke Ischemic strokes in Sri Lanka: 5-year data from the Ragama Stroke Registry

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**Introduction:** Stroke events and mortality are commoner in developing countries, but data are limited especially from the South Asian region.

**Aims:** To describe the demographic characteristics, clinical features, stroke subtypes, risk factors, stroke severity, and initial disability among patients with ischemic stroke in a Sri Lankan tertiary care setting.

**Methods:** The Ragama Stroke Registry is the only comprehensive stroke registry in Sri Lanka capturing data of all stroke patients admitted to an entire hospital. We analyzed data of patients with ischemic strokes admitted over a 5-year period.

**Results:** Of 1961 patients, 1588 (81.0%) had ischemic strokes [mean age (SD) 64.4 (12.1) years; 46.5% ≥65 years; 59.4% males]. A large number (38.2%) presented to a hospital within 3 hours of noticing symptoms. Lacunar infarction was seen in more than half of the patients. Hypertension (56.7%), diabetes (33.9%) and heart disease (19.1%) were the commonest risk factors. Obesity/overweight was common in women (53.13%), but not in men (15.65%). Smoking was very common among men (62.4%), but rare in women (2.2%). A history of stroke was noted in 13.9%, a history of TIA in 6.9%, and a family history of stroke in 21.8%. Admission NIHSS score was ≥8 in 43.3%. Functional disability on admission was common [Barthel index ≤60 in 76.0%, mRS ≥3 in 75.1%].

**Conclusions:** Lacunar infarction was the commonest subtype. Hypertension was the commonest risk factor identified. A large number presented to hospital within 3 hours, indicating opportunity for thrombolysis.

## WSC-1599

### Epidemiology of Stroke Stroke mortality in Temuco, Chile, during the period 2001–2010

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**Background:** Stroke is the first most common specific cause of death in Chile, since 2008, representing roughly 10% of total death. However the situation is not homogenous in our country. In Chile, the mortality rate for 2010 was 52.5 in Chile and Temuco is in 60.5. The increased risk in Temuco is explained by the prevalence of poverty, diabetes, a sedentary lifestyle and overweight.

**Objective:** To determine the mortality of stroke in Temuco, including all Health Service South Araucanía (HSSA) during the period 2001–2010.

**Methods:** The research is a descriptive Cross-Sectional Study. The study considers the databases of the department of statistics and health information (DEIS) for the years 2001–2010. The population of between 18 to 90 years old was considered that it presented an episode of stroke during the period 2001–2010, which received attention in the HSSA, and its principal diagnosis agree to the criteria of ICD-10 (I600-I609, I610-I619, I630-I639, I64x, I650-I659, I660-I669 and G458-G459).

**Results:** The HSSA has 771,114 inhabitants. During the study period was obtained 6548 hospital discharges. During hospitalization, the case fatality rate for subarachnoid hemorrhage was 32.4 (95% CI 29.7–35.1) for intracranial hemorrhage was 30.7 (95% CI 27.9–33.5) and ischemic stroke was 12.6 (95% CI 13.6–11.6).

**Conclusion:** This study shows the case fatality rates was higher for intracranial hemorrhages, subarachnoid hemorrhage than ischemic strokes. The rates are within what is observed in different studies, especially in the PISCIS study, in Iquique, Chile.

**Key words:** South America, stroke, prevalence, mortality.

## WSC-1468

### Epidemiology of Stroke Prevalence of stroke In Temuco (Health Service South Araucanía), Chile, during the period 2001–2010

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**Introduction:** Stroke is the first most common specific cause of death in Chile, since 2008. The increased risk in our region is explained by the prevalence of poverty, diabetes, a sedentary lifestyle and overweight.

**Aims:** To determine the prevalence of stroke in Temuco, including all Health Service South Araucanía (HSSA) during the period 2001–2010.

**Methods:** The research is a descriptive cross-sectional study. The study considers the databases of the Department of Statistics and Health information (DEIS) for the years 2001–2010. The population of between 18 to 90 years old was considered that it presented an episode of stroke during the period 2001–2010, which received attention in the HSSA, and its principal diagnosis agree to the criteria of ICD-10 (I600-I609, I610-I619, I630-I639, I64x, I650-I659, I660-I669 and G458-G459).

**Results:** The HSSA has 771,114 inhabitants. During the study period was obtained 6548 hospital discharges, of which 3531 (53.9%) cases were male and 3017 (46.1%) cases women. 7.1% had a subarachnoid hemorrhage, 23.5% an intracranial hemorrhage and 69.4% an ischemic stroke. Among men the percentages were 4.4%, 24.6%, 71% and among women 10.2%, 22.2%, 67.6% respectively.

**Conclusion:** In the study, the high percentage of patients with intracranial hemorrhages among stroke sufferers, is higher than that seen in people living in developed countries, but it is consistent with the reports of the studies of South America. Several factors may explain such differences, including high prevalence of uncontrolled arterial hypertension, dietary habits and alcohol abuse.

**Key words:** South America, stroke, prevalence, intracranial hemorrhage.

## WSC-1522

### Epidemiology of Stroke Acute incidental infarcts and their association with cognition

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**Introduction:** Acute incidental infarcts (AII) may be investigated using acute DWI lesions incidentally detected in subjects not undergoing MRI for acute stroke. However, there are few large studies reported.

**Aim:** To describe subjects with AII, and examine association with cognitive status.

**Methods:** Subjects were drawn from 2 ongoing dementia research studies, one community-based, and second dementia-clinic based. Participants underwent cranial MRI (with DWI). Subjects with hyperintense DWI lesions, indicative of AII were identified. Multiple logistic regression models used to analyze significant associations of AII.

**Results:** 12 of 937 subjects, over 3.6 years had AII; mean age 74.2 ( $\pm 8.8$ ) years. Estimated annual incidence -0.18% in community based, versus 0.67% in clinic-based cohort ( $p = 0.02$ ). All AIIs were lacunar ( $< 20\text{mm}$ ). In subjects with AII, significant white matter lesions (Fazekas score  $\geq 2$ ) seen in 10 (83.3%), intracranial stenosis ( $\geq 50\%$ ) -4 (33.3%); mean number of microbleeds -19.8 ( $\pm 39.1$ ). Frequency of AII by cognitive status -0% in normal cognition; 1.4% in CIND (cognitive impairment, no dementia), 4.8% in dementia. Cognitive status (OR 3.38; CI 1.15–9.93;  $p = 0.03$ ), total cerebral microbleeds (OR 1.02; CI 1.00–1.04;  $p = 0.04$ ) were significantly associated with presence of AII. No significant association with hypertension, diabetes, hyperlipidemia, atrial fibrillation, previous stroke.

**Conclusion:** Subjects with cognitive impairment are more likely to have AII. Although a cause-effect relationship is plausible, the association may be due to under-reporting of symptoms by individuals with cognitive impairment.

The association between AII and cerebral microbleeds may indicate common mechanism with cerebral vasculopathy, independent of traditional vascular risk factors.

### WSC-1174

#### Epidemiology of Stroke Survival of young ischemic stroke patients in Tartu, Estonia in 2003–2012

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**Introduction:** Although the outcome of stroke in the young is generally favorable, stroke still has a significant impact on person's quality of life and moreover can be fatal.

**Aims:** The aim of the study was to evaluate the long-term survival in young ischemic stroke patients in 2003–2012.

**Methods:** Medical documents of all consecutive patients aged 15–54 years with ischemic stroke from Tartu University Hospital from 2003 to 2012 were retrospectively analyzed. The Estonian Population Register was contacted to obtain the survival data. The 1- and 5-year outcome of young stroke patients was calculated by the Kaplan-Meier method.

**Results:** Of the 259 patients, 177 (70%) were men. The mean age of patients was 45.9 years (SD 7.7 years). The overall survival rate at 1 and 5 years was 0.94 (95% CI 0.91–0.97) and 0.90 (95% CI 0.86–0.94), respectively. The survival was significantly worse for men ( $P = 0.03$ ). According to the TOAST subtypes the patients with cardioembolic stroke ( $n = 51$ ; 20%) had the lowest survival (0.88 and 0.80 at 1 and 5 years, respectively), but it did not reach statistical significance.

**Conclusions:** Long-term survival in young stroke patients is generally good and improved compared to a previous study from Tartu (1991–2003). An ongoing study will focus on finding out the related factors.

### WSC-0540

#### Epidemiology of Stroke Unclear-onset ischemic stroke: Clinical features and functional outcomes

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**Introduction:** Unclear-onset ischemic strokes occur in about one-fourth of patients with ischemic stroke. However, the clinical characteristics of unclear-onset strokes are largely unknown.

**Aims:** In this study, we evaluated clinical features and functional outcomes among patients with unclear-onset ischemic strokes compared to those with clear-onset ischemic stroke.

**Methods:** This was a retrospective study on a prospectively collected database. We evaluated 250 consecutive patients with acute ischemic stroke who were admitted between September 2012 and August 2013. The baseline characteristics were compared between unclear-onset ischemic stroke group and clear-onset ischemic stroke group. The primary outcome measure was the median modified Rankin Scale (mRS) at 3 months. Other outcome measures were modified Rankin scale of 0 to 2, and mortality at 3 months.

**Results:** No significant differences were found in terms of baseline factors and stroke subtypes between the two groups. The initial NIHSS Scale score of patients with unclear-onset ischemic stroke was significantly higher than that of their clear-onset ischemic stroke counterparts (median [interquartile range]; 9 [3 to 14] versus 4 [1 to 5];  $p = 0.000$ ). The functional outcome of unclear-onset ischemic stroke group was worse than that of clear-onset group (median [interquartile range]; 3 [1 to 6] versus 1 [0 to 2];  $p = 0.000$ ).

**Conclusions:** Although the baseline characteristics of the unclear-onset ischemic stroke group were similar to those of persons enrolled in the clear-onset group, their outcomes were much poorer. We suggest that clinical approach for the identification of unclear onset ischemic stroke patients who can potentially benefit from recanalization therapy is essential.

### WSC-1275

#### Epidemiology of Stroke Is there any spousal concordance of cerebrovascular risk factors in stroke patients?: A pilot study

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**Introduction:** Cerebrovascular risk factors which are hypertension, diabetes mellitus, hyperlipidemia and obesity are related to genetic or environmental factors. Coronary diseases are also influenced by these risk factors. Familial concordance of vascular risk factors is well understood and there are many studies about interspouse concordance of the risk factors for coronary heart disease. However, there is no studies for interspousal relation of the risk factors in cerebrovascular disease patient.

**Aims:** This pilot study aim to find the tendency which risk factors are highly related between stroke patients and their spouses.

**Methods:** We enrolled 46 patients who had admitted our hospital due to stroke and their spouses. Interspouse correlation of body mass index, abdominal circumference, history of hypertension, blood pressure, history of diabetes, serum glucose, serum lipid panel, smoking, alcohol drinking and carotid intima-media thickness (IMT) known as cerebrovascular risk factors were investigated.

**Results:** There was statistically significant spousal concordance in some cerebrovascular risk factors, which is history of hypertension ( $\text{kappa} = 0.30$ ,  $p = 0.025$ ) and carotid IMT (pearson coefficient = 0.351,  $p = 0.017$ ). However, the further age-adjusted analysis revealed no significant result in carotid IMT (coefficient = 0.082,  $p = 0.63$ ).

**Conclusions:** There are tendencies of spousal concordance in some cerebrovascular risk factors although the age is major determinant in carotid IMT. These results might be influenced by the small number of subjects. Further study with large number of subjects should be needed to confirm the tendency in carotid IMT, found in the present study.

## WSC-0308

## Epidemiology of Stroke

## Atrial fibrillation: A rising cause of stroke. Report of a first level stroke unit

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**Introduction:** Cerebrovascular disease is the second commonest cause of death after ischemic heart disease and it is a leading cause of disability worldwide. Risk factors for stroke include high blood pressure, previous stroke or TIA, diabetes, high cholesterol and atrial fibrillation (AF). AF is the most common cardiac arrhythmia and increase fivefold the risk of stroke.

**Materials and methods:** We have collected medical data of all patients that underwent thrombolysis treatment from July 2010 to March 2014 in our Stroke Unit (SU) and we have made a statistical analysis of them.

**Results:** We have treated 74 patients (Male 46; mean age 68.7). The mean time of door-to-needle treatment was 1.20 hour. The reduction of NIHSS score after thrombolysis occurred in 78% ( $p < 0.0001$ ). The etiology of stroke was principally cardioembolic with half of case presenting paroxysmal AF. The type of stroke was mainly anterior circulation syndrome (68%); lacunar syndrome in 30% and posterior circulation syndrome 2%. The mean time of recovery in SU was  $6.2 \pm 4.7$  days. Ten patients (13.5%) went home directly from SU in  $5.9 \pm 3.2$  days (mean) and other 31 patients after a period in neurology division ( $7 \pm 4.1$  days mean). Thirty patients were transferred in rehabilitation department after  $12 \pm 7.2$  days (mean).

**Conclusion:** Thrombolysis is an efficacious treatment that reduce brain damage and consequently recovery time and health cost. We have found an increased prevalence of AF compared to the literature. This fact deserve attention, especially now that new oral anticoagulants exist.

## WSC-1149

## Epidemiology of Stroke

## Curacao stroke survey: Epidemiology of stroke on the Caribbean Island Curacao from 2010 till 2014

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**Introduction:** Accurate recent data on stroke epidemiology in the Caribbean region is scarce. Curacao is located in the southern Caribbean Sea and inhabits 150,000 persons. This abstract presents the first results of an ongoing project collecting epidemiological data on clinically admitted stroke patients in Curacao.

**Aims:** To measure the amount of clinical admissions for stroke and examine which factors influence incidence, management and outcome of stroke.

**Method:** Starting 1st of May 2010 the attending physician filled in a questionnaire (based on the WHO STEPwise approach to stroke surveillance) for each admitted patient suspect of stroke. All patients received Computed Tomography (CT) imaging. The data was analyzed till January 31st 2014.

**Results:** A total of 903 strokes was registered (53.7% males). Ischemic strokes accounted for 74% (672), intracerebral hemorrhage for 19% (171), subarachnoid hemorrhages for 4% (37). The incidence of hospital admitted strokes in Curacao was 181 per 100.000 in 2013. Hypertension was noted in 82% of patients with ischemic stroke and diabetes mellitus in 37%. In males 13% had a stroke before their 50th and 46% before their

65th birthday, in females these figures were 10% and 33%. Of the 672 ischemic strokes 27 (4%) patients received thrombolysis. Overall (in hospital) mortality was 19%.

**Conclusion:** The burden of stroke in Curacao appears to be considerable. The proportion of ischemic strokes that receives thrombolysis is unfortunately relatively low. The amount of young (male) patients with stroke seems disproportionately high. Further investigation to improve prevention and care for stroke is pending.

## WSC-0392

## Epidemiology of Stroke

## Lacunar infarction and deep intracerebral hemorrhage – Similarities and differences of two different clinical entities of cerebral small-vessel disease

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**Introduction:** Lacunar infarction (Lac) and deep intracerebral hemorrhage (DICH) are known as cerebral small-vessel disease in which hypertension plays a pivotal role in the development of pathology. We examined differences and similarities between them.

**Methods:** Between February 2008 and October 2013, 1287 patients were admitted to our institution within 1 week after the onset of stroke. Among the patients, 156 had Lac and 100 had DICH.

**Results:** Treatment for diabetes mellitus (DM; 27.7% vs. 8.0%;  $p < 0.0001$ ), calcification of the aortic arch (60.3% vs. 39.6%;  $p = 0.0022$ ), and left-sided stroke (62.8% vs. 52.0%;  $p = 0.033$ ) were significantly more frequent in Lac than in DICH. Multivariate analysis revealed that treatment for DM (OR 3.36,  $p = 0.0054$ ), calcification of aortic arch (OR 1.82  $p = 0.0046$ ), and left-sided stroke (OR 1.94,  $p = 0.027$ ) were significantly more common in Lac than in DICH. Prevalence of risk factors was analyzed after admission. Hypertension was significantly more common in DICH than in Lac (98.0% vs. 81.1%;  $p < 0.001$ ). On the other hand, Dyslipidemia (48.4% vs. 26.0%;  $p < 0.001$ ) and DM (39.8% vs. 18.0%;  $p < 0.001$ ) were significantly more common in Lac than in DICH.

**Conclusions:** Lac and DICH have similar backgrounds. However, left-sided stroke, calcification of the aortic arch, and a medical history of DM are more common in Lac than in DICH patients. Prevalence of hypertension was significantly more common in DICH. On the other hand, prevalence of dyslipidemia and DM were more common in Lac. These results suggest that there are subgroups of Lac in which the pathological process is different from that in DICH.

## WSC-1069

## Epidemiology of Stroke

## Autoimmune thyroiditis related to carotid dissection and stroke in two young patients

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**Introduction:** Stroke in young population has a different aetiology those occurring in elderly. Autoimmune hyperthyroidism leading to carotid arterial dissection and stroke were rarely reported in literature.

**Aims:** We report two cases of stroke in young patients due to carotid dissection associated with autoimmune hyperthyroidism in absence of detectable cardiac abnormality.

**Methods:** *Case 1:* 24 yo woman without vascular risk factors presented with sudden left hemiparesis (NIHSS8). CT showed cortical hypodense in the right frontal region. Investigation was normal except for marked auto-

immune hyperthyroidism. Vascular doppler and angiotomography showed dissection of right internal carotid. Treatment started with warfarin and methimazol with good recovery. *Case 2:* 27 yo man without vascular risk factors presented with severe right hemiparesis and aphasia. CT showed extensive hypodensity in the MCA territory. Cerebral angiography revealed left internal carotid dissection. No overt signs of hyperthyroidism was found at this time and he was discharged severely disabled with anticoagulation therapy. Shortly he was readmitted with normal INR, left hemiplegia and reduction of consciousness (NIHSS 26). CT scan showed new hypodense lesion in the right MCA territory. Angiotomography suggested a new dissection in the right carotid artery. Pronounced hyperthyroidism and no cardioembolic sources was found. Despite decompressive craniectomy patient's clinical status deteriorated resulting in death by sepsis.

**Results:** After completed diagnostic investigation autoimmune thyroiditis appeared related to dissection events in 3 arteries of 2 young patients

**Conclusions:** These two cases join to the few reports suggesting assessment of autoimmune thyroid disease in young people with arterial dissection.

### WSC-0694

#### Epidemiology of Stroke

#### Predictive value of C-reactive protein for the outcome after primary intracerebral hemorrhage

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**Introduction:** Primary intracerebral hemorrhage (PICH) carries high morbidity and mortality rates. Several factors have been suggested as predicting the outcome. The value of C-reactive protein (CRP) in predicting a poor outcome is unclear, and findings have been contradictory.

**Aim:** We tested in our population-based cohort whether, independent of confounding factors, elevated CRP levels on admission (<24h after ictus) are associated with an unfavorable outcome.

**Methods:** We identified all subjects with PICH between 1993 and 2008 among the population of Northern Ostrobothnia, Finland, and extracted their CRP values on admission from the laboratory records. Independent predictors of an unfavorable outcome (moderate disability or worse on the Glasgow Outcome Scale at three months) were tested by unconditional logistic regression in a model including all the well-established confounding factors and CRP on admission.

**Results:** Of 961 patients, 807 (84%) had CRP available within 24 hours of admission, and multivariable analysis showed elevated CRP at that point to be associated with an unfavorable outcome (OR 1.41 per 10 mg/l, 95% CI 1.09–1.81,  $p < 0.01$ ), together with diabetes (OR 1.99, 1.09–3.64,  $p < 0.05$ ), age (1.06 per year, 1.04–1.08,  $p < 0.001$ ), low GCS score (0.75 per unit, 0.67–0.84,  $p = 0.001$ ), hematoma size (1.05 per ml, 1.03–1.07,  $p < 0.001$ ) and the presence of an intraventricular hematoma (2.70, 1.66–4.38,  $p < 0.001$ ). Subcortical location predicted a favorable outcome (0.33, 0.20–0.54,  $p < 0.001$ ).

**Conclusions:** Elevated CRP on admission is an independent predictor of an unfavorable outcome and is associated with the clinical and radiological severity of the bleeding.

### WSC-0968

#### Epidemiology of Stroke

#### Stroke due to large vessel occlusion, used recanalization therapy and its outcome in Pauls Stradins Clinical University Hospital. Stroke registry data overview

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**Introduction:** In case of large vessel occlusions severe neurological deficit or lethal outcome is expected to occur.

**Material and method:** The data from Stroke register from 01.01.2010 till 31.12.2013 was used to analyze patients with large vessel occlusion, used treatment, NIHSS scale was used to evaluate effectiveness.

**Results:** There were 3608 cases of ischemic stroke, from them 2187 (60%) were because of large vessel occlusion. In 55% of cases ( $n = 1208$ ) large vessel occlusion was due to cardiac emboli, 32% ( $n = 705$ ) was due to large vessel atherothrombosis and in 13% ( $n = 274$ ) cause was unidentified. From 2187 patients 15% ( $n = 324$ ) received recanalization therapy – in 197 cases intravenous thrombolysis (IVT) and in 127 cases mechanical thrombectomy (MTE). Patients who received MTE on admission presented with higher NIHSS score average 15.98, compared to IVT patients with average NIHSS 12.07 and patients who didn't receive recanalization therapy – 11.54.

	NIHSS on admission day	NIHSS on discharge day	Exitus letalis
No recanalization therapy	11.54	8.38	185 (10%)
Intravenous thrombolysis	12.07	6.69	14 (7%)
Mechanical thrombectomy	15.98	7.74	10 (8%)

**Conclusion:** In case of reperfusion therapy better outcome is expected, regardless of used method. But in cases when mechanical thrombectomy is used more severe neurological symptoms are expected on admission.

### WSC-0966

#### Epidemiology of Stroke

#### Overview of Latvian Stroke Registry

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**Introduction:** In 2010th there was established first Latvian Stroke Registry.

**Materials and methods:** The data from Stroke register was used to analyze stroke patient parameters in Latvian population during the period of time from 01.01.2010 till 31.12.2013.

**Results:** Data about 5481 acute CI patients has been entered. Average age was  $72 \pm 8.4$  years. According to TOAST criteria of CI 33% ( $n = 1825$ ) of patients developed stroke due to the large vessel disease, 21% ( $n = 651$ ) -due the small blood vessel diseases, 34% ( $n = 1868$ ) of cases were of cardioembolic origin, 9% ( $n = 476$ ) were of unspecified origin, stroke due to other conditions were in 1% of the cases. Thrombolysis was performed in 6% of the cases ( $n = 252$ ), mechanical thrombectomy was done in 3% ( $n = 186$ ). According to the National Institute of Health stroke scale (NIHSS) 35% ( $n = 1,912$ ) of cases were minor stroke (<5 points), moderate stroke (5–15 points) were registered in 43% ( $n = 2,380$ ) of cases, and severe symptoms of stroke (>15) – 22% ( $n = 1189$ ). On discharge minor neurological deficit were in 56% of cases, moderate disability were in 26%, NIHSS >15 – 10%, exitus letalis – 8%.

**Conclusions:** Most common type of stroke was cardioembolic and due to large vessel disease. Reperfusion therapy was performed as often as in other European countries. More than half of the patients discharged with minor neurological deficit.

**WSC-1146****Epidemiology of Stroke  
Time trends in incidence and case fatality of ischemic stroke. The Tromsø Study 1977–2010**A M Vangen-Lønne<sup>1</sup>, T Wilsgaard<sup>2</sup>, S H Johnsen<sup>1</sup>, M Carlsson<sup>1</sup>, E B Mathiesen<sup>1</sup><sup>1</sup>Department of Clinical Medicine, The Arctic University of Norway, Tromsø, Norway<sup>2</sup>Department of Community Medicine, The Arctic University of Norway, Tromsø, Norway

**Introduction:** Ischemic stroke incidence has declined in industrialized countries the last decades, with a possible exception for the youngest age-groups.

**Aim:** To explore trends in incidence and 30-days case fatality of first-ever ischemic stroke from 1977 to 2010 in a Norwegian cohort.

**Methods:** We calculated incidence rates and case-fatality of first-ever ischemic strokes in 36 575 participants of the population-based Tromsø Study between 1974 and 2008, with follow-up through Dec. 31, 2010. Additional analyses were performed with a combined endpoint of ischemic strokes and strokes which were unclassifiable due to lack of imaging (or autopsy) at the time of diagnosis. The study was approved by the regional ethics committee. All participants gave written informed consent.

**Results:** There were 1214 ischemic and 77 unclassifiable strokes within a total follow-up time of 610 866 person years. Ischemic stroke incidence increased significantly in women aged 30–49 years, but not in analyses with the combined endpoint. There was a significant increase in ischemic stroke incidence in men aged 50–64 years. Incidence rates decreased significantly in participants aged 65–74 years and in women aged 50–64 years. Similar trends were found for the combined endpoint. Age- and sex-adjusted case fatality rates did not change from 1995 to 2010.

**Conclusion:** Ischemic stroke incidence increased in women aged 30–49 years, but not for the combined endpoint ischemic and unclassifiable stroke. The incidence of ischemic stroke declined significantly in women aged 50–74 years and in men aged 65–74 years. The 30-days case fatality rates were unchanged in the period.

**WSC-0447****Epidemiology of Stroke  
Nationwide stroke epidemiology survey in China:  
Methodological Issues**W Wenzhi<sup>1</sup>, S Haixin<sup>1</sup>, J Bin<sup>1</sup><sup>1</sup>Department of Neuroepidemiology, Beijing Tian Tan Hospital Capital Medical University, Beijing, China

**Objectives:** A large scale epidemiological survey of stroke in China was carried out in 2013, from which we can obtain the incidence, prevalence, mortality of stroke and some relevant data.

**Methods:** This epidemiological survey was conducted in 157 regions nationwide, and which come from the National Disease Surveillance System in 31 provinces. A multistage stratified cluster sampling method was applied to obtain the sample population based on national census data of 2010 in China. Each site completed the survey of 3800 people and the total sample size was more than 600,000 people. The survey was completed in cooperation of staffs from the Provincial Centers for Disease Control (CDC) and neurologists from the high level hospitals in each province. During the survey, the investigators from CDC firstly screen the patients (or possible patients) of stroke with a questionnaire, which ask some symptoms and signs of stroke/TIA history. The screening survey needs to be completed by door-to-door, and interview rate must be over 85%. Secondly, every individual with a positive symptom and sign or stroke/TIA history need to be re-interviewed by a neurologist and to make a diagnosis, and then neurologists record the relevant information in detail. Also neurologists need to re-check the death cases from January 1,

2012 to the survey date. We used the ARIC (Atherosclerosis Risk In Communities Study) diagnostic criterion in this survey.

From March, 2014, the data have been collected from different provinces, and the main results will be announced before the end of this year.

**WSC-0942****Experimental and Translational Neuroscience  
Inhibition of TNF-alpha attenuates in vitro cerebral barrier dysfunction and apoptosis during ischemic injury**Z Abdullah<sup>1</sup>, U Bayraktutan<sup>1</sup><sup>1</sup>Stroke Division of Clinical Neuroscience, University of Nottingham, Nottingham, United Kingdom

**Introduction:** Ischemic injury is associated with excessive generation of TNF- $\alpha$  and blood-brain barrier (BBB) dysfunction.

**Aims:** This study investigates whether inhibition of TNF- $\alpha$  could attenuate BBB damage and cell apoptosis.

**Methods:** TNF- $\alpha$  levels were measured in human brain microvascular endothelial cells (HBMEC) and astrocytes (HA) subjected to oxygen-glucose deprivation alone or followed by reperfusion (OGD $\pm$ R) using an ELISA-based kit. Total superoxide anion (O<sub>2</sub><sup>-</sup>) levels and NADPH oxidase activity by cytochrome C reduction and lucigenin-enhanced chemiluminescence assays, respectively. Protein expressions and matrix metalloproteinase (MMP) activities by western analyses and gelatin zymography, respectively. Apoptosis by caspase-3/7 and DNA fragmentation (TUNEL) assays. Stress fiber formation by immunocytochemistry and BBB integrity by measurements of transendothelial electrical resistance (TEER) and sodium fluorescein (NaF) or albumin (EBA) flux.

**Results:** Exposure of HBMEC and HA to OGD $\pm$ R led to marked increases in TNF- $\alpha$  levels which in turn significantly elevated total O<sub>2</sub><sup>-</sup> levels and NADPH oxidase activity. In HBMEC, MMP-2 and MMP-9 activities were increased by both OGD $\pm$ R and reperfusion phase alone, respectively. In HA, while reperfusion induced MMP-2 activity, MMP-9 activity were undetectable. OGD $\pm$ R suppressed tight junction proteins expression, claudin-5 and occludin. OGD $\pm$ R enhanced caspase-3/7 activity, DNA fragmentation and stress fiber formation in HBMEC and HA. Exposure of co-cultures to OGD $\pm$ R impaired BBB integrity as shown by reductions in TEER and concurrent increases in NaF and EBA flux. Inhibition of TNF- $\alpha$  by an anti-TNF- $\alpha$  IgG negated all the OGD $\pm$ R-induced deleterious effects on barrier integrity, protein expression and enzyme activity.

**Conclusions:** Inhibition of TNF- $\alpha$  after ischemic stroke may preserve BBB integrity and function.

**WSC-0699****Experimental and Translational Neuroscience  
Mechanism regulating D-serine and L-serine during transient middle cerebral artery occlusion in a mouse model**T Abe<sup>1</sup>, J Sasabe<sup>2</sup>, M Suzuki<sup>2</sup>, S Takahashi<sup>1</sup>, M Unekawa<sup>1</sup>, T Iizumi<sup>1</sup>, S Aiso<sup>2</sup>, N Suzuki<sup>1</sup><sup>1</sup>Department of Neurology, Keio University School of Medicine, Tokyo, Japan<sup>2</sup>Department of Anatomy, Keio University School of Medicine, Tokyo, Japan

(D-serine is thought to be involved in NMDA receptor-mediated neurotoxicity. The deletion of serine racemase SRR), which synthesizes D-serine from L-serine, was recently reported to be neuroprotective in a murine middle cerebral artery occlusion (MCAO) model. However, the regulatory mechanism for D-/L-serine remains elusive. First, we investigated D-serine and L-serine contents in brain after MCAO and clarify D-/L-serine release after hypoxia using in vitro ischemia model. Second, the

expression of SRR and 3-phosphoglycerate dehydrogenase (3-PGDH) which synthesize L-serine from 3-phosphoglycerate was determined in brain after MCAO by immunohistochemistry.

The D-/L-serine content in ischemic brain increased up to 120% and 300% until 20 hrs after recanalization respectively. After 24hrs hypoxia, the release of D-serine from neurons was significantly increased compared to control ( $7.1 \pm 2.0$  pmol/ $\mu$ g protein/24h, vs  $1.3 \pm 1.9$ : n = 6, p). Therefore, the increase in D-/L-serine is not related to an increase in SRR or 3-PGDH, but to an increase in the substrates of SRR and 3-PGDH.

## WSC-0672

### Experimental and Translational Neuroscience Correlation between TNF-alpha in serum with neurological deficit measured by NIHSS in acute thrombotic stroke

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**Introduction:** Tumor necrosis factor alpha (TNF- $\alpha$ ) has an important role in ischemic process in thrombotic stroke. TNF- $\alpha$  is a multifactor cytokine associated with inflammatory processes and immune reactions. Several experimental studies suggest that TNF- $\alpha$  cause adverse effects on brain tissue ischemia. But in another studies TNF- $\alpha$  was found have the neuroprotective effects.

**Aim:** This study aims to determine the correlation between the levels of TNF- $\alpha$  in serum with neurological deficit as measured by the NIHSS in patients with acute thrombotic stroke.

**Method:** Thirty patients with acute thrombotic stroke who were treated at the neurology ward of Dr. Soetomo General Hospital/ a Teaching Hospital of Faculty of Medicine, Airlangga University at period December 2011–February 2012 were measured serum levels of TNF- $\alpha$  with sandwich ELISA method using HS (High Sensitivity) TNF- $\alpha$  and neurological deficit was assessed using the NIHSS.

**Result:** Mean age of subjects was  $59.53 \pm 11.51$  years. The study subjects consisted of 20 men and 10 women. The mean serum levels of TNF- $\alpha$  is  $2 \pm 0.9$  pg/ml. Median NIHSS is 5 with a range of 2–19. There is a positive correlation with the strength is very weak between TNF- $\alpha$  with the NIHSS in patients with acute thrombotic stroke ( $r = 0.100$  and  $p = 0.600$ ).

**Conclusion:** There is a positive correlation with the strength is very weak between serum levels of TNF- $\alpha$  with neurological deficit measured by NIHSS.

**Key words:** TNF- $\alpha$ , HS TNF- $\alpha$ , NIHSS, acute thrombotic stroke.

## WSC-1413

### Experimental and Translational Neuroscience Neuroprotective effects of hemicraniectomy in malign middle cerebral artery infarctions: Experimental study

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Despite optimal medical therapy the mortality rate approaches 50% in MCA infarctions. Although recent studies have been showed life-saving

effect of hemicraniectomy ; there are a few data available in regard to neuroprotection effect of decompressive craniectomy (DC). We induced a malign cerebral ischemia model by intraluminal permanent MCA occlusion (MCAO) in male rats for defining the neuroprotective effects of early DC on brain-blood barrier (BBB) molecular changes, infarct size, cerebral edema.

**Material-Method:** 70 male Sprague Dawley rats were allocated to 4 group; sham (n = 12), control (n = 16), experiment 1 (n = 20), experiment 2 (n = 22). DC was performed by creating a bone flap, after MCAo at 4<sup>th</sup> and 24<sup>th</sup> hours. After 28 hours of survival, all animals were sacrificed. Infarction volumes were calculated from TTC (2,3,5-triphenyltetrazolium chloride)-stained brain sections. In all groups, cerebral edema were quantified as a change in % brain water content. Western Blot was used to analyze the expression of tight junction protein claudin-5 and occludin.

**Results:** Brain water content was calculated  $75.19 \pm 1.69\%$  in the early DC group and  $77.76 \pm 1.60\%$  in the late DC group. No significant difference was found between experiment groups. ( $p = .178$ ) In the early DC group; occludin and claudin-5 were significantly expressed at higher levels compared to late DC group (for occludin  $p = .013$ ; for claudin-5  $p = .034$ ). At early DC group ( $69.38 \pm 57.11$  mm<sup>3</sup>) the final infarct volumes were significantly smaller than in the late DC group ( $577.18 \pm 468.37$  mm<sup>3</sup>) ( $p = .014$ ).

**Conclusion:** The study results supported the neuroprotective effects of early DC in malign MCA infarcts.

## WSC-0286

### Experimental and Translational Neuroscience Age-dependent reorganization of axonal structures, myelin, mitochondrial dynamics, and calcium homeostasis underlie the vulnerability of aging white matter to ischemia

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**Introduction:** Aging white matter (WM) becomes increasingly more susceptible to neurodegenerative diseases and stroke.

**Aims:** We hypothesized that alterations in axon-myelin architecture, mitochondrial dysfunction, and impaired mitochondrial-sarcoplasmic reticulum (SER) interactions lead to changes in Ca<sup>2+</sup> homeostasis and ATP production, which predisposes aging axons to more severe injury during stroke.

**Methods:** We utilized a pure WM tract, mouse optic nerve (MON), obtained from 2- or 12-month-old wild-type and Thy-1 mito CFP transgenic mice, where mitochondria are intrinsically fluorescent. Axon function was quantified using electrophysiological recordings with suction electrodes. The structures of axons, myelin, mitochondria, and SER were assessed by immunohistochemistry, 3-dimensional electron microscopy, western blotting and biochemical assays.

**Results:** Aging axons recovered less after ischemia compared to young axons. Structurally, aging axons became thicker with lower g-ratios associated with nodal and paranodal changes such as smaller clusters of voltage-gated Na<sup>+</sup> channels and thinner and longer CASPR overlapping with voltage-gated K<sup>+</sup> channels. Aging mitochondria had increased volume and width compared to younger axons, but they were less associated with SER. A mismatch of mitochondrial shaping proteins with aging resulted in aggregation of mitochondria, which were thicker and longer with a lower ATP production capacity.

**Conclusions:** Our results suggest that aging alters axonal morphology as well as axonal mitochondrial structure and function, leading to reduced ATP production that may disrupt Ca<sup>2+</sup> homeostasis, which may underlie the increased vulnerability of aging WM to ischemia and neurodegenerative diseases.

WSC-0255

**Experimental and Translational Neuroscience  
Role of interleukin -6 correlated to chlamydia  
pneumoniae for prediction of stroke severity in acute  
ischemic stroke**

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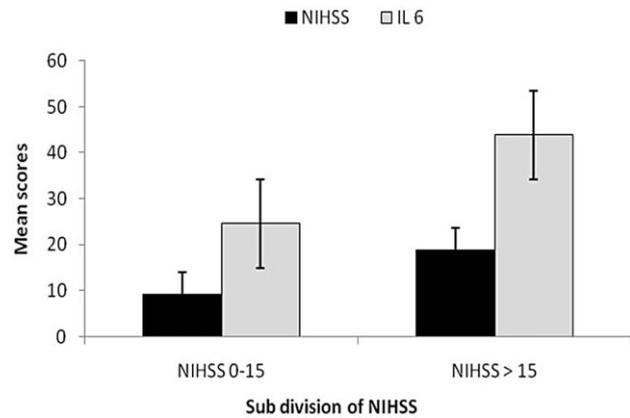
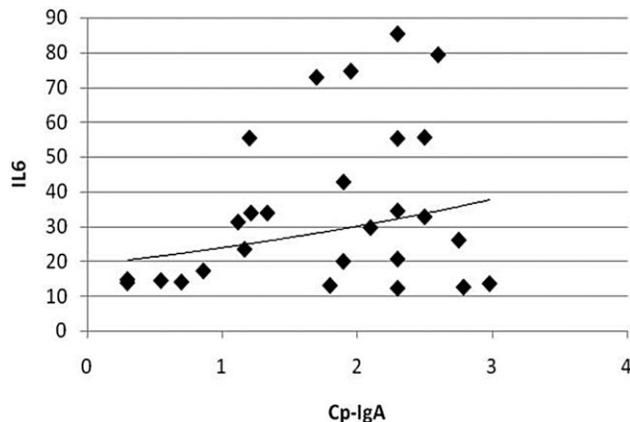
**Background:** Stroke in young is the leading cause of morbidity and mortality in the Indian subcontinent with a reported incidence of 15–30% of all stroke patients. The mechanisms for stroke in the young may include unconventional risk factors such as infections. Causative role of *C. pneumoniae* infection in patients with acute ischemic stroke (AIS) remains unresolved till date, although the link between *C. pneumoniae* and cerebrovascular disease has been investigated in many studies.

**Aims:** This study examined the upregulation of IL6 after acute cerebral ischemia and correlated the same with the *C.pneumoniae* antibody titres (Ig G, Ig A, IgM).

**Methods:** We studied blood samples from eighty acute stroke patients and healthy age and sex matched controls. Blood samples were drawn within one week from the onset of stroke. Detection of IgA, IgG and IgM antibodies to *C pneumoniae* was done with a validated microimmunofluorescence (MIF) technique from 5ml of serum in all subjects. Interleukin 6 was estimated with sandwich ELISA method.

**Results:** The IL-6 levels were elevated in patients with a mean  $28.9 \pm 8.6$  pg/ml as compared to  $4.7 \pm 1.8$  pg/ml in healthy age matched controls (95% CI; 37.7 to 78.4,  $p = 0.004$ ). On correlation of IL 6 to stroke severity, it was found that 30 patients with NIHSS between 0–15 had mean IL 6 of 24.6 and 50 patients had NIHSS of 18.8 (severely affected) with a mean IL 6 of  $43.8 \pm 5.6$ . On multivariate analysis after adjusting for sex, hypertension, diabetes mellitus, smoking and alcohol, the IgA seropositivity yielded an adjusted OR for stroke (4.72; 95% CI 1.61, 13.83;  $p = 0.005$ ), while IgG seropositivity did not show a statistically significant result. We also observed that 81% of cases were seropositive for IgA vs 32% of controls ( $p = 0.003$ ) followed by IgG, as 52.7% of cases were seropositive vs 17.3% of controls ( $p = 0.05$ ). Multiple regression analysis was done with IL 6 as dependent variable to antibody with IL6 as dependent variable to Cp-IgA, Cp-IgG and IgM with 10.4% change in the IL6 titres showing statistical significant result [ $F(4,115) = 3.32, p = 0.01$ ].

**Conclusions:** IL-6 has important role after acute ischemic stroke and is correlated with stroke severity and may correlate to acute or chronic infectious states with *C. pneumoniae*.



WSC-1239

**Experimental and Translational Neuroscience  
Predicting functional potential after autologous stem  
cell transplantation in stroke patients using diffusion  
tensor imaging**

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**Introduction:** Diffusion tensor imaging (DTI) has opened up new challenges and possibilities of imaging fiber tracts in the brain. Motor skill recovery is well correlated with microstructural properties of corticospinal tracts (CST) forming the basis of neurophysiological recovery after stroke.

**Aims:** The objectives were to study whether DTI-derived measures of corticospinal tracts predict motor improvement after autologous stem cell transplantation and correlate with functional recovery in Stroke patients.

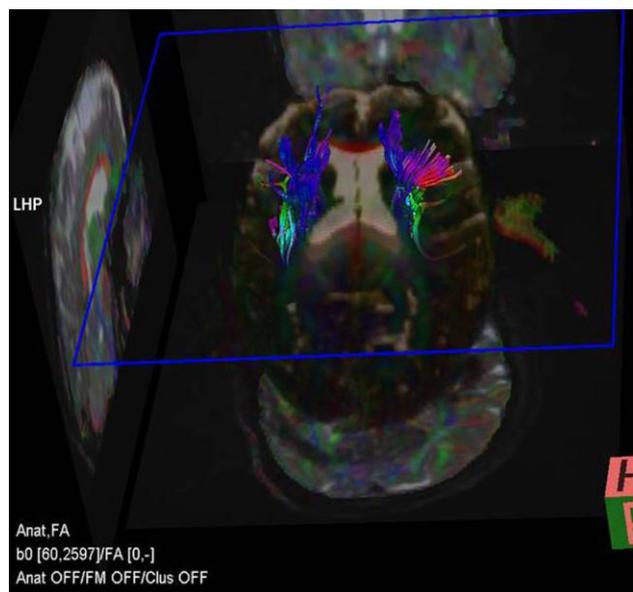
**Methods:** Forty stroke patients ( $n = 40$ ) were recruited from neurology clinics of which twenty ( $n = 20$ ) were transplanted with autologous bone marrow derived stem cells and rest served as controls. All patients were evaluated clinically (Fugl Meyer, modified Barthel Index, Brunstrom stage) and radiologically (f MRI) at baseline and at 15 months (one and half year). DTI parameters were as: TE = 76ms, TR = 10,726 ms,  $128 \times 128$  matrix, FOV 230 mm and 4 mm slice thickness with b values (0, 100 s/mm<sup>2</sup>) in 12 non collinear directions. ROIs were drawn on CST emerging in both the hemispheres and rFA, r FL and rFN were calculated.

**Results:** Modified Barthel Index (mBI) was statistically significant in stem cell group,  $p = 0.05$ ). Significant improvement ( $p < 0.05$ ) was observed in mean FA ratio in the stem cell group as compared to controls. An increase of 17.1% in FL ratio and 28% in the FN ratio was found between baseline and one year follow up (95% CI- 12.3–3.4,  $p = 0.06$ ) in all stem cell patients as compared to the controls. The mean axial diffusivity ( $\lambda_{||}$ ) in the affected hemisphere was 0.30 and radial diffusivity ( $\lambda_{\perp}$ ) was 0.40 indicating Wallerian degeneration to axonal damage (Table 1) (Fig. 1).

**Conclusion:** Cell transplantation was safe and feasible. Temporal association of rFA, % signal intensity and CST involvement was observed with the clinical scores in all patients. Stem cell group showed a trend of improvement with an increase in FA ratio at one year indicating axonal remodeling and sprouting of fibers facilitating motor recovery.

**Table 1** DTI parameters at baseline and one and half year follow up in stem cell group

	Baseline	8 weeks	54 weeks
Trace D	3.73	3.68	3.1
Radial Diffusivity	0.40	0.35	0.30
Axial Diffusivity	0.30	0.28	0.25
FA	0.47	0.53	0.78
FL	0.22	0.24	0.27
FN	0.27	0.33	0.41

**Fig. 1** Showing corticospinal tract on 2D FA color map.**WSC-0288****Experimental and Translational Neuroscience**  
**Acute alpha lipoic acid treatment is neuroprotective and promotes functional recovery after cerebral ischemia in rats**K H Choi<sup>1</sup>, J M Kim<sup>1</sup>, K W Kang<sup>1</sup>, D S Oh<sup>1</sup>, M S Park<sup>1</sup><sup>1</sup>Neurology, Chonnam National University Hospital, Gwangju, Korea

**Introduction:** Recent evidences suggest that oxidative stress is a fundamental mechanism of brain damage in stroke. A recent study suggests that the antioxidant properties of alpha-lipoic acid (aLA) correlate with its ability to promote neuroproliferation. However, there have been no reports of comprehensive studies examining the neurorestorative effects of aLA administered after the onset of ischemia.

**Aims:** Here we report the role of aLA as neurorestorative agent in focal cerebral ischemia.

**Methods:** The middle cerebral artery (MCA) of adult rats was occluded for 2 hours and then reperused. aLA (20 mg/kg) was administered in 71 animals (aLA group) through the left external jugular vein immediately after reperfusion. An equivalent volume of vehicle was administered to 71 animals (control group). A neurological deficit score (NDS) was obtained, and motor impairment was assessed by the accelerating rotarod test. Levels of endogenous neural precursor and glial cell were analyzed by immunohistochemistry.

**Results:** Immediate aLA administration group after reperfusion significantly reduced the mortality, infarct size, and NDS than control group

( $P = 0.005$ ,  $P = 0.002$ , and  $P = 0.001$ , respectively). Long-term functional outcomes by Rotarod test were also markedly improved by aLA treatment ( $P = 0.013$ ). Furthermore, aLA treatment enhanced the earlier proliferation of endogenous neural precursor and glial cell using co-stain labeled with BrdU, nestin, and GFAP antibody along the infarct and infarct core regions.

**Conclusions:** These results indicate that urgent treatment with aLA after ischemic injury may have significant neurorestorative effects through enhanced neuroproliferation. Thus, aLA may be a useful intervention for the treatment of acute ischemic stroke.

**WSC-0320****Experimental and Translational Neuroscience**  
**Nox4 mediates actin depolymerization in the cerebrovasculature after hypoxia**M Coucha<sup>1</sup>, W Li<sup>1</sup>, M Abdelsaid<sup>1</sup>, M Johnson<sup>2</sup>, A El-Remessy<sup>3</sup>, S Fagan<sup>3</sup>, A Ergul<sup>1</sup><sup>1</sup>Physiology Department, Georgia Regents University, Augusta, USA<sup>2</sup>Biostatistics Department, Georgia Regents University, Augusta, USA<sup>3</sup>Clinical and Experimental Therapeutics, University of Georgia, Augusta, USA

**Introduction:** Ischemia/reperfusion and the resulting oxidative stress impair cerebral myogenic tone (MT) via actin depolymerization. Yet, the exact mechanism by which ischemia/reperfusion alters the actin cytoskeleton is undetermined. NADPH oxidase (Nox); a major source of vascular oxidative stress; is a promising therapeutic target for ischemia/reperfusion. However, it is unclear which Nox isoform is relevant for ischemia/reperfusion-mediated cerebrovascular dysfunction.

**Aim:** To determine whether hypoxia upregulates Nox4 expression causing actin depolymerization via increased nitration which could contribute to MT impairment.

**Methods:** Male Wistar-rats ( $n = 6-9$ ) were subjected to sham or 30 min ischemia/ 45 min reperfusion. Rats received apocynin (50 mg/kg i.p) or vehicle at reperfusion. MT was measured using pressurized arteriography. Human-brain-vascular-smooth-muscle-cells were exposed to 30 min hypoxia/ 45 min reoxygenation. Nox4 expression was reduced by small interfering RNA. Nox2, Nox4 expression, nitrotyrosine levels (NY) and F:G actin were determined.

**Results:** Ischemia/reperfusion impaired MT, which was restored by inhibiting Nox with apocynin ( $p < 0.001$  ischemia-treatment interaction). Nox4 expression was significantly upregulated following hypoxia or ischemia/reperfusion ( $p < 0.001$ ). Hypoxia augmented NY levels while reduced F actin and both effects were nullified by inhibiting nitration with epicatechin or Nox4 silencing ( $p < 0.001$  hypoxia-treatment interaction).

**Conclusion:** Actin depolymerization after hypoxia may be mediated via Nox4-, which could be the underlying mechanism for MT impairment following ischemia/reperfusion.

**WSC-1550****Experimental and Translational Neuroscience  
Neuroprotective effect of the recombinant heat shock protein Hsp70 against focal cerebral ischemia in rats**E Melnikova<sup>1</sup>, A Dayneko<sup>1</sup>, A Shmonin<sup>1</sup>, T Vlasov<sup>2</sup>, I Guzhova<sup>3</sup>, B Margulis<sup>3</sup>, M Shevtsov<sup>4</sup><sup>1</sup>Neurology, Pavlov First Saint Petersburg State Medical University, Saint Petersburg, Russia<sup>2</sup>Pathophysiology, Federal Almazov Medical Research Centre, Saint Petersburg, Russia<sup>3</sup>Cytology, Institute of Cytology of the Russian Academy of Sciences (RAS), Saint Petersburg, Russia<sup>4</sup>Neurology, A.L.Polenov Russian Research Scientific Institute of Neurosurgery, Saint Petersburg, Russia

Molecular chaperone Hsp70 is well known for its cell protective functions in case of stress and thus could be applied as therapeutic agent for management of patients with acute ischemic stroke. Neuroprotective and neurotherapeutic activity of the recombinant Hsp70 was explored in the model of experimental stroke in rats. Ischemia was produced by the occlusion of the middle cerebral artery for 45 minutes. For assessment of neuroprotection 20 min prior to ischemia Hsp70 at various concentrations was intravenously injected. 48 hours after ischemia rats were sacrificed and brain tissue sections were stained with 2% triphenyl tetrazolium chloride to assess the infarction volume. Preliminary treatment with Hsp70 significantly reduced the ischemic zone in animals (optimal response at 2.5 mg/kg). For considering Hsp70 neurotherapeutic activity following 2 hours after reperfusion (2¼ hours after ischemia) we intravenously administered Hsp70 via femoral vein. Rats were subjected for 48 hours to survive. Ischemic region was analyzed using high-field 7.1 T MR scanner. Administration of the Hsp70 3-fold as therapeutic agent did not show significant difference between the infarction zones in control and experimental groups. Long-term treatment of the ischemic rats by Hsp70 encapsulated into alginate granules with retarded release of protein further reduced the infarct volume in the brain. Subsequent immunohistochemical staining for the presence of Annexin V demonstrated the reduction of the apoptotic area in the Hsp70-treated animals in comparison to control rats.

**Conclusion:** Hsp70 due to its neuroprotective potential can be applied in management of the acute ischemic stroke.

**WSC-1549****Experimental and Translational Neuroscience  
Assessment methods of neurological deficiency in different terms after 30-minutes focal cerebral ischemia in rats**A Dayneko<sup>1</sup>, A Shmonin<sup>1</sup>, A Shumeeva<sup>1</sup>, E Kovalenko<sup>1</sup>, T Vlasov<sup>2</sup>, E Melnikova<sup>1</sup><sup>1</sup>Neurology, Pavlov First Saint Petersburg State Medical University, Saint Petersburg, Russia<sup>2</sup>Pathophysiology, Federal Almazov Medical Research Centre, Saint Petersburg, Russia

Designing of neurological test that could assess neuroprotective properties of researched drugs is very topical issue. In the present study we carried out the comparison of several neurological deficiency examination methods in rats, aimed to identify the most sensible postischemic damage assessment criteria in different terms after ischemia. Using the Koidzumi model of focal transient cerebral ischemia we studied the structure of neurological deficiency in rats with the help of following functional tests: Ledge tapered beam test, Bracing test, Corner test, Placing test, modified Neurological Severity Scores (mNSS), Bederson test and Garcia score test. Tests were managed before the ischemia and on the 2, 7, 14, 21, 28 days after ischemia. Infarct size was determined on the 28 day of the experi-

ment. Arterial blood flow was registered in the area of left MCA vascularization with use of high-frequency ultrasound Doppler flowmetry. 30-minutes transient MCA occlusion led to mainly subcortical lesion of the left hemisphere. Directly after recovery from anesthesia species reflexes damage and behavioral disturbances were observed, focal neurological deficiency was presented by movement, sensory, coordination and balance disorders, general motion activity decrease. All proposed tests let reveal and evaluate quantitatively neurological deficiency in rats till 21 day after ischemia, focal neurological disorders completely regressed by 28 day after ischemia.

**Conclusion:** The most sensible and representative tests provided to be Placing test, Garcia score test and Bederson test.

**WSC-0198****Experimental and Translational Neuroscience  
The effect of dried aloe vera gel powder on synaptic zone after spinal cord injury in adult rats**  
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**Introduction:** Spinal cord injuries (SCI) is one of the major accident in juvenile population. Aloe vera, has been mentioned as a multi functional herb.

**Aim:** This study was conducted to evaluate neuroprotective effect of this plant after SCI in rats.

**Methods:** 24 adult female rats were divided randomly into four groups, Group I: Sham +gavage distilled water. Group II: Sham +gavage Aloe vera gel powder (200 mg/kg/d). Group III: Group II+SCI. Group IV: Group I +SCI. After 4 weeks, the rats were sacrificed. Synaptic changes were analyzed in a blinded manner for qualitative ultrastructural changes. The data analyzed.

**Results:** Synaptic changes was seen due to SCI ( $P \leq 0.05$ ). Usage of Aloe vera gel powder showed decreased pathological synaptic changes in synaptic zone and mitochondria ( $P \leq 0.05$ ).

**Conclusions:** Aloe vera kept synaptic ultrastructure after SCI.

**WSC-1212****Experimental and Translational Neuroscience  
Exploring the evolution of cortical excitability following acute stroke**W Huynh<sup>1</sup>, S Vucic<sup>1</sup>, A Krishnan<sup>1</sup>, C Lin<sup>1</sup>, M Kiernan<sup>2</sup><sup>1</sup>Neurology, Neuroscience Research Australia, Sydney, Australia<sup>2</sup>Neurology, Brain and Mind Research Institute, Sydney, Australia

**Introduction:** Evolution of changes in cortical excitability following stroke, particularly in the contralesional hemisphere, is being increasingly recognized in relation to maximizing the potential for functional recovery.

**Aims:** The present study utilized a prospective longitudinal design over an 18-month period from stroke onset, to investigate the evolution of cortical excitability involving both motor cortices and their relationship to recovery.

**Methods:** Comprehensive clinical assessments and cortical excitability were undertaken at stroke onset in 33 patients, using a novel threshold-tracking paired-pulse transcranial magnetic stimulation technique, and repeated at 3, 6, 12 and 18 months.

**Results:** A total of 432 clinical and 216 electrophysiological assessments were performed over the study period. Immediately following stroke, short-interval intracortical inhibition (SICI) was significantly reduced in both lesioned and contralesional hemispheres that correlated with degree of recovery over the subsequent 3 months. Over the follow-up period, ipsilesional SICI remained suppressed in all patient groups, whilst SICI

over the contralesional hemisphere remained suppressed only in the groups with cortical stroke and more baseline functional impairment.

**Conclusion:** The current study has demonstrated that evolution of cortical excitability, particularly over the contralesional hemisphere, may vary between patients with differing baseline stroke and clinical characteristics, suggesting that ongoing contralesional network recruitment may be necessary for those patients who have significant disruptions to the integrity of ipsilesional motor pathways. Results from the present series have implications for the development of neuromodulatory brain stimulation protocols to harness and thereby facilitate stroke recovery.

### WSC-0356

#### Experimental and Translational Neuroscience Metabolomic profiling of middle cerebral artery occlusion models in the rats using GC-MS for exploration of blood metabolic biomarkers associated with acute cerebral ischemia

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**Aims:** Our aim was to investigate metabolic profiles in plasma of cerebral ischemic rats and to explore the metabolic change associated with ischemic stroke.

**Methods:** We performed temporary middle cerebral artery occlusion of Wister rats (n = 12) and collected plasma at baseline and during 2 hours after the onset of ischemia. Plasma samples from sham operated control rats (n = 10) were also collected. Water-soluble metabolites were extracted and then analyzed using gas-chromatography/mass-spectrometry (GC/MS). The obtained data were analyzed by multivariate statistical method.

**Results:** Ninety-seven metabolites were detected by GC/MS. To reduce the effects of variations between individuals, results were analyzed as a percent change from baseline. Multiple factor analysis using FactoMineR package of R demonstrated good separation between ischemia and control group on the 3rd component (Fig. 1). The metabolites that had significantly high correlation with the 3rd component demonstrated discriminative temporal profile (Fig. 2). The concentrations of several metabolites were differed between cerebral ischemia and these metabolites were thought to have the potentiality of the candidate biomarkers with cerebral ischemia.

**Conclusions:** Metabolomics profiling in plasma of rats was suggested to be useful for distinguishing ischemic rats from control rats.

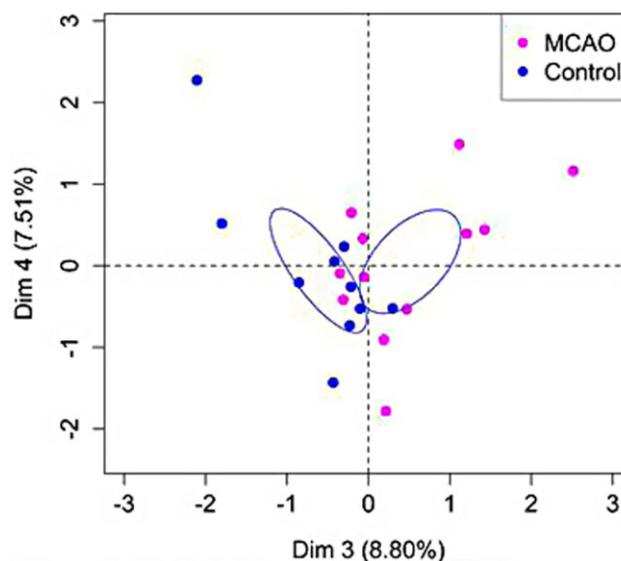


Fig. 1 Multiple factor analysis (MFA).

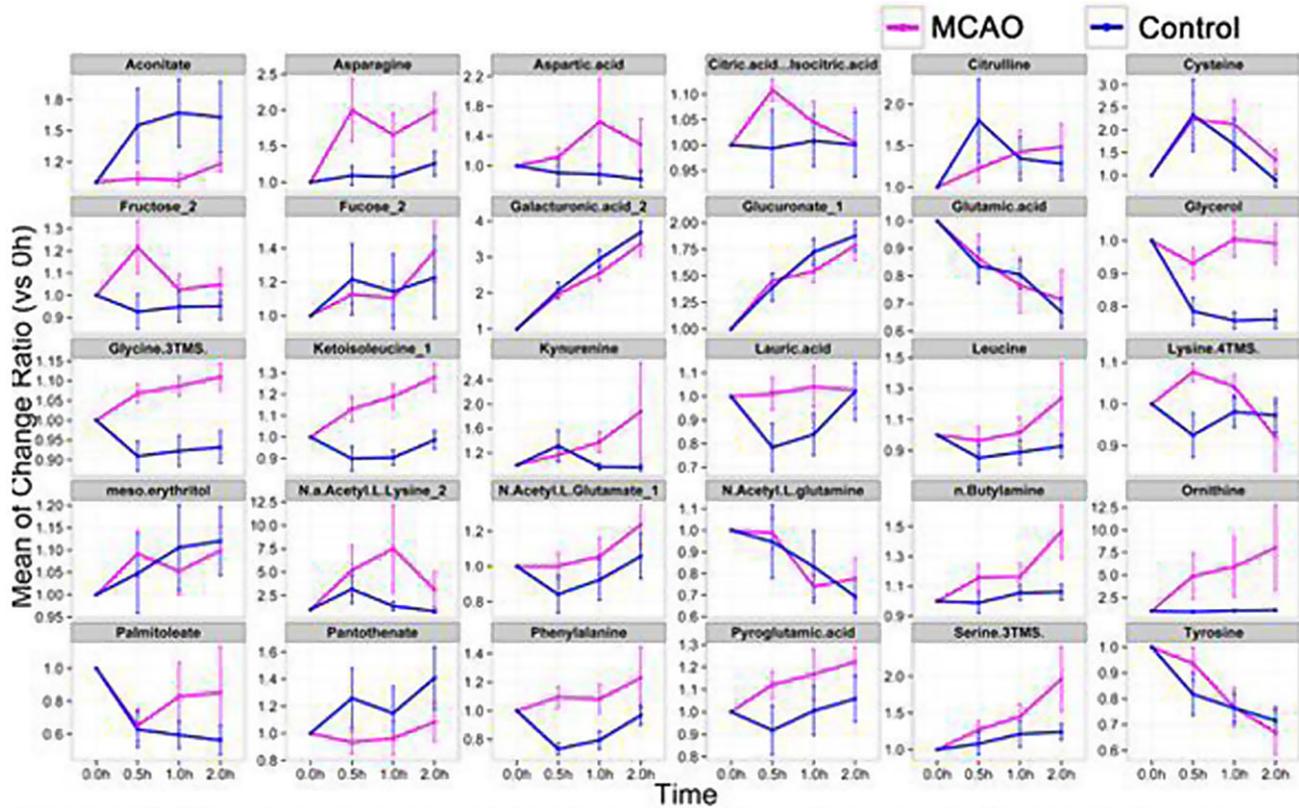


Fig. 2 The metabolites that had significantly high correlation with the 3rd component of multiple factor analysis.

**WSC-0864**

**Experimental and Translational Neuroscience  
Neuroprotective effects of pretreatment with macrolide antibiotics on cerebral ischemia reperfusion injury**

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*Objective:* This study aims to determine if macrolide antibiotics have neuroprotective effects against transient cerebral ischemia. Several recent reports have shown that macrolide antibiotics influence several inflammatory mechanisms that strongly contribute to ischemic injury.

*Methods:* Sprague-Dawley rats were subjected to middle cerebral artery occlusion for 90 min followed by 24 hours of reperfusion. The animals received a suspension of roxithromycin (RXM), clarithromycin (CAM), erythromycin (EM), azithromycin (AZM), or kitasamycin (INN) dissolved in 0.5% methylcellulose at a dose of 10 mg/kg or 100 mg/kg orally for 7 days before ischemia. The infarct volume, edema volume, and neurological performance were evaluated at 24 hours after reperfusion. The cerebral blood flow (CBF) was measured by CASL with an MRI system at 90 minutes after ischemia.

*Results:* RXM, CAM, AZM and INN significantly reduced infarct volume in the high-dose group at 24 hours after reperfusion, whereas EM left the infarct volume unchanged. All of the agents significantly decreased the edema in the high-dose groups, while only CAM and AZM significantly reduced the edema volume in the low-dose groups. All of the macrolide antibiotics at the high dose significantly improved neurological deficit scores at 24 hours. There were no differences in the areas of decreased CBF between the vehicle and respective antibiotic groups.

*Discussion:* These results demonstrate that the macrolide antibiotics RXM, CAM, EM, AZM, and INN may confer neuroprotective effects

against ischemic damage following cerebral ischemia without affecting the CBF. The macrolide antibiotics may hold promise as a neuroprotective agent for acute ischemic stroke.

**WSC-0552**

**Experimental and Translational Neuroscience  
Recruitment curve pattern of transcranial magnetic stimulation with different force outputs in healthy subjects: A preliminary study**

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*Background and purpose:* The recruitment curve (RC) of transcranial magnetic stimulation (TMS) displays the motor evoked potential (MEP) response as a function of stimulus intensity and is an indication of cortical excitability. The testing protocol typically involved 10% maximal voluntary contraction (MVC). However during daily functional activities, varying force outputs are generally involved. This study aimed to investigate the RC with different force outputs in healthy subjects.

*Methods:* Three college students volunteered to participate in this preliminary study (mean age 23 years old). Cortical stimulation was applied by means of a TMS stimulator (MagStim 200, UK) with a double cone coil placed over the cortical motor area of the dominant tibialis anterior (TA) muscle while the subject sat comfortably. Five trials were given in each normalized resting motor threshold (RMT) from 1RMT to 1.4RMT with different force outputs, i.e., 0%, 25%, 50%, 75%, and 100% MVCs.

*Results:* Positive relationships between the MEP and stimulus intensity were observed for all subjects in conditions of 0% (p = .000) and 25% MVC (p = .036). However, the patterns of RC were variable, i.e., some

subjects showed positive, others showed negative correlations for conditions of equal and greater than 50% MVC.

**Conclusions:** These preliminary results suggested that the patterns of RC are more consistent at lower force outputs (resting and 25% MVC) than higher force outputs for healthy subjects. Future study is needed to investigate the consistency of results in stroke patients. Our results support the use of 10% MVC for RC measures in TMS studies.

### WSC-0317

#### Experimental and Translational Neuroscience The role of DPP-4 inhibitor gemigliptin in the amelioration of vascular smooth muscle cell hyperplasia

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Gemigliptin is a recently developed anti-hyperglycemic agent which acts by inhibiting dipeptidyl peptidase-4 (DPP-4) thereby protecting GLP-1 action on increasing insulin secretion. Increased cardiovascular diseases including atherosclerosis have been known to be associated with obesity and diabetes and serum DPP-4 levels are reported to be increased in these subjects. However, the causal relationship between atherosclerosis and DPP-4 is yet to be elucidated. Therefore, we assessed whether DPP-4 inhibitor gemigliptin might prevent abnormal vascular proliferation.

Primary rat vascular aortic smooth muscle cells (RASMCs) were obtained from aorta of 4 week-old male Sprague Dawley rat. We confirmed cell growth of primary RASMCs with Cell Counting Kit-8 and cell counting with hemocytometer by trypan-blue staining. Flow cytometry was performed to identify the effect of gemigliptin on cell cycle. To induce SMC hyperplasia, complete ligation of left common carotid artery (CCA) on 7-week-old male C57BL/6N mice was done.

Vascular smooth cells density as well as proliferation were decreased by gemigliptin in a dose-dependent manner. Proven by flow cytometry, gemigliptin induced G1 phase arrest in accordance with decreased Rb phosphorylation. In addition, TNF $\alpha$ -induced p65 translocation to nucleus was blocked by gemigliptin and TNF $\alpha$ -induced matrix metalloproteinase-2 activity and TNF $\alpha$ -induced mRNA expression level of MCP-1, VCAM-1 were also decreased in VSMC, suggesting its role in the amelioration of vascular inflammation. Finally, gemigliptin dose dependently inhibited neointimal hyperplasia in CCA ligation mice.

Anti-hyperglycemic agent gemigliptin might become a possible novel treatment strategy in the atherosclerotic disease which often is preceded by diabetes.

### WSC-0623

#### Experimental and Translational Neuroscience Intra-arterial injection of CD133-positive cells, but not bone marrow mononuclear cells, improves functional recovery in a murine stroke model

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**Introduction:** Bone marrow derived mononuclear cells and CD133-positive cells are known to include hematopoietic stem/progenitor cells

that improve angiogenesis at the site of ischemia. Cell-based therapy using hematopoietic stem cells had been initiated in patients with ischemia, including cerebral infarction.

**Aims:** We confirmed whether the administration of CD133-positive cells had therapeutic effect on stroke outcome.

**Methods:** We investigated the effects of administration of hematopoietic stem/progenitor cells on stroke outcomes using experimental stroke model with variety of condition, including route of administration (tail vein or carotid artery), cell type (bone marrow derived mononuclear cells or bone marrow derived CD133-positive cells) and cell dose ( $5 \times 10^3$ ,  $1 \times 10^4$  or  $1 \times 10^5$  cells/animal).

**Results:** Intravenous  $1 \times 10^5$  CD133-positive cells injection and intra-arterial  $1 \times 10^4$  CD133-positive cells injection had similar therapeutic effect on stroke outcomes. In contrast, though intravenous  $1 \times 10^5$  bone marrow derived mononuclear cells injection improved stroke outcomes, intra-arterial bone marrow mononuclear cells injection did not improve stroke outcomes in any dose.

**Conclusions:** Bone marrow derived mononuclear cells are the mixture of various cell types, including hematopoietic stem cells and inflammatory cells that can exaggerate inflammation at the site of cerebral infarction. Filtration of adhesive inflammatory cells at lung might have critical role for effective cell therapy with bone marrow derived mononuclear cells. In contrast, intra-arterial injection would be recommendable for cell therapy with CD133-positive cells.

### WSC-0865

#### Experimental and Translational Neuroscience Neuroprotective effects of erythromycin on cerebral ischemia reperfusion-injury and cell viability after oxygen-glucose deprivation in cultured neuronal cells

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This study aims to determine if erythromycin has neuroprotective effects against transient ischemia and oxygen-glucose deprivation (OGD) in cultured neuronal cells. Sprague-Dawley rats were subjected to middle cerebral artery occlusion for 90 minutes, followed by reperfusion. The animals received a subcutaneous single injection of erythromycin lactobionate (EM, 50 mg/kg) or vehicle immediately after ischemia. Infarct volume, edema index, and neurological performance were evaluated at 24 and 72 hours after reperfusion. Immunohistochemical analyses for oxidative stress (4-HNE, 8-OHdG) and inflammation (Iba-1, TNF- $\alpha$ ) were conducted in the cortex at 24 hours. Primary cortical neuronal cell cultures were prepared from the cerebral cortices of the animals and then subjected to OGD for 3 hours. Ten or 100  $\mu$ M EM was added before OGD to determine the effect of EM on cell viability after OGD. EM significantly reduced infarct volume ( $p < 0.05$ ) at 24 and 72 hours without affecting CBF measured at 90 minutes after ischemia. EM significantly suppressed the accumulation of 4-HNE ( $p < 0.01$ ) and 8-OHdG ( $p < 0.01$ ) and markedly reduced Iba-1 ( $p < 0.01$ ) and TNF- $\alpha$  expression ( $p < 0.01$ ). Treatment with 100  $\mu$ M EM in vitro significantly reduced cell death after OGD. EM reduces neuronal damage following cerebral ischemia and OGD and may have antioxidant and anti-inflammatory effects. Our data suggest that EM may hold promise as a neuroprotective agent for acute ischemic stroke.

## WSC-0955

### Experimental and Translational Neuroscience

#### Neural differentiation of CD31-positive cells derived from cerebral cortex in mouse embryo

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**Introduction:** The previous studies showed that embryonic meninges and cerebral microvessels were expressing not only CD31 but also nestin, known as a neural stem cell marker. We have already reported that embryonic leptomeninges can be a resource of neural stem cells. Few have been revealed about neurogenesis of CD31-positive cells in brain.

**Aims:** We examined whether CD31-positive cells derived from embryonic cerebral cortex have a potential to differentiate into neural lineage.

**Methods:** The localization of CD31-positive cells in embryonic or neonatal mouse brain were analyzed by immunohistochemistry and immunoelectron microscopy. Culturing MACS-sorted CD31-positive embryonic cerebral cortex cells in neurosphere-producing medium were followed by differentiation into neural lineage including neurons and oligodendrocytes.

**Results:** Immunohistochemistry for CD31, PDGFR-beta, NG2 and nestin showed that cells close to the pial and cerebral microvessels expressed nestin as radial glia did. These vessel-associated nestin-positive cells co-expressed CD31 and NG2, a pericyte marker. Immunoelectron microscopy confirmed that CD31 was localized to not only endothelial cell membranes but also the adhesion site of pericyte-like cell membranes to endothelial cells. The CD31-positive cells derived from E17 cerebral cortex and sorted by MACS could produce neurospheres, which differentiated into neural lineage.

**Conclusions:** These results indicate that CD31-positive cerebral endothelial cells and pericytes also express nestin and have a potential to differentiate into neural cells limited in fetal and neonatal stage. It is well known that the interaction of neurogenesis and angiogenesis is coordinated in postnatal brain. The present study suggests the new mechanism for regulating neurogenesis of postinjured brain.

## WSC-1255

### Experimental and Translational Neuroscience

#### A urinary metabolomic analysis of patients with minor stroke and transient ischemic attack

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**Introduction:** We performed a metabolomic analysis of the urine in patients with minor ischemic stroke or transient ischemic attack (TIA).

**Aims:** Our aim was to provide pathophysiological insights worthy of further study and to establish whether such techniques could be clinically informative.

**Methods:** We used liquid chromatography-mass spectrometry to compare the urinary metabolite profile of cases (ischemic stroke or TIA) to high

cardiovascular risk controls. We explored changes across the entire metabolome and mapped findings to existing reference maps. An adjusted p value of <0.05 was used to determine a significant difference. Pathways with six or more metabolites that differed significantly between cases and controls were deemed to be significantly disrupted. Nearest neighbor analysis was used to develop a multi-marker classifier and explore clinical predictive ability of the metabolomic findings.

**Results:** A total of 106 patients were included (64 cases (44 ischemic stroke, 20 TIA) and 42 controls). A total of 54 metabolites differed significantly between cases and controls. Five Kyoto Encyclopedia of Genes and Genomes (KEGG) metabolic pathways were significantly disrupted (ko 01110, biosynthesis of secondary metabolites; ko00380, tryptophan metabolism; ko01210, 2-Oxocarboxylic acid metabolism; ko00340, histidine metabolism and ko1230, biosynthesis of amino acids). A multi-marker model was highly sensitive for the detection of cases.

**Conclusion:** We were able to identify patterns of significant metabolomic derangement in the urine of cases of minor stroke and TIA and these changes may be sufficiently powerful to facilitate diagnosis in cases of suspected stroke or TIA.

## WSC-0584

### Experimental and Translational Neuroscience

#### fh1 is newly identified causative factor for CADASIL

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**Introduction:** Cerebral autosomal-dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL) is the most common form of hereditary stroke disorder and is caused by mutations in the Notch3 gene.

**Aims:** Derivation of patient-specific vSMCs from induced pluripotent stem cells (iPSCs) may facilitate the study of disease mechanisms and development of novel therapeutic interventions for CADASIL.

**Methods:** Here, we report the development of iPSC lines from three CADASIL patients with a missense mutation in exon 4 or exon 6 of Notch3.

**Results:** These CADASIL-iPSC lines were successfully differentiated into vSMCs. vSMCs derived from iPSC lines carrying the exon 4 mutation exhibited lower  $\alpha$ -smooth muscle actin expression than vSMCs derived from both the wildtype line and lines carrying the exon 6 mutation. However, vSMC derived from all CADASIL iPSC lines displayed  $\alpha$ -actin filament bundling and cytoskeletal organization abnormalities, as well as hypercontractility and hypersensitivity to muscarinic receptor agonist treatment. We also provide evidence that the expression of a large gene cluster associated with actin filament sliding and extracellular matrix components is decreased in CADASIL patient-specific vSMCs. Furthermore, we report a novel Hes6-Hey2-FHL1 interaction for the first time in CADASIL patient-specific vSMCs.

**Conclusions:** Disease modeling via iPSC technology is a valuable tool in the study of CADASIL pathophysiology, identification of biological targets for therapy, and may potentially provide a platform for therapeutic development.

This work was carried out with the support of "Cooperative Research Program for Agriculture Science & Technology Development (Project title: Diversification of food materials for new demands in domestic Oat, Project No. PJ010508042014)" Rural Development Administration, Republic of Korea.

## WSC-0427

### Experimental and Translational Neuroscience Characterization of white matter injury by diffusion tensor mri in a rat model of chronic cerebral hypoperfusion

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**Background:** White matter lesions, resulting from chronic cerebral hypoperfusion, have been suggested as a culprit of cognitive impairments in patients with vascular dementia. Using diffusion tensor MRI (DTI), we investigated characteristics of white matter injury in a rat model of chronic cerebral hypoperfusion and possible attenuation of white matter injury by cilostazol.

**Methods:** In Wistar rats, chronic cerebral hypoperfusion was modeled by permanent occlusion of bilateral common carotid arteries. The experimental animals were divided into the cilostazol group (n = 4) and the vehicle group (n = 5). White matter injury was investigated by serial DTI at 1 week and 5 weeks after hypoperfusion. Parameters for white matter injury, including fractional anisotropy (FA), trace, axial diffusivity, and radial diffusivity were evaluated in the white matter of the cranial nerve, such as optic chiasm, or brain parenchymal white matter, such as corpus callosum and external capsule.

**Results:** Both experimental groups showed significantly reduced FA in the optic chiasm, compared to the baseline FA (p < 0.05). In the serial DTI study, vehicle group showed significant ongoing decrease of FA in the optic chiasm, compared to the cilostazol group (p = 0.034). The vehicle group showed significant ongoing elevation of trace (p = 0.024), axial diffusivity (p = 0.044), and radial diffusivity (p = 0.042) values of the corpus callosum.

**Conclusion:** Characteristics of white matter injury resulting from chronic cerebral hypoperfusion may consist of demyelination and ongoing vasogenic edema with loss of tissue integrity. Cilostazol may have protective effect for the white matter injury by chronic cerebral hypoperfusion.

## WSC-0835

### Experimental and Translational Neuroscience Hypoxia/reoxygenation preconditioned bone marrow-derived mesenchymal stromal cells restore ischemic rat cortical neurons by enhancing trophic factor release and migration

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**Introduction:** Bone marrow-derived mesenchymal stromal cells (BM-MSCs) represent a promising tool for stem cell based clinical trials in ischemic stroke. However, the majority of MSCs fail to reach the site of injury, and they are known to have only minimal therapeutic effects.

**Aims:** In this study, we aimed to determine whether hypoxia/reoxygenation preconditioned culture of human BM-MSCs could increase migration capacity and demonstrate its beneficial effect on ischemic rat cortical neuron.

**Methods:** Human BM-MSCs were cultured with various hypoxia/reoxygenation time to search the optimal condition of increasing cell viability and proliferation. The functional analysis of hypoxia/reoxygenation cultured BM-MSCs were performed by trophic factors and migration assay. The functionally improved BM-MSCs were co-culture with ischemic rat cortical neurons to compare with normoxia cultured BM-MSCs.

**Results:** The cell viability and proliferation of BM-MSCs were potently increased after 1-day of hypoxia (1% oxygen) and followed by 5-days of reoxygenation. This condition maintained the immunophenotypes and

multi-lineage differentiation of BM-MSCs. In addition, hypoxia/reoxygenation preconditioned BM-MSCs significantly enhanced the expression of mRNA levels of various trophic factors, expression of pro-survival genes such as Akt, migration capacity, and expression of migration-related molecules such as CXCR4. Finally, viability of ischemic rat cortical neurons were increased with hypoxia/reoxygenation preconditioned BM-MSCs than normoxia cultured BM-MSCs.

**Conclusions:** These findings suggest that hypoxia-reoxygenation preconditioned culture of human BM-MSCs may restore more ischemic cortical neurons by increasing trophic factor release and migration. Optimized hypoxia/reoxygenation culture method could be a new strategy for stem cell therapy in ischemic stroke patients.

## WSC-1412

### Experimental and Translational Neuroscience Liposomal nanodelivery systems for iodine-based CT contrast agent

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**Introduction:** Rapid thrombus visualization represents a critical step in stroke therapy. A novel approach of thrombus imaging is based on the targeted CT contrast liposomes. Liposomes represent nontoxic advanced and versatile nanodelivery systems. Liposomes are capable to encapsulate CT contrast agents as well as to conjugate the various targeting ligands. The targeted CT liposomes facilitate specific and selective accumulation in the desired tissue (e.g. thrombus resulting in an increased thrombus to tissue density difference expressed as HU).

**Aims:** The aim of this study was the preparation of nanoliposomes capable to entrap CT contrast agent.

**Materials and methods:** Liposomes were prepared by lipid film hydration followed by freeze-thaw extrusion through 100-nm polycarbonate filters. Phosphatidylcholine, cholesterol (AvantiLipids, AL) and iohexol (Omnipaque 350, GE Healthcare) were the main components used for preparation of CT contrast liposomes. For characterization of the prepared CT liposomes, dynamic light scattering and UV/VIS spectroscopy were performed.

**Results:** We have developed technology applicable for preparation of the CT contrast liposomes. The prepared liposomes had appropriate parameters such as size distribution (120–150 nm, PDI 0.17) and entrapment efficacy of iohexol (26%).

**Conclusions:** The prepared nanoliposomes were able to entrap the CT contrast agent. This concept represents the basic characterized platform and will be utilized for the further construction of advanced targeted nanoliposomal systems used for monitoring the effect of thrombolysis.

**Acknowledgements:** This work was supported by the following grants: the Ministry of Education, Youth and Sports (CZ.1.07/2.3.00/30.0043) and the Grant Agency of the Czech Republic (GAP304/10/1951).

**WSC-0717****Experimental and Translational Neuroscience  
Liposomal nanodelivery systems for iodine-based CT contrast agents**S Koudelka<sup>1</sup>, V Jelinkova<sup>2</sup>, J Turanek<sup>3</sup>, R Mikulik<sup>4</sup><sup>1</sup>*I. Neurological Clinic/Department of Pharmacology and Immunotherapy, St. Anne University Hospital in Brno-International Clinical Research Center/Veterinary Research Institute, Brno, Czech Republic*<sup>2</sup>*I. Neurological Clinic, St. Anne University Hospital in Brno-International Clinical Research Center, Brno, Czech Republic*<sup>3</sup>*Department of Pharmacology and Immunotherapy, Veterinary Research Institute, Brno, Czech Republic*<sup>4</sup>*I. Neurological Clinic, St. Anne University Hospital Brno – International Clinical Research Center, Brno, Czech Republic*

**Introduction:** Rapid thrombus visualization represents a critical step in stroke therapy. A novel approach of thrombus imaging is based on the targeted CT contrast liposomes. Liposomes represent nontoxic advanced and versatile nanodelivery systems. Liposomes are capable to encapsulate CT contrast agents as well as to conjugate the various targeting ligands. The targeted CT liposomes facilitate specific and selective accumulation in the desired tissue (e.g. thrombus resulting in an increased thrombus to tissue density difference expressed as HU).

**Aims:** The aim of this study was the preparation of nanoliposomes capable to entrap CT contrast agent.

**Materials and methods:** Liposomes were prepared by lipid film hydration followed by freeze-thaw extrusion through 100-nm polycarbonate filters. Egg phosphocholine, cholesterol (AvantiLipids, AL) and iohexol (Omnipaque 350, GE Healthcare) were the main components used for preparation of CT contrast liposomes. For characterization of the prepared CT liposomes, dynamic light scattering and UV/VIS spectroscopy were performed.

**Results:** We have developed technology applicable for preparation of the CT contrast liposomes. The prepared liposomes had appropriate parameters such as size distribution (120–150 nm, PDI 0.17) and entrapment efficacy of iohexol (26%).

**Conclusions:** The prepared nanoliposomes were able to entrap the CT contrast agent. This concept represents the basic characterized platform and will be utilized for the further construction of advanced targeted nanoliposomal systems used for monitoring the effect of thrombolysis.

**Acknowledgements:** This work was supported by the following grants: the Ministry of Education, Youth and Sports (CZ.1.07/2.3.00/30.0043) and the Grant Agency of the Czech Republic (GAP304/10/1951).

**WSC-1618****Experimental and Translational Neuroscience  
Assessment of the stroke neuronal damage by immunoassay**S Kugler<sup>1</sup><sup>1</sup>*Anesthesiology and Intensive care, Donetsk National Medical University, Donetsk, Ukraine*

**Introduction:** To date, the most promising markers of damage to the central nervous system and brain are NSE (neuron – specific enolase) and GFAP (glial fibrillary acidic protein). Create an antigenic complex followed by the determination of antibody titer to gray and white matter of the brain in acute ischemic stroke can be a real alternative to expensive and inaccessible markers of CNS injury.

**Aims:** Examining levels of NSP, designing of brain antigen system, determination of antibody titer to the gray and white matter of the brain in the first 14 days of stroke.

**Methods:** Study included 116 patients with a diagnosis of stroke (4 groups). There were IgG and IgM identified. Levels of NSE and GFAP were

determined by immunoassay on 1st, 7th and 14th day. Groups 1 and 3 received neuroprotection. The primary neuroprotection were prescribed to restore rheology, microcirculation, endothelial dysfunction, state of glia and BBB: L-lysine aescinat, Lattren, Reosorbilakt, HES. Secondary neuroprotection: drugs affecting the regenerative-reparative processes in neurocyte and glial cells: Tiocetam, Actovegin, Cerebrocurin, Gliatilin, Citicoline. Conclusions:

1. Test-system of brain antigen with a subsequent determination of the titer of brain tissue antibodies at ischemic stroke was designed.
2. Analysis of the dynamics of antibody showed that in the groups of neuroprotection immune response to brain damage was statistically significantly lower than in the groups of patients of standart therapy.

**WSC-0809****Experimental and Translational Neuroscience  
Activation of M2 macrophage at the late phase after cerebral ischemia promotes the expression of neurogenesis related molecules**Y Kurashiki<sup>1</sup>, K Kitazato<sup>1</sup>, K Shimada<sup>1</sup>, Y Tada<sup>1</sup>, J Satomi<sup>1</sup>, M Kohrai<sup>1</sup>, K Yagi<sup>1</sup>, M Sumiyoshi<sup>1</sup>, T Miyamoto<sup>1</sup>, Y Uto<sup>2</sup>, S Nagahiro<sup>1</sup><sup>1</sup>*Department of Neurosurgery, The University of Tokushima, Tokushima, Japan*<sup>2</sup>*Department of Life System Institute of Technology and Science, The University of Tokushima, Tokushima, Japan*

**Introduction:** Macrophages (M $\phi$ ) are major effectors in the early phase of postischemic inflammation. They contribute to the resolution of inflammation and to tissue repair in the late phase. Peripheral M $\phi$  includes M1 M $\phi$  that produce pro-inflammatory cytokines and M2 M $\phi$  that produce anti-inflammatory cytokines. On the other hand, inflammation produces the group-specific component (Gc) protein-derived macrophage activating factor (GcMAF). GcMAF stimulates phagocytosis of M $\phi$ . The relationship between M1-, M2 M $\phi$  and microglia, and the role of GcMAF in the postischemic brain remain unclear.

**Aims:** We studied our hypothesis that treatment with GcMAF in the early postischemic phase exacerbates brain damage, while in the late phase it may facilitate brain repair.

**Methods:** We used 7-week-old male Wistar rats with experimental middle cerebral artery occlusion for 2 hours. They were divided into 2 groups. One group was injected for 7 days with GcMAF and the other was the vehicle control in the early- and late phase after ischemia induction.

**Results:** In the early postischemic phase, GcMAF increases the expression of M1 M $\phi$  in the ischemic area, resulting in the exacerbation of ischemic brain damage. On the other hand, treatment with GcMAF in the late phase increased microglia and M2 M $\phi$ , associated with phagocytosis and cleaned the infarct area. Late-phase GcMAF treatment was also associated with an increase in the incorporation of BrdU, and the appearance of survival-related molecules and neurovascular units.

**Conclusion:** GcMAF treatment in the late postischemic phase may play an essential role in the promotion of regeneration.

**WSC-0313****Experimental and Translational Neuroscience  
The role of PDK4 in calcified atherosclerotic vessel**I Lee<sup>1</sup>, S Lee<sup>1</sup>, J Jeon<sup>1</sup>, K Lee<sup>2</sup>, M Choi<sup>3</sup><sup>1</sup>*Department of Internal Medicine, Kyungpook National University School of Medicine, Daegu, Korea*<sup>2</sup>*Department of Internal Medicine, University of Ulsan College of Medicine, Seoul, Korea*<sup>3</sup>*Department of Internal Medicine, College of Medicine Hallym University, Chuncheon, Korea*

Vascular calcification is a well-established risk factor of cardiovascular events associated with aging, diabetes, renal failure, vitamin D intoxication, and hyperphosphatemia. Osteogenic switch of vascular smooth

muscle cells (VSMCs) is triggered by procalcific stimuli such as ROS and excess inorganic phosphorus (Pi). We observed that expression of PDK4, a mitochondrial protein to regulate glucose oxidation, is increased in human VSMCs cultured in mineralization medium. Therefore, whether inhibition of PDK4 could decrease vascular calcification was assessed.

We evaluated the mineralization induced by Pi *in vitro* using von Kossa staining and quantitative analysis of calcium in VSMCs and isolated aorta. Vitamin D was injected to PDK4 deficient mice for inducing vascular calcification *in vivo*.

PDK4 overexpression by using PDK4 containing adenoviral vector, even without BMP2 pretreatment, increased vascular calcification. PDK4 deficient mice showed profound attenuation of aortic calcification induced by Vitamin D3 *in vivo*. The VSMCs cultured from PDK4 deficient mice also presented a decrease of mineralization and mRNA expression of osteogenic markers. Furthermore, DCA, a known PDK inhibitor, attenuated the mineralization of VSMCs and aorta cultured in Pi-treated medium. Additionally, PDK4 directly bound R-smad and further enhanced phosphorylation of R-Smad confirmed by GST-pull down assay and *in vitro* kinase assay. In consistent with these results, vascular calcification induced by Vitamin D *in vivo* was also decreased in DCA-treated mice by gavage. PDK4 augments osteogenic switch of VSMCs and vascular calcification through the direct phosphorylation of R-Smad. This study suggests that PDK4 might be a novel target to inhibit vascular calcification.

### WSC-0284

#### Experimental and Translational Neuroscience Effect of labeling with iron oxide nanoparticles on the functionality of human bone marrow derived mesenchymal stem cells *in vitro* and *in vivo*

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**Introduction:** Mesenchymal stem cells (MSC) were shown beneficial in various preclinical studies on CNS disorders. Whereas in the past, researchers looked mainly at the functional benefits following MSC transplantation attention is now being paid to the fate and function of grafted cells. Several classes of contrast agents suitable for cell labeling and non-invasive cellular imaging have been proposed. However, successful implementation of cell tracking requires efficient labeling yet without deleterious effect on cell biology.

**Aims:** Here we assess the efficiency of super-paramagnetic iron oxide (SPIO) labeling of human bone marrow mesenchymal stem cells (hBM-MSC) on their function *in vitro* and *in vivo*.

**Methods:** hBM-MSC (Lonza) were tagged with SPIO nanoparticles and longitudinal *in vitro* observation of labeled cells was performed during 3 weeks of culture. Furthermore, SPIO labeled hBM-MSC (10<sup>6</sup>/1 ml) were transplanted by intracarotid injection into adult rats 48h after ouabain model of stroke had been induced. Then follow-up studies of the distribution and characterization of transplanted cells were performed.

**Results:** SPIO labeling of hBM-MSC did not affect viability and baseline expression of CD90, SSEA-4, CXCR-4, VLA-4 genes or trophic factors. There was also no effect on proliferation or differentiation capability of hBM-MSC *in vitro*. After intracarotid cell transplantation hBM-MSC tagged with SPIO were detected in ipsilateral hemisphere of ouabain injured rat brain predominantly localizing in the zone between cortex and striatum. Analysis of transplanted cells and their functional potential *in vivo* is in progress.

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### WSC-0443

#### Experimental and Translational Neuroscience Limb remote ischemic conditioning during ischemia triggers the autophagy switch via AKT/BCL-2 pathway in a transient cerebral ischemic rat model

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**Introduction:** Autophagy is thought to clear impaired mitochondria and reduce mitochondria-mediated injury. Recent studies have reported that limb remote ischemic conditioning (RIC) applied during ischemia (RIC-I) shows neuroprotection and reduces cerebral ischemic injury.

**Aims:** This study investigated whether RIC-I induces these neuroprotective effects via activating the autophagy pathway and how RIC-I triggers the autophagy.

**Methods:** Neurological deficits were assessed using foot-fault test. The infarction volume were determined with TTC staining. Western blotting was used to investigate proteins expression. Immunoprecipitation was carried out and the AKT inhibitor was used to block the AKT pathway.

**Results:** Rats with RIC-I treatment at 30 min or 60 min after onset of MCAO, demonstrated less infarction and better neurological function than those with RIC at reperfusion (RIC-R), showing that RIC-I treatment confers better neuroprotection. The autophagy level and membrane potential in isolated mitochondria from ischemic hemispheres were promoted by RIC-I treatment. Moreover, the AKT/BCL-2 pathway was upregulated by RIC-I and immunoprecipitation showed that RIC-I dissociated the Beclin1/BCL-2 complex (the autophagy switch) to trigger the autophagy and lead to CytC release. Furthermore, RIC-I triggered more autophagy switches to induce a higher autophagy level and led to less CytC release than RIC-R. Blocking the AKT/BCL-2 pathway with an AKT inhibitor, suppressed the RIC-induced autophagy and reversed CytC release, suggesting a critical role for AKT/BCL-2-dependent autophagy in RIC-I-afforded protection.

**Conclusions:** These findings indicate that RIC-I offers protection via upregulating autophagy and reduces mitochondrial injury, both of which require the involvement of the AKT/BCL-2 pathway to trigger the autophagy switch.

### WSC-0460

#### Experimental and Translational Neuroscience Intra-arterial human bone marrow mesenchymal stem cells in experimental stroke model: *In vivo* biodistribution and behavioral outcome

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**Introduction:** Intravascular cell therapy is a promising approach for the treatment of stroke. Efficient homing of the cells in the injured brain without complications is necessary to facilitate therapeutic use of cell therapy in stroke. However, high accumulation of cells to internal organs is a major concern after intravenous transplantation. This is possible to circumvent by intra-arterial (IA) infusion. Aim of this work was to study whole-body biodistribution of IA administered human bone marrow derived cells (BMMSCs) after middle cerebral artery occlusion (MCAO) in rats and its effect on behavioral and histological outcome.

**Methods:** For biodistribution study, <sup>99m</sup>Tc-HMPAO-labeled BMMSCs were slowly infused through the stump of external carotid artery (ECA). Whole-body biodistribution of the cells was studied using SPECT/CT.

Next we studied the effect of IA administered (day 2 or 7) BMMSCs on sensorimotor recovery in rats subjected to tMCAO (60 min), during a 42-day follow-up sensorimotor recovery in rats was evaluated.

**Results:** IA infusion was resulted in immediate cell entrapment in the brain; however most of signal was relocated to liver and spleen following next 6 hours. Histological staining of blood vessels showed enhanced perilesional angiogenesis in MCAO rats. Behavioral recovery was not improved by human BMMSCs during the follow-up.

**Conclusion:** Human BMMSCs produce efficient localization in the brain and enhanced angiogenesis after intra-arterial delivery in rats with cerebral ischemia, but do not seem to promote functional recovery in MCAO rats.

## WSC-1241

### Experimental and Translational Neuroscience Do hemodynamic changes elicit the formation and rupture of experimental cerebral aneurysms?

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**Introduction:** Subarachnoid hemorrhage (SAH) is a catastrophic event that results in high morbidity and a poor prognosis. To prevent SAH its pathogenesis must be understood. Hemodynamic stress is an initiating factor for the formation of cerebral aneurysms. We established a rat aneurysm model that involves oophorectomy, right common carotid artery ligation (CCA), and renal hypertension. In these rats the incidence of aneurysms at the anterior carotid artery-olfactory artery (ACA-OA) bifurcation is high. We examined our hypothesis that additive hemodynamic changes lead to an acceleration of the development and rupture of cerebral aneurysms.

**Methods:** We divided 10-week-old female Sprague-Dawley rats into 3 groups. Group A (n = 8) was subjected to oophorectomy, left CCA ligation (CCA), and experimentally-induced renal hypertension, group B (n = 26) to ligation of the right pterygopalatine artery (PPA), the right external carotid artery (ECA), and the left CCA, and group C (n = 10) to ligation of the right PPA, right ECA, left CCA, and bilateral vertebral arteries.

**Results:** In the course of 4–7 weeks after the first operation, 5 group B rats (19%) suffered aneurysmal rupture and 8 (31%) developed aneurysms at the circle of Willis, as did one rat (10%) in group C. No group A rats manifested aneurysmal formation or rupture and none of our 44 rats presented with ruptured aneurysm at the ACA-OA bifurcation.

**Conclusion:** Our findings suggest that occlusion of the right PPA and right ECA elicits hemodynamic changes and the formation and rupture of aneurysms at the circle of Willis.

## WSC-0657

### Experimental and Translational Neuroscience Mild ischemic insult promotes neurogenesis in the cerebral cortex

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**Introduction:** Endogenous neurogenesis has been proposed as a therapy for central nervous system (CNS) disorders including stroke. We recently have demonstrated that ischemia-induced neural stem/progenitor cells (iNSPC) are generated in the cerebral infarction following permanent

occlusion of middle cerebral artery (MCA). However, in human stroke the reperfusion injury are progressing after intervention therapy. In this study we examined whether such neurogenesis would develop following transient ischemic insult.

**Methods:** Transient ischemia for 15 min (mild) or 20 min (severe) was produced by occluding MCA of CB-17-SCID mice. Animals were fixed 3 days after the ischemia, and brain sections were subjected to immunohistochemistry for nestin, PDGFR $\beta$ , MAP2 and GFAP. The ischemic tissue was removed 3 days after the ischemia, and dissociated by passage through needles. The cell suspensions were incubated in medium promoting formation of neurosphere-like cell clusters.

**Results:** Loss of MAP2-staining was apparent in the ischemic cortex following 20 min of ischemia, but was not observed after 15 min-insult. On the other hand, GFAP-positive astrocytes proliferated after 15 min- but not 20 min-insult. Nestin was expressed in PDGFR $\beta$ -positive pericytes in association with the endothelial cells. From cell culture, substantial amount of neurospheres which differentiated into neurons, were obtained. The number of iNSPC obtained from mild ischemic tissue was less than that from the permanent or severe ischemic insult.

**Conclusions:** These results demonstrate that neurogenesis is promoted even after transient ischemic insult. The present study suggests the combination with endogenous neurogenesis and vascular intervention as a new therapy for poststroke CNS.

## WSC-1151

### Experimental and Translational Neuroscience Mesenchymal stem cells distribution and migration in ischemic and intact rat brain

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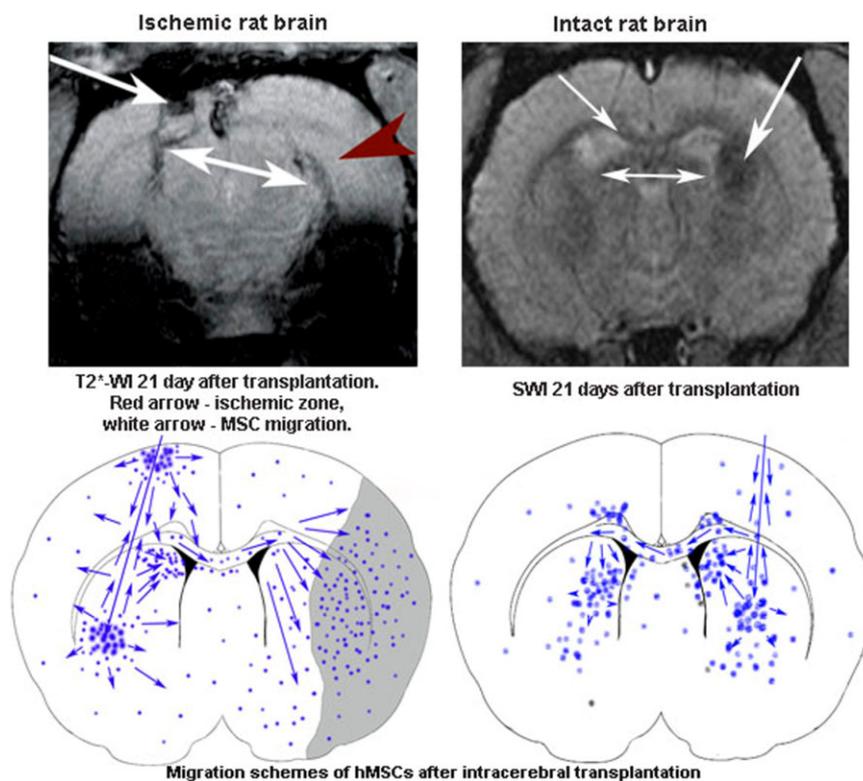
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**Introduction:** Transplantation of human mesenchymal stem cells has been shown to improve functional outcome and decrease infarct size in rodent models of stroke and in humans during first clinical trial. However, the mechanism of therapeutic effects, migration and fate of transplanted hMSCs has not been fully understood.

**Aims:** Intention of our study was to evaluate distribution and migration of labeled hMSCs after intracerebral administration in intact and ischemic rat brain.

**Methods:** HMSCs derived from placenta and labeled with SPIO and fluorescence mark were transplanted stereotactically intracerebral to male Wistar rats: 1) into the contralateral to ischemic lesion hemisphere (n = 15) two days after MCAO; 2) into the intact rat brain (n = 12). MRI (ClinScan-Bruker BioSpin, 7T) and immunohistochemistry was performed.

**Results:** In ischemic region hMSC were detected 14 days after transplantation. Some of hMSC were human GFAP+ and NeuN+. In both groups hMSC migrated to subventricular zone and parahippocampal region within 7 days. Staining with antibodies to Ki-67 demonstrated significantly higher number of dividing cells in these areas.



**Conclusions:** We evaluated the ability of hMSC to migrate within the brain after transplantation, reach and accumulate in the ischemic area. hMSC are capable of directed migration to areas of endogenous neurogenesis in conditions of ischemia and healthy brain. Transplanted hMSC started to express neuronal, glial markers and stimulate cell proliferation in these regions.

### WSC-1478 Experimental and Translational Neuroscience Effect of angiotensin II type 1a receptor knockout on nitric oxide and hydroxyl radical production during global cerebral ischemia and reperfusion

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**Objective:** We examined the effect of angiotensin II type 1a receptor knockout on not only NO but also hydroxyl radical metabolism during global cerebral ischemia and reperfusion.

**Methods:** Male angiotensin II type 1a receptor knockout mice (AT1a-KO group, n = 8), and wild type C57BL/6 (n = 10: used as a control group) were used. Probes were inserted into both sides of striatum and perfused with Ringer's solution. After 2 hours equilibrium period, fractions were collected every 10 minutes. Global ischemia was produced by clipping both common carotid arteries for 10 minutes. The levels of nitrite (NO<sub>2</sub><sup>-</sup>) and nitrate (NO<sub>3</sub><sup>-</sup>) were measured by the Griess reaction, and measured by salicylate trapping method monitored by 2,3-dihydroxybenzoic acid (DHBA) and 2,5-DHBA.

**Results:** (1) *Mean arterial blood pressure (MABP)*: MABP in AT1a-KO (50.0 ± 8.0 mmHg, mean ± SD) was significantly lower than that of controls (71.0 ± 8.0 mmHg). (2) *CBF*: There were no significant differences. (3) *NO Metabolites*: No significant differences were observed in NO<sub>2</sub><sup>-</sup> levels. After reperfusion between 60 minutes and 90 minutes, NO<sub>3</sub><sup>-</sup> levels

in the dialysate in not only AT1a-KO group (1.57 ± 0.41: baseline = 1) and control group (1.49 ± 0.68: baseline=1) were significantly higher than those of Baseline NO<sub>3</sub><sup>-</sup> levels. No significant differences were observed between AT1a-KO group and control group. (4) *DHBA Metabolites*: After reperfusion, 2,3-DHBA levels in AT1a-KO group (0.57 ± 0.21 pg/10 microliter: baseline 0.57 ± 0.20 pg/10 microliter) was significantly lower than that of control group (0.92 ± 0.31 pg/10 microliter: baseline 1.28 ± 0.23 pg/10 microliter).

**Conclusion:** These data suggest that angiotensin II 1a receptor knockout reduces 2,3-DHBA production not only ischemic phase but also pre-ischemic phase.

### WSC-0709 Experimental and Translational Neuroscience Clarithromycin protects cortical neurons from ischemic injury in vivo and in vitro

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There is no satisfactory drug treatment in clinical practice although various neuroprotective compounds have been developed for neuroprotection against ischemic brain injury. A major macrolide antibiotic, clarithromycin has many biological function, such as alteration of inflammatory factors. Here we show that clarithromycin acts neuroprotectively after ischemic insult both *in vivo* and *in vitro*. Pretreatment with a suspension of oral of clarithromycin dissolved in 0.5% methylcellulose for 7 days before ischemia significantly reduced infarct volume and edema volume and reversed motor impairments at 24 hours after reperfusion. Moreover, immunohistochemical analysis revealed that clarithromycin significantly suppressed the accumulation of 4-HNE and 8-OHdG and markedly reduced Iba-1 and TNF-α expression. The neuroprotective activity of clarithromycin was tested *in vitro* on dissociated rat cortical neurons, using a protocol of oxygen-glucose deprivation (OGD). Clari-

thromycin protected cultured cortical neurons from damage and maintained if employed as a pretreatment alone to OGD. These results suggest that clarithromycin may induce neuroprotection and functional recovery after ischemic injury via the modulation of oxidative stress and neuroinflammation.

### WSC-1037

#### Experimental and Translational Neuroscience Vascular dysfunction is attenuated by mannose-binding lectin deficiency in ischemic mice

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**Introduction and aims:** We have previously demonstrated that mannose-binding lectin (MBL), a recognition molecule of the lectin complement pathway, is deposited on the ischemic endothelium within 48h after cerebral ischemia and that its inhibition is highly protective. Since the complement and the coagulation cascades interact, we have investigated the vascular consequences of MBL deletion after ischemia.

**Methods:** Animal studies were approved by Italian Ministry of Health. Focal cerebral ischemia was induced in wild type (wt) or MBL<sup>-/-</sup> (MBL-A and MBL-C double-knockout) mice by transient middle cerebral artery occlusion. Diameter of blood vessels, blood flow speed and vascular permeability were measured by *in vivo* two-photon microscopy (2-PM) before, 1h and 24h after brain injury. Analysis of cytokine levels in platelets and in the blood was performed at 6h or 24h reperfusion.

**Results:** Blood vessels with <45µm initial diameter were analyzed with 2-PM. At 1h after ischemia, the vessels pertinent to the imaged volume showed significant blood flow speed reduction and plasma extravasation, with no genotype effect. At 24h, blood vessels in MBL<sup>-/-</sup> mice showed a better flow recovery (MBL<sup>-/-</sup>: 48.81 ± 37.44, wt: 21.87 ± 29.71% of baseline, mean ± sd) and lower extravasation (113.20 ± 25.90, wt: 148.80 ± 35.91% of baseline, mean ± sd).

At 6h reperfusion, MBL<sup>-/-</sup> mice showed reduced IL-1α expression in platelets and in the blood. At 24h, MBL deficiency was associated with significantly lower levels of circulating C3 fragments (complement activation) and increased thrombomodulin (anticoagulant factor) plasma levels.

**Conclusions:** Our data support the hypothesis that MBL has proinflammatory and toxic vascular effects resulting in increased vascular damage.

### WSC-1312

#### Experimental and Translational Neuroscience Correlation between endothelial dysfunction and cholinesterase activity in different ischemic stroke subtypes

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**Objective:** This study investigated the association between serum markers of endothelial dysfunction (the levels of NO metabolites) and cholinergic system (acetylcholinesterase activity) in atherothrombotic, lacunar, and cardioembolic strokes.

**Materials and methods:** One hundred consecutive acute first-ever ischemic stroke (IS) patients were recruited and divided into three groups, depending on ischemic stroke subtype: 42 patients with atherothrombotic

stroke (ATS), 41 patients with lacunar stroke (LS), and 17 patients with cardioembolic stroke (CES). The average age of the patients was 62.63 ± 4.68 (interquartile range 25–92) years old. Inclusion criteria were the most frequent ischemic stroke subtypes (atherothrombotic, lacunar and cardioembolic) confirmed by CT and/or MRI of the brain in all the patients confirming cerebral or brain stem infarcts. To determine subtypes of ischemic stroke we used the TOAST classification, Vereschagin-Suslina's criteria and computed program of the Russian National Stroke Center. Exclusion criteria were intracerebral hemorrhage, previous stroke, brain tumor, severe systemic diseases, stroke of unusual cause, and stroke of undetermined cause. In venous blood serum of all the patients we determined NO<sub>2</sub> and NO<sub>3</sub> levels using Griss reactant, as well as acetylcholinesterase (ACE) level by spectrophotometer method. Control group consisted of 20 patients at the same age without any stroke and severe systemic diseases. All statistical analyses were performed using methods of variation statistics.

**Results and discussion:** In IS the levels of NO metabolites significantly decreased on 37.3%, in comparison with control. The most significant decrease of NO level was noted in CES (on 40.4%; 13.20 ± 1.02 mkmol/l) than in LS (on 36.8%; 14.00 ± 0.35 mkmol/l) and ATS (on 34.7%; 14.46 ± 0.39 mkmol/l). Serum level of acetylcholinesterase decreased on 24% (76.73 ± 1.61 mmol/(h-L)), in comparison with control (100.1 ± 1.76 mmol/(h-L)) that is evidence of cholinergic system deficit in IS. The most significant decrease of acetylcholinesterase level was revealed in CES (on 31.5%) than in LS and ATS (on 20.3% and 18%, respectively). Thus, we could find significant endothelial dysfunction and cholinergic deficit in CES and LS. The roughest changes in NO and cholinergic system, testifying to decrease of synthesis and elevated inactivation of NO and acetylcholine, were registered in poor outcome of each stroke subtype, especially on a background of heart diseases, diabetes mellitus, hypertension, and hypercholesterolemia. Correlation analysis showed that NO level was straightly proportionally dependent on acetylcholinesterase level. This may indicate decreased stimulation of endothelial relaxation factor (NO) in stroke. We could find straight correlative interrelation of deficits of these substances in stroke subtypes, which was stronger in CES (r = 0.79) and LS (r = 0.72) and weaker in ATS (r = 0.68).

**Conclusion:** Endothelial dysfunction, characterized by endothelial NO reduction, and cholinergic neuromediation deficit, conditioned by decrease in cholinesterase level in blood serum of patients with IS, are considered to play the important role in the development of IS. NO reduction was found to be significantly correlated with serum level of cholinesterase and severity of ischemic stroke, especially in cardioembolic and lacunar strokes.

### WSC-0665

#### Experimental and Translational Neuroscience NG2 proteoglycan-expressing cells as multipotent stem cells following cerebral infarction

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**Introduction:** Endogenous neurogenesis has been proposed as a therapy for central nervous system (CNS) disorders including stroke. We recently have isolated neural stem/progenitor cells specifically induced by post-stroke brain (iNSPC), a part of which come from PDGFRβ-positive pericytes. However identification of their ancestors is not defined, because brain pericytes can be classified into several subtypes. NG2 is known as a marker of pericytes as well as oligodendrocyte precursor cells (OPC) and microglia.

**Aims:** We demonstrated that NG2-expressing cells are one of the sources of iNSPC by using NG2-red fluorescent protein (RFP) transgenic rats.

**Methods and results:** Focal cerebral ischemia was produced by occluding the middle cerebral artery of adult NG2-RFP transgenic rats. Brain section were prepared 3 days after stroke. Double immunofluorescence histochemistry for RFP and nestin, CD31, PDGFRa, PDGFRb, or Iba1 showed that NG2/RFP cells co-expressed PDGFRb, but did not express nestin in nonischemic cortex. In the ischemic region, however, some of them co-expressed nestin, and others expressed PDGFRa, Iba1 as well as PDGFRb. These cells were in close association to the CD31-positive endothelial cells. Then we produced iNSPC/neurosphere from postischemic brain of rats as we produced them from mice brain. Such neurosphere consisted of RFP-positive cells, which differentiated into neurons, oligodendrocytes and Iba1-positive microglia. These results suggest that some NG2-expressing cells are pericytes, and after stroke they acquire a multipotent stemness.

**Conclusions:** Although the precise characteristics of NG2 cells are still unknown, the present study suggests the new mechanism for repairing CNS by NG2-expressing cells in postinjured brain.

### WSC-1267

#### Experimental and Translational Neuroscience The UCP2-866 G/A polymorphism explains different functional prognosis in ischemic stroke after MCA recanalization

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**Introduction:** Recent studies based on experimental animal models of stroke have suggested that uncoupling protein 2 (UCP2), an inner mitochondrial membrane that are thought to regulate energy metabolism and reduce reactive oxygen species (ROS) generation, provides protection against reperfusion damage.

**Aims:** To investigate whether -866G/A polymorphism in the promoter of UCP2 gene, which enhances its transcriptional activity, is associated with functional prognosis in patients with embolic ischemic stroke after early recanalization.

**Methods:** Hospital-based prospective cohort of patients with acute ischemic stroke due to occlusion of MCA who obtained a partial/complete recanalization 24h after administration of intravenous thrombolysis. The main end point of the study was functional independence defined as modified Rankin Scale 0 to 2 on day 90.

**Results:** A total of 80 patients were enrolled. The UCP2-866 G/A polymorphism was determined by PCR restriction fragment length polymorphism technique (genotype A/A (18%), 45 genotype A/G (56%) and 21 genotype G/G (26%). The percentage of patients with good functional outcome at 3mo was significantly higher in patients harboring the A/A genotype than in those with A/G or G/G genotypes (85% vs 41%,  $p < 0.01$ ). The A/A genotype was found to be an independent marker of good prognosis after adjustment for secondary variables (age, sex, glucose level, NIHSS score baseline, complete recanalization and early neurological improvement) in a logistic regression analysis (OR 0.05, 95% CI 0.01–0.48,  $p < 0.01$ ).

**Conclusions:** Our results strongly suggest that AA genotype of UCP2-866 may predict a better functional outcome in ischemic stroke after recanalization of proximal MCA occlusion.

### WSC-0191

#### Experimental and Translational Neuroscience Study of locomotor and cognitive disorders in the ovariectomized female Wistar rats

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**Objective:** Menopause is accompanied by a cognitive and neurodegenerative dysfunction. These disorders are mainly due to the collapse of the level of estrogen causing a chronic inflammation in the brain associated with a several unbalance in neurotransmission. This study has for objective to study the impact of the deficit in estrogens on the levels of anxiety on ovariectomized female Wistar rat.

**Methodology:** Female rats (172 to 226 g), aged 6 months, were used during this study. The animals were randomly divided into two groups: a control group "C" and an ovariectomized group "OVX". Three months later, the levels of anxiety were evaluated by valid behavioral tests, Open Field test (OFT) and elevated plus maze (EPM).

**Results:** The parameter values are collected and statically analyzed show partiality that:

\* In the OFT, the number of central squares visited as well as the time spent in the central squares by the OVX rats are significantly lower than the recorded values among the control.

\* In the test EPM test, the time spent in the open arms by the OVX rats is substantially lower than that recorded by the control rats.

randomly divided into two groups: a control group "C" and an ovariectomized group "OVX". Three months later, the levels of anxiety were evaluated by valid behavioral tests, Open Field test (OFT) and elevated plus maze (EPM).

**Conclusion:** These preliminary results suggest that the ovariectomy is associated with an increase in the level of anxiety, which would be due to a decrease in the secretion of ovarian hormones, particularly estrogen.

**Key words:** ovariectomized rat, cognitive disorders, OFT, EPM.

### WSC-0704

#### Experimental and Translational Neuroscience Endogenous neurogenesis in poststroke secondary degeneration

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Endogenous neurogenesis may contribute to repair central nervous system following brain injury such as stroke. We demonstrated that neural stem/progenitor cells (NSPC) induced by ischemia, which differentiated into neurons, astrocytes and oligodendrocytes, were generated within the poststroke area of the cortex. Using the same model we also found the secondary damage induced in the ipsilateral ventroposterior nucleus (VPN) of thalamus. In this study, we examined whether neurogenesis would develop even at the secondary degeneration.

Cerebral infarction was produced by occluding the left middle cerebral artery of CB17/SCID mice. Animals were perfusion-fixed 14 or 28 days after stroke, and brain sections were subjected to immunohistochemistry for nestin, PDGFR $\beta$ , MAP2, GFAP and Iba-1. In other groups, total RNA was extracted from the VPN, and RT-PCR was carried out to confirm the expression of nestin. Then the cells separated from same region were incubated in medium promoting formation of neurosphere-like cell clusters.

All poststroke mice showed secondary neuronal damage selectively at the ipsilateral VPN where loss of MAP2-staining with proliferation of GFAP-

positive astrocytes and Iba1-positive microglial cells were shown. Immunocytochemistry and RT-PCR confirmed the expression of nestin in the same region. Neurosphere-like clusters obtained from the ipsilateral thalamus had a potential to differentiate into MAP2-positive neurons and MAG-positive oligodendrocytes.

These results demonstrate that neural stem/progenitor cells are generated even in the secondary degenerated region following cerebral infarction. Although the precise fate of this NSPC is still unknown, the present study suggests the new insight for treating CNS by NSPC cells in poststroke brain.

## WSC-0550

### Experimental and Translational Neuroscience Using a chemokine binding protein to treat acute stroke

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**Introduction:** Following cerebral ischemia, neuronal death can trigger inflammatory responses that lead to immune cell infiltration, and expression of numerous chemokine-related genes is markedly increased in the brain following stroke.

**Aim:** To test whether targeting and binding a group of chemokines is beneficial for stroke outcome, we employed a chemokine-binding protein (CBP) encoded by parvovirus bovine papular stomatitis virus that is able to interrupt a broad range of chemokine signaling (by numerous CC, CXC and XC ligands), and thus prevent leukocyte recruitment in inflammation. We tested if CBP may be neuroprotective when administered following cerebral ischemia-reperfusion in mice.

**Methods:** Ischemic stroke was induced in male C57Bl6 mice by middle cerebral artery occlusion for 1 h, followed by reperfusion for 23 h. Mice were treated intravenously with either vehicle (5 mg/ml BSA; n = 10) or CBP (1 µg, 1xCBP, n = 10; or 10 µg, 10xCBP, n = 10) at the commencement of reperfusion. Plasma levels of the chemokines Mcp-1 (CCL2) and Mip-2 (CXCL2) were also measured (n = 5–8). Mice were then euthanized at 24 h, and brain leukocyte infiltration, infarct and edema volumes were analyzed.

**Results:** Following stroke, mice treated with 10xCBP had ~50% reductions in stroke-induced leukocyte infiltration in the brain and infarct volumes. These mice also had a tendency for reduced levels of Mcp-1 (vehicle, 958.9 ± 491.1; 10xCBP, 255.4 ± 194.4 ng/ml) and Mip2 (vehicle, 1387 ± 642.1; 10xCBP, 190.8 ± 42.94 ng/ml) in plasma compared with vehicle mice.

**Conclusions:** Our findings indicate that intravenous administration of CBP after stroke can reduce plasma chemokine levels in association with attenuated brain inflammation and infarct development.

## WSC-0296

### Experimental and Translational Neuroscience Impact study of treatment antiepileptique at a population of the Algerian East

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**Introduction:** The epilepsy is a chronic neurological disease which relates to all the countries of the world, the main aims are to give:

- An epidemiologic approach of the epilepsy in the area of the East-Algerian

- Antiepileptic determination of the impact of the treatment among these patients

**Method:** We carried out a descriptive retrospective study on the treatment antiepileptic starting from an investigation in 49 patient epileptics on the Algerian East followed to the service of neurology CHU Annaba – Algeria during March to May 2013.

**Results:** The great evil was the type dominating with 16, 32%, the symptomatic epilepsy presented 40, 82% of the epilepsies, the cranial trauma and the hyperthermia of infectious origin presented the causes most announced by the patients (45%), the family trauma was regarded as the principal preexistent factor supporting the epilepsy (60%), then the stress (53,33%) and the anxiety (46,67%); in particular at the women. We noted a prevalence of the cognitive disorders in the epileptics; whose disorders of memory (57, 14%) were at the head, the emotional disorders (44, 89%) and mental health disorders (42, 86%) in second position, others turbid of nature neurological, cardiovascular and gastro-intestinal were obtained with a less frequency.

**Conclusion:** the results suggest the need for medical and psychosocial assumption of responsibility by the improvement of the therapeutic follow-up like by the clarification and the programming of psycho-behavioral and cognitive therapy for the epileptics.

**Key words:** epilepsy, cognition, turbid mnemonic, antiepileptic, neuropsychology.

## WSC-1332

### Experimental and Translational Neuroscience Protective effects of estrogen receptor-beta against the formation of intracranial aneurysms in mice

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**Introduction:** Epidemiological studies suggest that estrogen has protective effects against the formation of intracranial aneurysms.

**Aims:** We hypothesized that estrogen or specific agonist of estrogen receptors (ERs) has protective effects against the formation of intracranial aneurysms and examined the hypothesis.

**Methods:** Experiments were conducted in accordance with the guideline approved by the University of California, San Francisco's Institutional Animal Care and Use Committee. Intracranial aneurysms were induced in female mice by a combination of a single injection of elastase into the cerebrospinal fluid and deoxycorticosterone acetate salt hypertension. Ovariectomized mice were treated with 17β-estradiol (E2), ERα agonist, ERβ agonist with and without nitric oxide synthase (NOS) inhibitor (L-NAME) or vehicle control. We treated ERβ knockout mice with DPN.

**Results:** There was a trend that the incidence of intracranial aneurysm was higher in ovariectomized mice (59%) than in sham-ovariectomized mice (36%) and that the treatment with E2 reduced the incidence of intracranial aneurysms from 56% to 38%. ERβ agonist but not ERα agonist significantly reduced the incidence of intracranial aneurysms. To verify the role of ERβ, we treated ERβ knockout mice with ERβ agonist. ERβ agonist did not reduce the incidence of aneurysms in ERβ knockout mice. The protective effects of ERβ agonist were abolished by L-NAME, indicating that stimulation of ERβ inhibits aneurysm formation through the activation of NOS.

**Conclusions:** We demonstrated that the activation of ERβ reduced the formation of intracranial aneurysms through the activation NOS. Activation of ERβ may be a promising therapeutic strategy in intracranial aneurysms.

**WSC-0438****Experimental and Translational Neuroscience  
Roles and regulation of ketogenesis in cultured  
astroglia and neurons under hypoxia and hypoglycemia**S Takahashi<sup>1</sup>, T Iizumi<sup>1</sup>, K Mashima<sup>1</sup>, T Abe<sup>1</sup>, N Suzuki<sup>1</sup><sup>1</sup>Department of Neurology, Keio University School of Medicine, Tokyo, Japan

**Introduction:** Exogenous ketone bodies (KBs), acetoacetate (AA), and  $\beta$ -hydroxybutyrate (BHB) act as alternative energy substrates in neural cells under starvation.

**Aims:** The present study examined the endogenous ketogenic capacity of astroglia under hypoxia with/without glucose and the possible roles of KBs in neuronal energy metabolism.

**Methods:** Cultured neurons and astroglia were prepared from Sprague-Dawley rats. Some cells were placed in a hypoxic chamber (1% O<sub>2</sub>). Palmitic acid (PAL) and L-carnitine (LC) were added to the assay medium. The 4 to 24-h production of AA and BHB was measured using the cyclic thio-NADH method. <sup>14</sup>C-labeled acid-soluble products (KBs) and <sup>14</sup>CO<sub>2</sub> produced from [1-<sup>14</sup>C]PAL were also measured. L-[U-<sup>14</sup>C]lactic acid ([<sup>14</sup>C]LAC), [1-<sup>14</sup>C]pyruvic acid ([<sup>14</sup>C]PYR), or  $\beta$ -[1-<sup>14</sup>C]hydroxybutyric acid ([<sup>14</sup>C]BHB) was used to compare the oxidative metabolism of the glycolysis end-products with that of the KBs.

**Results:** PAL/LC induced a higher production of KBs in astroglia than in neurons, while the CO<sub>2</sub> production from PAL was less than 5% of the KB production in both astroglia and neurons. KB production in astroglia was augmented by the AMPK activators, AICAR and metformin as well as hypoxia with/without glucose. Neuronal KB production increased under hypoxia in the absence of PAL. In neurons, [<sup>14</sup>C]LAC and [<sup>14</sup>C]PYR oxidation decreased after 24 h of hypoxia, while [<sup>14</sup>C]BHB oxidation was preserved.

**Conclusions:** Astroglia respond to ischemia *in vitro* by enhancing KB production, and astroglia-produced KBs derived from fatty acid might serve as a neuronal energy substrate for the TCA cycle instead of lactate, since pyruvate dehydrogenase is susceptible to ischemia.

**WSC-0333****Experimental and Translational Neuroscience  
In vivo optical imaging in poststroke mice model  
treated with bone marrow stromal cells or free radical  
scavenger edaravone**T Yamashita<sup>1</sup>, T FengFeng<sup>1</sup>, D Kentaro<sup>1</sup>, K Abe<sup>1</sup><sup>1</sup>Department of Neurology, Okayama University, Okayama, Japan

**Introduction:** Recent studies show modern *in vivo* optical imaging can detect matrix metalloproteinase (MMP) activation in the ischemic brain. In this study, we analyzed the protective effects of bone marrow stromal cell (BMSC) and free radical scavenger edaravone (EDA) against tissue plasminogen activator (tPA)-related MMP activation in ischemic brain, with *in vivo* optical fluorescence MMP imaging.

**Methods:** At 48 hours after 60 minutes of transient middle cerebral artery occlusion (tMCAO) with tPA, C57BL/6J mice were subjected to motor function analysis, *in vivo* optical imaging for MMP activation, gelatin zymography and immunofluorescent analyses with or without intravenous BMSC transplantation and the intravenous EDA.

**Results:** Massive intracerebral hemorrhages were observed in the ischemic hemispheres of the tPA group, only slight hemorrhages were found in the tPA/BMSC, tPA/EDA and EDA groups. While, *in vivo* fluorescent signals for MMP were detected over the heads of living mice 48 hours after tMCAO; the strongest were in the tPA group, which was reduced by BMSC or EDA treatment.

**Conclusions:** The present study provides a correlation of *in vivo* optical imaging of MMP activation to improving ischemic brain damage caused by tPA after tMCAO and treated by BMSC and EDA.

**WSC-0791****Experimental and Translational Neuroscience  
Motor dysfunction prevention after cerebral ischemia  
in rats by new hypothalamic proline-rich polypeptide-1**E M M A Yeritsyan<sup>1</sup>, M Balasanyan<sup>2</sup>, H Topchyan<sup>3</sup>, A Galoyan<sup>4</sup><sup>1</sup>Pharmacy, Yerevan State Medical University, Yerevan, Armenia<sup>2</sup>Pharmacology, Yerevan State Medical University, Yerevan, Armenia<sup>3</sup>Drug Technology, Yerevan State Medical University, Yerevan, Armenia<sup>4</sup>H. Buniatian Institute of Biochemistry of the National Academy of Sciences of the Republic of Armenia 5/1 Paruir Sevag Str. Yerevan 0014 ARMENIA, Yerevan State Medical University, Yerevan, Armenia

**Introduction:** The proline rich peptide (PRP-1) is a cytokine and a unique mediator, isolated from neurosecretory granules of the bovine neurohypophysis produced by *N. supraopticus* and *N. paraventricularis*. It was shown immune cells stimulator effect of PRP-1, also its potential antimicrobial, antioxidative and neuroprotective properties.

**Aims:** Based on obtained data, the present study was designed to investigate the potential effects of PRP-1 on motor coordination deficits in rats induced by cerebral ischemia.

**Materials and methods:** To simulate better the typical human ischemic outcomes, in the present study focal cerebral ischemia was induced by middle cerebral artery occlusion (MCAO) of the rats. Experiments were carried out on male, albino rats weighting 200–240g (n=56). Cognitive impairment were assessed using the Rota-rod test. The results were registered before MCAO and after the 3<sup>rd</sup>, 6<sup>th</sup> and 12<sup>th</sup> postischemic days. After MCAO the rats received an *i/p* injection of PRP-1 (20  $\mu$ g/kg, daily 2 times).

**Results:** On the 3<sup>rd</sup> and 6<sup>th</sup> days following MCAO, the motor coordination of rats was markedly impaired: 28.7%, 58.5% accordingly, in comparison with intact animals. On the 12<sup>th</sup> post ischemic day there was a noticeable loss of motor coordination (80.4%). In the case of PRP-1 treated rats, after the 3<sup>rd</sup>, 6<sup>th</sup> and 12<sup>th</sup> postischemic days motor coordination values 61.5%, 91.6%, 99% were increased compare with ischemic rats.

**Conclusion:** Thus, systematic administration of PRP-1 has been proven to significantly decrease ischemia-induced motor dysfunction. Hence, it may be concluded that PRP-1 could be useful clinically in the prevention of cerebral ischemia outcomes.

**WSC-0597****Experimental and Translational Neuroscience  
IgG encephalopathy and cognitive disorientation**F Zallaghi<sup>1</sup>, I Ahmed<sup>2</sup><sup>1</sup>Internal Medicine, University of Missouri Kansas City, Kansas City, USA<sup>2</sup>Neurology, Research Medical Center, Kansas City, USA

Immunoglobulin G related neurological disorders are a newly recognized and treatable disorders which can manifests in several different ways including Hypophysitis, hypertrophic patchy meningitis syndrome and can be a cause of rapidly declining cognitive function and have mild Parkinsonism symptoms. This is a case report of rapidly declining cognitive function in an elderly patient with mild Parkinsonism symptoms.

81-year-old Caucasian female presented with decline in cognitive function for last 2 months duration with difficulty in ambulation. No headache / visual difficulty or sphincter problem. No history of hypertension, hyperlipidemia or diabetes. Neurological and cognitive testing reveals mild bradykinesia dysarthria and memory difficulties. Neuroimaging studies showed mild Brain atrophy and thickened meninges, EEG showed bilateral slowing in theta frequency lumbar puncture showed no cells, normal

glucose, Elevated proteins to 123mgm/millimeter. Gamma globulin fraction very thigh and high IGg synthesis rate all cultures were negative and viral DNA for herpes virus were negative. A meningese biopsy was inconclusive. All blood work, including immunological work up was negative. Patient receives immunoglobulin with some improvement in the neurological status, and being continually evaluated. IGg induce meningoencephalopathy should be consider in patient with a rapidly declining cognitive function, ataxia and parkinsonian features as it can be potential reversible cause of dementia.

### WSC-0777

#### Experimental and Translational Neuroscience Relationship between plasma matrix metalloproteinase-9 level and hemorrhagic transformation in acute ischemic stroke

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**Introduction & aims:** We intended to study the relationship between plasma MMP-9 concentrations within the first 24 hours of stroke and HT in a Chinese hospital based stroke registry.

**Methods:** We prospectively enrolled a consecutive cohort of patients with ischemic stroke who were admitted within the first 24 hours of onset from January, 2003 to February, 2007 into the analysis. Blood samples and initial CT scan were obtained on admission. the presence of HT were examined by a secondary CT or MRI in hospital day 3–14. Baseline characteristics and plasma MMP-9 concentration were compared between HT group and non-HT group.

**Results:** 168 eligible patients with a median duration of 5 hours from stroke onset and 40 healthy subjects were included. HT was observed in 29 (17.25%) patients. Median plasma MMP-9 concentration were significantly higher in the HT group (244.30 ng/ml) than in the non-HT group (110.04 ng/ml) ( $P = 0.006$ ) and in the healthy control group (63.26 ng/ml) ( $P = 0.0001$ ), even in the patients within 3 hours of symptom onset, and patients within 6 hours, and cardioembolic stroke. When assessed for discrimination with ROC curves, the plasma MMP-9 concentration gave an area under the ROC curve of 0.865 for occurrence of HT, a concentration of 181.7ng/ml was found both of high sensitivity and specificity. Further logistic regression proved plasma MMP-9 level  $\geq 181.7$ ng/ml was independently associated with HT after adjustment for potential confounding factors (OR = 17.78, 95% CI: 6.01–52.53,  $P = 0.0001$ ).

**Conclusions:** Plasma MMP-9 level  $\geq 181.7$  ng/ml within the first 24 hours might be an independent predictor for HT in acute ischemic stroke patients.

### WSC-0205

#### Genetics

#### The relative contribution of genetic and nongenetic factors on quality of anticoagulation control and vascular events in atrial fibrillation patients

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**Introduction:** Warfarin has narrow therapeutic window. We hypothesized that genetic factors associated with warfarin dosing (CYP2C9 and

VKORC1) is more important over modifiable factors in the quality of anticoagulation, and are related with thromboembolic and hemorrhagic risks.

**Aims:** We conducted a retrospective cohort analysis on the factors associated with labile international normalized ratio (INR) and clinical events.

**Methods:** Clinical and genetic data from 380 patients with atrial fibrillation (AF) were collected and followed for average 4 years. We evaluated the factors associated with therapeutic time in range (TTR, INR 2–3) and vascular events (either thromboembolic or hemorrhagic), including both genetic factors (CYP2C9 and VKORC1 genotype) and modifiable factors (e.g. anticoagulation service, frequent INR check).

**Results:** Genotypic frequencies of CYP2C9 and VKORC1 variants were 9.5% and 16.3%, respectively. TTR varies greatly depending on the VKORC1 polymorphism: TTR was higher in VKORC1 variants than in wild type carrier ( $61.7 \pm 16.0\%$  vs.  $56.7 \pm 17.4\%$ ,  $p = 0.031$ ). Multivariate testing showed that VKORC1 genotype and anticoagulation service were independently related with labile INRs (TTR < 65%). Vascular events were observed in 66 (18.4%) patients during the study period. Cox proportional hazard model showed that the use of anticoagulation service and patients' characteristics, such as AF-thromboembolic risk (CHA<sub>2</sub>DS<sub>2</sub>-VASc score) and consequence (neurologic disability), but not genetic factors were independently associated with vascular events.

**Conclusions:** Both genetic determinant of response to warfarin (VKORC1 genotype) and clinical efforts (anticoagulation service) influence on labile INRs during warfarin maintenance. However, clinical events were more strongly associated with clinical features and efforts than genetic factors.

### WSC-0200

#### Genetics

#### Correlation of prothrombotic coagulation parameters with genetic markers of thrombosis in ischemic stroke

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**Background:** This study evaluates prothrombotic coagulation parameters in acute phase of thrombosis with genetic markers of thrombosis in stroke cases to see if there is any contribution of these parameters in development of stroke.

**Methods:** 39 adult patients of ischemic stroke were included. EDTA, Citrated and Plain blood samples taken before instituting therapy. Protein C&S, Antithrombin (AT), APC-R, Lupus Anticoagulant (LAC) and antiphospholipid antibody (APA) assays were performed. Common genetic variants of inherited Thrombophilia like factor V leiden (FVL), Prothrombin (G20210A), MTHFR (C677T), analyzed by PCR-RFLP. Severity of stroke assessed by NIHSS scale.

**Results:** Cases were divided by TOAST criteria. Most strokes occurred in young to middle aged (range 18–57 years) healthy adults without noteworthy comorbidities. The strokes were mostly of moderate NIHSS severity (79.5%, 31/39). Various inherited /acquired thrombophilic factors contributed to 36% ischemic stroke. Protein C, S & AT deficiency in 5.1%, 12.8%, 2.5%. Anti cardiolipin IgG antibody in 2.5% and IgM in 7.7%. One case each was positive for  $\beta$ 2glycoprotein IgG & IgM. LAC positive in 23% (9/39). Factor V leiden present in two cases whereas 17 had MTHFR. LAC alone and in combination with other thrombophilic risk factors is an important independent risk factor for stroke of moderate severity ( $p = 0.04$ ). Majority of the patients with thrombophilic risk factors had anterior circulation (71.4%) & large vessel involvement (50%). None had small vessel disease.

**Conclusion:** The presence of multiple thrombophilic risk factors is an independent predisposing cause for Large vessel stroke of Moderate Severity. This showed strong association with younger age. Lupus anticoagulant was an independent risk factor.

**WSC-0290****Genetics****Association of -2578C>A, -1154G>A, and +936C>T polymorphisms of VEGF gene and lipid profile to aortic calcification**B Shin<sup>1</sup>, B Yadav<sup>2</sup><sup>1</sup>Neurology, Chonbuk National University Medical School, Jeonju, Korea<sup>2</sup>Medical Science, Chonbuk National University Graduate School, Jeonju, Korea

**Introduction:** Aortic calcification is developed due to accumulation of large amount of calcium in the aorta, and it is the leading cause of aortic valve replacement and the third leading cause of cardiovascular disease.

**Aims:** The purpose of this study was to investigate the correlation between aortic calcification and VEGF SNPs (-2578C>A, -1154G>A and +936C>T) and to evaluate the association of these SNPs with biochemical parameter in relation to aortic calcification.

**Methods:** Aortic calcification was diagnosed by examining the posteroanterior chest X-rays by radiologist and was graded into four groups. The real-time polymerase chain reaction with melting curve analysis in a LightCycler was used to genotype the VEGF SNPs.

**Results:** Among the VEGF SNPs, a significant genetic difference was found only between the aortic calcification and control group with VEGF SNP -2578C>A but haplotypes C-G-A and T-A-C of +936/-1154/-2578 were significantly different in control and aortic calcification group and could enhance the aortic calcification development with the odd ration 1.50 and 2.79, respectively. By regression analysis, it was found that age, hypertension, diabetes, dyslipidemia, hyperhomocysteinemia were found significantly different with the different genotypes of VEGF SNPs which may induce aortic calcification development.

**Conclusions:** Age, hypertension, diabetes, dyslipidemia, and hyperhomocysteinemia were established as aggravating factors for the development of aortic calcification in association with different VEGF genotypes.

**WSC-0520****Genetics****Familial aggregation of stroke among young patients in Lund Stroke Register**A Ilinca<sup>1</sup>, U Kristofferson<sup>2</sup>, A Lindgren<sup>1</sup><sup>1</sup>Neurology, Skåne University Hospital, Lund, Sweden<sup>2</sup>Clinical Genetics, Skåne University Hospital, Lund, Sweden

**Background:** The presently known monogenic forms of stroke are rare and represent only a small proportion of all strokes.

**Methods:** Lund Stroke Register (LSR) is an ongoing register of consecutive patients with first-ever stroke from a defined geographical area in southern Sweden. We systematically screened early-onset (≤55 years) stroke patients registered in 2004–2013 with regard to family history, and compiled families with stroke aggregation.

Participants provided information on any occurrence of stroke in their families. Information on cardiovascular risk factors (hypertension, diabetes mellitus, hypercholesterolemia, cardiac disease, smoking, previous TIA) and clinical stroke subtype (CCS-TOAST) was collected.

Family history for stroke was considered positive when the patient reported

A. ≥1 first-degree relative with stroke,

or

B. ≥3 second or third-degree relatives with stroke in a distribution compatible with monogenic inheritance.

**Results:** Of 4,103 consecutive patients registered, 412 had first-ever stroke at ≤55 years. Of these, 107 (26%) reported positive family history; 99 (93%) fulfilled criterion A and 8 (7%) criterion B; 152 did not provide information about family history. Twenty-one (20%) of the probands

with positive family history had no known vascular risk factors. We identified 29 families with ≥4 members with stroke. All affected individuals had more than one generation compatible with monogenic dominant inheritance with complete or high penetrance in one ancestral line.

**Conclusion:** Aggregation of stroke in families of early-onset stroke patients is not uncommon, suggesting that genetic factors with high impact on stroke risk, including monogenic causes, play an important role.

**WSC-0523****Genetics****Evaluation of polymorphisms of the angiotensinogen M235T and angiotensin-converting enzyme gene insertion/deletion in patients craniocervical arterial dissection**H Celik<sup>1</sup>, Y Kaplan<sup>1</sup>, E Yesilada<sup>2</sup>, G Gulbay<sup>2</sup>, O Kamisli<sup>1</sup>, C Ozcan<sup>1</sup>, S Altinayar<sup>1</sup><sup>1</sup>Neurology, Inonu University, Malatya, Turkey<sup>2</sup>Medical Biology and Genetic, Inonu University, Malatya, Turkey

**Aims:** Both the angiotensinogen (AGT)-M235T and angiotensin-converting enzyme (ACE) gene insertion/deletion (I/D) polymorphisms are significantly associated with classic ischemic stroke in various ethnic populations. However, neither carotid artery dissection (CAD) nor vertebral artery dissection (VAD), which are special categories of stroke, have been evaluated regarding their relationships with these polymorphisms. This study investigated whether these polymorphisms are underlying risk factors associated with CAD or VAD.

**Methods:** Patients were retrospectively and prospectively reviewed and 63 patients diagnosed with CAD or VAD and 100 healthy human volunteers were included. In both patients and volunteers, the I/D gene polymorphism genotypes II, ID, and DD were evaluated for the ACE gene and the polymorphism genotypes MM, MT, and TT were evaluated for the AGT-M235T gene. Real time polymerase chain reaction analyses were used for genotyping.

**Results:** The genotype frequencies for II, ID, and DD were 6.3%, 54%, and 39.7%, respectively, in the patient group and 51%, 29%, and 20% in the control group. The frequencies of ID and DD were significantly higher in patients than in the control group ( $p < 0.05$ ). The frequencies for MM, MT, and TT were 12.7%, 63.5%, and 23.8%, respectively, in the patient group and 46%, 33%, and 21% in the control group. The frequency of MM was significantly higher in controls than in patients whereas that of MT was higher in patients ( $p < 0.05$ ).

**Conclusions:** The DD and ID polymorphisms of the ACE gene and the MT polymorphism of the AGT gene significantly contribute to the risk of craniocervical arterial dissection.

**WSC-1344****Genetics****Association between beta-1 adrenergic receptor gene polymorphism and ischemic stroke in North Indian population: A case control study**A Kumar<sup>1</sup>, K Prasad<sup>1</sup>, M Tripathi<sup>1</sup>, M Padma<sup>1</sup>, S Vivekanandhan<sup>2</sup><sup>1</sup>Neurology, All India Institute of Medical Sciences New Delhi, New Delhi, India<sup>2</sup>Neurobiochemistry, All India Institute of Medical Sciences New Delhi, New Delhi, India

**Introduction:** Stroke is a multi-factorial disease and influenced by both genetic and environmental factors. **Aims:** The purpose of this case control study was to determine the relationship of beta-1 adrenergic receptor polymorphism with ischemic stroke in North Indian Population.

**Methods:** In this study, 224 patients and 224 age- and sex-matched controls were recruited from Outpatient Department and neurology ward of All India Institute of Medical Sciences New Delhi. Genotyping was performed by using Polymerase chain reaction–Restriction fragment length polymorphism (PCR-RFLP) method. PCR results were confirmed by DNA sequencing. Frequency distributions of genotypes and alleles were compared between cases and control using logistic regression.

**Results:** Mean age of cases and controls were  $53.9 \pm 13.4$  and  $53.6 \pm 12.9$  respectively. Multivariate logistic regression analysis showed independent association between Ser49Gly polymorphism and ischemic stroke under dominant model of inheritance (OR 2.5; 95% CI 1.2 to 5) and Large vessel stroke (LVD) stroke under recessive model of inheritance (OR, 6.5; 95% CI 1.7 to 23;  $P = 0.005$ ). Independent association of Gly389Gly genotype with small vessel stroke (SVD) stroke (OR, 7.09; 95% CI, 1.9 to 25;  $P = 0.003$ ) under recessive model of inheritance. All the observed genotype frequencies were in Hardy-Weinberg equilibrium in both cases and controls.

**Conclusions:** This is the first report to have examined the association of beta-1 polymorphism in ischemic stroke. The findings of present study Ser49Gly polymorphism of ADRB1 gene confers higher risk of ischemic stroke in North Indian population and especially in patients with LVD stroke. Our findings also show that Arg389Gly polymorphism of ADRB1 confer higher risk of SVD stroke in North Indian Population.

## WSC-0980

### Genetics

#### Vascular endothelial growth factor: Genetic polymorphisms in patients with intracranial aneurysm and its relation to hypertension and diabetes mellitus

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**Background:** Vascular Endothelial Growth Factor (VEGF) is an important regulator and a genetic marker of vasculogenesis and angiogenesis. VEGF polymorphisms can be considered as risk factors for intracranial aneurysm (IA).

**Objective:** Analyze VEGF polymorphism, lifestyle and comorbidities in the Brazilian casuistic with IA.

**Methods:** 856 individuals distributed into groups: G1- 43 (familial IA); G2- 177 (G1 family); G3 – 120 (sporadic IA); G4 – 285 (G3 family); G5 – 104 (controls); G6 – 127 (G5 family). VEGF-C936T was analyzed by PCR.  $P < 0.05$  was considered statistically significant.

**Results:** Prevalence of genotype wild C/C in G5 (10.5%) in comparison with G1 (2.3%) and G3 (0.0%) ( $P = 0.03$  for both) and the risk genotype (T/T) was significant between G4 (75.3%) and G6 (78.0%;  $P < 0.0001$ ). The distribution of allele T was similar between groups (G1 = 0.86; G2 = 0.88; G3 = 0.87; G4 = 0.87; G5 = 0.81; G6 = 0.89;  $P > 0.05$ ). We observed a high frequency of smoking and drinking habits in G1 (79%

and 40%, respectively) compared to G5 (30.0% and 22%, respectively;  $P < 0.0001$  for all). An association between hypertension and IA was observed in G1 (49%) and G3 (49%) compared to G5 (21%;  $P = 0.003$ ;  $P < 0.0001$ ). It was not observed differences between patients and controls in relation to diabetes mellitus.

**Conclusion:** The polymorphism for VEGF was more prevalent only in the family of patients with IA. On the other hand, smoking, drinking habits and hypertension were observed in Brazilian patients with IA. Studies in families with a history of IA may allow greater attention to preventive care with respect to the disease.

## WSC-1516

### Genetics

#### NOTCH3 protein localization in fibroblasts from CADASIL patients : An immunofluorescence study

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**Introduction:** CADASIL is an inherited cerebrovascular disease caused by mutations in the NOTCH3 gene, encoding a protein belonging to the Notch receptor family. Notch signaling is involved in a broad spectrum of function, from the cell proliferation to apoptosis. It is expressed in adult human tissues such as peripheral blood lymphocytes (PBLs) and fibroblasts.

**Aims:** Our aim was to evaluate Notch3 protein expression in human fibroblasts from CADASIL patients.

**Methods:** We perform the investigation on the fibroblasts from four CADASIL patients and a normal subject. The patients were genetically characterized, and carried a C174Y, a R332C, a c.341–24\_26delAAC, a R61W mutations, respectively. Fibroblasts were grown in DMEM with 10% FBS, Glutamine, Streptomycin–Penicillin. At 80% of confluence, cells were washed in TBS and fixed on a slide with paraformaldehyde.

The slides were treated with a mouse anti Human Notch3 antibody that recognizes the extracellular domain ECD and a rabbit antibody that recognizes the intracellular domain NICD. Anti-mouse and anti-rabbit secondary antibodies revealed the primary antibodies.

**Results:** Different patterns of localization were detected. In cells with mutation R61W an immunoreactive predominance of the intranuclear NOTCH3 NICD, and in cells from patients with R332C mutation an immunoreactive predominance of the N3ECD extracellular NOTCH3 domain was observed when compared both with cells from normal subject, and with the remaining CADASIL cells.

**Conclusions:** The obtained results show that in CADASIL fibroblasts the mutation type is associated with a relative differential localization of Notch3. This likely might be due to alterations in the protein processing. The work was supported by the Italian Ministero dell'Istruzione, dell'Università e della Ricerca (MIUR). Grants Miur-PRIN2009\_20095)PSNA\_002

## WSC-0831

### Genetics

#### Clinical features of 7 patients with anteromedial thalamic infarction

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**Aim:** We examined the clinical characteristics, brain imaging findings, and higher brain functions of patients with anteromedial thalamic infarctions.

**Methods:** The subjects were 7 patients (3 women; mean age 72, range 50–87 years) with an isolated anteromedial thalamic infarction (3 had a right-sided infarct, while 4 had a left-sided infarct). Higher brain functions were evaluated using the Mini-mental state Examination, Wechsler Memory Scale, and Word Fluency tests. MRI and single-photon emission computed tomography (SPECT) were also performed.

**Results:** The clinical subtype was cardiogenic embolism in 3 patients, lacunar infarction in 3, and atherothrombotic infarction in 1. Two out of the 7 patients were aphasic. In 1 patient, aphasia had developed due to a previous cerebral infarction. In all patients, anterograde and recent memory impairments were remarkable compared to immediate memory loss. Both verbal and visual-volatile memory were impaired. There was no difference in memory impairment for lesions in different brain sides. Attention disorders, cognitive impairment, and intellectual impairment were mild in all patients. SPECT images were examined in 5 cases; these revealed hypoperfusion in both the frontal lobes in two cases, in both the temporal lobes in 1 case, and in both sides of the cerebral hemispheres in 1 case. Impairment of higher brain functions, especially memory, was persistent.

**Conclusion:** In patients with anteromedial thalamic infarctions, regardless of the laterality, higher brain functions, especially frontal lobe functions, were impaired. The recovery of higher brain functions was not insufficient. SPECT demonstrated hypoperfusion areas in the frontal and temporal lobes.

## WSC-0769

### Genetics

#### a hereditary vascular leucoencephalopathy mapped to 20q13: A transcranial Doppler ultrasound study

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**Introduction:** We studied a family with an evidently hereditary vascular leucoencephalopathy, mapped to chromosome 20q13. This new entity is marked by a slow and late clinical phenotype, yet with an overwhelming MR imaging. We refer to Hervé et al. who first labeled this new 20q13 syndrome and described an anatomopathological image of extensive leucoencephalopathy, characteristic to amyloid angiopathy and angiosclerosis, similar to observations in hypertensive small vessel disease.

**Objective:** We performed transcranial Doppler ultrasound measurements with the aim to understand the underlying mechanisms and consequences in cerebral hemodynamics in this rare leucoencephalopathy.

**Methods:** Three family members, two brothers and their father, with a confirmed 20q13 variant, were invited to undergo a transcranial Doppler ultrasound study of the medial cerebral artery (MCA), before and after an intravenous acetazolamide (ACZ) challenge. The subjects had no known medical history of cardiovascular, nephrological or neurological disease.

**Conclusions:** The cerebral reserve is constraint in the iconographic most pathologic advanced case, namely the father of higher age. In the two younger individuals this was not the case. There seems mainly a microscopic impact rather than a functional influence. Because, even with disease progression on a vascular basis, there was no clear phenotype observed. Comparisons with CADASIL (Cerebral Autosomal-Dominant Arteriopathy with Subcortical Infarcts and Leucoencephalopathy) and other vascular leucoencephalopathies are discussed in this context.

## WSC-0913

### Genetics

#### Telomere length and risk of type 2 diabetes: New prospective cohort study and literature-based meta-analysis

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**Introduction:** Type 2 diabetes mellitus (T2DM) is responsible for approximately 15% of all stroke events worldwide. It has been suggested that biological ageing reflected by telomere length is related to the development of T2DM.

**Aims:** To quantify in detail the association of leukocyte telomere length (LTL) with new-onset T2DM.

**Methods:** LTL was measured using quantitative PCR in 607 subjects free of T2DM at baseline participating in the prospective population-based Bruneck Study. We calculated hazard ratios (HRs) for T2DM across quartiles of baseline LTL using Cox regression models adjusted for age, sex, BMI, smoking, socio-economic status and physical activity. We estimated HRs corrected for within-person variability using multivariate regression calibration of repeated measurements taken up to 15 years apart. To contextualize our findings, we systematically sought PubMed, Web of Science and EMBASE for relevant articles and pooled results in a random-effects meta-analysis.

**Results:** Over 15 years of follow-up, 44 out of 607 participants developed new-onset T2DM. The adjusted HR for T2DM comparing the bottom vs top quartile of LTL was 1.89 (95% confidence interval: 0.85 to 4.20;  $P = 0.120$ ). The corresponding HR corrected for long-term variability was 3.05 (1.21 to 7.69;  $P = 0.018$ ). In a meta-analysis of three prospective studies involving 6,992 participants and 2,011 incident T2DM events, the pooled relative risk was 1.30 (1.06 to 1.59;  $P = 0.010$ ;  $I^2 = 68\%$ ).

**Conclusions:** LTL is independently associated with the risk of incident T2DM. To avoid regression dilution biases in observed associations of LTL with disease risk, future studies of LTL should implement methods correcting for within-person variability.

## WSC-0278

### Genetics

#### Genetic variation of osteopontin promoter T-443C in Indonesian children with parental history of ischemic stroke

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Genetic factor is one of the risk factor in increasing carotid intima media thickness (CIMT) which is an early manifestation of atherosclerosis. The aim of this study were to identified genetic variation of OPN promoter T-443C in Javanese Indonesian children with parental history of ischemic stroke and explain its association with the increasing of CIMT. An analytical observational study with case-control design was used in this study. Sample consisted of 20 case sample and 12 control sample. Case group is 10–21 years old Javanese Indonesian children with parental history of ischemic stroke. Control group is 10–21 years old Javanese children without parental history of ischemic stroke. Patient characteristic data, laboratory and ultrasound measurement result were obtained from previous study. Analysis of OPN genotyping was performed using PCR method in Physiology Laboratorium, Medical Faculty of Brawijaya University. Sequencing result were analyzed by Main Workbench 6.0 and

Sequencher 5.1 program. Result of this study revealed there was genetic variation of OPN T-443C in 4 case groups and 2 control groups. There was no significant difference of CIMT between case and control groups ( $p = 0.819$ ). Genetic variation of OPN promoter T-443C was not significant as a risk factor of CIMT OR = 0.467 (CI: 0.067–3.373). This study conclude that genetic variation of OPN promoter T-443C was found in Javanese children with parental ischemic stroke and became one of risk factors for increasing of CIMT.

## WSC-1047

### Heart and Brain

#### Occult atrial fibrillation detected by auto-triggered loop recorder screening in a community-based population (a result of the first 40 participants)

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**Introduction:** Atrial Fibrillation is the most frequent source of cardiac emboli in patients with ischemic stroke. The majority of Atrial Fibrillation events are under-diagnosed, as it is often asymptomatic or intermittent and, therefore, may not be detected on standard 12-lead ECG or even 24-hour ECG recording (Holter).

**Aims:** The evaluation of the frequency of Atrial fibrillation by using an auto-triggered external loop recorder in a community-based population. **Methods:** We enrolled 40 participants, 65 years age or older, with no history of Atrial Fibrillation (normal ECG), stroke or transient ischemic attack (TIA) from 4 retirement facilities and 2 community clinics in Edmonton city. The primary outcome was to detect any Atrial Fibrillation event (>3 seconds) during the monitoring period.

**Results:** The median monitoring duration was 19 days (range 1–22 days) resulting in an Atrial Fibrillation detection rate of 35% (14/40), of which 79% (11/14) were < 30 seconds and the remaining 21% (3/14) were > 30 seconds. Paroxysmal Atrial Tachycardia was detected in 50% (20/40) of participants, of which 45% (9/20) evident with concomitant Atrial Fibrillation.

**Conclusions:** There is a high rate of occult Atrial Fibrillation (mostly < 30 seconds) detected by auto-triggered external loop recorders in the community population. The use of external loop recorders to evaluate for Atrial Fibrillation or Paroxysmal Atrial Fibrillation may be considered in population at high risk of stroke.

## WSC-0425

### Heart and Brain

#### Based on atherogenic condition, additional higher DGLA and CKD Are important risk factors for AMI, and hypertension for atherothrombotic stroke

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**Introduction:** The major three atherothrombotic diseases, that are coronary artery disease, cerebrovascular disease and peripheral arterial disease,

are often based on the similar risk factors and coexist as polyvascular disease. However, it is still unknown which risk factors differentiate three diseases.

**Aim:** To clarify the difference of risk factors between acute atherothrombotic events in heart (AMI) and brain {large artery atherosclerosis (LAA) and branch atheromatous disease (BAD)}.

**Methods:** We defined LAA and BAD according to MRI findings. Consecutive patients with AMI and atherothrombotic stroke, 244 and 79 (including 47 LAA and 32 BAD), respectively, were enrolled in this study. As well as classical risk factors, new emerging biomarkers including polyunsaturated fatty acids were examined. We used ANOVA for statistical analysis.

**Results:** Although we could not find any significant difference in classical risk factors like LDL-C and HbA1c between AMI and atherothrombotic stroke, we observed significant increase of dihomogamma-linolenic acid (DGLA,  $p = 0.02$ ), uric acid ( $p = 0.03$ ) and decrease of estimated glomerular filtration rate (eGFR,  $p < 0.001$ ) in the AMI group. High DGLA suggested higher intake of linoleic acid in patients with AMI. Hypertension predominated in ischemic stroke. These result suggested that on the base of classical atherogenic condition, additional CKD and high linoleic acid would be the leading factors for AMI and hypertension would be for atherothrombotic stroke.

**Conclusions:** DGLA and CKD are important risk factors for AMI and hypertension for atherothrombotic stroke.

## WSC-0539

### Heart and Brain

#### The importance of left atrial volume in identifying the cause of ischemic stroke

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**Introduction:** Identifying the cause of ischemic stroke (IS) guides management. Atrial fibrillation (AF) may be intermittent, so markers predicting stroke due to atrial fibrillation are needed.

**Aim:** In this study we aim to determine echocardiographic features which differentiate stroke due to AF from other causes of stroke.

**Methods:** 90 patients with IS were included: 30 with cardioembolic stroke (CES); 30 with large artery stroke (LAS) and 30 with small vessel disease (SVD) stroke. All Patients underwent echocardiography, Holter monitoring and cervical artery imaging as part of their stroke work up.

**Results:** LAS and SVD patients were similar among all characteristics, including age, lipoproteins, and echo parameters including left atrial volumes (32.0 ml/m<sup>2</sup> vs 33.7 ml/m<sup>2</sup>,  $p = 0.524$ ). CES patients were older than both LAS and SVD groups (76.3 ± 8.68 yrs, 66.03 ± 12.79 yrs, 67.7 ± 14.7 yrs), and had a significantly larger left atrial volume (50.6 ml/m<sup>2</sup> vs 32.7 ml/m<sup>2</sup>  $p < 0.05$ ). The most significant predictors of CES were age (F-statistic 6.02,  $p = 0.02$ ) and left atrial volume (LAV, F-statistic 18.6,  $p < 0.0001$ ). LAV was the most significant independent predictor of CES after adjusting for age ( $p < 0.0001$ ), however, other measures of diastolic function also predicted CES. Correction of LAV for other measures of diastolic function removed the independent association of LAV with CES, suggesting a causal association between diastolic dysfunction, LAV and CES.

**Conclusion:** In our study, increased left atrial volume was the most important predictor separating CES from other forms of IS, with diastolic dysfunction being a likely underlying cause for increased LAV.

**WSC-1395****Heart and Brain****Associação between left ventricular hypertrophy and cerebrovascular events**

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**Introduction:** There are studies that describe high prevalence of left ventricular hypertrophy (LVH) in populations with ischemic stroke, it remains poorly studied this relationship in Latin America.

**Aim:** Study the prevalence of LVH by echocardiography in patients with ischemic stroke in a Brazilian population.

**Method:** This was a cross-sectional prospective study including 147 consecutive patients with stroke or transient ischemic attack. Transthoracic echocardiograms were performed on all patients by the same examiner. Statistical analysis was used to describe the findings on cerebrovascular events and ventricular hypertrophy.

**Results:** All 147 patients (95 men) were included in the analysis. Patients' ages ranged from 23 to 85 years (65 ± 12.4 years). Most of the patients (58/5%) were Caucasian, while 41.5% were African-Brazilian. In the patients studied, 87.8% presented with LVH by echocardiogram.

**Conclusion and discussion:** The high prevalence of LVH in this study population is noteworthy and indicates a close association between myocardial hypertrophy and cerebrovascular events. In a systematic review including 10 studies of hypertensive patients, Pewsner et al. found that 38% of myocardial hypertrophy cases could be determined by echocardiography. This finding, which is in agreement with those of others, is much lower than that found in the present study. We previously described a close association between LVH and atherosclerotic plaque in the ascending aorta in patients with stroke or TIA. In that study, the LVH prevalence was as high as 90%. Therefore, our results are consistent with the well-known role of LVH as a risk marker of cerebrovascular events.

**WSC-1484****Heart and Brain****Effects of CPAP therapy on cardiac functional and structural alterations in patients with resistant arterial hypertension and obstructive sleep apnea – A randomized trial**

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**Introduction:** Effects of CPAP therapy on cardiac alterations in patients with OSA and resistant hypertension have not been previously reported.

**Aims:** To evaluate the effects of CPAP therapy on the heart.

**Methods:** This is an open label, randomized trial of parallel groups involving 69 patients treated with CPAP therapy or no treatment (control) for three-month.

**Results:** Patients aged 18 to 70 years with primary resistant hypertension i.e. systolic BP >13 mmHg and/or diastolic BP >85 mmHg despite using at least 3 optimally dosed antihypertensive medications of different classes, including a diuretic and an apnea-hypopnea index (AHI) ≥ 15 were studied. 24-hour ABPM was used to define resistant hypertension. Behavioral questionnaires included the Pittsburgh Sleep Quality Index and the Epworth Sleepiness Scale (ESS). Echocardiography was performed at baseline and after three-months of CPAP therapy. Sixty-nine patients completed three months of CPAP therapy (N = 37) or no treatment (N = 32). No differences regarding gender, age, excessive daytime sleepiness (ESS > 10) and number of previous cardiovascular events were found. Neck circumference tended to be higher in cases treated with CPAP. More than 60% of patients in both groups had an AHI > 30 and arousal index was not different between groups. At baseline, echocardiographic mea-

asures were not different between patients and control subjects. After three months, right ventricular diameter was reduced and the ventricular ejection fraction was increased in patients treated with CPAP therapy. A reduction of the arterial pulmonary artery pressure was observed in the CPAP treated group.

**Conclusion:** CPAP therapy improves cardiac function in patients with resistant arterial hypertension.

**WSC-1264****Heart and Brain****Clinical features, risk factors and short term outcome of ischemic stroke in patients with and without atrial fibrillation: Data from Ludhiana population based registry**

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**Background and aims:** Little is known about the clinical features, risk factors and short term outcome of ischemic stroke (IS) in patients with AF from low and middle income countries (LMICs). We aimed to explore the differences in age, gender, clinical features, risk factors and short term outcome of IS patients with and without AF from Ludhiana population based stroke registry.

**Methods:** All first ever stroke patients (≥18 years) from Ludhiana city were included from January 2011 to March 2013. Trained research staff collected data from the hospitals, scan centers and general practitioners using WHO STEPS methodology with modification. The short term outcome was assessed using modified Rankin Scale [mRS] (mRS ≤ 2: good outcome at 28 days) by telephonic interview.

**Results:** A total of 3300 patients were enrolled in this registry. Out of 3300, 1181 had IS. One hundred eleven (9%) patients had AF. There were no significant differences seen in age (AF patients 63 ± 14 years versus non AF 60 ± 15 years; p = 0.06) and gender (AF patients men 61%: women 39% versus non AF men 61%: women 39%; p = 0.89). Risk factors such as hyperlipidemia (34% versus 20%, p = 0.001), coronary heart disease (34% versus 11%; p = 0.001), carotid stenosis (7% versus 3%; p = 0.03), more prevalent in patients with AF. Patients with AF had poor outcome (47% versus 37%; p = 0.04).

**Conclusion:** Stroke patients with AF had poor outcome. Age and gender differences were not observed in between the two groups.

**Acknowledgement:** The Indian Council of Medical Research Task Force Project.

**WSC-0517****Heart and Brain****Transient left ventricular apical ballooning syndrome caused by bilateral insular infarct**

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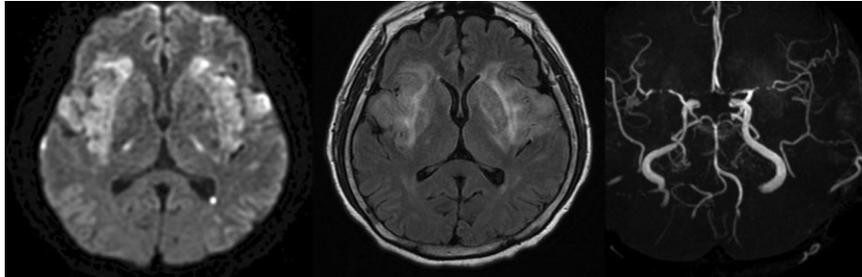
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A sixty-year-old woman was transferred to the emergency room presenting with stupor mentality, respiratory failure and low blood pressure. Her past history was unremarkable.

Her initial ECG was shown LBBB and blood pressure were marked 80/60 mmHg. The troponin I was elevated 2.933 ng/ml, PCO<sub>2</sub> level was 115 mmHg and pulmonary edema was founded in the chest CT.

The emergent echocardiogram was examined, Findings of akinesia of apical anteroseptal segment and decreased ejection fraction as 39.6% announced strongly acute myocardial infarction. Subsequently emergent angiography was shown stenoses of the right coronary, the left anterior descending, the left circumflex arteries, but these were noncritical luminal stenosis enough to cause cardiogenic shock. After the admission, the medical treatment including aspirin was administered and vital signs were changed. Although enough doses of antihypertensive agent were injected, blood pressure was checked higher than 180/100mmHg for several days. Uncontrolled hypertension, despite use of

multiple anti hypertensive drug, was checked over 2 weeks. Additionally severe sweating on whole body was observed on everyday. Seven days later, simple brain CT was examined and there were founded bilateral insular cortex infarcts. The Brain MR was shown that bilateral insular cortex lesions were induced by bilateral MCA severe stenoses. Follow up Echocardiogram was examined and the ejection fraction was 55.2% and normal left ventricular chamber size was confirmed. The patient's cardiac dysfunction has been recovered, however decreased mentality, quadriplegia are still observed. We concluded that transient cardiogenic shock was caused by bilateral lesions of insular cortex.



**Fig. 1** DWI, T2 FLAIR hyperintensities in the bilateral posterior internal capsules and cerebral peduncles. Multifocal severe stenoses in the bilateral M1 MCAs.

### WSC-1083

#### Heart and Brain

#### Cardiac autonomic dysfunction in ischemic stroke patients

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**Introduction:** The cardiovascular system is regulated by cortical modulation. Stroke can be associated with cardiac autonomic imbalance, therefore causing secondary cardiovascular complications. Heart rate variability (HRV) analysis is a simple method to assess the autonomic nervous function.

**Objectives:** The purpose of this study was to investigate the cardiac autonomic activity in ischemic stroke patients.

**Methods:** Using Biopac Acquisition System, we monitored ECG in rest condition and during Ewing's tests. From these measurements, HRV parameters (coefficient of variation, low and high frequency power spectrum of the ECG) were determined in 15 right hemisphere stroke patients and in 15 left-hemisphere ischemic stroke patients, in chronic phase. Data were compared with 15 age- and sex-matched healthy controls.

**Results:** Ischemic stroke patients had significantly lower high and low frequency power spectral density than controls ( $p < 0.05$ ). Cardiac parasympathetic innervation was more reduced in patients with right hemisphere ischemic stroke ( $p < 0.01$ ). From Ewing's battery patients with left-hemisphere ischemic stroke showed impairment in heart rate response to deep breathing ( $p < 0.01$ ), patients with right hemisphere ischemic stroke had impairment in two parasympathetic tests (heart rate response to deep breathing,  $p < 0.001$  and Valsalva ratio,  $p < 0.006$ ) compared to controls.

**Conclusions:** Cardiac autonomic imbalance occurs more often after right hemisphere ischemic stroke. Parasympathetic dysfunction is predominant 3 months after the ischemic stroke. Autonomic changes in stroke patients increase the risk of cardiovascular complications. HRV analysis is a non-invasive tool that can be used for screening in primary and secondary stroke prevention.

**Key words:** autonomic dysfunction, ischemic stroke, electrocardiography.

### WSC-0472

#### Heart and Brain

#### Systemic dysfunctions in cerebrovascular diseases

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The onset, the course and the prognosis of cerebrovascular diseases are influenced by a milieu of negative factors, as inflammation, cardiac and renal dysfunctions. We described increased levels of White Blood Cells, Eritro-Sedimentation Rate, C Reactive Protein, Troponin T, Pro-Brain Natriuretic Peptide, Urinary Polyclonal Light Chains in cerebrovascular conditions, especially in acute stroke (AS) in the context of a chronic cerebrovascular disease (CCVD), compared to other neurological diseases (OND) (*intergroup variability*). No significant fluctuations were found within each group of patients at repeated measurements in one week time (*intragroup unvariability*) (WCN 2013, SIN 2013, IHBC, 2014).

The aim of our current longitudinal study is to evaluate the predictive value of our findings on patients readmitted in our neurological units for first AS or stroke recurrence in CCVD.

Preliminary results show that inflammatory markers are significantly increased in AS and AS recurrence, especially in patients affected with CCVD. The fluctuations of the other markers resulted to be not significant at repeated measurements. Reduced ejection fraction, increased pulmonary arterial pressure and atrial dilatation were found in AS/CCVD compared to OND.

In conclusion, these markers are pivotal in monitoring the course of the acute phase and predict the outcomes. However, they reflect more the chronicity rather than the acuity of cerebrovascular events. We suggest to include inflammatory parameters for assessing the risk of AS and AS recurrence. Further studies are needed on the association among hematological, urinary, echocardiographic and perfusion/diffusion parameters

for better defining the burden, reversibility and lesional load of cerebrovascular diseases.

### WSC-1436

#### Heart and Brain

#### A novel preoperative evaluation for refractory hypertension

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A causative relationship between neurovascular compression (NVC) of the rostral ventrolateral medulla (RVLM) and refractory hypertension has been well documented. However, the surgical indication for refractory hypertension remains still controversial. Here, we present a rare case with refractory hypertension, which was successfully treated with neurovascular decompression under a confirmation of NVC of the RVLM by endovascular technique.

A 37-year-old female suffered from high blood pressure despite of multiple antihypertensive drugs. Magnetic resonance imaging revealed the left vertebral artery compressing the RVLM. Preoperative angiography showed contortion of left vertebral artery (VA). Straightening of the left VA with guidewire to relieve the compression of the RVLM decreased her blood pressure temporarily. Subsequently, neurovascular decompression was performed and her blood pressure was significantly decreased immediately after the operation.

Appropriate patient selection for surgical treatment of refractory hypertension is crucial. With this report we highlighted preoperative evaluation using simple angiographical technique to confirm NVC for refractory hypertension.

### WSC-0613

#### Heart and Brain

#### Clinical features of cardioembolism with atrial fibrillation in Saiseikai Stroke Database

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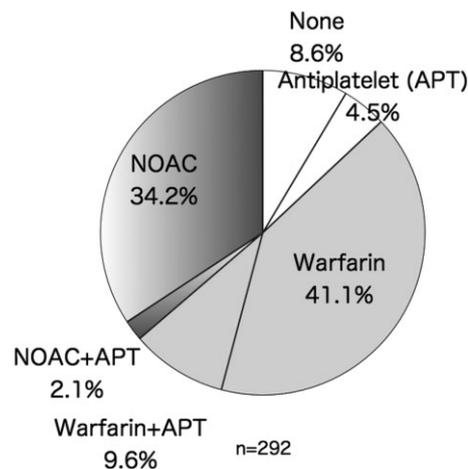
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**Introduction and aims:** Since the Novel Oral Anticoagulants (NOAC) appeared in 2011, the anticoagulation for the prevention of cardioembolism becomes widely used. We assessed the large Japanese stroke database to reveal the clinical features of cardioembolism with atrial fibrillation (AF) and anticoagulation for secondary prevention after NOAC appearance.

**Method:** We analyzed the Saiseikai Stroke Database, a prospective acute stroke patient registry.

**Results:** From April 2013 to February 2014, 2228 acute ischemic stroke patients were enrolled at 23 Saiseikai hospitals in Japan. Of these, 362 (16.2%) were cardioembolism with AF. The distribution rate of cardioembolism with AF was increasing with advanced age (18.5% in 70–79, 25.2% in 80–89 and 31.8% in 90?). AF was detected for the first time during admission in 48 cardioembolic patients. Mortality rate of cardioembolism with AF was 10.1% during admission. At discharge, the distribution rates of antithrombotic agents were showed in the attached graph.

**Conclusions:** From the large Japanese acute stroke registry database, 16.2% of ischemic stroke was cardioembolism with AF. 13.3% of cardioembolic patients with AF had not been detected AF before stroke onset. The mortality rate of cardioembolism with AF was high in acute phase. For secondary prevention, NOAC was prescribed in 36.3% of the cardioembolic patients with AF at discharge.



### WSC-0410

#### Heart and Brain

#### Analysis of neurological and neuropsychological status of patients sustained the primary coronary balloon angioplasty

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**The purpose** is an analysis of neurological and neuropsychological status of patients sustained the primary coronary balloon angioplasty. The urgency of this pathological state studying is determined by its high prevalence.

**Material and methods:** The features of the cognitive sphere determine an objective assessment of neurological and neuropsychological status of patients sustained the primary coronary balloon angioplasty. 19 patients were examined, 13 – men (68.4%), 6 women (31.6%). The average age of patients was 44–59 y.o.

**Results and evaluation:** During analyzing the results of neuropsychological and clinical assessment of neurological status, the patients were divided into 2 groups: the first comprised 11 (57.9%) patients, men – 7 and women – 4. Neuropsychological examination of 9 (81.8%) patients in the first group revealed slowness and monotony during performing the tests to inhibition and strength of visual and auditory stimulus in terms of homogeneous interference. In the neurological status of first group's patients, 6 (54.5%) had scattered focal symptoms with elements of static and locomotor and dynamic ataxia.

Among 8 (42.1%) of second group's patients regulation and control of auditory and visual memory were reduced, 3 (37.5%) patients had decreased interhemispheric transfer of visual information. In the neurological status revealed slight asymmetry of tendon reflexes and peripheral cervical insufficiency syndrome. The survey results indicate a functional insufficiency of subcortical structures and higher cortical functions of modal-specific nature.

**Conclusions:** Thus, patients sustained the primary coronary balloon angioplasty require special attention and adequate individual therapy involving neurologists and psychologists.

**WSC-0455****Heart and Brain****Screening of proteome changes in platelets activated by oxidized low density lipoproteins**P Karimi<sup>1</sup>, M Farhoudi<sup>1</sup><sup>1</sup>Neurology, Neurosciences Research Center (NSRC), Tabriz, Iran

**Introduction:** The activated platelets are involved in the pathophysiology of Atherosclerosis. Vast protein reorganization and posttranslational modifications occur in the activation process by oxidative agents like oxidized Low-density lipoproteins (oxLDLs).

**Aims:** The goal of this study was to identify proteomic changes in activated platelets versus resting platelets.

**Methods:** A basic research was performed on human platelet by differential proteomics approach. Obtained Platelets from healthy donors who referred to Tabriz blood transfusion center were divided in two groups, resting and activated by oxidized low density lipoproteins. Two dimensional electrophoresis (2DE) SDS-PAGE (pI 3–10) was used to separate platelet lysate proteins. Scanned gels were analyzed by Progenesis SameSpots statistical software. The proteins were identified by Matrix Assisted laser Desorption Ionization Time of Flight mass spectrometry.

**Results:** 241 spots were found to be significantly different. Of these, ten randomly chosen spots were successfully identified. We found three candidate signaling proteins, c-mer proto-oncogene tyrosine kinase swiss-prot; Q12866, Cation-independent mannose-6-phosphate receptor (IGF-II) swiss-prot; P11717 and Protein polybromo-1 swiss-prot; Q86U86 that may be part of oxLDL specific activation or signal transduction pathway(s).

**Conclusion:** Our results showed that may be wnt signaling pathway originated from c-mer proto-oncogene tyrosine kinase are involved in platelets activation by oxidative stress. Moreover these outcomes can thus add to our basic knowledge about platelets and development of novel antiplatelet drugs.

**WSC-1197****Heart and Brain****Factors influencing the recurrence of stroke with aortic arch atheroma**S Kim<sup>1</sup>, G Lee<sup>1</sup>, M Kim<sup>1</sup>, J Hong<sup>1</sup><sup>1</sup>Neurology, Gyeongsang National University Hospital, Jinju, Korea

**Introduction:** Aortic arch atheroma (AAA) has now been established as an independent risk factor in patients with cryptogenic embolic stroke. However, risk factors and optimal treatment associations of AAA in recurrence of stroke are unknown.

**Aims:** This study investigated clinical stroke vascular risk factors and radiological characteristics associated with recurrence of stroke with AAA.

**Methods:** The 163 acute ischemic stroke patients without evident stroke etiology were included and they underwent multiplanar transesophageal echocardiograms (TEE) within 1 week of symptom onset again at 12 months. Stroke risk factors; use of anticoagulant, antiplatelet, and hypolipidemic drugs; and clinical and etiological subtypes of stroke were recorded and compared in patients stratified for the presence or absence of aortic atheroma progression. The characteristics of diffusion-weighted MRI (DWI) lesions were analyzed in terms of the number and size of the lesions, and the involved vascular territories.

**Results:** A total of 87 cryptogenic stroke patients with AAA were included in this study. DWI revealed that they had multiple and small lesions in multiple vascular territories that were mainly located in cortical and border-zone regions in AAA group. The 17 (19.5%) patients with anticoagulation had no recurrence and any bleeding events, but 4 (4.6%) patients during antiplatelet medication had recurrence ischemic stroke

within 12 months. In 52 (59%) patients with anticoagulation or/and antiplatelet remained unchanged over 12 months,

**Conclusions:** Our study suggests that there is a protective effect of anticoagulation on the recurrence of stroke and other embolic events in patients with AAA on TEE.

**WSC-1281****Heart and Brain****Evaluation of the differences in the effects of antihypertensive drugs on blood pressure variability by 24-hour ambulatory blood pressure monitoring in chronic cerebrovascular disease**S Kinoshita<sup>1</sup>, R Nishioka<sup>1</sup>, T Yamamoto<sup>1</sup>, M Shiibashi<sup>2</sup>, R Tomioka<sup>1</sup>, Y Nakazato<sup>1</sup>, T Shimazu<sup>1</sup>, K Ishizawa<sup>1</sup>, Y Ito<sup>1</sup>, N Tamura<sup>1</sup>, N Araki<sup>1</sup><sup>1</sup>Department of Neurology, Saitama Medical University, Iruma-gun, Japan<sup>2</sup>Information Technology Center, Saitama Medical University, Iruma-gun, Japan

**Introduction and aims:** It has been suggested that antihypertensive drug therapy is attributable to the lower blood pressure variability, we investigated the effects of four classes of antihypertensives on the blood pressure variability; in addition, we also compared the effects among four calcium channel blockers.

**Methods:** We measured the 24-hour blood pressure variability in 309 patients with a history of cerebrovascular disease treated with angiotensin converting enzyme inhibitor, angiotensin receptor blocker,  $\beta$  blocker or calcium channel blocker.

**Results:** The daytime blood pressure variability treated with  $\beta$  blockers ( $14.3 \pm 3.1$ ) was higher than that treated with an angiotensin receptor blockers ( $11.5 \pm 3.1$ ) or calcium channel blockers ( $12.6 \pm 3.4$ ) in patients with cerebrovascular disease (p

**Conclusion:** From the results, it is suggested that angiotensin receptor blocker and calcium channel blockers rather than  $\beta$  blockers, and among the calcium channel blockers, cilnidipine, may be more favorable for blood pressure management in patients with cerebrovascular disease.

**WSC-1024****Heart and Brain****Cerebral disorder and changes of polysomnographic (PSG) parameters after cardiac surgery**T Kishmaria<sup>1</sup>, I Rukhadze<sup>1</sup>, Z Katsitadze<sup>2</sup>, V Kaloiani<sup>3</sup>, T Chanishvili<sup>2</sup><sup>1</sup>Neurology and Clinical Neurophysiology, Central University Clinic after Academic N. Kipshidze, Tbilisi, Georgia<sup>2</sup>Cardiology, Central University Clinic after Academic N. Kipshidze, Tbilisi, Georgia<sup>3</sup>Critical Care, Central University Clinic after Academic N. Kipshidze, Tbilisi, Georgia

**Introduction:** Cerebral disorders are the most frequent complication of cardiac surgery and not seldom is associated with: death high risks and high quality of disability. Four neurologic and cognitive complications are observed after Cardiopulmonary Bypass CPB: stroke (the most serious, with an incidence of 1.5 to 5.2%) 12; postoperative delirium (10 to 30%) 345; and short-term (33 to 83%) 67 as well as long-term cognitive changes (20 to 60%).

**Aim:** Correlates Clinical neurological and physiological parameters before and after cardiac surgery.

**Methods:** In our clinic for the last three years were 507 patients with cardiac surgery. 104 patients out of these (55 men and 49 women) were under neurological monitoring. The patients underwent the following types of cardiac surgery:

Coronary artery bypass grafting (CABG) 74 patient, valve operation in 25 cases, intervention on ascending aorta and aortal arch 5 cases. In 71 cases out of surgical treatments were provided without CBP.

In all patients we used PSG (polysomnographic) monitoring before and after cardiac surgery, with AURA PSG system.

**Results:** Postoperative neurological disorder was detected in 69 patients. Patients were divided into three clinical groups. Revealed changes in the PSG parameters: sleep latency, REM latency, sleep stages and etc.

**Conclusion:** Cardio surgical intervention is high risk of postoperative cerebral disorders. The changes of PSG parameters defends of types neurological disorders after cardiac intervention therapy.

## WSC-1007

### Heart and Brain

#### Angioplasty with stenting and condition of neurological status and cognitive function in patients with myocardial infarction

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**Introduction:** Angioplasty with stenting (AS) of the coronary arteries has become the main method in the interventional treatment of patients with myocardial infarction (MI).

**Materials and methods:** The study involved 25 patients with MI (17 men), which got AS. ACS with ST-segment elevation on the ECG was recorded in 15 (G1), ACS without ST elevation on ECG – in 10 (G2).

**Results:** There were no focal neurological symptoms. In 21 patients (84%) were identified violations in at least two of the four used tests. The mild cognitive impairment was identified in 18 patients (72%), moderate – in 3 (12%). In G1 patients had a more pronounced cardiac pathology, the ratio of persons with and without cognitive impairment was 6.5 : 1, while in G2 – 4:1, so in patients with MI without ST elevation ECG cognitive impairment detected less frequently. The high level of affective depression detected in 10 (40%), medium – in 9 (36%), light – in 4 (16%). Affective disorders were found in both groups equally often. Anxiety level was higher in patients in G2.

**Conclusion:** We did not observe any significant neurological disorders after AS. But in majority of patients (84%) after AS we found the changes in at least two of the four used cognitive tests. The level of cognitive dysfunction largely influenced from severity of MI. Levels of anxiety and depression were elevated in more than half the examined patients.

## WSC-1588

### Heart and Brain

#### The incidence of patent foramen ovale in ischemic stroke patients – An observational study

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**Aims:** To find the incidence of Right to left shunt (RLS) in stroke patients in Korea.

**Methods:** We assessed RLS by TCD from middle cerebral artery (MCA) of the stroke patients from whom MCA could be detected through temporal bone window. We tried to find microembolic signal (MES) at the MCA for

90 seconds after injection air agitated saline in the right antecubital vein. This procedure was performed 2 times in one of the middle cerebral artery with and without Valsalva maneuver.

**Results:** Seven hundred and fifty five stroke patients (430 male, mean age of 66.7 ± 12.1) were enrolled. We also performed TCD monitoring in 1347 controls (patient with other than stroke with or without headache, 915 male, mean age of 51.2 ± 2) for the comparison of the detection rate of RLS in stroke patients and control. RLS was detected in 59 stroke patients, while in control group 170 cases (7.8% vs. 12.6%, p = 0.001). In stroke patients, the mean age of those with RLS was significantly different from those without RLS (62.3 ± 11.3 vs. 67.0 ± 12.1, p = 0.004). There were no significant differences in the prevalence of PFO among stroke subtypes by TOAST classification (large artery atherosclerosis, 7.3%; small arterial occlusion, 7.9%; cardioembolic, 7%; undetermined cause, 8.3%).

**Conclusions:** The frequency of RLS in general population is about 11%, but decreased in stroke patients compared to controls. And the incidence of RLS is slightly increased in stroke patients with undetermined cause without significant difference from those of stroke patients with other etiology.

## WSC-0225

### Heart and Brain

#### Transcranial Doppler with agitated saline for the diagnosis of patent foramen ovale

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**Introduction:** Trans cranial doppler (TCD) with agitated saline injection is a useful way of detecting patent foramen ovale (PFO) in patients with cryptogenic stroke & Transient ischemic attack (TIA).

**Method:** 200 patients were subjected to a complete TCD examination followed by injection of agitated saline to the ante cubital vein. 9ml of saline and 1ml of air were mixed together & agitated using a 3 way stopcock and two 20 ml syringes. Either the right or the left middle cerebral artery (MCA) was continuously monitored using a 2 Mega Hertz probe fixed to ahead frame. In 5 patients the basilar artery was monitored due to lack of temporal window.

**Results:** The patients ranged in the age group from 20 to 65 years. Out of the 200 patients, 148 had cerebrovascular accident (CVA) and 52 had TIA. 12 PFOs were detected with in 1 minute of injection of agitated saline.

**Conclusion:** TCD with agitated saline is a useful way of detecting PFOs in TIA & cryptogenic stroke. This test obviates the need of Trans esophageal echo (TEE) studies.

## WSC-0492

### Heart and Brain

#### Usefulness of SFMC AND F1+2 as surrogate markers under warfarin anticoagulation

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**Introduction and aims:** It is well known that the novel oral anticoagulants (NOAC) can be monitored with exact precision by neither conventional prothrombin time nor activated partial thromboplastin time. To innovate investigate the possibility of new surrogate markers for efficacy of NOAC efficacy, we evaluated the utility of two hemostatic molecular markers indicating thrombin or fibrin generation among patients with nonvalvular atrial fibrillation (NVAF) undergoing chronic warfarin anticoagulation.

**Methods:** We recruited the patients with NVAf who were treated with warfarin anticoagulation for at least six months continuously. Two hemostatic molecular markers, prothrombin fragment 1+2 (F1+2) and soluble fibrin monomer complex (SFMC), and PT-INR were measured simultaneously.

**Results:** Blood specimens from 69 patients with NVAf (mean age = 73.4 ± 9.3, 22 females) were taken into investigation. Among the INR ranges between 1.11 and 3.76 (mean INR = 1.94), there existed a significant negative correlation between INR and F1+2 ( $r = 0.4668$ ,  $p < 0.0001$ ), whereas an SFMC measurement showed a lack of significant correlation with INR and F1+2.

**Conclusions:** This study revealed the utility of F1+2 as a new surrogate marker for chronic anticoagulation including that with NOAC, whereas SFMC is not tenable as such due to poor correlation.

## WSC-0610

### Heart and Brain

#### A single center experience of carotid artery stenting without protection devices for the treatment of obstructive extracranial carotid artery disease

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**Introduction:** Carotid artery stenting (CAS) with protection devices is a less invasive noninferior alternative to conventional carotid endarterectomy and became a widely used procedure in critical extracranial carotid artery stenosis. However the role of protection devices is debatable.

**Aims:** In this study, we evaluated the safety and clinical outcomes of CAS without protection devices.

**Methods:** We retrospectively evaluated the safety and clinical outcomes of CAS in 300 carotid lesions in 286 (mean age 59.3 ± 9.8, 198 male) patients between March-2008 and March-2013. Of these, 92% were symptomatic and 8% asymptomatic, although very critical lesions. All CAS procedures performed by single experienced angioplaster who had done more than 50000 coronary angiograms, 6000 cerebral angiograms and 10000 coronary angioplasties for last 14-years. Patients were analyzed according to the primary end points of periprocedural minor and major stroke, transient ischemic attack (TIA), death, or myocardial infarction.

**Results:** Out of 300 Carotid lesions treated with CAS, 156 (52.0%) had left internal carotid artery (ICA) stenosis, 130 (43.3%) had right ICA stenosis and 14 (4.7%) bilateral stenosis. The patients' demographic profile was 43.0% diabetes mellitus, 69.3% hypertension and 18.4% smokers. 49.0% had evidence of coronary artery disease and 38.4% and 53.0% had history of previous stroke and TIA, respectively. Procedural success was 99.5%. The 3-month TIA / stroke / death rate was 1.3%: TIA 1 (0.3%), death 2 (0.7%), major stroke 0 (0%) and minor stroke 1 (0.3%). There was no neurological death, one died due to urosepsis septicemia after 3-weeks and another died after 2-months during CABG.

**Conclusions:** In conclusion, this large volume, single-center, retrospective study supports that CAS without any protection device seemed safe and feasible with acceptable stroke/death rates.

## WSC-0719

### Heart and Brain

#### Proteinuria in patients with nonvalvular atrial fibrillation and ischemic stroke during adequate oral anticoagulation therapy

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**Introduction:** Ischemic cerebrovascular events occur frequently in patients with nonvalvular atrial fibrillation (NVAf) and chronic kidney disease (CKD). There are evidences that, in patients with NVAf, CKD is an independent risk factor for stroke, but its role in the occurrence of stroke during oral anticoagulation therapy (OAT) is still not well defined.

**Aims:** The purpose of this study is to assess the prevalence of CKD in this population, particularly in patients who experienced an acute ischemic event despite adequate anticoagulation.

**Methods:** We selected ischemic stroke patients with known NVAf on OAT admitted to our department from 2001 to 2013. We evaluated the glomerular filtration rate (MDRD and CKD-EPI formulas), the proteinuria, the degree of CKD (according to KDIGO criteria), the severity of stroke (NIHSS) and INR on admission, the disability at discharge (modified Rankin scale), prior cerebrovascular events and stroke risks factors.

**Results:** Among 159 patients, the prevalence of CKD was 59.7%, nearly 2-fold the prevalence of CKD in the general population with the same age (27.6%). CKD was more prevalent in the ischemic stroke group compared with transient ischemic attack group (66.4% vs. 44.9%,  $p = 0.039$ ). In the ischemic stroke group, proteinuria was significantly present in patients with PT- INR in range at the time of the event ( $p = 0.02$ ).

**Conclusions:** CKD is common in patients with cerebrovascular events and known NVAf on OAT. Kidney damage, even if in a preclinical phase, could be a risk factor for ischemic stroke independently of adequate anticoagulation.

## WSC-0814

### Heart and Brain

#### Stroke after left ventricular assist device for long-term implantation: A case report

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**Introduction:** The left ventricular assist device (LVAD) for long-term is implantable, magnetically accentuated axial low pump designed to support the left ventricle for adults with end-stage heart failure until heart transplant.

**Aim:** To describe the stroke with end-stage cardiac failure who were supported with the LVAD.

**Case report:** J.A.S., male, 53 years, ex-tobacco smoker, hypertensive, dyslipidemic, Acute Myocardial Infarction (AMI) previous, with cardiac failure (CF), having opted for anticoagulation. After 5 years evolved with a new AMI and cardiogenic shock. After one month, he presented unstable angina, evolving with CF functional class IV refractory to inotropic medication therapy. It required an aortic balloon, with subsequent implant of LVAD (Berlin Heart INCOR®). After 30 days he presented with lacunar ischemic stroke of the right thalamus. Patient prescribed double antiaggregation and anticoagulation, receives hospital discharge with mRS 2. At 1 month after hospital discharge he indicated dependent ventilatory thoracic pain and difficulty in grasping objects with the right hand, evolving with NIHSS 19; and CT showed extensive intraparenchymatous hema-

toma in the left hemisphere. He underwent anticoagulation reversion, hematoma drainage and decompressive craniectomy.

**Conclusion:** Ischemic cardiovascular disease and ischemic stroke are frequently associated. In this patient, there is probable compromise of cerebral microcirculation characterized by disease of small vessels, resulting in cerebral ischemia, and subsequent severe intraparenchymatous hemorrhage. Although LVAD can alter the cerebral hemodynamic, its true role in stroke genesis remains unclear. Given the high prevalence of these comorbidities, screening for diseases of the small vessels must be suggested prior to LVAD.

## WSC-0816

### Heart and Brain

#### A case report: Sick sinus syndrome and stroke

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**Introduction:** Sick sinus syndrome (SSS) is characterized by dysfunction of the sinoatrial node (SN) that is secondary to degeneration of the automatic cells of the SN, occurring predominantly in the elderly. These abnormalities can result in profound sinus bradycardia, sinus pauses, sinus arrest, SN exit block, and inappropriate responses to physiological demands during activity. SSS can also be accompanied by paroxysmal supraventricular tachycardia as part of the tachycardia-bradycardia syndrome. Patients with SSS therefore may share the same risk factors for stroke as patients with known Atrial Fibrillation.

**Case report:** L.F.B., 75 y, with left homonymous hemianopia associated with dysarthria and left hemiparesis. As antecedents one year of TIA, smoker for 65 y, ex-alcoholic, did not use drugs depressors of SN function. Performed CT head showed lacunar ischemia in the right internal capsule and in the right occipital. During hospitalization, the patient developed symptomatic bradycardia requiring a dopamine pump for a few hours to stabilize. Duplex carotid and vertebral arteries were showed to be normal. Echocardiogram showed no cardiomyopathy. Holter 24h monitoring showed sinus automaticity and depressed chronotropism; the presence of sinus pauses and bouts of supraventricular tachycardias featuring sinus node dysfunction. Upon review of Cardiac Surgery, he underwent the implementation of permanent pacemaker with occurrence of motor aphasia and dysarthria during the procedure, with complete remission after normalization hypotension occurred. He was discharged with anticoagulation (warfarin).

**Conclusion:** Although cardioembolic sources are common causes of ischemic Stroke, the SSS is still described as a rare cause, requiring larger studies to elucidate their physiopathology.

## WSC-1309

### Heart and Brain

#### Cerebro-renal dysfunction in ischemic stroke patients with cardiogenic embolism

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**Introduction:** Patients with cardioembolic ischemic stroke are prone to have comorbidities such as impaired renal function. Because polypharmacotherapy is often required in those patients, renal function is important to consider in light of renally cleared medications such as direct oral anticoagulants.

**Aims:** In this study, we analyzed frequency and predictors for impaired renal function and its impact on functional outcome in stroke patients with cardioembolic stroke.

**Methods:** We prospectively analyzed 27 patients with acute first-ever ischemic stroke of cardioembolism genesis aged  $63.82 \pm 4.68$  years (48.1% men and 51.8% women). In anamnesis, myocardial infarction was in 14 patients, atrial fibrillation was in 12 patients (of them, constant form in 7 patients), dilatatory cardiomyopathy was in 4 patients. Estimated glomerular filtration rate (eGFR) was calculated on admission and during hospitalization from the equation of the Modification Diet for Renal Disease. Outcome measures included mortality and functional outcomes at 3 months after stroke, assessed as modified Rankin Scale (mRS) score. **Results:** On admission, cerebro-renal dysfunction was found in 40.7% (n = 11) and was associated with worse 3-month outcome (mRS score  $\leq 2$ : 25.9% versus 44.4%,  $P = 0.001$ ) and a higher mortality rate (22.2% versus 14.8%,  $P = 0.043$ ). Multivariate logistic regression identified older age and history of myocardial infarction as independent predictors of renal dysfunction on admission ( $P < 0.05$ ), especially in women. Normalization of eGFR during hospitalization was achieved in 55.6%.

**Conclusions:** In patients with cerebro-renal dysfunction due to acute cardioembolic ischemic stroke on admission is frequent and associated with worse outcome. Normalization of eGFR can often be achieved during hospitalization, but in everyday life, fluctuations of renal function because of infection or dehydration have to be considered. Careful monitoring of cerebro-renal status is indispensable and should influence drug treatment decisions.

## WSC-0513

### Heart and Brain

#### Long-term ECG-Holter monitoring in detection of paroxysmal atrial fibrillation in young cryptogenic ischemic stroke patients

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**Introduction:** The cause of ischemic stroke (IS) remains often unclear, especially in younger patients. Atrial fibrillation represents very frequent cause, thus undetected paroxysmal AF (PAF) is considered the cause in patients with cryptogenic ischemic stroke (CIS).

**Aims:** to assess the rates of PAF detected using electrocardiography (ECG) Holter monitoring in young CIS patients and if prolongation of monitoring (up to 3 weeks) can be beneficial.

**Methods:** IS patients  $\leq 50$  years enrolled in the prospective HISTORY (Heart and Ischemic STroke Relationship study) study consisted of study set. In all patients, brain ischemia was confirmed on CT/MRI. CIS was defined according to the TOAST criteria. Admission ECG, cardiac markers, echocardiography, 24-hour and 3-week ECG-Holter were performed in all patients.

**Results:** In total, 536 patients were enrolled in the HISTORY study and out of 80 enrolled patients  $\leq 50$  years, 71 (89%) were identified as CIS (39 males, mean age  $38 \pm 8.5$  years). All CIS patients had normal admission ECG. In total, PAF was detected in 6 (8.5%) patients (four males, mean age  $42 \pm 3.9$  years); in two patients during 24-h ECG Holter and in next four patients during 3-week monitoring. 60% of PAF patients had elevated admission cardiac markers ( $p < 0.0001$ ).

**Conclusion:** PAF was detected in 8.5% of young CIS patients. Prolongation of ECG-Holter monitoring improved the PAF detection. *Acknowledg-*

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### WSC-0235

#### Heart and Brain

#### The effect of CoQ10 supplementation on serum lipoproteins, IL-6, ICAM-1 and plasma fibrinogen in hyperlipidemic patients with myocard infarction

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*Introduction:* It seems that CoQ10 may have beneficial effects on serum lipoproteins but it's effects on hyperlipidemic patients with myocard infarction is not clear.

*Aims:* The aim of this study was 'The effect of CoQ10 supplementation on serum lipoproteins, IL-6, ICAM-1 and plasma fibrinogen in hyperlipidemic patients with myocard infarction'.

*Methods:* The study as a randomized double blind clinical trial, was conducted in 52 hyperlipidemic patients (TG > 150 mg/dl, TC > 200 mg/dl) in the 70- to 30-year age range who have suffered acute myocardial infarction. In this study, patients randomly assigned to CoQ10 [(n = 26) 200 mg daily supplement and control groups] (n = 26) were taking the placebo for 3 months.

*Results:* At the end of study, serum levels of TC, TG, LDL-C in CoQ10 group compared with baseline (P < 0.001). Serum levels of TC/HDL-C (p < 0.05, p < 0.05, p after 3 months no significant change was seen in plasma fibrinogen in CoQ10 group compared with placebo.

*Conclusion:* 200 mg daily CoQ10 supplement for 3 months in hyperlipidemic patients with myocard infarction had beneficial effects on serum lipoproteins, IL-6 and ICAM-1 but no effects on fibrinogen so may have beneficial effects in these patients.

### WSC-0788

#### Heart and Brain

#### Mitral valve fibroelastoma: A rare cause of cardioembolic stroke

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We report the case of a 44-year-old gentlemen who sustained an acute cerebral infarct secondary to cardiac papillary fibroelastoma (PFE) of the mitral valve. Primary tumors of the heart are very rare. Some autopsy series suggest that the incidence is as low as 0.02%. Myxomas are the most common of the cardiac tumors. These are predominantly left sided tumors which are attached to the atrial septum by a stalk. After a myxoma and lipoma, the third most common cardiac tumor is a papillary fibroelastoma (PFE).

This case demonstrates that PFEs, although rare, are an important cause of cardioembolic stroke. It is difficult to suspect a PFE from clinical examination alone therefore investigation using transthoracic/oesophageal echocardiography is recommended. In young patients, TOE is superior to TTE in identifying a specific source of cardiac embolism.

If there are no contra-indications for surgery then this should be considered, particularly where the PFEs are symptomatic and large (>1 cm) or highly mobile in the presence of a stalk, in those who are asymptomatic. In this case our patient did not currently meet the criteria for surgical resection. He was the first patient at our hospital to be started on a new oral anticoagulant agent Dabigatran, a direct thrombin inhibitor, 150 mg twice daily. Currently this patient is 24 months postinitiation of anticoagulation and has not had any further recurrent symptoms. We aim to demonstrate how you would investigate and manage embolic phenomenon from a cardiac source.

### WSC-1165

#### Heart and Brain

#### REP3 score: A new atrial fibrillation prediction score in cerebrovascular disease

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*Introduction:* Atrial Fibrillation (AF), especially paroxysmal AF (PAF) can lead to stroke and may often be missed in the initial investigations. Recent studies have shown that PAF is much more likely to be diagnosed with prolonged cardiac monitoring. We designed a PAF prediction score, REP3 (Recurrent stroke, Etiology, Pattern of infarction on imaging, Premature atrial beats, Palpitations) and tested it in detecting AF in patients with TIAs and acute stroke.

*Methods:* During a 10 months' time (from July 2012 to Sept 2013), patients seen at University of Alberta stroke program in whom Holter monitoring was negative for PAF were prospectively enrolled in the. The REP3 prediction score (low, medium and high) was tested to determine the risk for the arrhythmia in the patients using prolonged cardiac monitoring.

*Results:* A total of 102 patients had 14 (±8) days of monitoring (SpiderFlash-t™ monitor, Sorin, Italy). PAF was seen in 36.36% patients with low score (4/11), 42.1% of patients with medium score (8/19) and 44.44% of patients with high score (32/72). In addition, atrial flutter was seen in two patients with high score (embolic risk in 44% patients). The diagnosis resulted in initiation of anticoagulation in 31 patients.

*Conclusions:* The REP3 score allows for selection of patients with suspected embolic disease who may benefit from prolonged cardiac monitoring. Further studies may help with better determination of patient selection leading to changes in antithrombotic therapy.

### WSC-1568

#### Heart and Brain

#### The association of baseline syntax score with long term risk of stroke in acute myocardial infarction patients treated with primary angioplasty

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*Introduction:* Baseline SYNTAX score (SXs) was determined as an independent predictor of heart failure and death in patients with ST-elevation myocardial infarction (STEMI) treated with primary angioplasty (p-PCI). *Aim:* To examine the relation between SXs at the time of hospitalization and occurrence of stroke in the long term follow-up.

**Method:** All patients who underwent p-PCI and did not have fibrinolytic therapy before or after PCI between January 2006 and February 2010 were searched retrospectively. The patients were evaluated in two groups as those with without stroke (ischemic and hemorrhagic).

**Results:** A total of 3205 patients were followed-up for a median of 58 months (81 patients with stroke vs 3102 patients without stroke). In patients experiencing stroke baseline SxS was higher ( $18.9 \pm 8.1$  vs  $15.2 \pm 7.1$ ,  $p < 0.001$ ), left ventricular ejection fraction after the procedure was lower ( $43.7 \pm 7.6$  vs  $46.9 \pm 7.7\%$ ,  $p < 0.001$ ) and occurrence of in-hospital atrial fibrillation was significantly higher (23.5% vs 4.5%,  $p < 0.001$ ). Multivariate analysis showed that peripheral arterial disease [Odds Ratio (OR) 1.95, 95% CI 1.03–3.71,  $p = 0.042$ ], acute atrial fibrillation (OR 4.02, 95% CI 2.20–7.31,  $p < 0.001$ ), baseline SxS (OR 1.04, 95% CI 1.01–1.08,  $p = 0.007$ ) and level of baseline C-reactive protein (OR 1.03, 95% CI 1.01–1.05,  $p = 0.018$ ) were independent predictors of stroke occurrence. Long term mortality was higher in patients with stroke (39.5% vs 11.9%,  $p < 0.001$ ).

**Conclusion:** In patients with STEMI who underwent p-PCI baseline SxS is an independent predictor of stroke occurrence during in hospital stay and in the long term follow-up period.

### WSC-1487

#### Hemorrhage – Intraparenchymal Longitudinal change of clinical picture of cerebral hemorrhage in Japanese urban area

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**Introduction and Aims:** We investigated longitudinal change of clinical picture of cerebral hemorrhage in Japanese urban area.

**Methods:** The patients who admitted to our hospital with acute cerebral hemorrhage were registered database of stroke center. The consecutive patients with cerebral hemorrhage from January 2009 to December 2013 were enrolled in this analysis. We extracted following data of subjects from database; age, sex, location of hemorrhage, cause of hemorrhage, risk factors, and treatment of hypertension. We analyzed correlation and longitudinal change among these factors.

**Results:** We enrolled 273 patients; mean age was 64.3 years, with acute cerebral hemorrhage in this analysis. Study population consisted of 202 males and 71 females. During the study period, mean age of males did not change annually, but mean age of females decreased from 78.1 years to 70.5 years in every year. Subcortical and pontine hemorrhage increased, but thalamic hemorrhage decreased in all patients every year. Rate of hypertensive hemorrhage revealed no significant change during study period. Rate of putaminal and thalamic hemorrhage gradually decreased, but subcortical and pontine hemorrhage increased every year in male patients. By contrast, in female patients, rate of putaminal hemorrhage significantly increased from 13% to 47%, and thalamic hemorrhage decreased every year. Rate of treatment of hypertension was low, 38.2% in males and 54.3% in females.

**Conclusion:** Age of female patients gradually grew younger, and putaminal hemorrhage increased in Japanese urban area every year. Many of patients with cerebral hemorrhage did not undergo treatment for hypertension.

### WSC-0653

#### Hemorrhage – Intraparenchymal Bilateral hypertrophic olivary degeneration as a complication of endovascular cerebral aneurysm treatment

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**Introduction:** Hypertrophic olivary degeneration (HOD) is a form of trans-synaptic degeneration with hypertrophy of the inferior olivary nucleus in response to neurologic insult to the dentatorubro-olivary pathway. HOD is a relatively rare disorder that may mimic many diseases including tumors and demyelinating processes. We herein present our experience with a case of bilateral HOD, which was a result of a thromboembolic complication during endovascular aneurysm embolization.

**Case:** 60-year-old male with vertigo admitted to our emergency department. Nonenhanced brain tomography revealed an aneurysmatic dilatation located in right ambient cistern. Digital subtraction angiography showed a wide-necked right superior cerebellar artery aneurysm. The patient was treated with stent-assisted coil embolization. The procedure was completed and the patient recovered with left facial paralysis and left hemiparesis. Diffusion-weighted imaging immediately after procedure showed an acute ischemia in the posterior aspect of right cerebral peduncle and superior cerebellar peduncle, caused by thromboembolic occlusion of a perforating artery arising from stented proximal right posterior cerebral artery. Two months after initial insult, T2-weighted MR images showed enlargement and increased signal intensity in both olivary nuclei, consistent with bilateral HOD.

**Conclusion:** In conclusion, HOD can be seen after endovascular treatment of posterior circulation aneurysms secondary to procedure related thromboembolic events. The disease itself does not require any treatment, but neurointerventionists and neurologists should be familiar with the appearance of this rare entity to prevent further unnecessary interventions.

### WSC-0515

#### Hemorrhage – Intraparenchymal Intracerebral hemorrhage after sildenafil intake: A cause or coincidence?

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**Introduction:** Sildenafil citrate is a selective inhibitor of phosphodiesterase type 5, widely used for male erectile dysfunction treatment. There are few case reports probably related to sildenafil use regarding neurological disorders such as migraine, seizure, transient global amnesia, nonarteritic ischemic optic neuropathy and stroke. We report a case presenting with spontaneous intracerebral hemorrhage (ICH) following the use of sildenafil citrate.

**Case:** A 61-year-old man was admitted with acute confusion, slurred speech and weakness of right body part 1 hour after ingesting 50 mg of Viagra. His medical history revealed daily 300 mg acetylsalicylic acid due to 2 years history of ischemic stroke. His vitals were normal (Blood Pressure: 120/80 mmHg, Pulse Rate: 72). In neurological examination, he was agitated, uncooperative and had right homonym hemianopia, right hemiparesis. The laboratory findings were normal. Brain CT showed left thalamic hemorrhage extended to the lateral ventricles. The patient was

followed up in neurology intensive care unit (ICU). There was no significant pathology explaining the etiology in his cranial MR and MRA.

**Conclusion:** The main causes of nonhypertensive ICH are structural vascular anomalies, coagulations disorders and drug side effects. Among drug induced ICH causes, sildenafil use is rarely reported. While cardiovascular side effects of sildenafil are well recognized, little is known about its neurological adverse effects. Although our patient regularly has been using acetylsalicylic acid for 2 years, ICH developed after sildenafil intake. This might indicate a relationship between sildenafil use and ICH development.

#### WSC-1493

##### **Hemorrhage – Intraparenchymal Subarachnoid hemorrhage associated with isolated posterior cerebral artery dissection**

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Isolated posterior cerebral artery (PCA) dissection is generally responsible for ischemic stroke. However, subarachnoid hemorrhage due to PCA dissection is rarely reported. We present a case of subarachnoid hemorrhage associated with dissection in p1 segment of PCA. A 58-year-old female patient admitted with diplopia, headache spreading from the neck, dizziness and disturbance in speech. She had diabetes mellitus, arterial hypertension, chronic renal failure, amputated right lower limb and head tremor. Her systemic examination was normal except high arterial blood pressure (180/100 mmHg). Her neurological examination revealed dysarthria, left nasolabial sulcus asymmetry, left lateral horizontal gaze palsy, diplopia and nystagmus in all gaze directions of both eyes, unresponsive left plantar reflex and bilateral dysmetria. Cranial computerized tomography (CT) and magnetic resonance (MR) imaging showed left infratentorial subarachnoid hemorrhage. Digital subtraction angiography (DSA) revealed dissection in p1 segment of PCA. The patient was followed up in intensive care unit with supportive treatment. Control CTs were normal two week after the onset. She had mild improvement. At the discharge, 100 mg/day acetylsalicylic acid was given. Although management of isolated intracranial arterial dissection is debated, approach to patients with associated subarachnoid hemorrhage may be more complicated; surgical or endovascular methods may be thought as the first line therapy but rare patients with spontaneous recovery were also reported.

#### WSC-0710

##### **Hemorrhage – Intraparenchymal Kernohan-Woltman notch phenomenon secondary to a subdural hematoma in a young man**

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Uncal herniation through the tentorial notch is occasionally associated with false localizing ipsilateral hemiparesis and hemiplegia, known as Kernohan-Woltman notch phenomenon. Compression of the contralateral cerebral peduncle against the tentorial edge causes the signs. The rigid edge of the tentorium may cut into the cerebral peduncle, particularly the fibres that project to the leg. In etiology, there are supratentorial mass lesions and most notably traumatic intracranial hematomas. The herniation caused by supratentorial lesions, commonly acute or chronic subdural hematoma (SDH). In reported cases, lesions of the contralateral cerebral peduncle has been clearly demonstrated by magnetic resonance imaging (MRI) and shown as hyperintense on T2-weighted images. The lesion has been best demonstrated on coronal imaging.

A 43-year-old alcoholic male who presented with unconsciousness, in his medical history, there were drop attacks and epileptic seizures. Neurological examination revealed right mydriasis and ipsilateral hemiplegia. By neuroimaging, a large right hemispheric SDH was detected and immediately evacuated. The postoperative MRI showed T2-hyperintensity of the right cerebral peduncle compatible with the compression. In the early postoperative period, the patient was alert but right hemiplegia was persisting. We want to present this case due to well demonstrated compression, Kernohan-Woltman notch phenomenon.

#### WSC-1314

##### **Hemorrhage – Intraparenchymal Risk factors of subacute progression in primary spontaneous intracerebral hemorrhage**

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**Purpose:** Some intracerebral hemorrhage patients may undergo neurologic deterioration after initial alleviation, which is referred to as subacute progression. This phenomenon has not been reported or studied much, so we aim to identify the subacute progressing cases among intracerebral hemorrhage patients, and analyze the possible causes and risk factors.

**Methods:** We retrospectively reviewed all the cases admitted in our hospital with primary intracerebral hemorrhage from Dec. 2007 to Dec. 2010. The patients with subacute progression are identified and enrolled into the cases group, and the control group was selected randomly among the patients without subacute progression. General condition, vital signs on admission, past medical and personal history, lab findings, information of series CT scan, and treatment protocol were extracted from the medical records.

**Results:** 21 cases were enrolled as subacute progressing hemorrhagic stroke cases group. The possible progression causes were mainly brain edema and infection. The fasting blood glucose level ( $8.98 \pm 3.8$  VS  $6.45 \pm 3.29$ ,  $P = 0.030$ ) and neutrophil counts proportion ( $82.3\% \pm 8.43\%$  VS  $77.3\% \pm 8.33\%$ ,  $P = 0.037$ ) were significantly higher in the cases group, while the lymphocyte counts proportion was significantly lower in the cases group ( $10.88\% \pm 5.99\%$  VS  $14.99\% \pm 5.98\%$ ,  $P = 0.014$ ). Neutrophil proportion above 74.6% (OR = 4.93) and lymphocyte proportion below 6.75% (OR = 24.62) might be risk factors of subacute progression.

**Conclusion:** Subacute progressing hemorrhagic stroke do exist, and the primary reasons for subacute progression are perihematomal edema and infection. Neutrophilia and lymphocytopenia after intracerebral hemorrhage may be relevant to subacute progression.

#### WSC-1316

##### **Hemorrhage – Intraparenchymal Secondary coagulation system changes and high-density lipoprotein cholesterol levels after spontaneous intracerebral hemorrhage are associated with hematoma expansion**

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**Purpose:** Early hematoma expansion is associated with death and poor prognosis after spontaneous intracerebral hemorrhage. We aim to explore the relationship between secondary changes of coagulation system and blood lipids after spontaneous intracerebral hemorrhage with early hematoma expansion.

**Method:** We prospectively collected the patients diagnosed as acute spontaneous intracerebral hemorrhage identified by CT scan in our hospital. We evaluated the patients at the emergency department, on admission to

the ward, and within 24–72 hours. We recorded the general condition, vital signs on admission to the emergency department, medical and personal history, laboratory findings within 24–72 hours, initial and repeated CT scan within 24–72 hours and treatment protocol. Early hematoma expansion was defined as >33% or >12.5 mL increase in the hematoma volume.

**Results:** 40 patients were enrolled into the study and 11 underwent early hematoma expansion. PT, INR, and APTT level in the early hematoma expansion group is significantly lower than in the nonearly hematoma expansion group (PT,  $11.65 \pm 0.66$  VS  $12.69 \pm 0.93$ ,  $p = 0.002$ ; APTT,  $33.69 \pm 3.07$  s VS  $38.03 \pm 5.8$  s,  $p = 0.033$ ; INR,  $0.88 \pm 0.07$  VS  $0.98 \pm 0.09$ ,  $p = 0.002$ ) while the HDL-C level in the early hematoma expansion group is significantly higher than in the nonearly hematoma expansion group ( $1.17 \pm 0.33$  mmol/L VS  $0.82 \pm 0.29$  mmol/L,  $p = 0.003$ ). In multiple regression analysis, age <55.5 years, HDL-C  $\geq 1.005$  mmol/L and the interaction of APTT <37.1 s and PT <12.05 s were associated with early hematoma expansion.

**Conclusion:** Secondary coagulation system changes and HDL-C level after spontaneous intracerebral are significantly associated with early hematoma expansion.

### WSC-0507

#### Hemorrhage – Intraparenchymal Inflammation and oxidative stress in sICH: A dangerous liaison with a potential for predicting outcome

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**Introduction:** Inflammation and oxidative stress play a significant role in the complex pathophysiology of spontaneous intracerebral hemorrhage (sICH), but the predictive value of inflammatory and oxidative stress markers for sICH outcome has not yet been clarified.

**Aims:** The aim of the present investigation was to determine the predictive significance of some inflammatory and oxidative stress markers in sICH patients within 48 hours from onset.

**Methods:** The study included 101 patients with sICH (42 of them followed prospectively over a 3-month period) and 51 age-matched healthy controls. Traditional risk factors, neurological status, neuroradiological and blood biochemical parameters were evaluated.

**Results:** The serum hs-CRP level ( $p = 0.027$ ) and the hematoma volume ( $p = 0.005$ ) were found to be independent predictors of lethal outcome, while the lipid hydroperoxides concentration (ROOH) ( $p = 0.011$ ) was significantly associated with the functional outcome on the 7th day after sICH. Glucose ( $p = 0.034$ ), hs-CRP ( $p = 0.004$ ) and total antioxidant status (TAS) ( $p = 0.036$ ) were significant indicators for lethal outcome over a 3-month period. The increased ROOH was associated with unfavorable outcome over a 7-day period after sICH, while hyperglycemia and lowered TAS were significantly associated with lethal outcome over a 3-month period after sICH. Patients with hs-CRP more than 4.5 times above normal showed a lower survival rate within a 3-month period.

**Conclusion:** Along with the traditional risk factors, the inflammatory and oxidative stress markers should be considered additional criteria in predicting sICH prognosis.

### WSC-1452

#### Hemorrhage – Intraparenchymal Do intracerebral hemorrhage “nonexpanders” actually expand into the ventricular space?

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**Background and Purpose:** The CT-angiography spot sign as a predictor of hematoma expansion (HE) is limited by its modest sensitivity and PPV. Spot sign studies restrict HE definitions to the parenchymal component of ICH and do not consistently evaluate intraventricular hemorrhage (IVH) expansion. Decompression of ICH into the ventricular space can lead to underestimation of HE and overestimation of false-positive spot signs. We hypothesized that a proportion of ICH “nonexpanders” expand into the ventricular space, and including IVH expansion in HE definitions will improve the predictive performance of the spot sign. Our objectives were: 1) determine the proportion of ICH “nonexpanders” who expand into the ventricles, 2) determine the proportion of false-positive spot signs that expand into the ventricles, and 3) recalculate the performance of the spot sign when IVH expansion is included in HE definitions.

**Methods:** We analyzed patients from the multicenter PREDICT ICH spot sign study with complete baseline and follow-up imaging. We defined HE as  $\geq 6$  mL absolute or  $\geq 33\%$  relative parenchymal expansion (PREDICT definition), or  $\geq 2$  mL IVH expansion.

**Results:** Of 315 patients with complete imaging, 215 did not meet the 6 mL/33% expansion definition (“nonexpanders”). Only 14/215 (6.5%) of “nonexpanders” had  $\geq 2$  mL IVH expansion: 10/176 (5.7%) of the spot-negatives had IVH expansion only and 4/39 (10.3%) of spot-positives had IVH expansion only. With IVH was added to the HE definition, spot sign sensitivity = 46%, specificity = 83%, PPV = 60%, NPV = 73%.

**Conclusion:** IVH expansion occurs in a minority of “nonexpanders” and does not sufficiently explain the modest sensitivity and PPV of the spot sign.

## WSC-0952

### Hemorrhage – Intraparenchymal Efficacy of frameless stereotactic aspiration and thrombolysis in elderly patients with moderate-sized thalamic hemorrhage

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**Objective:** Thalamic hemorrhages have a high mortality and morbidity. And selection for surgical treatment or conservative treatment depends on volume of hematoma. The aim of this study is to assess the efficacy of frameless stereotactic aspiration for moderate thalamic hemorrhage in the elderly patients.

**Methods:** In a retrospective study, a total of 68 patients with moderate thalamic hemorrhage were treated by conservative treatment (n = 29) or surgical treatment (n = 39). The procedure was performed using a frameless neuronavigational system. We reviewed age, sex, Glasgow coma scale (GCS) on admission, accompanied disease, intraventricular hemorrhage (IVH), time to operation from stroke onset. And functional outcome was rated using Glasgow outcome scale (GOS). A favorable outcome was defined as a GOS scale 4 or 5.

**Results:** The GOS scale in the aspiration group was significantly higher than that in the conservative group (p < 0.05). Seven patients (24.1%) had a favorable outcome in the conservative group, while 19 patients (48.7%) had a favorable outcome in the aspiration group and this difference was significant (p < 0.05).

**Conclusion:** We conclude that frameless stereotactic aspiration is effective for improvement of neurological outcome for moderate thalamic hemorrhage in the elderly patients.

## WSC-1454

### Hemorrhage – Intraparenchymal Intraoperative transcranial motor-evoked potentials predict the outcome of motor function in intracerebral hemorrhage surgery

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**Introduction:** Prediction of post-ICH motor function often poses a diagnostic challenge.

**Aims:** We investigated whether intraoperative transcranial motor-evoked potentials (TC-MEPs) monitoring could predict postoperative motor function in this study.

**Methods:** We reviewed 13 patients underwent consecutive removal of supra-tentorial ICH with hemiplegia from June in 2011 to December in 2013. Anesthesia was maintained with Sevoflurane strictly controlled within 1.0 ± 0.2% and continuous infusion of remifentanyl. MEPs were recorded from the bilateral thenars and tibialis anterior muscles. We examined the correlation of intraoperative MEPs and improvement of motor function.

**Results:** MEPs were detected in 8 of 13 cases (62%) before and after the removal of hematoma, and postoperative motor function was improved in all cases in the group. In three cases (23%), MEPs were not detected throughout the operation, and postoperative motor function was not improved. In two cases (15%), MEPs were not measured before the removal of ICH, but detected after the removal. They were considered false-positive, due to a postoperative cerebral infarction and a deep stimulation causing the detection of bilateral MEPs, and did not show recovery of motor function. In three cases of motor function improvement, stable MEPs were able to be detected in spite of severe motor dysfunction (MMT1-3).

**Conclusions:** Incapable of MEPs detection shows a low possibility of postoperative motor function improvement. On the contrary, stable MEPs

imply benign prognosis. Intraoperative TC-MEPs may provide an indication of the preservation of pyramidal tracts and the outcome of motor function in intracerebral hemorrhage surgery.

## WSC-1164

### Hemorrhage – Intraparenchymal Coronary artery disease is associated with deep (nonlobar) cerebral microhemorrhages in patients with acute stroke

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**Introduction:** MRI frequently demonstrate cerebral microhemorrhages (CM). Factors associated with CM are currently being elucidated.

**Aim:** To determine the association of cardiovascular risk factors with lobar vs deep locations in patients with acute stroke.

**Methods:** We identified patients in our database between November 1, 2009 to November 30 2011, with acute ischemic stroke(AIS) or TIA, ICH and aneurysmal subarachnoid hemorrhage(aSAH) with MRI-GRE/SWI sequences. Demographics, medical history, detailed laboratory values and medication history were collected. Bivariate analysis of CM presence, lobar and deep CM were performed with Fisher exact test and paired t-test. Logistic and linear regression models were used for multivariate analysis.

**Results:** Three hundred sixty-nine patients were identified. Patients were excluded due to poor quality (45) and no MRI (41), leaving 273 patients. Forty-nine(17.9%) patients had CM, Eight (16.3%) patients had exclusively lobar, Eighteen (36.7%) exclusively deep locations; Twenty-three (46.9%) had in both deep and lobar locations. 79% had AIS/TIA, 15.4% ICH and 5.5% aSAH. On bivariate analysis; age (68.7 yrs vs 62 yrs p = 0.001), hypertension(83.7% vs 66.7% p = 0.017), coronary artery disease (CAD)(18.4% vs 8.1% p = 0.029) and hemorrhagic strokes (HS) (ICH/aSAH) (63.3% vs 17.4% p = 0.003) were associated with CM. Based on CM location, lobarCM were associated with age(69 yrs vs 62 yrs p = 0.003), total cholesterol (158.3 vs 180.6 p = 0.031) and HS (35.5% vs 17.4% p = 0.018). DeepCM was associated with age (69.7 yrs vs 62 yrs p = 0.0003), males (65.9% vs 45.7% p = 0.018), hypertension (87.8% vs 66.4% p = 0.006), CAD (19.5% vs 8.1% p = 0.024), atrial fibrillation (12.2% vs 4.5% p = 0.05), estimated GFR (74.3 vs 85.5 p = 0.025) and HS (36.6 vs 17.4 p = 0.005). On multivariate analysis, lobarCM were associated with age and HS. NonlobarCM was associated with age, CAD and HS. **Conclusion:** Compared to previous studies, only a history of CAD differentiated deep and lobarCM. Age and HS were universally associated with deep and lobarCM.

## WSC-0357

### Hemorrhage – Intraparenchymal Relationship between plasma matrix metalloproteinase-9 (MMP-9) and hemorrhagic transformation in acute ischemic stroke

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**Introduction:** Matrix metalloproteinase-9 (MMP-9) activity has been associated with hemorrhagic transformation (HT) in experimental models of cerebral ischemia.

**Aim:** Our aim was to investigate the relationship between MMP-9 concentrations in blood within 24 hours of stroke onset and subsequent HT of cerebral infarction.

**Methods:** We studied 35 patients with an acute ischemic stroke in comparison with 35 normal subjects. Early CT signs of cerebral infarction were evaluated on admission. The HT and infarct size were analyzed from the CT performed on days 4–7. MMP-9 levels were determined by enzyme-linked immunosorbent assay in blood samples obtained on admission.

**Results:** HT was observed in 8 patients. A total of 7 patients (20%) received anticoagulants before the second CT scan. Large infarction size and treatment with anticoagulants were significantly higher in the group with HT ( $P < 0.001$ ). Mean plasma MMP-9 concentrations were higher in the HT group ( $P < 0.001$ ). MMP-9 concentrations  $\geq 900$  ng/mL had the highest sensitivity (100%), specificity (81.48%), and negative and positive predictive values (100% and 61.53%, respectively), MMP-9  $< 900$  ng/mL was associated with HT (odds ratio, 1; 95% confidence interval, 1.21;  $P < 0.001$ ) after adjustment for potential confounders and final infarct size.

**Conclusions:** High plasma MMP-9 concentration in the acute phase of a cerebral infarct is an independent biochemical predictor of HT in all stroke subtypes.

### WSC-1583

#### Hemorrhage – Intraparenchymal

#### A reason to recurrent intracerebral hemorrhage:

#### Cerebral amyloid angiopathy

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**Introduction:** Age of ICH onset, bleeding localization, the presence of hypertension is important in determining the etiology. In the elderly, amyloid angiopathy accounts for up to one-third of the cases with often multiple and lobar localized bleedings.

**Case:** Sixty-two-year-old male patient was admitted with weakness on the right side. His blood pressure was normal. Neurological examination revealed dysarthria, right central facial paralysis, right sided slight hemiparesis and extensor plantar response on the right side. CT showed hematoma in the left paramedian frontal lobe, 2 × 2 cm in size (Fig. 1). In his second episode, 4 months after his first admission, hematoma localized in the left temporoparietal region detected by cranial CT (Fig. 2); and the third episode was 8 months after the second one, which was multifocal, bilateral parasagittal posterior parietal and more prominent on the right revealed by cranial CT (Fig. 3); finally he suffered from fourth ICH with the localization of right temporal region detected by cranial CT (Fig. 4). In all of them, all laboratory tests were normal, including blood clotting tests. Cranial MR angiography was also normal. According to the multiple and cortical localizations of the lesions on CT, the normal blood pressure of the patient while hospital admission and absence of any other underlying causes patient diagnosed with cerebral amyloid angiopathy.

**Discussion:** With this case report, we wanted to draw attention to the need that cerebral amyloid angiopathy must be kept in mind when an elderly patient admitted to hospital with normal blood pressure and findings of multifocal intracerebral hematomas.

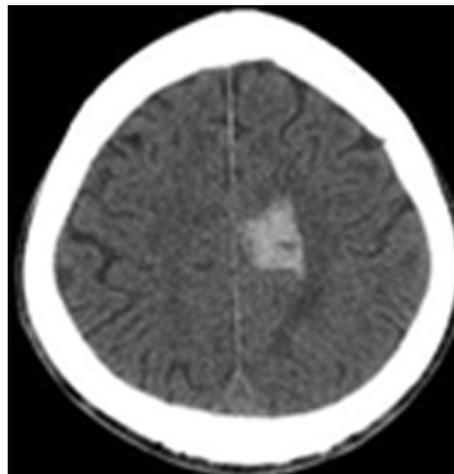


Fig. 1

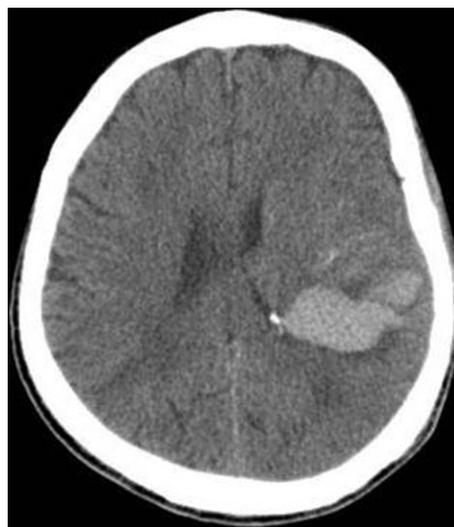


Fig. 2

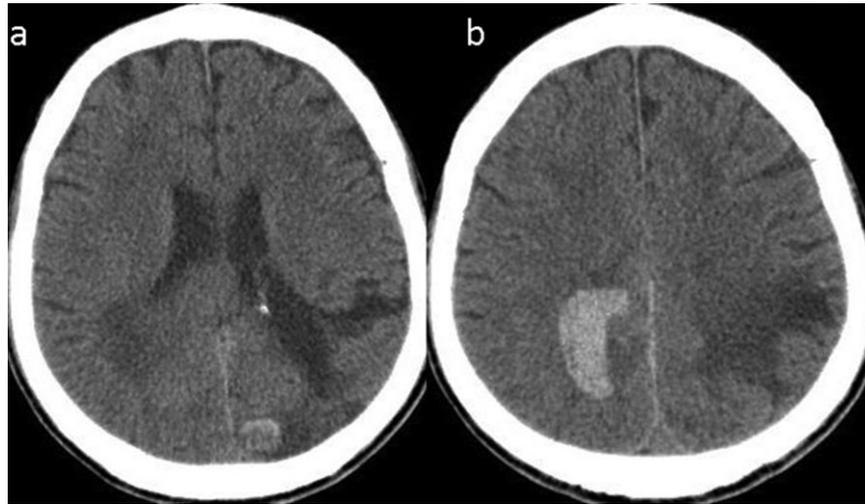


Fig. 3

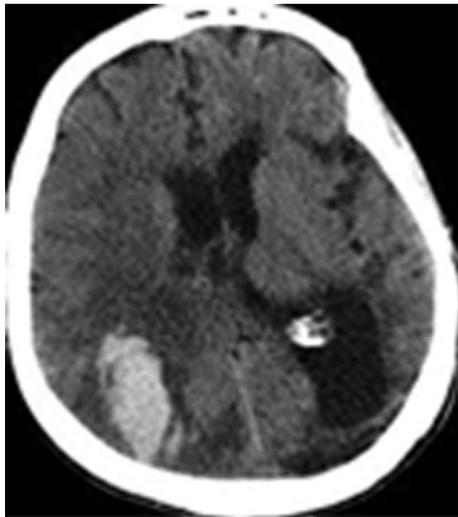


Fig. 4

#### WSC-0647 Hemorrhage – Intraparenchymal Subdural hemorrhage as a complication of spinal anesthesia

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**Introduction:** Spinal anesthesia is used frequently because it provides local anesthesia and decreases the morbidity and mortality (1). While headache is the most common complication of this procedure, subdural hematoma is observed rarely (2,3).

**Case:** A 30-year-old female patient presented with throbbing headache in the anterior part of the head and left-sided numbness which had been lasting for 2 days. In her personal history, it was learned that she had deep vein thrombosis 4 months ago and a cesarean section with spinal anesthesia 4 days ago. On physical examination, left hemihypoesthesia which also involved the face and frust paresia in the right arm was present. On

the first day of hospitalization, complex partial seizures which occurred for 8 times were observed. On brain CT, a lesion compatible with hyperdense hemorrhage was observed adjacent to the right frontal and left lateral ventricular posterior horn. Cranial MRI revealed hyperintense hemorrhage areas in the subdural and subarachnoidal space on T1 vs T2 Flair-weighted sections (Figs 1 and 2). The seizures were controlled with antiedema and antiepileptic treatment.

**Discussion:** With this rare case we aimed to emphasize the necessity to keep intracranial events in mind and the importance of imaging, although headache is a very common complaint following spinal anesthesia.

#### WSC-1155 Hemorrhage – Intraparenchymal Conservative and surgical management of hypertensive intracerebral hemorrhages

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**Introduction:** Surgical treatment of hypertensive intracerebral hemorrhages (HIH) is controversial and disputable.

**Purpose:** Comparison of results of conservative and surgical management in the management of HIH.

**Material and Methods:** One hundred eighteen patients observed during 2000 to 2012. Among them 42 patients managed operatively, 76 patients managed conservatively. The indication for the surgical treatment was: 1. deterioration during conservative therapy; 2. The HIH volume more than 40 ml; 3. Cerebellar hemorrhage; 4. An obstructive hydrocephalus; 5. Glasgow Coma Scale.

Patients were divided into 3 groups: group 1, 52 patients operated with puncture/aspiration method with a local fibrinolysis; group 2, 26 patients managed with encephalotomy and an open aspiration of HIH; group 3, 42 managed conservatively.

**Results:** In the 1st group after operation, 11 (22%) died; in the 2nd, 6 (24%); in the 3rd, 14 (31%). Lethality among operated in a sopor of the 1st group made 34%, and in the 2nd, 23%. All patients operated in a coma died. In the 3rd group in stupor the lethality was 61%, in a sopor, 79%.

**Conclusion:** The puncture/aspiration method is effective at massive HIH, with consciousness from a stupor to a sopor. Open encephalotomy and HIH aspiration in a coma is inexpedient. Patients with IVH are preferable to operate with a puncture-aspiration method. In case of a full

intraventricular tamponade the puncture-aspiration method in a combination to an external drainage of ventricles is effective. Conservative treatment of ICH complicated by IVH is noneffective.

### WSC-0237

#### Hemorrhage – Intraparenchymal Endoscopic assisted surgical removal of intracerebral hemorrhage

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**Introduction:** The main purpose of surgery of intracerebral hemorrhage is minimally invasive removal of hematoma with maximal volume evacuation.

**Aim:** For the purpose of increasing the efficiency of surgery of intracerebral hemorrhage, we developed and applied an endoscopy assisted manipulator for minimally invasive evacuation of intracerebral hemorrhage and analyzed the results of treatment of patients using that technique.

**Methods:** The manipulator is consisted from rigid endoscope of Aesculap AG, including irrigation and suction channels, transparent sheath and its holder. The main advantages of the surgical evacuation of intracerebral hemorrhage using of the endoscopy assisted manipulator are: 1) Burr hole approach under local anesthesia. 2) The transparent sheath improves visualization of the border between brain parenchyma and hemorrhage. 3) Free-hand surgery without fixing the endoscope. 4) The capability of manipulation in deep area of the brain through narrow surgical approach.

**Results:** We performed surgery using the manipulator in 102 patients with intracerebral hemorrhage during 24 h after onset. The range of hematoma volume was 18–116 cm<sup>3</sup>, the mean hematoma volume – 54.2 ± 6.8 cm<sup>3</sup>. The main duration time of surgery was 62.5 ± 8.4 min, the mean hematoma removal rate was 98.7 ± 2.8%. The lethal outcome rate was 12.8%. No postoperative recurrence of hemorrhage with deterioration of symptoms occurred.

**Conclusion:** We consider that evacuation of intracerebral hemorrhage using the endoscopy assisted manipulator allows improving the treatment outcome of patients with intracerebral hemorrhage.

### WSC-1201

#### Hemorrhage – Intraparenchymal Sex differences of the etiology and 3-month outcome in nontraumatic intracerebral hemorrhage in China: A multiple-center prospective study

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**Introduction:** The study about etiology and the management of nontraumatic intracerebral hemorrhage in women patients in developing country such as China is scarce, and the previous studies on the sex differences have shown inconsistent results.

**Aims:** The objective of this prospective study was to verify and explain differences between men and women in etiology and 3-month disability after nontraumatic intracerebral hemorrhage in a national multiple-center perspective.

**Methods:** All the patients who have spontaneous intracerebral hemorrhage were included in China Intracerebral Hemorrhage Registry. We started the register from 2012. The mRS was dichotomized into independence (mRS 0–2) and disability (mRS 3–5)

**Results:** A total of 778 nontraumatic intracerebral hemorrhage patients with 3-month follow up have been consecutively enrolled when the abstract was reported. 35%(274/778) of the included patients were female.

The age of females (55 ± 17 ys) are older than males (53 ± 17 ys) (p = 0.03), the level of cholesterol and high density lipoprotein (HDL) on admission in females (CHOL4.44 ± 1.02 mmol/l, HDL1.50 ± 0.47 mmol/l) was more higher than males (CHOL4.18 ± 1.05 mmol/l, HDL1.31 ± 0.48 mmol/l) (p = 0.002, p < 0.01) and alcohol consumption of males is 9.597 times more frequent (95% CI 3.828–24.061). The 3-month disability between genders is not significant (p = 0.539), so as the proportion of etiology of nontraumatic intracerebral hemorrhage (p = 0.914)

**Conclusion:** The sex differences of etiology and 3-month disability was not significant. The details of etiology of spontaneous ICH will be reported in our following study.

### WSC-0632

#### Hemorrhage – Intraparenchymal Clinical features of transient hydrocephalus following intracerebral hemorrhage

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**Introduction:** There are few reports of transient hydrocephalus in patients with ICH. Therefore in this study, we aimed to describe the clinical and radiological features of transient hydrocephalus.

**Methods:** Three hundred seventy-four patients with primary spontaneous ICH admitted to our hospital within 7 days after the onset between January 2011 and July 2012 were enrolled. Of those, 105 patients with supratentorial ICH, hemorrhage volume

**Results:** Transient hydrocephalus was found in 4 patients (3.8%). In 3 of the 4 patients, delirium developed in acute phase, but fully resolved within 24 hours. Repeated CT scans showed that resolution of hydrocephalus was accompanied by migration of the aqueductal clot into the fourth ventricle in all cases. The mGS was lower in patients with transient hydrocephalus than in those with acute hydrocephalus treated with drainage procedures (mean mGS: 6.5 vs. 20.0, P = 0.009), whereas the parenchymal hematoma volume was comparable (mean volume: 19.0 ml vs. 21.5 ml, P = 0.41).

**Conclusion:** Transient hydrocephalus was detected in 3.8% of acute supratentorial ICH with IVH. Acute and transient delirium following ICH may be a key feature of transient hydrocephalus. A small clot in the aqueduct was the responsible cause for transient hydrocephalus after ICH.

### WSC-1150

#### Hemorrhage – Intraparenchymal Large intracerebral hemorrhage surgery: Where to stop?

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The current trend regarding intracerebral hemorrhage surgery dictates the removal of an adequately large part of the blood clot, in order to reduce the intracranial pressure.

But, how much is “adequate”? Where must the surgeon say: “Stop”?

**Methods:** We are evaluating our last 2 years results for 42 patients, age range 42–82 yrs, mean 71.5 yrs, regarding large (>5 cm diameter) intracerebral hemorrhage surgeries where we have achieved near total clot

removal (Group A) and we compare them with our two previous year's results for 31 patients, age range 51–80, mean 71 yrs, where we opted for 'adequate' (in the 50% range) subtotal clot removal (Group B.).

**Results:** Group A produced significantly better results, both in terms of survival rates (18.2% vs 12.6%,  $p < 0.01$ ) and in terms of survivors GOS (Mean = 3.5 vs 2.7,  $p < 0.05$ )

Additionally, the postoperative CT scans for Gr. A demonstrated less perilesional edema than Gr. B patients.

**Conclusion:** (1) Our initial interpretation of the above results was that Near total clot removal led to minimizing an alleged significant irritating effect of blood on the brain tissue was WRONG. (2) The true explanation of the above results is – as proved by post op ICP measurements (Table 2) – that what we considered as “subtotal” and “adequate” for the Gr. B patients was in reality marginal at the time of the operation and evolved to “insufficient” shortly afterwards. (3) The answer to the question: “How much is adequate?” should probably be: “Somewhat more than you initially estimate” . . . unless there is severe suspicion of vascular pathology dictating prudence!

### WSC-1163

#### Hemorrhage – Intraparenchymal Posterior fossa ICH – Far more benign than its supratentorial equivalent with the proper management

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**Introduction:** Posterior fossa ICH represents a significantly rarer entity compared to supratentorial ICH.

It usually is a more challenging diagnosis and reaches the neurosurgeon later, except the most severe cases presenting comatose.

But what's the surgeons point of view? Operate or not? And when?

**Materials/Methods:** We have analyzed our series of 13 Posterior fossa ICH patients, and we are comparing with our own series of 38 supratentorial ICH patients

**Results:** The infratentorial ICH subgroup A (Mean age = 64,3 yrs, 60% males) had a survival of 87% and Mean GOS = 4,1.

The supratentorial ICH subgroup B (Mean age = 61,3 yrs, 62% males) had a survival of 67% and Mean GOS = 3,3.

**Conclusions:** Infratentorial ICH is a Far more benign entity when treated promptly. Both survival rates and especially GOS results are excellent. It is to be noted though that the results themselves would be similarly better with conservative treatment.

Waiting and observing has an increased chance of evading surgery than supratentorial but the risk of more acute deterioration is to our eyes more important than the operative risk for the standard patient.

It is a technically more demanding operation, but definitely worth it and a very good training operation for the medium to senior level registrars.

### WSC-1147

#### Hemorrhage – Intraparenchymal Intracerebral hemorrhage – Prognosis and surgical decision making

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**Introduction:** Intracerebral hemorrhage surgery still remains one of the most controversial issues in neurosurgery.

In this study we will try to answer one crucial question: Who and when to operate.

**Methods:** We have retrospectively analyzed our own results of 52 patients operated for large intracerebral hemorrhage. We have initially assessed the correlation between each of the suspected prognostic factors and both survival rates and GOS with bivariate analysis and then we run a multi-variable regression analysis to estimate their relative impact to the final outcome.

The prognostic factors were

(a) radiologic: Size of lesion, location, depth, edema

(b) demographics: Age

(c) clinical: GCS, rate of deterioration, anisocoria, dilation, pupillary response

(d) monitoring: ICP

(e) surgery type

**Results:** All prognostic factors were found to have a statistically significant correlation to both survival rate and GOS ( $p < 0.05$ ).

The multiple regression model comprising of all the significant factors had a very strong predictive value ( $R^2 = 0.87$  – which means 87% correct GOS prognosis), but suffered of severe multicollinearity problems because many of the examined predictors are highly intercorrelated. For example: mydriasis without pupillary reactivity to light almost unavoidably coexists with very elevated ICP and GCS = 3.

So after a stepwise regression analysis for a practical model, we ended up with: (1) GCS before surgery; (2) location of lesion; (3) age.

**Conclusion:** The selected model provides 0.75 predictive value and -since for any given patient lesion location and age are constants – determining who and when to operate solely in terms of GCS observation!

### WSC-1136

#### Hemorrhage – Intraparenchymal Comparison of classic vs endoscopic assisted surgery for ICH

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**Introduction:** Surgical treatment of ICH remains a disputed issue in current neurosurgery and the results are not always satisfactory. The introduction of the endoscope can reduce the size of the corticotomy and thus might contribute to a better postoperative outcome. Is this the case?

**Methods:** We have performed a retrospective study on ICH patients who were operated by the same group of surgeons with and without an endoscope.

Group A consisted of 34 patients (Mean Age 63,4 yrs, 62% males) who were operated with classic removal of he clot.

Group B consisted of 15 patients (Mean Age 65,1 yrs, 60% males) who were operated with endoscopic assisted removal.

**Results:** No difference was found in survival rates between the 2 groups.

For Group A survival was 67% and GOS was 3,14 while

For Group B survival was 65% and GOS was 3,73.

**Conclusions:** The use of the endoscope does not alter survival rates and it increases the operative time by approximately 30 minutes.

On the other hand it offers a definite statistically significant ( $p < 0.01$ ) improvement at the GOS especially for a subgroup of patients with deeper seated basal ganglia lesions.

## WSC-0551

### Hemorrhage – Intraparenchymal Florbetapir imaging in deep and cerebral amyloid angiopathy related intracerebral hemorrhages

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**Introduction:** Several studies have suggested that Positron Emission Tomography (PET) amyloid imaging could help in vivo Cerebral Amyloid Angiopathy (CAA) diagnosis.

**Aim:** We aimed to evaluating Florbetapir, a PET amyloid ligand, as a potential marker of CAA in a population of patients with acute Intracerebral Hemorrhage (ICH). We hypothesized that cortical florbetapir retention was higher among patients with lobar ICH than among patients with deep ICH.

**Methods:** Consecutive patients admitted in the stroke unit of our institution for acute spontaneous supratentorial ICH were prospectively screened. Patients with primary ICH were categorized as lobar or deep ICH. Cortical florbetapir standard uptake value ratios (SUVRs) were calculated using the whole cerebellum as reference. Patients with lobar and deep ICH were compared for mean cortical florbetapir SUVR.

**Results:** Thirty-nine patients (mean age  $\pm$  SD = 65.5  $\pm$  11 years) with acute primary supratentorial ICH were enrolled. 21 patients had deep ICH. 18 patients (10 probable CAA and 4 possible CAA according to the Boston criteria) had lobar ICH. Mean cortical florbetapir SUVR was significantly higher in patients with lobar ICH than in patients with deep ICH (1.20 [95% CI 1.14–1.26] vs 1.12 [95% CI 1.08–1.15];  $p = 0.01$ ). Among patients with lobar ICH, cortical florbetapir SUVR was greater in patients with probable CAA than in patients with other lobar ICH (1.26 [1.18–1.33] vs 1.13 [1.05–1.22];  $p = 0.034$ ).

**Conclusion:** Cortical Florbetapir uptake is increased in patients with lobar ICH, especially in patients with probable CAA. Florbetapir PET appears as a promising tool in assessing the amyloid vascular load in CAA-related ICH.

## WSC-1091

### Hemorrhage – Intraparenchymal Plasma glial fibrillary acidic protein (GFAP) for differentiation between hemorrhagic and ischemic strokes in prehospital stroke care

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**Background:** Intracerebral hemorrhage (ICH) accounts for 10–15% of strokes. Both, acute ischemic stroke (AIS) and ICH require early but different treatment. High levels of glial fibrillary acidic protein (GFAP) at hospital admission are associated with ICH diagnosis. Prehospital diagnosis of ICH via GFAP could provide important information with regard to patient transport) and treatment.

**Methods:** Acute stroke patients cared in the Stroke Emergency Mobile (STEMO) were asked for participation. The STEMO ambulance is inte-

grated in the emergency medical system (EMS) of Berlin/Germany. It is equipped with a CT scanner, point-of-care laboratory and is staffed by a specialized team. Blood was drawn immediately after diagnosis of acute stroke, stored at 4°C until arrival at the EMS station and then at –25°C until analysis using research assays from Roche diagnostics. Clinical accuracy of GFAP was tested with a cut-off of 0.29 ng/ml. Diagnosis of stroke subtype was established on STEMO.

**Results:** Blood samples of 74 stroke patients were analyzed (mean age: 73.4+/-10.5 y, median NIHSS: 7.5, median onset to blood sampling time (OBT): 62,5 minutes). ICH was diagnosed in 25 patients (age: 69.4  $\pm$  10.5 y, NIHSS: 15, OBT: 43 min, median volume of ICH: 17.8 ml). GFAP concentrations were significantly higher in ICH versus AIS (median: 0.057 ng/ml (IQR: 0–1.4) vs. 0.0 (IQR: 0–0),  $p < 0.001$ ). The sensitivity and specificity of GFAP for differentiating between ICH and AIS were 36.0% and 100%.

**Conclusion:** GFAP levels > 0.29 ng/ml confirm the diagnosis of ICH. However, sensitivity is low in the ultra-early time window of prehospital stroke care.

## WSC-0811

### Hemorrhage – Intraparenchymal Association of cerebral microbleeds with mortality in stroke patients having atrial fibrillation

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**Introduction and Aims:** We investigated the association of cerebral microbleeds (CMBs), which is putative marker for bleeding prone state, with long-term mortality in patients with nonvalvular atrial fibrillation (NVAF) according to burden and distribution of CMBs.

**Methods:** This was a retrospective hospital-based observational study. In total, 504 consecutive ischemic stroke patients with NVAF who underwent brain gradient-recalled echo magnetic resonance imaging, were included. Data for the date and causes of death were based on the death certificates from the Korean National Statistical Office. We determined the association of the presence, burden, and distribution of CMBs with mortality from all-cause, ischemic heart disease, ischemic stroke, and hemorrhagic stroke. **Results:** CMBs were found in 30.7% of patients (155/504). During a median follow-up of 2.5 years, 176 (34.9%) patients died (ischemic stroke, 81; hemorrhagic stroke, 12; ischemic heart disease 32). Patients with CMBs died more frequently than those without (41.9% versus 31.8%,  $p = 0.028$ ). After adjusting for age, sex, and other significant variables, the presence of multiple ( $\geq 5$ ) CMBs was as an independent predictor for all-cause (hazard ratio [HR]: 1.99) and ischemic stroke (HR: 3.39) mortality. Patients with strictly lobar CMBs had an increased risk of hemorrhagic stroke mortality (HR: 5.91).

**Conclusions:** The presence and burden of CMBs were associated with increased mortality in stroke patients with NVAF. Patients with lobar CMBs were at increased risk of death due to hemorrhagic stroke. The diagnosis of CMBs is of value in predicting long-term prognosis in stroke patients with NVAF.

**WSC-1006**  
**Hemorrhage – Intraparenchymal**  
**Baseline characteristics of patients enrolled in the**  
**start up phase of tranexamic acid for hyperacute**  
**primary intracerebral hemorrhage (TICH 2)**

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*Background:* Treatment options for intracerebral hemorrhage (ICH) remain limited and a proportion of patients will undergo early hematoma expansion with resultant significant morbidity and mortality. Tranexamic acid (TA), an anti-fibrinolytic drug, significantly reduced mortality in bleeding patients following trauma when given rapidly. The on-going TICH-2 is testing whether TA is effective at improving outcome in spontaneous ICH.

**Table 1** Clinical characteristics at randomization

		n	N = 381	
Age (years)*	Mean (SD) Range	381 (100%)	68.5 (14.07) [22,97]	
Sex*	Male (%)	381 (100%)	205 (53.8%)	
Time from onset to randomization (hours)*	Median [IQR] (Range)	381 (100%)	3.5 [2.6,4.6] (1.1,7.9)	
	>3 hours (%)	381 (100%)	237 (62.2%)	
Prestroke mRS	Median [IQR] (Range)	381 (100%)	0 [0,1] (0,4)	
Glasgow coma scale	Median [IQR] (Range)	381 (100%)	15 [12,15] (5,15)	
NIHSS score*	Median [IQR] (Range)	381 (100%)	13 [8,19] (0,40)	
Systolic blood pressure (mmHg)*	Mean (SD) Range	381 (100%)	174.4 (28.53) [105,264]	
Diastolic blood pressure (mmHg)	Mean (SD) Range	381 (100%)	94.2 (18.72) [53,155]	
Intraventricular hemorrhage*	Yes (%)	375 (98%)	156 (40.9%)	
History of antiplatelet therapy on admission*	Yes (%)	373 (98%)	102 (26.8%)	
History of previous stroke or TIA	Yes (%)	373 (98%)	58 (15.2%)	
History of IHD	Yes (%)	370 (97%)	24 (6.3%)	
History of thromboembolism	Yes (%)	381 (100%)	4 (1.0%)	
Advanced imaging performed	Yes (%)	353 (93%)	29 (7.6%)	
	– Spot positive	Yes (%)	29 (7.6%)	11 (37.9%)
	– Spot negative	Yes (%)	29 (7.6%)	18 (62.1%)
Hematoma location	Yes (%)	338 (89%)	338 (88.7%)	
	– Supra-tentorial Lobar	Yes (%)	338 (89%)	111 (32.8%)
	– Supra-tentorial Deep	Yes (%)	338 (89%)	192 (56.8%)
	– Infra-tentorial	Yes (%)	338 (89%)	24 (7.1%)
	– Combination: Lobar and Deep	Yes (%)	338 (89%)	7 (2.1%)
	– Combination: Lobar and Infra	Yes (%)	338 (89%)	1 (0.3%)
	– Combination: Deep and Infra	Yes (%)	338 (89%)	3 (0.9%)

\*Minimization criteria.

**WSC-1381**  
**Hemorrhage – Intraparenchymal**  
**Natural course of intracerebral hemorrhage and**  
**perihemorrhagic edema and the impact on outcome**

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*Introduction:* Intracerebral hemorrhage (ICH) is a devastating disease with a poor outcome. Hematoma volume and intraventricular hemorrhage (IVH) represent important prognostic predictors. Perihemorrhagic edema (PHE) may influence mortality in patients with higher ICH volumes; however, its effect on functional outcome remains unclear. Aim of the present study was to elucidate the impact of the natural course of ICH and PHE on functional outcome.

*Methods:* Patients were identified from our institutional ICH database. Individuals with supratentorial ICH who received >3 computed tomog-

*Methods:* We are performing an on-going International Multicenter, randomized, double blind placebo controlled trial of TA (intravenous 1 g bolus, 1 g infusion/8 hours) in acute (<8 hours) ICH: a 12-month start up phase (30 centers, recruit a minimum of 300 participants) then main phase (120 centers, recruit a total of 2,000 participants). Primary outcome is death or dependency (ordinal shift on mRS) at day 90.

*Results:* As of April 2nd 2014, 381 patients had been enrolled, from 53 centers in 2 countries. 205 (53.8%) of them were male and 156 (40.9%) of them had an Intraventricular hemorrhage. The mean (SD) age was 68.5 (14.07) and the mean (SD) systolic blood pressure (mmHg) was 174.4 (28.53). The median (IQR) time between stroke onset and enrollment was 3.5 (2.6, 4.6) hours and the median (IQR) NIHSS score was 13 (8,19). See Table 1.

*Conclusion:* There is a need for better treatments for ICH. TICH-2 has achieved its start up phase objectives and now proceeds to the main phase. New centers are welcome.

raphy (CT) scans over a period of 12 days were included. ICH volumes >50 ml were excluded in order to keep the focus on the effect of PHE. PHE volume was calculated using a semiautomatic threshold based volumetric algorithm. CT scans performed on days 1, 2–3, 4–6, 7–9 and 10–12 were analyzed. Dichotomized Modified Rankin Scale(0–4 vs. 5–6) at discharge and clinical characteristics were obtained from medical records.

*Results:* PHE data were available for 489 patients. The selection algorithm resulted in 80 patients (lobar ICH:33; basal ganglia (BG)-ICH:47). Mean age was 69 years(range 45–94). Maximum ICH volume of 29.3 ± 2.45 ml was reached at day 2.9 ± 0.28. Maximum PHE volume of 48.3 ± 3.6 ml was reached at day 9.4 ± 0.41 and was predicted by maximum ICH volume(R<sup>2</sup> = 0.3, p < 0.001). In lobar ICH neither ICH nor PHE volume predicted outcome. In BG-ICH ICH volume showed a strong trend towards prediction of poor outcome (p = 0.051). PHE volume showed a significant effect in univariate analysis(p = 0.009), but failed in multivariate testing.

*Conclusions:* PHE may negatively influence functional outcome in BG-ICH < 50 ml. PHE is an ICH-volume dependent but modifiable factor which should be further examined.

## WSC-0761

### Hemorrhage – Intraparenchymal Sporadic cerebral amyloid angiopathy in etiologic diagnosis of ICH: A systematic review

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**Introduction:** Sporadic cerebral amyloid angiopathy (CAA) is considered one of leading etiologic causes of ICH, but in clinical practice it is hard to diagnose, thus restricted more etiology-specific management of ICH. This study systematically reviewed all reported CAA diagnosis in ICH patients to demonstrate with which methods and criteria CAA were diagnosed in ICH patients in different regions and how it develops throughout the time. We also hoped to find the most appropriate way of diagnosis by this study.

**Methods:** Any study reports patients with ICH that were diagnosed CAA were eligible for inclusion. Electronic searches were conducted in Ovid MEDLINE, and Ovid EMBASE. Two authors independently assessed the compliance of studies with eligibility criteria, and extracted data from included studies.

**Results:** Among 2961 cases reported in 337 publications, 73.4% (2173 cases) of total diagnosis were purely pathological. The Congo Red staining technique predominates most reported pathologically diagnosed cases. Autopsy is the major way of sampling, while biopsy on brain tissue or surgical removed hematoma were conducted in only 193 cases. One well design comprehensive clinical diagnostic criteria – the Boston criteria is identified, being used in part of the world especially in America and Europe, made up 26.6% (788 cases) of total diagnosed cases.

**Conclusions:** The Boston criteria provided a clinical possible way to diagnose CAA in ICH patient, with its recent modifications by GRE/SWI MR imaging radiological markers, it is possible to make better and more timely etiological diagnosis for etiology-specific management on CAA-related ICH.

## WSC-1525

### Infections Diseases and Stroke Copresence of Ramsay Hunt syndrome and cerebrovascular disease

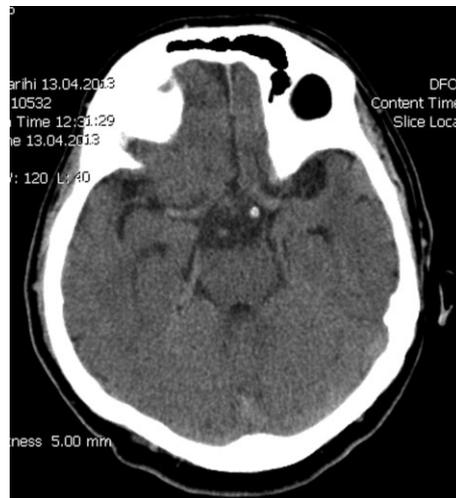
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**Introduction:** Varicella zoster virus (VZV) is A DNA virus of the human virus family. When the viruses are activated for a variety of reasons, herpes zoster occurs. Although the infection most commonly involves thoracic T5-T12 dermatomes, cranial nerve involvement can also be found in 14–20% of the cases. Central nervous system involvement presents itself with vasculitis that develops secondary to the infection (6). Vasculopathy and stroke syndromes were reported to stem from VZV following herpes zoster attacks.

**Case:** A 67-year-old male patient presented at the emergency service complaining from rash on the right half of the face, inability to close the right eyelid, drooping on the left side of the mouth for 3 days and speech disorder, difficulty in swallowing, nausea, and vomiting which were added to the other complaints 1 day ago. It was seen in the neurological examination that he had grade 4 right peripheral facial paralysis, reduced gag reflex, bulbar dysarthria, 5-/5 muscle strength in the left upper limb and 5-/5 muscle strength in the left lower limb, as well as a positive Babinski reflex. Additionally, the patient had painful herpetic rash in the right maxillary and mandibular regions and right ear auricle. Cranial CT performed in the emergency service was normal (Fig. 1). Diffusion MRI performed in the ER revealed a hyperintense area consistent with acute

ischemia in the right half of the bulbous (Fig. 2). The Cranial MRI performed on the fourth day of his admission showed patchy areas of ischemic signal change in the right half of the medulla oblongata at the level of inferior cerebellar peduncle (Fig. 3).

**Result:** We contend that the case of ischemic cerebrovascular disease associated with Ramsay Hunt Syndrome will contribute to the literature in terms of diagnosis and treatment approaches that can be adopted in the co-presence of these two diseases.



## WSC-0749

## Infections Diseases and Stroke

## Neurocysticercosis in Germany: A case report

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**Introduction:** Neurocysticercosis is a parasitic disease of the nervous system caused by the *Taenia solium* larva. NCC is rare in Western Europe and mainly occurs in immigrants from endemic regions.

**Case Presentation:** A 62-year-old German man who was diagnosed with neurocysticercosis with symptomatic epilepsy. He presented with transient word finding difficulty for the first time. Brain imaging shows proof of multiple mainly extra axial lesions on both sides of supratentorial and together CT examination shows small local hemorrhage and calcification. Cervical thoracic and lumbar spine MRI proof two small cystic lesions in the right musculus rectus capitis posterior major and in the superficial paraspinal muscles. Other vital signs examinations are normal. Motor activity, reflexes, sensibility and coordinations are normal. Therapy with levetiracetam was given for the word making disorder which was due to the symptomatic epilepsy in the context of cerebral lesions. However the dignity of the masses at the time of dismissal is still unclear and both neurocysticercosis as well as malignancy cannot be excluded.

**Conclusions:** Neurocysticercosis is the most common parasitic disease of the central nervous system and the most common cause of acquired epilepsy worldwide. However its diagnosis remains difficult, clinical manifestations are not specific, most neuroimaging findings are not pathognomonic and some serologic tests have low sensitivity and specificity.

## WSC-1227

## Infections diseases and stroke

## A case of curable stroke

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Lyme neuroborreliosis (LNB) is diagnostically challenging due to its diverse manifestations. The well-documented neurological spectrum incorporates an early disseminated phase with presenting features including lymphocytic meningitis, cranial neuropathies and a radiculitis poten-

tially followed, if left untreated, by a more persistent phase of peripheral neuropathy, chronic encephalomyelitis and mild encephalopathy.

This case report describes a 65-year-old man who presented to the hyper-acute stroke unit at 12.30 pm October 2013 with bilateral lower motor neurone cranial nerve VII palsies, left arm weakness and left leg polyradiculopathy affecting the sciatic nerve roots L5, S1 and S2. The diagnosis of LNB was confirmed through serology and CSF studies. He showed significant improvement with intravenous ceftriaxone with excellent functional recovery.

Prompt diagnosis and treatment provide symptomatic relief and improve neurological outcomes. LNB presenting in this fashion within the UK is poorly reported in the literature.

## WSC-1153

## Infections Diseases and Stroke

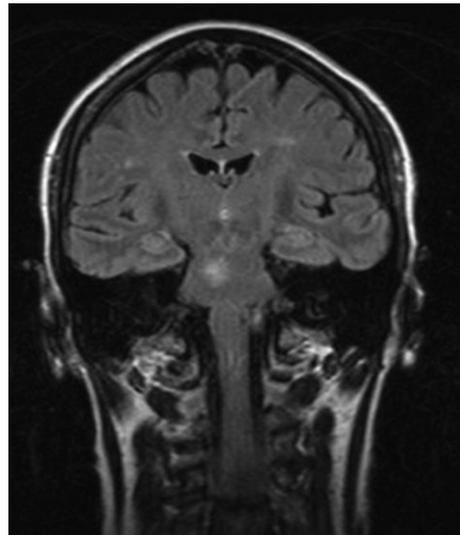
## Varicella zoster viral (VZV) vasculopathy presenting as crescendo TIAs

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A 64-year-old woman presented with sensory disturbance affecting her right face and arm, difficulty mobilizing and dysarthria. Three weeks earlier she had been diagnosed with and treated for multidermatomal herpes zoster reactivation (right trigeminal and upper cervical distribution). CT, MRI with diffusion weighted imaging and MRA were normal supporting an initial diagnosis of migraine. One week later she represented with 'Crescendo TIAs' manifesting with recurrent transient left sided weakness (face, arm and leg) and dysarthria. Three days later she developed progressive left sided weakness (face, arm and leg) and a left gaze palsy. Repeat MRI showed a right pontine infarct. Repeat MRA was normal.



CSF examination showed an inflammatory CSF with pleocytosis and intrathecal VZV IgG production confirming VZV Vasculopathy. Treatment included a 5-day course of steroids (1 mg/kg/day), 3 weeks of intravenous acyclovir (30 mg/kg/day) followed by a 6-month course of valciclovir 1 gm/day. Further extensive investigations found no evidence of immune deficiency.

Prompt treatment of VZV vasculopathy may reverse and prevent neurological deterioration. Key to the diagnosis is identification of intrathecal

VZV IgG production as VZV DNA is often absent. Presentation can occur many months after the varicella rash or with no preceding rash. Treatment is by expert consensus as there are no published randomized control trials. With aging populations the incidence of VZV vasculopathy is predicted to rise.

### WSC-0916

#### Infections Diseases and Stroke

##### Early diagnosis of infective endocarditis by brain MRI

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**Introduction:** Infective endocarditis (IE) carries a high risk of morbidity and mortality. Rapid diagnosis and effective treatment are essential to good patient outcome. Diagnosis of IE is often difficult in patients presenting various nonspecific clinical manifestations. An association between IE and cerebral microbleeds has been reported recently, but the clinical significance remains unclear.

**Aims:** To assess the clinical importance for detecting silent lesions in the brain, we investigated hypointense signal spots detected on the brain T2\*-weighted MR imaging in patients with IE.

**Methods:** We retrospectively reviewed 44 consecutive patients with definite or possible IE who underwent T2\*-weighted MRI and were admitted to Nagasaki University Hospital, Japan, between January 2007 and November 2014.

**Results:** Thirty-eight patients (84.0%) showed hypointense signal spots on T2\*-weighted MR imaging. Twenty-one (46.0%) patients had ischemic lesions, 10 (22%) had subarachnoid hemorrhage, 4 (9%) had intraparenchymal hemorrhage, and 4 (9%) had a infectious aneurysm. Hypointense signal spots on T2\*-weighted MR imaging were preferentially distributed in cortical areas.

**Conclusions:** T2\*-weighted hypointense signal spots are highly frequent in patients with IE and could be quite useful in monitoring brain lesions associated with IE, even if they are asymptomatic. The strong association found between IE and T2\*-weighted hypointense signal spots supports the need for further evaluation as additional diagnostic criteria of IE.

### WSC-0354

#### Infections Diseases and Stroke

##### A novel point-of-care clinical risk score for predicting pneumonia in acute stroke care: A UK multicenter cohort study

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**Introduction:** Pneumonia frequently complicates stroke and has a major impact on outcome. We therefore derived and internally validated a simple point-of-care clinical risk score using baseline patient characteristics for predicting stroke-associated pneumonia (SAP).

**Methods:** We extracted data for patients with ischemic stroke or intracerebral hemorrhage (ICH) from the Sentinel Stroke National Audit Pro-

gramme multicenter UK registry. The data were randomly allocated into derivation (n = 11,551) and validation (n = 11,648) samples. A multivariable logistic regression model was fitted to the derivation data to predict SAP in the first 7 days of admission. The characteristics of the risk score were evaluated using receiver operating characteristics (discrimination) and by plotting predicted versus observed SAP frequency in deciles of risk (calibration).

**Results:** Prevalence of SAP was 6.7% in both the derivation and validation samples. The final 22-point score (ISAN: prestroke Independence [modified Rankin scale]; Sex; Age; National Institutes of Health Stroke Scale score) exhibited good discrimination in the ischemic stroke derivation (C-statistic 0.79; 95% CI 0.77–0.81) and validation (C-statistic 0.78; 95% CI 0.76–0.80) samples. The score was well calibrated in ischemic stroke and was further classified into meaningful risk groups (low 0–5, medium 6–10, high 11–14, very high ≥15) associated with SAP frequencies of 1.6, 4.9, 12.6 and 26.4% respectively in the validation sample. The score performed less well in the ICH patients with an apparent ceiling effect.

**Conclusions:** The ISAN score is a simple and promising tool for predicting SAP in clinical practice. External validation is required in ischemic and hemorrhagic stroke cohorts.

### WSC-0548

#### Infections Diseases and Stroke

##### Risk of major cardiovascular events in patients with down syndrome

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**Introduction:** Incidence of major cardiovascular events (CVEs) in Down Syndrome (DS) is unknown.

**Aim:** To determine the risk of incident cerebrovascular and coronary events in DS.

**Methods:** A population-level cohort study compared the risk of incident CVEs between individuals with and without DS. The sample was derived from hospitalizations within the Australian state of Victoria from 1993–2010 using the International Classification of Diseases (ICD-9/ICD-10) for diagnostic coding. For each DS admission, an exact age-matched non-DS admission was randomly selected from all hospitalizations within a week (±7 days) of the relevant DS admission. Main outcome measures were the risk of incident cerebrovascular and coronary events in DS, adjusting for sex, vascular risk factors and dementia.

**Results:** There were 4,081 DS (52.7% male) and 4,081 non-DS (49.4% male) individuals, mean age 18.5 years, SD (20.0). The DS group had a higher prevalence of congenital heart disease, cardiac arrhythmia, dementia, hypertension, diabetes and sleep apnea (all P < .0001), but were less likely to have smoked (P < .0001). DS was associated with a 2–3 fold greater risk (all P < .01) of all cerebrovascular events and strokes. The association of DS with ischemic strokes was substantially attenuated by adjusting for cardioembolic risk. DS was independently associated with a lower risk of coronary events and MI (P < .01).

**Conclusions:** Hospitalized individuals with DS are at high risk of strokes, mainly expressed at younger age. Ischemic stroke risk in DS appears mostly driven by cardioembolic risk. Lower risk of coronary events in DS may be partly explained by low smoking rates.

## WSC-1564

## Infections Diseases and Stroke

## Mycotic aneurysm and subarachnoid hemorrhage from basilar artery as complication of bacterial meningitis:

## A case report

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**Introduction:** The mycotic aneurysm is a rare complication due to bacterial and mycotic infections. I describe a case diagnosed in our service of neurology.

**Patient and Methods:** A 59-year-old female was admitted in ER because she had holocranean headache, stiffness, confusion and fever; a week ago she was someted to epidural anesthesia for a hip reemplazed. A first CT scan was reported normal and a lumbar puncture was suggestive of neuroinfection, with gram tinction reported gram positives cocos in chain. Dexamethasone and antibiotics were administrated. Due to neurological deterioration in FOUR Scale and Coma Glasgow Scale, an angio-CT Scan was performed and reported a basilar artery aneurismatic formation, blood in peri-pontine region and hidrocefaly. The patient was admitted to ICU, and died 7 days later. Autopsy study was not performed.

**Results:** Mycotic aneurism is a rare complication due to infections such as endocarditis, meningitis, cavernous sinus thrombophlebitis or orbital cellulitis. Mostly located in anterior circulation (1). This case had criteria for intracranial infectious aneurysm (2), that is the demonstration of intracranial aneurysm by neuroimaging and 12 supportive criteria drawn from three domains. Most of practitioners suggest antibiotics more that endovascular intervention, with antibiotics to treat *S. aureus* in most cases (3).

**Conclusions:** These is the first case report in our literature, and is one of the complications reported in patients with bacterial meningitis.

## WSC-0473

## Large Clinical Trials

## Epileptic type manifestation in patients with primary brain tumors

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**Introduction:** The clinical of primary brain tumors very often manifests itself in the form of various types of epilepsy and therefore diagnosis of tumor of cerebral is very difficult.

**Methods:** The results of examination and treatment of 392 patients with brain tumors. There were 186 males and 206 females. The patients' age varied from 1 to 75 years. Children under 15 years were 38 cases, representing 9.7% of patients, in the age of 15–20 years, 30 (7.7%); 21–30 years, 46 (11.7%); 31–40 years, 67 (17.1%); 41–50 years, 82 (30%); 51–60, 91 (23.2%); more than 60 years, 38 (9.7%) patients.

**Results:** There were 129 cases of brain tumor in the frontal area; temporal, 33; parietal, 99; occipital, 8; cerebellum, 54; in the brainstem, 41; and in the pituitary gland, there were 28 cases. 276 patients of them were operated; this is more than 70%.

The epileptic type of clinical manifestation were observed – in 92 (23.4%) cases, primary tumor type – in 238 (60.7%), vascular type – in 50 (12.7%), psychopathological type – in 12 (3%) cases.

It was found, that in epileptic type of clinical manifestation there were 68.4% of cases when the age of the patients was over 35 years.

**Conclusions:** Among patients admitted with primary brain tumors, the epileptic type of clinical manifestation was identified almost a quarter of patients. Basically, this type of manifestation is marked in patients over 35–40 years.

## WSC-0898

## Large Clinical Trials

## Rationale, objectives and design of a secondary stroke prevention study of dabigatran etexilate versus acetylsalicylic acid in patients with embolic stroke of undetermined source (RE-SPECT-ESUS)

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**Introduction:** About 20–25% of ischemic strokes are cryptogenic. The new category 'Embolic Stroke of Undetermined Source (ESUS)'<sup>1</sup> provides an operational definition based on exclusion of lacunar infarction, cardiac sources of embolism and relevant stenoses/occlusions of vessels supplying the affected brain territory.

**Aim:** As patients with ESUS may benefit from anticoagulation, a trial testing novel anticoagulants, such as dabigatran etexilate (DE), vs. current standard of care (acetylsalicylic acid [ASA]) is warranted.

**Methods:** RE-SPECT-ESUS is an international, phase III, double-blind, randomized trial comparing DE (150 mg or 110 mg twice daily) with ASA (100 mg once daily) for secondary stroke prevention in patients with ESUS. The trial will be approved by Institutional Review Boards in all participating countries before study start; written informed consent will be obtained from patients. Patients (modified Rankin Score  $\leq 3$ ) included will be  $\geq 60$  years or 50–59 years with a risk factor for stroke, and diagnosed with ESUS within 3 months of randomization (6 months, if  $\geq 60$  years plus an additional stroke risk factor). The trial is event-driven and powered to detect superiority (~6000 patients; observation 0.5–3 years). Primary efficacy outcome is recurrent stroke (ischemic, hemorrhagic or unspecified). Key secondary efficacy endpoints include ischemic stroke and composite of nonfatal stroke, nonfatal myocardial infarction and cardiovascular death. Primary safety endpoint is incidence of major bleeds (comparable rates assumed for both treatment arms).

**Conclusion:** Results obtained will help physicians choose appropriate therapy for secondary stroke prevention in patients with ESUS.

## Reference

1 Hart RG *et al.* Lancet Neurology 2014; 13: 429–38.

**WSC-0435****Large Clinical Trials****Analysis of the 7-year alias parts 1 and 2 trials suggests adaptive designs may be considered for future trials to account for evolving medical management of stroke**

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**Introduction:** The Albumin in Acute Stroke (ALIAS) Parts 1&2 Trials were conducted from July 2006 to December 2012. The purpose was to determine whether albumin improves 90-day clinical outcome in acute ischemic stroke patients, with or without thrombolytics treatment. Most subjects were followed for 1 year.

**Aims:** Analyze efficacy and safety outcomes from the combined Trials to yield statistically more powerful analyses and to assess the variations in subject/medical management characteristics in the 7-year course of the Trials.

**Methods:** The subject-level data from the trials were concatenated for the analyses of 90-day and 1-year outcomes. We provide graphical presentations of the study parameters over the study period to highlight some of the temporal trends in subject characteristics.

**Results:** Four hundred thirty-four and 841 subjects were randomized in Parts 1 and 2, respectively. The study samples were similar with a few notable differences: Part 2 subjects were younger (median age: 72 vs 66), and more received IV tPA (75% vs 85%) and endovascular thrombolytic treatment (7% vs 11%). While the % good clinical outcome increased from 35% in Part 1 to 44% in Part 2 overall, it remained nearly identical between the treatment groups in the combined analysis (41%). Additional salient outcomes will be presented.

**Conclusions:** While the combined analyses show little differences in the outcomes between the groups, we noted some temporal changes in subject characteristics and management overall. In designing a trial with long recruitment period, we recommend consideration of thoughtful adaptive designs based on some parameters that potentially could affect the outcomes.

**WSC-0841****Multidisciplinary Clinical Rehabilitation****Comparison of the staple food of Japanese (rice, bread and noodles) for stroke patients with dysphagia in convalescence rehabilitation wards by videofluorography**

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**Aims:** Currently, ingestion of bread and noodles has increased with westernization and diversification of diet progresses in Japan. However, it is difficult for stroke patients with dysphagia to chew and swallow these food due to the stiffness and shape of these food. This study examined the swallowing disturbance of Japanese staple food (rice, bread and noodles)

for stroke patients in convalescent rehabilitation wards by use of videofluorography (VF).

**Subjects:** We examined 36 stroke patients (25 men and 11 women, aged 37–94 y/o, mean 64.9 ± 14.3) with dysphagia who stayed in the convalescence rehabilitation ward since January 2012 and who can eat modified form food by evaluating VF. The days from onset of stroke to VF was 58.5 ± 32.1 (range, 15–136).

**Methods:** We evaluated their dysphagia using VF. The evaluation item are oral cavity holds, residual volume of oral cavity, bolus formation, elicited time of swallowing reflex, residual volume of epiglottis valley and pyriform sinus, laryngeal penetration, and aspiration.

**Results:** There was no aspiration and laryngeal penetration in all forms of food. There was no delay in elicited time of swallowing reflex. However, in swallowing bread, bolus formation was more difficult compared with other food. It also pointed out that the residual volume of oral cavity, epiglottis and pyriform fossa after swallowing reflex were much larger in swallowing bread compared with other food.

**Conclusion:** This study suggested that it is necessary to take care and observe the stroke patient with dysphagia when they eat bread.

**WSC-0731****Multidisciplinary Clinical Rehabilitation****Effects of occupational therapy task-oriented approach in upper extremity poststroke rehabilitation**

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**Introduction:** There is an immense need for effective poststroke upper extremity (UE) rehabilitation methodologies. Occupational Therapy Task-Oriented approach (TO) might be an effective and client-centered approach that was not studied in a clinical trial before.

**Aims:** we evaluated the functional and the impairment effects of TO approach poststroke for paretic UE.

**Methods:** Randomized cross-over trial with blinded evaluators. Participants of 3 months or more poststroke (mean chronicity = 62 months), minimally demonstrated 10° active affected shoulder flexion and abduction and elbow flexion-extension, were randomized into immediate (n = 10) and delayed intervention (n = 10) groups. Immediate group got 6 weeks of 3 hours/week TO treatment then got 6 weeks of no-treatment control. The delayed group underwent the reversed order. TO included intensive functional activities resembling actual treatment goals of each participant. Measurements included Canadian Occupational Performance Measure (COPM), Motor Activity Log (MAL), Wolf Motor Function Test (WMFT), active range of motion, and handheld dynamometry strength of the paretic UE.

**Results:** TO treatment was followed by larger functional change scores. COPM performance and satisfaction were 2.83 and 3.46 units greater respectively ( $p < .001$ ), MAL amount of use and quality of use were 1.1 and 0.87 units greater ( $p < .001$ ), WMFT time was 8.35 second faster ( $p = .009$ ).

**Conclusions:** TO approach appears an effective UE poststroke rehabilitation approach inducing clinically meaningful UE functional improvements. Results failed to support hypothesis of the impairment effects superiority of the TO. More studies are needed to provide more evidence for this approach.

**WSC-0270****Multidisciplinary Clinical Rehabilitation  
Assessment of poststroke rehabilitation using spect  
and a diagnostic system for dementia**Y Araki<sup>1</sup>, M Furuichi<sup>1</sup>, H Nokura<sup>1</sup>, T Iwata<sup>2</sup><sup>1</sup>Neurosurgery, General Inuyama Chuo Hospital, Inuyama,  
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*Introduction:* With the increase of dementia, some stroke patients show dementia-related symptoms before the occurrence of stroke.

*Aims:* Using SPECT and a computer-assisted dementia diagnostic system,<sup>1</sup> we investigated the effect of stroke rehabilitation and the dementia-specific cerebral blood flow reduction in the nonaffected side of stroke.

*Methods:* A total of 33 patients, consisting 10 intracranial hemorrhages and 23 cerebral infarctions, are included. The ROIs concerned with Alzheimer disease were automatically placed in the parietal lobe (PA) and the postcingulate gyrus and precuneus (CP). We classified patients into three groups; group A with abnormal Z-sum<sup>1</sup> scores of PA and/or CP, group N with normal value of both PA and CP, and group B of the rest. The effect of rehabilitation was evaluated by motor FIM gain during rehabilitation period of 1–2 months in the chronic stage. Our institutional review board approved this study.

*Results:* (1) Average values of Functional Assessment Staging before stroke onset were 3.7, 1.9 and 1.9, of group A, B and N, respectively. (2) The motor FIM gain of group A was significantly decreased of 2.5, comparing to group B of 7.1 and group N of 10. (3) Multiple regression analysis revealed that age, NIHSS and Z-sum scores were significant factors to explain the motor FIM gain ( $R = 0.654$ ,  $P < 0.01$ ). The higher the values, the gain of rehabilitation was lower.

*Conclusions:* Our results suggest that the investigation for dementia by SPECT brings the effective rehabilitation for stroke patients.

**Reference**

1 Eur J Nucl Med Mol Imaging 2009; 36:831–40.

**WSC-0756****Multidisciplinary Clinical Rehabilitation  
The impact of program based computer software  
versus Mozart's music on hemiparetic patients using  
magnetic resonance spectroscopy: A randomized  
control trial study**G Bayat<sup>1</sup>, S Dastgheib<sup>2</sup>, A Shoeibi<sup>3</sup><sup>1</sup>Student Research Committee Faculty of Medicine, Mashhad  
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*Introduction:* Stroke is not only second leading cause of death worldwide, but also is the leading cause of serious, long-term disability during the life. It seems that, because of high burden of stroke in all over the world on patients and their families, it is necessary to find and use the novel, easy, inexpensive and noninvasive rehabilitation methods.

*Aims:* The aim of our study was to evaluate the efficacy of program based computer software and Mozart's music on cognition and motor improvement in patients who are suffering from acute stroke.

*Methods:* We conducted a 6-month multiple blind randomized control study in 60 patients which were divided randomly into 4 groups with special instruction neurorehabilitation treatment. The first group were

asked to work with software for an hour every night. In the second group, patients should listen to the Mozart's sonata, K.448. For the third group music Mozart's sonata was also applied to the computer software. The fourth group plays the role of control group which received no intervention. Magnetic resonance spectroscopy was used to examine N-acetyl-aspartate, creatine, myoinositol, choline, and glutamate concentrations. Magnetic resonance spectroscopy, Fugl-Meyer Assessment of Physical Performance and MMSE tests are performed before, at third and sixth month of intervention.

*Results and Conclusion:* This is an ongoing study and the results are not ready yet but the analysis of the data of the third month of intervention will be ready by the time of congress to present.

**WSC-1590****Multidisciplinary Clinical Rehabilitation  
Computer cognitive training for patients with  
cognitive impairments in acute ischemic stroke**A Bezdenezhnykh<sup>1</sup>, S Prokopenko<sup>1</sup>, E Mozheyko<sup>1</sup>, T Koryagina<sup>1</sup>,  
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*Introduction:* The special complex of computer neuropsychological programs for cognitive training has shown effectiveness in patients with vascular cognitive impairments in early recovering period of stroke.

*Aim:* To evaluate effectiveness of neuropsychological computer programs for correction cognitive impairments in acute ischemic stroke.

*Methods:* Patients with cognitive impairments after hemispheric stroke in acute period ( $N = 100$ , age 45–65) were randomized into two groups. Patients in the intervention group had 10–14 daily training sessions with neuropsychological computer programs of 40 min duration for 2 weeks. The control group patients received standard treatment without special cognitive correction. Cognitive, neurological, affective and functional states were assessed before and after training period and in 6 months of follow-up.

*Results:* There were no statistically significant differences between groups after 10–12 days of poststroke period (MMSE, FAB, CDT, Speech tests). Significant improvements were found in the intervention group after 18–20 days of training and these changes did not decrease after 6–8 months of follow-up.

*Conclusions:* We found spontaneous improvements of cognitive functions after 10–12 days of stroke. We discovered persistent effectiveness of computer cognitive training for patients using neuropsychological computer programs from 10–12 to 18–20 days after stroke.

**WSC-1113****Multidisciplinary Clinical Rehabilitation  
The effects of upper limb motor function, spasticity,  
postural stability on reaching motor performance in  
subjects with stroke**C Bozdemir Ozel<sup>1</sup>, R Demirtas<sup>2</sup><sup>1</sup>Faculty of Health Sciences, Hacettepe University, Ankara,  
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*Introduction:* Postural control during reaching forward is dependent on many factors.

*Objective:* To evaluate the effects of upper limb motor function, spasticity, postural stability on reaching motor performance in patients with stroke.

*Methods and Materials:* Twenty poststroke hemiparetic subjects whose Brunnstrom upper extremity recovery scores were 3 and above were assessed using the Functional Reach Test, Brunnstrom Motor Function

Test of arm (BRS-A), the Fugl-Meyer motor scale (FMMS), Modified Ashworth Scale for upper limb muscles, the Trunk Impairment Scale (TIS), the Melsbroek Disability Scoring Test (MDST), the Berg Balance Test (BBT) and the Rivermead Mobility Index (RMI). The arm reaching forward was recorded as 3 stages according to loss balance while trying/ requires external supports; can reach forward more than 5 cm safely and can reach forward confidently more than 25 cm.

**Results:** The arm reaching forward increased while FMMS arm score ( $p = 0.001$ ), dynamic sitting balance ( $p = 0.027$ ), coordination ( $p = 0.012$ ) subscales and total scores ( $p = 0.008$ ) of TIS, BBT ( $p = 0.000$ ) and RMI ( $p = 0.024$ ) scores. The arm reaching forward decreased while spasticity of the latissimus dorsi ( $p = 0.004$ ), biceps brachii ( $p = 0.001$ ), pronators of forearm ( $p = 0.004$ ), flexors of wrist and hand fingers ( $p = 0.004$ ) and MDST score ( $p = 0.040$ ) increased.

**Conclusion:** These results show that not only upper limb motor function but also spasticity of upper limb muscles and postural stability adversely affects the reaching performance in subjects with stroke. That's why, the physiotherapy modalities used to inhibit spasticity and improve postural stability should be also added to rehabilitation programs of the subjects with stroke.

### WSC-1098

#### Multidisciplinary Clinical Rehabilitation Mobility level and preservation of some functions in stroke patients

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**Introduction:** A stroke usually causes problems in movement controlling.

**Aim:** We wanted to determine the relationship between the degree of mobility of patients after stroke with impairment of some bodily functions.

**Methodology:** In a sample of 92 patients, we compared the state of mobility in relation to age, sex, neurological damage to the body, the presence of urinary tract infections, speech disorders, the ability to control urination, defecation, etc..

**Results:** The average age of the sample was 70.17 years, with approximately equal gender representation. Data were taken on average 32.64 days after stroke.

The sample consisted of 32.60% independently moving patients, 13.00% moving to comply, 14.10% of patients using mobile tool and 40.20% immobile patients. 39.13% of patients have urinary tract infection, 66.30% needed help with personal hygiene, 33.69% of the sample has no defecation control and 42.39% of patients have urinary incontinence.

Communication disorders had 41.30% of the sample, problems swallowing 17.39% and the occurrence of pressure changes on the skin 3.26% of the sample. 19.56% of the sample had dizziness, 13.04% headache and 2.17% vomiting.

Pressure ulcers and dysphagia, as a rule, occurred in immobile patients, and most immobile patients had difficulties in urination, defecation, personal hygiene and urinary tract infections.

**Conclusion:** The largest number of immobile patients had problems communicating, swallowing, urinary tract infection, problems in controlling urination and defecation, and difficulties in maintaining personal hygiene and were mostly dependent on someone else's care and support. Other categories of patients had lower degree of dependence and complications.

### WSC-0586

#### Multidisciplinary Clinical Rehabilitation Improving access to psychology services in Australian rehabilitation hospitals: Could a telemedicine service be feasible?

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**Background:** Early detection and management of neuropsychological impairments can improve outcome. However, few patients with stroke have access to psychology services.

**Aims:** To illustrate the potential benefits of a telemedicine service to provide a rationale for improving access to neuropsychological services in 5 sub-acute rural hospitals located in Victoria (Australia).

**Methods:** A decision-analytic model was developed using best available data including the National Stroke Foundation Audit of Rehabilitation Services (2010 and 2012), Victorian Department of Health hospital separations data, reference hospital data for the cost of transfers, salaries and bed days. Descriptive statistics and multivariable median regression with adjustment for known confounders (i.e. age, gender and stroke severity) were undertaken to determine differences in length of stay used as input variables for the model. Three scenarios were compared to current practice access: a) increase local clinicians (private services); b) transport patients to urban services; and c) telemedicine.

**Results:** Among 305 separations in 2012, 265 (87%) were predicted to have a neuropsychological impairment (cognitive or mood disorder) and 45% would require psychology services ( $n = 115$ ). Based on 2010 audit data only 4% ( $n = 10$ ) would be seen by psychology (current practice estimate). Patients who require psychology assessment have an 8-day longer length of stay (95% CI 5–11 extra days). Average costs per patient was the least for the Telemedicine scenario (AUD710 versus AUD4179 [more local clinicians], AUD2200 [transport] and AUD5200 [current practice]).

**Conclusion:** Telemedicine neuropsychology services could reduce waiting times and reduce the burden of neuropsychological impairment in stroke survivors.

### WSC-0993

#### Multidisciplinary Clinical Rehabilitation Melodic intonation therapy: Application to Turkish patients with aphasia

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**Introduction:** The Melodic Intonation Therapy is designed to facilitate speech production of nonfluent aphasic patients from intoning 2–3 syllables to speaking 6+ syllables. The program consists of 3 levels including automated speech, common words and phrases. MIT uses the melodic elements of speech, such as intonation and rhythm, to facilitate and improve language production. Although there is a controversy among clinicians about the effectiveness of MIT, it has been translated into several languages and is frequently applied in clinics.

**Aim:** This study, we investigated the probability of the ability of patients with right – side hemiplegia and severe apraxia to communicate independently after Melodic Intonation Therapy (MIT).

**Methods:** 14 Subjects were suffering from aphasia after left hemisphere stroke, time poststroke 2–3 months, premorbidly right-handed, age 18–67, native speaker of Turkish, that were admitted to our clinic between August 2011 and February 2014. Participants' MRI images were used for CVO localizations. Gülhane Aphasia Battery and our university clinics' motor speech protocol were completed before and completion of therapy. Sessions were 1:1 bases, twice a week for 45 minutes.

**Results:** There was an increase in the scores of spontaneous speech, functional automatic speech, and Wh- questions. The phrase length was improved from single words to 3+ words.

**Conclusion:** MIT is not an appropriate technique for all. These results underline the importance of carefully selecting utterances to be trained. MIT should be tailor-made, training sentences that are functionally relevant for the individual patient.

### WSC-0692

#### Multidisciplinary Clinical Rehabilitation Spontaneous swallow frequency and dysphagia/stroke related outcomes in acute stroke

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**Introduction/Aims:** We examined dysphagia and stroke related outcomes in acute stroke patients subsequent to dysphagia screening with spontaneous swallow frequency analysis (SFA).

**Methods:** 96 stroke patients received dysphagia screening via SFA within 3 days following symptom onset. Dysphagia and stroke severity were assessed with standard scales. Dysphagia related outcomes were monitored via electronic medical record including: length of stay, infections, referral for dysphagia evaluation, dysphagia treatment, PEG placement, dysphagia at discharge, diet level at discharge, institutionalization, and death. Univariate statistics were used to investigate associations between SFA and dysphagia/stroke related outcomes.

**Results:** Dysphagia prevalence at baseline was 38%. Mean swallow frequency rate was lower rates in patients with dysphagia (0.51 vs. 0.27;  $p < 0.0001$ ). At baseline SFA was significantly correlated with dysphagia ( $r = 0.30$ ,  $p = 0.003$ ), diet level ( $r = 0.32$ ,  $p = 0.002$ ), disability ( $r = 0.28$ ,  $p = 0.007$ ), and handicap ( $r = 0.34$ ,  $p = 0.001$ ), but not stroke severity, age, or time to screening. Baseline SFA was significantly associated with length of stay and comprehensive dysphagia assessment during acute care ( $t = 2.14$ ,  $p = 0.04$ ). Baseline SFA was also associated with dysphagia ( $t = 1.99$ ,  $p = 0.05$ ), modified diet ( $t = 2.25$ ,  $p = 0.02$ ), disability ( $t = 2.21$ ,  $p = 0.03$ ), and handicap ( $t = 2.38$ ,  $p = 0.02$ ) at discharge.

**Conclusions:** As a dysphagia screening tool, spontaneous SFA has high potential to identify dysphagia and is associated with dysphagia and stroke related outcomes in acute stroke.

### WSC-0243

#### Multidisciplinary Clinical Rehabilitation Prognosis and severity of young woman's stroke

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**Introduction:** The Stroke in women is a condition in progress. The prognosis of this condition depends on a number of factors, the greater longevity of women, the conditions specific to women such as pregnancy, oral contraceptives or hormone replacement therapy for menopause.

**Aims:** Our aims are to determine the severity and prognosis of stroke in young women.

**Methods:** This is a descriptive cross-sectional study from 1 September 2012 to 31 May 2013, conducted the service of Neurology CHNU FANN. Fifty-two patients of childbearing activity aged 15 years and 49 years and with a confirmed by brain imaging stroke were included in our study.

**Results:** The average age of patients was 35 years, 75% were married. 34.6% of patients had a family history high blood pressure. We noted 24 cases of ischemic stroke (46%) and 28 cases of hemorrhagic stroke (54%). 36 patients (69.2%) had grade 4 Rankin while 73.1% had an NIHSS score of between 5 and 15. The average hospital stay was 21 days. The outcome was favorable in more than half of the patients, but most had neurological sequel.

**Conclusion:** Stroke of the young woman imposes appropriate care and specific because of its severity and prognosis sometimes reserved.

### WSC-0729

#### Multidisciplinary Clinical Rehabilitation The impact of neurorehabilitation software versus Mozart's music on hemiparetic patients using SPECT imaging: A randomized control trial study

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**Introduction:** Stroke is blamed for sustained impairments in 5 million people per year. Recent evidence has demonstrated the use of music, especially Mozart's works and specialized computer software as novel noninvasive methods which could improve recovery of cognition, motor, gait and balance involving the top-down system of brain.

**Aims:** With the goal of bringing neuroscience into practice, we aim to determine and compare the effects of computer neurorehabilitation software and Mozart's music on brain plasticity and clinical improvement of patients suffering from hemiparesis after acute stroke.

**Methods:** In this study, we present a multiple blind randomized control trial including 60 patients aged 30–60 years old with acute stroke. Patients were divided into 4 groups. For 6 months, the patients were asked to perform as following instructions for 1 hour, every night. In the first group, patients were given a computer rehabilitation software to play designed to improve motor and premotor cortex function. In the second group Mozart's sonata, K.448, was given to patients to listen and in third group; music was played in the background of computer software during the patients played. The forth group was control and did not receive any intervention. SPECT imaging, Fugl-Meyer Assessment of Physical Performance and MMSE tests are performed before, at third and sixth month of intervention.

**Results and Conclusion:** This is an ongoing study and the results are not ready yet but the analysis of the data of the third month of intervention will be ready by the time of congress to present.

### WSC-1076

#### Multidisciplinary Clinical Rehabilitation Associations of upper limb motor function, trunk control and activity of daily living in patients with stroke

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**Introduction:** The upper limb motor function (ULMF) is a predictor of both the upper limb disability and activity of daily living (ADL). But, correlation of ULMF and trunk control is known less.

**Aims:** To investigate the correlations of ULMF, trunk control and ADL in patients with stroke.

**Methods:** The patients with stroke whose stroke duration was 3 months and more, are participated in this study. The ULMF of the patients were evaluated with the Fugl-Meyer motor scale (FMMS). To assessment the trunk motor function (TMF), the Trunk Impairment Scale (TIS) and the Melsbroek Disability Scoring Test (MDST) were used. The ADL was assessed with the Barthel Index (BI) and Functional Independence Measurement (FIM).

**Results:** Twenty patients with stroke (mean age:  $53,7 \pm 9,83$  years) were participated in the study. There were significant associations of FMMS arm score with static sitting balance ( $r = ,445$   $p = 0.049$ ), dynamic sitting balance ( $r = ,664$   $p = 0.001$ ), coordination ( $r = ,626$   $p = 0.003$ ) subscales and total ( $r = ,772$   $p = 0.000$ ) scores of TIS and MDST score ( $r = -,587$   $p = 0.007$ ). BI and FIM were correlated to FMMS arm scores ( $r = ,805$   $p = 0.001$ ;  $r = ,677$   $p = 0.001$ ), dynamic sitting balance ( $r = ,570$   $p = 0.009$ ;  $r = ,415$   $p = 0.069$ ), coordination ( $r = ,488$   $p = 0.029$ ;  $r = ,485$   $p = 0.030$ ) subscales and total ( $r = ,713$   $p = 0.000$ ;  $r = -,555$   $p = 0.011$ ) scores of TIS and MDST score ( $r = -,770$   $p = 0.000$ ;  $r = -,596$   $p = 0.006$ ), respectively.

**Conclusion:** The arm motor function was negatively affected with impairment of TMF. So, the upper limb disability and impairment of TMF were reflected to ADL. Therefore, the rehabilitation programs should be also included the trunk exercises to improve the ULMF and ADL in patients with stroke.

### WSC-0987

#### Multidisciplinary Clinical Rehabilitation REsources And Life Strategy Management (REALISM) trial: Protocol for a stroke rehabilitation intervention using a goal setting and attainment framework

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**Introduction:** Some key considerations for a stroke rehabilitation intervention framework should accommodate for life management changes, alterations to self-regulation and acknowledge losses that individuals experience poststroke. One such framework that may be considered for use with a rehabilitative orientation is the Baltes and Baltes Model of Selective Optimization with Compensation (SOC). A proposed intervention called REsources And Life Strategy Management (REALISM) was developed based on the SOC Model.

**Aims:** The proposed aim is to determine if the REALISM intervention improves outcome poststroke in comparison to standard care.

**Methods:** The intervention REALISM will involve providing patients with a training program on managing short- and long-term effects at 4 weeks, 3 and 6 months poststroke using a goal setting and attainment care plan based on the adaptive strategies selection, optimization and compensation. The intervention study will be a single-blinded randomized control trial where the control group will receive standard care and the intervention group the REALISM training program.

**Results:** Primary outcomes will determine improvements in metacognition measured by the Meta-cognition Questionnaire 30, self-regulation measured by the Self-regulatory Interview and executive function using the Trial Making Test (A+B). Secondary outcomes will include functional ability, health-related quality of life and mood.

**Conclusions:** Findings from this intervention study will establish if the use of the REALISM training program for stroke patients and their carers' in using life management strategies will improve self-care, wellbeing and transferability of care, aiding discharge planning from acute to community settings.

### WSC-0976

#### Multidisciplinary Clinical Rehabilitation Metacognitive function poststroke: A review of definition and assessment

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**Introduction:** Metacognition is generally defined as the knowledge individuals have about their own cognitive abilities and the regulation of these activities through the use of processes to coordinate cognition. Many authors have defined and used the concepts metacognition and executive function interchangeably, resulting in these concepts not clearly differentiated and lacking clarity regarding their shared and unique characteristics.

**Aims:** The aim of this review was to identify the definitions and assessment tools used to examine the concept metacognition in stroke studies.

**Methods:** A computer database search was conducted using PubMed, CINAHL, PsychINFO and the Cochrane Library. Search terms included those relevant to the assessment of metacognition following stroke. We assessed all studies retrieved against specific inclusion criteria, excluded executive function and collated only those studies that emphasized subjective assessment of metacognitive function in stroke patients.

**Results:** A total of 647 publications were retrieved from the initial database search and  $n = 16$  articles remained eligible after inclusion criteria applied. Twelve studies were cross-sectional descriptive studies and  $n = 3$  were intervention and/or case studies where metacognition was referred to mainly as awareness of deficits. Only one author ( $n = 3$  articles) defined metacognition similar to its generic context within the neuropsychological literature. Assessment tools also varied greatly including assessment of meta-memory, self-awareness deficits, cognitive complaints and self-regulation skills.

**Conclusions:** Although, there have been a number of recent reviews conducted on executive functioning and awareness deficits, there still remains to be poor clarification and differentiation of these cognitive functions from a conceptual and methodological perspective.

### WSC-0923

#### Multidisciplinary Clinical Rehabilitation Long-term outcomes related to bone health in stroke patients

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**Aims:** Stroke survivors have an increase of fall risk and greater bone loss entailing higher risk for hip fracture. Fracture risk is higher during the 1<sup>st</sup> y after stroke and more common in the paretic side. However, no longitudinal studies with longer  $>3$  y follow-up are available and thus may result in an underestimation of the rate of fractures. The aim of this study was to know the hip fracture risk and factors associated in stroke survivors followed for  $>5$  y.

**Methods:** Consecutively hospitalized acute stroke patients for rehabilitation management (period 2000–2007) were included. In 2012, a telephone survey (cognitive and functional status, falls, drug treatments and fragility fractures) was fulfilled.

**Results:** 1071 stroke survivors were included: 301 had died in this period, 96 could not be located and telephonic surveys were fulfilled in 674 patients. Only the 15% were taking some preventive treatment for osteoporosis. Hip fracture was reported in 43 patients (6.3%); 69.7% of them in the hemiparetic side, occurring at  $41.3 \pm 28.9$  months poststroke.

Patients with hip fracture presented no differences in cognitive status or drug treatments. However, patients with hip fracture after the stroke presented a higher rate of institutionalization ( $p = 0.01$ ), disability (Rankin 4–5) ( $p = 0.01$ ), nonindependent walking ( $p = 0.01$ ) and dependence on ADL ( $p = 0.08$ ) at the time of the survey.

**Conclusions:** Hip fracture affects the 6.3% of stroke survivors in this study, presenting >3 y after stroke in the 50%. Preventive treatments are applied too infrequently even though stroke patients suffering a hip fracture have a higher rate of institutionalization and disability.

#### WSC-0845

### Multidisciplinary Clinical Rehabilitation Physical activity level in subacute ambulatory stroke patients and its relation with nonmotor functions

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**Aims:** The role and importance of physical activity in the prevention of diseases is known. The aim of our study were evaluated physical activity level (PAL) in patients with subacute ambulatory stroke within the community and determined nonmotor symptoms that may influence on PALs.

**Methods:** Thirty subacute stroke patients with level 3 and above according to functional ambulation category ( $65.2 \pm 12.6$  years) and thirty subjects who had not previously stroke ( $61.7 \pm 7.5$  years) were included to study. PAL were evaluated by "International Physical Activity Questionnaire (Short Form)", and depression level were investigated by "Geriatric Depression Scale." "Standardized Mini Mental State Examination" was performed to assess cognitive status and "Apathy Rating Scale" was applied to determine the level of apathy.

**Results:** There are not significant difference in age, gender, education, level of dyspnea, depression and cognitive status between patients and control group ( $p > 0.05$ ). PAL was significantly higher in healthy group ( $p < 0.0001$ ), and apathy level was significantly higher in patients with stroke ( $p = 0.002$ ). There were not found any relationship between PAL, and apathy degree, cognitive status and depression scores in patients with stroke ( $p > 0.05$ ).

**Conclusion:** PAL is thought to be more affected by motor functions in stroke. When compared with healthy individuals, apathy level was found high and PAL was found low in patients with subacute ambulatory stroke in our study. When PAL was evaluated in terms of nonmotor functions, our study has been shown that PAL was not influenced with nonmotor symptoms in patients who have lesser influenced in terms of motor functions.

#### WSC-0938

### Multidisciplinary Clinical Rehabilitation Stroke research productivity between the years of 2009 and 2013: Perspective of Turkey

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**Introduction:** While stroke is the second leading cause of death and disability, investigations about prevention, treatment and rehabilitation continue on.

**Aims:** Our objective in this study is to examine studies on stroke during 2009–2013 in Turkey.

**Methods:** 102 journals were searched during 2009–2013 in the Turkish National Citation Index (additionally *Turkish Journal of Physiotherapy Rehabilitation*). Journals were held preliminary elimination by issues and 807 volumes of 52 journals within the General Medical Journals were examined one by one. Total volume was 98 in *Turkish Journal of Physical Medicine and Rehabilitation*, *Journal of Neurological Sciences-Turkish*, *Turkish Neurosurgery*, *Turkish Journal of Neurology*, *Turkish Journal of Cerebrovascular Disease* and they were examined as site-specific journals. Studies were analyzed by type of study, issue and department.

**Results:** While 52 journals have a total of 807 volumes and 10146 articles, only 66 studies (28 original articles, 11 reviews, 17 case reports) were found related to the stroke within the General Medical Journals. 26, 15, 20, 16, 20 articles were found in 2009, 2010, 2011, 2012, 2013 respectively. While site-specific journals have 92 volumes and 1714 articles, 98 studies were found. 22, 19, 15, 16, 26 articles were found in 2009, 2010, 2011, 2012, 2013 respectively. *Turkish Journal of Physiotherapy Rehabilitation* has no articles.

**Conclusions:** Although there are some studies related to the stroke in Turkey, the number of these studies is not enough while its important for the public and health progression, especially in General Medical Journals. We expect more original articles will be published in recent future.

#### WSC-1107

### Multidisciplinary Clinical Rehabilitation Modified forced used therapy can change balance in poststroke hemiparetic subjects

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Forced Used Therapy is a rehabilitation technique developed to improve use of the paretic upper limb after stroke. The goal of this technique is reversing the learned nonuse, condition found in poststroke chronic patients. The literature shows how effective is this technique and variations for the rehabilitation of paretic upper limb. However, we didn't find works that evaluate the effects on lower limb. This study aim to evaluate the modified FUT (mFUT) effects in the lower limbs, specifically in balance. For that we evaluate before, during, immediately after treatment and 90 days follow-up. This study included 14 hemiparetic poststroke, independent sex. The immobilization of nonparetic upper limb was made by a tubular mesh, 24 hours-day, 5 days-week, for 4 weeks. Subjects were evaluated 4 times (Start, 2 and 4 weeks of treatment and 90 days follow-up). We evaluate the balance with a force platform (EMG System do Brazil, Sao Jose dos Campos). We analyzed the anteroposterior and mediolateral average position. The data was analyzed by ANOVA and *Holm-Sidak post hoc*,  $p < 0.05$ . We found patients who had different starts, some posterior, others anterior. The same happened to medium lateral position. This fact was used to clustered the patients in subgroups according the starts (posterior, anterior, left and right). We found that the balance was affected by the restriction, posterior ( $F = 8.693$ ;  $p < 0.001$ ), anterior ( $F = 2.027$ ;  $p = 0.164$ ), left ( $F = 0.838$ ;  $p = 0.483$ ) and right ( $F = 3.477$ ;  $p < 0.05$ ). This data show mFUT as effective to change the balance in hemiparetic poststroke.

**WSC-1110****Multidisciplinary Clinical Rehabilitation  
Analysis of 4 weeks and follow up after constriction  
of nonparetic upper limb poststroke**A Fuzaro<sup>1</sup>, T P Dos Santos<sup>1</sup>, T S Mucciaroni<sup>1</sup>, J E De Araujo<sup>1</sup><sup>1</sup>*Department of Biomechanics Medicine and Rehabilitation of Locomotor Apparatus, Medicine School of Ribeirao Preto of University of Sao Paulo, Ribeirao Preto, Brazil*

The Forced Used Therapy (FUT) is used in the rehabilitation of patients after stroke to reverse the learned nonuse. We have a shortage studies about the constriction effects in nonparetic upper limb (NPUL), this study aims to analyze the impact caused by that. Eighteen hemiparetic poststroke patients were randomized into two groups, the FUT (FUTG), which received the constriction for 4 weeks, 24 hours a day, 5 days a week and control group (CG), which received conventional physical therapy for 4 weeks, 2 times a week. We used a handgrip dynamometer (Saehan, Korea), a surface electromyography equipment (EMG System, Brazil) in the extensor muscles of the wrist and the Wolf Motor Function Test (WMFT). For the data obtained in GTUF an ANOVA was used, while for the GC, the paired t test and for intergroup comparison (IC), the t test,  $p < 0.05$ . No statistically significant differences were found for grip strength in GTUF ( $F = 0.44$ ;  $p = 0.72$ ), in CG ( $t = 0.17$ ;  $p = 0.87$ ) and IC ( $t = 0.33$ ;  $p = 0.74$ ). Neither for the electromyography data in GTUF ( $F = 0.43$ ;  $p = 0.73$ ), in GT ( $t = 0.98$ ;  $p = 0.39$ ) and the IC ( $t = 1.17$ ;  $p = 0.25$ ). In the same direction, the overall average obtained by WMFT in GTUF ( $F = 2.15$ ;  $p = 0.10$ ) in CG ( $t = 2.7$ ;  $p = 0.07$ ) and IC ( $t = 0.36$ ;  $p = 0.72$ ). Analyzing the activities individually, we only found significant differences in the extend elbow in GT activity ( $t = 7.16$ ,  $p = 0.006$ ) and turn key in lock GTUF ( $F = 4.24$ ,  $p = 0.01$ ). Our data show there is no motor damage to NPUL after receiving the constriction used in this protocol.

**WSC-1115****Multidisciplinary Clinical Rehabilitation  
Evidences of anteroposterior and mediolateral  
displacement poststroke**A Fuzaro<sup>1</sup>, T S Mucciaroni<sup>1</sup>, T P Dos Santos<sup>1</sup>, J E De Araujo<sup>1</sup><sup>1</sup>*Department of Biomechanics Medicine and Rehabilitation of Locomotor Apparatus, Medicine School of Ribeirao Preto of University of Sao Paulo, Ribeirao Preto, Brazil*

Stroke is a neurological disorder that can produce postural changes in the affected patients. The aim of this study was to analyze the anteroposterior and mediolateral displacement of the center of pressure in hemiparetic patients after stroke through the static stabilometry. The sample consisted of 65 patients who suffered stroke and was being treated at the Center of Integrated Rehabilitation of HE FMRP/USP. Of these patients, 39 had right hemiparesis and 29, left hemiparesis. For stabilometry, was used a force platform EMG System of Brazil. The patients were analyzed in four subgroups: group with right displacement ( $n = 7$ ), group with left displacement ( $n = 58$ ), group with anterior displacement ( $n = 21$ ) and group with posterior displacement ( $n = 44$ ). The assessment was performed with bipedal support and with their eyes opened. For statistical analysis, we used the *t*-test, significant values  $p < 0.05$ . The mediolateral analysis showed that most patients shifted to the left ( $n = 58$ ), and comparing the amount of displacement, there were no differences between the displacement to the right or to the left ( $t = -1.588$ ;  $p = 0.177$ ). In the anteroposterior analysis, we could observe that most patients shifted to the posterior ( $n = 44$ ), and comparing the amount of displacement, the displacement to posterior was larger than to anterior ( $t = 2.191$ ;  $p < 0.05$ ). Our data showed that regardless of the side of hemiparesis, postural pattern is posterior and left displacement of the center of pressure; moreover, the posterior displacement was the most significant.

**WSC-0708****Multidisciplinary Clinical Rehabilitation  
Very early rehabilitation in speech (verse): Progress  
report on an Australian randomized controlled trial of  
aphasia therapy after stroke**E Godecke<sup>1</sup>, E Armstrong<sup>1</sup>, J Bernhardt<sup>2</sup>, S Middleton<sup>3</sup>, T Rai<sup>4</sup>, D Cadilhac<sup>5</sup>, A Whitworth<sup>6</sup>, M Rose<sup>7</sup>, N Ciccone<sup>1</sup>, G J Hankey<sup>8</sup>, A Holland<sup>9</sup><sup>1</sup>*Psychology and Social Science, Edith Cowan University, Perth, Australia*<sup>2</sup>*Stroke, The Florey Institute of Neuroscience and Mental Health, Melbourne, Australia*<sup>3</sup>*Faculty of Health Sciences, St Vincent's & Mater Health Sydney and Australian Catholic University, Sydney, Australia*<sup>4</sup>*School of Mathematical Sciences, University of Technology Sydney, Sydney, Australia*<sup>5</sup>*Translational Public Health Stroke and Ageing Research, Monash University, Melbourne, Australia*<sup>6</sup>*Psychology, Curtin University of Technology, Perth, Australia*<sup>7</sup>*Human Communication Sciences, La Trobe University, Melbourne, Australia*<sup>8</sup>*School of Medicine and Pharmacology, University of Western Australia, Perth, Australia*<sup>9</sup>*Speech Language and Hearing Sciences, University of Arizona, Tucson, USA*

**Background:** Results of studies investigating the effects of very early and early aphasia rehabilitation are equivocal. The Cochrane Review stated there was "insufficient evidence to establish the effectiveness of one speech and language therapy approach over another".

**Aims:** This research aims to determine if early intensive aphasia rehabilitation is more effective and cost saving than usual ward based rehabilitation when therapy is commenced early in stroke recovery.

**Methods:** This 3-arm, prospective, randomized, open-label, single-blinded controlled trial has an endpoint (aphasia quotient score) at 3 months. Participants with acute poststroke aphasia will be randomized to usual care (UC), usual care-plus (UC-Plus) or VERSE therapy. UC therapy is usual ward based aphasia therapy; UC-Plus is usual ward based therapy but provided daily, and VERSE therapy is a prescribed aphasia therapy intervention provided on a daily basis. Therapy will commence before day 14 poststroke and will be provided for 20 sessions. Twelve sites across Australian will recruit participants with mild to severe poststroke aphasia. **Discussion:** This study is the first in Australia, and one of the first in the world to address the research gaps in early aphasia intervention, using a robust study design. This research will determine if a prescribed type and amount of aphasia therapy will enhance spontaneous communication recovery within the first 3 months poststroke. It will provide the first prospective cost effectiveness data for aphasia after stroke. A detailed rationale and methodology for the study will be presented.

**WSC-1584****Multidisciplinary Clinical Rehabilitation  
Scarcity of scientific information on stroke survivors'  
medical rehabilitation in Ukrainian medical journals:  
Pilot systematic review**D V Gulyayev<sup>1</sup>, M V Gulyayeva<sup>1</sup><sup>1</sup>*Scientific Educational and Publishing Projects, Ukrainian Anti-Stroke Association, Kiev, Ukraine*

**Introduction:** We have not met in Ukrainian literature any assessments of availability and quality of information on stroke victims' rehabilitation.

**Methods:** Manual search of articles, directly or indirectly related to the subject "medical rehabilitation of stroke patients", published in 2009–2014 by Ukrainian authors in all Ukrainian journals on neurology and reha-

bilitation, available in the National Medical Library of Ukraine. Assessment of articles numbers by year and type, and evaluation of research articles quality.

**Results:** The numbers of articles by year and type are presented in Table 1. Most of articles were of undefined category “other” – i.e. neither research, nor review, – representing mainly opinions of their authors, and without any strong evidence. Quality of all research articles, particularly scored using PEDro Scale, was extremely poor.

**Table 1** Numbers of articles by year and type

	2009	2010	2011	2012	2013	2014	Totally
Research	1	3	3	1	2	–	10
Review	1	1	1	2	–	–	5
Other	3	9	6	7	4	4	33
Totally	5	13	10	10	6	4	48

**Conclusions:** Problems of stroke victims’ rehabilitation are underrepresented in Ukrainian medical literature, without any trend to improvement. Attention of Ukrainian stroke specialists to the problems of medical rehabilitation of stroke survivors is urgently required. It is appropriate for the medical institutions involved into stroke care in Ukraine to schedule multidirectional activities for development of this area of stroke medicine. Editorial boards of Ukrainian medical journals have to pay more attention to quality of publications in this field.

### WSC-1283

#### Multidisciplinary Clinical Rehabilitation Development and clinical trial of a simple training-assistance robot with motion angle assistance for the upper extremities in stroke patients: A preliminary study

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**Introduction:** It is desirable that the rehabilitation staff provides ample rehabilitative training for stroke patients in spite of human resource limitations.

**Aims:** To develop a simple training-assistance robot for upper extremities in stroke patients, named Mirror Image Motion Arm Trainer with Assistance of the Motion Angle (MAMA), and to confirm its effectiveness as a preliminary study.

**Methods:** We asked the Kitakyushu Foundation for the Advancement of Industry Science and Technology to synergistically coordinate the fields of medicine, technology and local enterprise to develop MAMA, and then we evaluated this device for use by hemiplegic patients at a university hospital.

**Results:** MAMA consisted of two pairs of a grip attached to a rotor, touch panel on the desk, personal computer and two servomotors under the rotors. One of the following four training modes was selected by operating the touch panel: 1) passive mode, 2) active-assistive mode 1 and 2, 3) active mode. The patient sat at the desk, and was able to flex and extend their wrists with robotic assistance while holding the grips. Intensive occupational therapy including MAMA was applied in six stroke inpa-

tients, each of whom demonstrated improvements in the Fugl-Meyer Assessment, Modified Ashworth Scale and Wolf Motor Function Test after the 3-week intervention.

**Conclusion:** The advantages of MAMA include its moderate production cost, ease of operation and volitional mirror image motion training. Based on these results, MAMA is considered to be a useful device, and we have therefore initiated a randomized controlled study for chronic hemiplegic patients.

### WSC-0924

#### Multidisciplinary Clinical Rehabilitation Anxiety and depression are associated with poststroke fatigue (PSF)

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**Introduction:** Fatigue is one of the most frequently cited difficulties post-stroke. Rates of psychological distress are also elevated among this population. Research exploring the relationship between these two phenomena has focused extensively on depression while the role of anxiety has largely been overlooked.

**Aims:** Three different types of anxiety and their relationship with PSF were examined: generalized anxiety, health anxiety and stroke related anxiety. The role of positive psychological resources (i.e., coping strategies, social-support and self-compassion) in ameliorating distress was also explored. **Methods:** A cross-sectional design was used; participants (n = 98) completed a questionnaire battery within a 2-year timeframe poststroke assessing; fatigue, anxiety, depression, sleep-disturbance, pain, coping, social-support and self-compassion.

**Results:** High rates of fatigue (47%) were reported as measured by the Fatigue Assessment Scale (FAS). Participant’s scores on the Hospital Anxiety and Depression Scale (HADS) suggested much higher rates of anxiety (36.7%) than depression (15.3%). Significant relationships were observed between fatigue scores and scores on all three anxiety measures: HADS-Anxiety,  $r = .37$ ; Health Anxiety Inventory,  $r = .31$ ; and Stroke Anxiety Questionnaire,  $r = .33$  (all  $ps < .01$ ). A significant negative relationship was observed between psychological distress (HADS-Total) and scores on the Self-compassion Scale ( $r = -.44$ ,  $p < .01$ ). Regression analyses revealed that depression, anxiety, pain and sleep disturbance accounted for 32% of the variance in fatigue scores ( $p < .01$ ).

**Conclusions:** The findings highlight the importance of anxiety-related factors in understanding PSF as well as the influence of positive coping resources in ameliorating distress in this population.

### WSC-0413

#### Multidisciplinary Clinical Rehabilitation Factor affecting walking ability for severe hemiplegic patients using a logistic regression analysis in a convalescence rehabilitation ward

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**Aims:** The purpose of this study was to consider the relationship between the physical function on the admission and the ability of walking on the discharge in the convalescence rehabilitation ward.

**Subjects:** Fifty-six first attack stroke patients with severe hemiplegic in the lower extremity at admission took part in this study. Their age were 39–84 years old (means age:  $62.6 \pm 10.8$ ), their primary disease was cerebral infarction in 39, cerebral hemorrhage in 12 and subarachnoid hemorrhage in 5. They all performed physical therapy with Knee-Ankle Foot Orthosis at admission.

**Methods:** We divided them using Functional Ambulation Classification into two group based on the ability of walking at discharge: the independent walking group ( $n = 38$ ) and the assistant walking group ( $n = 16$ ). The background factors (age, sex, duration from onset to admission, paretic side, disease), impairment factors (Japan Stroke Scale: JSS, Mini-Mental State examination: MMSE, presence of cognitive function: aphasia, apraxia and unilateral neglect, Trunk Control Test: TCT, muscle strength of nonparalyzed side leg) were compared in two groups. We also performed logistic regression analysis on each group.

**Result:** Age, MMSE, JSS, presence of function, TCT and muscle strength of nonparetic side leg were found to be significantly different between the groups. In this result of the logistic regression an discriminant analysis, Age (Odds ratio: 1.194), TCT(Odds ratio:0.906) was significantly related to the ability of ambulation at discharge.

**Conclusion:** We concluded that age and TCT are useful indicators for determining the prognosis of ability of walking for severe hemiplegic patients at discharge.

### WSC-1363

#### Multidisciplinary Clinical Rehabilitation Effect of repetitive transcranial magnetic stimulation in stroke patients with nonfluent aphasia

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**Introduction:** Previous research suggests that Transcranial Magnetic Stimulation (rTMS) applied to the right hemisphere can improve language function in patients with nonfluent aphasia. The current study further examined this issue in a random-controlled experiment in patients nonfluent aphasia patients.

**Aims:** To explore the effects of 10 Hz and 1 Hz rTMS upon the recovery of language function through stimulating the Broca's mirror area in the right hemisphere of patients with nonfluent aphasia following stroke.

**Methods:** Patients with nonfluent aphasia following stroke were randomly divided into 4 groups: high-frequency rTMS group (10 Hz), low-frequency rTMS group (1 Hz), sham stimulation group and control group. Patients of rTMS groups were treated with rTMS at the Broca's mirror area in right hemisphere, once a day, maintaining 10 minutes every time, and the treatment course was 10 days in total. Western Aphasia Battery was adopted to assess language ability before and after treatment, 2 months later after treatment.

**Results:** After rTMS treatment, patients of low-frequency rTMS group got obviously improved scores of spontaneous speech, hearing and AQ; and 2 months later after the treatment, patients treated with low-frequency rTMS got more obviously improved score of spontaneous speech and AQ.

**Conclusions:** Both low-frequency rTMS treatment and High-frequency rTMS treatment can improve language function, and the former is better. Low-frequency rTMS invention may inhibit the excitability of right hemisphere to reduce inhibition from the healthy hemisphere to the suffered one; the high-frequency rTMS may improve the language function through promoting the restructuring of language function areas in the cerebral cortex.

### WSC-0461

#### Multidisciplinary Clinical Rehabilitation Nicergoline and cilostazol decreases the function of norepinephrine transporter, which is known as cellular target of antidepressants

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**Introduction:** The norepinephrine (NE) transporter (NET) is selectively expressed at presynaptic sites in NE neurons and induces the termination of neurotransmission through NE reuptake into nerve terminals. NET is also critical target for various antidepressant and psychostimulants. Depression is considered to be a common and important neuropsychiatric poststroke complication. Moreover, apathy occurs in various neurological disorders including stroke. Nicergoline, an ergoline derivative, is used to treat various symptoms related to cerebrovascular disease including cognitive deficits and dizziness. Cilostazol is a selective phosphodiesterase III inhibitor that was originally prescribed as an anti-platelet agent, and increases cerebral blood flows in the cerebral infarction. Interestingly, the antidepressive effects of nicergoline and cilostazol on poststroke depression have been reported, but the exact mechanism of this action is unknown.

**Aims:** In this study, we examined the direct effects of nicergoline and cilostazol on NET function.

**Methods:** SK-N-SH cells were incubated with [<sup>3</sup>H]NE (0.1 μM) in the presence or absence of nicergoline and cilostazol to assess the norepinephrine uptake.

**Results:** Nicergoline and cilostazol decreased the [<sup>3</sup>H]NE uptake by SK-N-SH cells in a concentration-dependent manner (0.1–10 μM, 1–100 μM), respectively. The inhibitory effect of nicergoline was more effective than that of cilostazol. Eadie-Hofstee analysis showed that nicergoline induced a decrease in the maximal velocity ( $V_{max}$ ) of [<sup>3</sup>H]NE uptake with little change in the apparent Michaelis constant ( $K_m$ ), indicating noncompetitive inhibition.

**Conclusions:** These results indicate that nicergoline and cilostazol inhibit NET function at clinically relevant concentration, which is likely to show the antidepressant effect on poststroke depression.

## WSC-0825

**Multidisciplinary Clinical Rehabilitation**

The effect of obesity on functional outcome at 6 months after stroke: A prospective multicenter study

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**Introduction:** Previously, association between body mass index (BMI) and admission functional independent measure (FIM) score was reported. However, few studies investigated the value of obesity as a predictive factor of 6 months functional outcome after stroke.

**Aims:** The aim of this study is to examine whether BMI predicts the 6-month FIM after stroke onset with adjustment for cardiovascular disease risk factors socioeconomic position and health behavior factors in stroke patients.

**Methods:** This is an interim report of the Korean Stroke Cohort for Functioning and Rehabilitation (KosCo). The sample included 1,299 stroke patients, both ischemic and hemorrhagic, aged 18–92 years. FIM score was assessed at 6 months after stroke onset. Subjects were classified into three groups based on their baseline BMI categories at admission: normal ( $18.5 \leq \text{BMI} < 23$ ), overweight ( $23 \leq \text{BMI} < 25$ ), or obese ( $\text{BMI} \geq 25$ ) groups.

**Results:** The mean age was 64.1 ( $\pm 12.8$ ) years. The distribution of overweight and obese groups was 28.5% and 36.3%, respectively. The mean 6-month FIM was 109.3 ( $\pm 29.4$ ) and 107.1 ( $\pm 31.4$ ), respectively. The 6-month FIM significantly increased in obese group compared to the normal BMI group after adjustment for confounding factors. In the ischemic stroke, the 6-month FIM was increased in the obese group ( $p < 0.05$ ), but not in the hemorrhagic stroke.

**Conclusions:** This hospital-based cohort study showed that obesity measured by BMI may predict good 6 months functional outcome, especially, for the ischemic stroke patients (Supported by Korea Centers for Disease Control and Prevention (2013E3301700)).

## WSC-0822

**Multidisciplinary Clinical Rehabilitation**

**Diabetes mellitus and functional outcome at 6 months after stroke: A prospective multicenter study**

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**Introduction:** Few studies investigated the diabetes mellitus (DM) as a predictable factor of 6 months FIM outcome after stroke.

**Aims:** The aim of this study is to investigate whether DM predicts the outcome of FIM at 6-month after stroke with adjustment for cardiovascular disease risk factors, socioeconomic position and health behavior factors.

**Methods:** This is an interim report of the Korean Stroke Cohort for Functioning and Rehabilitation (KosCo). The sample included 1,199 stroke patients aged 45–92 years. FIM score was assessed at 6 months after onset. We divided subjects into two age groups: the middle aged (45–64 years old) and the elderly (over 65 years old). Subjects who met one of the following requirements were defined as having DM: taking an oral hyperglycemic agent, using insulin, clinical diagnosis of diabetes, or a fasting glucose level  $> 125$  mg/dL.

**Results:** The mean age of the middle aged group was 55.8 ( $\pm 5.44$ ) years old and the elderly group was 74.3 ( $\pm 6.14$ ) ( $p < 0.001$ ). The distribution of DM was 20.8% and 28.9%, respectively ( $p < 0.001$ ). The mean 6-month FIM was 115.9 and 101.1, respectively ( $p < 0.001$ ). The 6-Month FIM significantly decreased in DM group compared to the non DM group after adjustment for confounding factors. In the middle aged group, the 6-month FIM decreased in DM group ( $p < 0.01$ ), but in the elderly group.

**Conclusions:** This hospital-based cohort study showed that DM may predict poor 6-month FIM outcome, especially, for the middle aged group (Supported by Korea Centers for Disease Control and Prevention (2013E3301700)).

## WSC-0824

### Multidisciplinary Clinical Rehabilitation Normal fasting blood sugar level and functional outcome at 6 months after stroke: A prospective multicenter study

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**Introduction:** Few studies investigated the relationship between the normal fasting blood sugar (FBS) level at onset and functional outcome at 6 months after stroke.

**Aims:** The aim of this study is to investigate whether normal FBS level predicts 6-month FIM after adjustment for cardiovascular disease risk factors socioeconomic position and health behavior factors in Korean stroke patients.

**Methods:** This is an interim report of the Korean Stroke Cohort for Functioning and Rehabilitation (KosCo). The sample included 816 ischemic stroke patients aged 18–92 years. FIM score was assessed at 6 months after stroke onset. We divided subjects into three FBS levels according to FBS tertile: lower ( $70 \leq \text{FBS} < 104$  mg/dl), medium ( $104 \leq \text{FBS} < 118$  mg/dl), and higher ( $118 \leq \text{FBS} < 140$  mg/dl).

**Results:** The mean age of subjects was 63.2 ( $\pm 13.6$ ) years. The mean of discharge FIM and 6-month FIM was 97.3 ( $\pm 30.3$ ) and 108.8 ( $\pm 30.1$ ), respectively. The mean of discharge FIM for patients with lower, medium, and higher FBS level at onset was 99.0 ( $\pm 29.5$ ), 92.6 ( $\pm 31.6$ ), and 91.9 ( $\pm 35.5$ ), respectively ( $p < 0.05$ ); the mean of 6-month FIM 112.6 ( $\pm 26.9$ ), 108.2 ( $\pm 31.0$ ), and 105.7 ( $\pm 31.8$ ), respectively ( $p < 0.01$ ). The 6-month FIM significantly decreased in patients with higher and medium FBS levels compared to lower FBS levels after adjustment for confounding factors ( $p < 0.05$ ).

**Conclusions:** These hospital-based cohort study showed that higher and medium FBS level at onset may predict poor functional outcome at 6 months after stroke (Supported by Korea Centers for Disease Control and Prevention (2013E3301700)).

## WSC-0984

### Multidisciplinary Clinical Rehabilitation Development and evaluation of a smartphone-enabled carer-supported educational intervention for management of disabilities following stroke in India – Protocol for the research study

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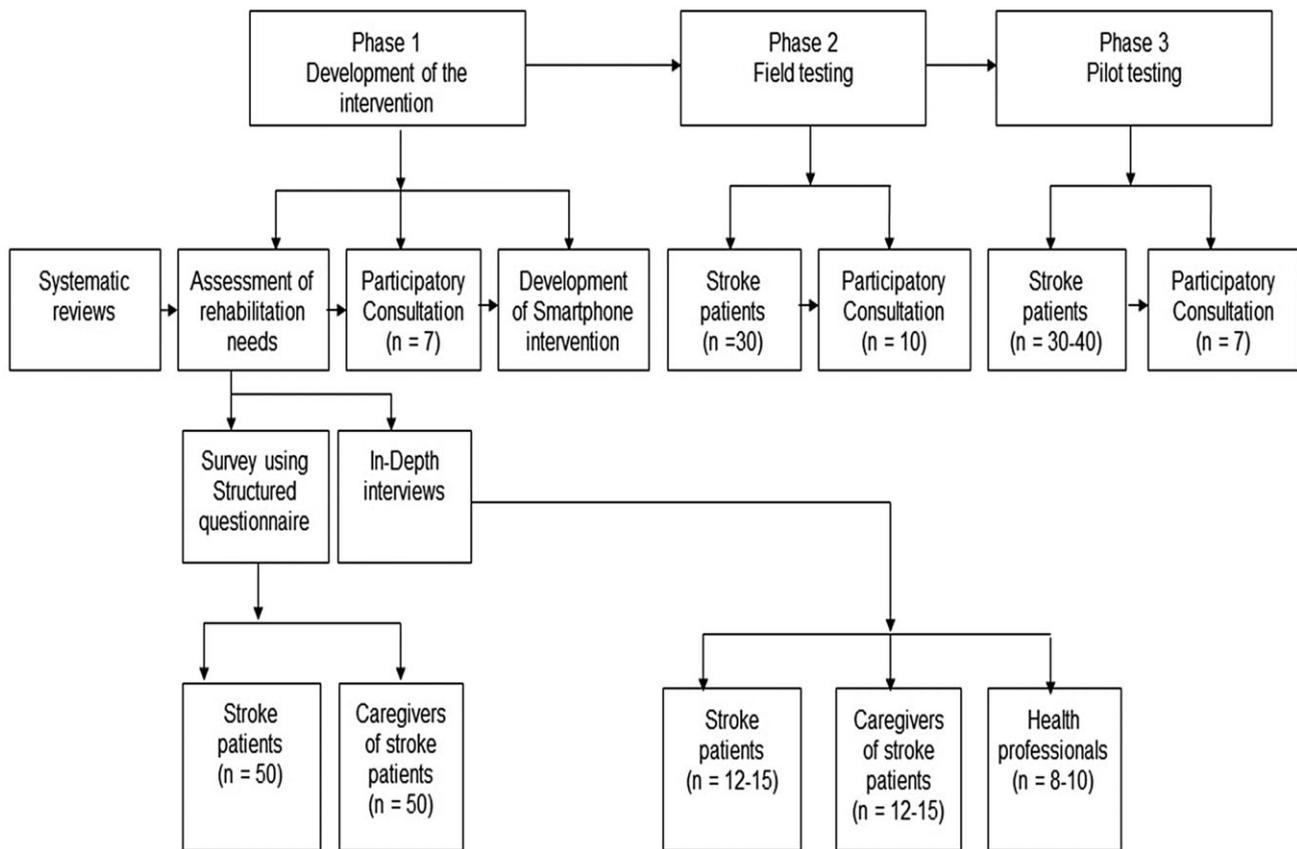
**Background:** The incidence and prevalence of stroke in India, has reached epidemic proportions and it is considered a major public health problem. The growing magnitude of disability in patients with stroke in India poses a major public health challenge. In addition, the availability of rehabilitation services for people with disabilities is inadequate in India. Thus, identification of cost-effective ways to rehabilitate people with stroke-related disability is of public health importance.

Educational interventions in stroke rehabilitation assist the stroke survivors to make informed decisions regarding their on-going treatment and self-manage their condition.

This formative research study aims to systematically develop an educational intervention for management of poststroke disability for stroke survivors in India and evaluate the feasibility and acceptability of delivering the intervention using Smartphones and with caregiver support.

**Methods:** The research study will be conducted in Chennai, India, and it will be organized in three different phases.

Ref:



I am applying a mixed methods approach to develop and evaluate the intervention.

**Expected Outcomes:** The proposed research will provide valuable information for clinicians and policy makers. If successful, it will help realize the potential of using Smartphone-enabled, carer-supported educational intervention to bridge the gaps in service access for rehabilitation of individuals with stroke-related disability in India.

## WSC-0628

### Multidisciplinary Clinical Rehabilitation Evaluation of automobile driving resumption in stroke patients using a simple driving simulator

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**Introduction:** Driving resumption is difficult problem in stroke patients.

**Aims:** To reveal the usefulness of a simple driving simulator (SiDS) by comparing simulation results between stroke patients who resumed driving and those who did not.

**Methods:** The subjects were 37 patients (mean age, 53.0 ± 11.5 years) with a 1-year history of stroke. They were divided into two groups, namely the resumed drivers (RDs) and nonresumed drivers (NRDs). The SiDS was developed by Katsuya Matsunaga. It consists of a personal computer, a steering wheel, game pedals, and software program. The SiDS examination consisted of a cognition-reaction time test, timing test, and driving test. The parameters obtained were as follows: (1) mean cognition-

reaction time, (2) standard deviation of the cognition-reaction time, (3) mean predicted error in the timing test, (4) standard deviation of the predicted error, and (5) rate of risky distance between cars in the driving test. The measurements obtained from both groups were analyzed using a *t* test.

**Results:** The numbers of RDs and NRDs were 22 and 15, respectively. The mean cognition-reaction time (RDs vs. NRDs) was: 0.84 ± 0.14 vs. 1.00 ± 0.21 (*p* < 0.01); its standard deviation, 0.11 ± 0.04 vs. 0.13 ± 0.05 (NS); predicted error in the timing test, 0.84 ± 1.58 vs. 0.63 ± 1.15 (NS); its standard deviation, 0.40 ± 0.71 vs. 0.37 ± 0.36 (NS); rate of risky distance, 23.9 ± 25.0 vs. 43.1 ± 26.9 (*p* < 0.05). The RDs had a faster mean cognition-reaction time and a lower rate of risky distance than the NRDs.

**Conclusions:** The SiDS is therefore considered to provide important information regarding driving resumption in stroke patients.

## WSC-0422

### Multidisciplinary Clinical Rehabilitation Early supported discharge promotes physical activity among stroke survivors

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**Introduction:** Recent work has demonstrated sedentary behaviors in patients in hospital stroke rehabilitation unit settings. Early supported discharge (ESD) is the preferred option for stroke survivors who are medically stable and can be rehabilitated at home. One possible benefit of ESD is increased intensity and frequency of physical activity through re-engagement with familiar domestic and social roles.

**Aim:** To test the hypothesis that physical activity would increase among stroke survivors at the transition from inpatient care to ESD.

**Methods:** An observational study of the physical activity behavior of stroke survivors before and after discharge with ESD. A physical activity monitor (ActivPal, Glasgow, UK) was located on the thigh during a 48-hour in-patient period and a second 48-hour period within a week of discharge to ESD. Statistical difference was tested with a one-way ANOVA. **Results:** Thirty stroke survivors (mean age 69, mean Rivermead mobility index 30) were recruited, 28 completed all follow up. There was a statistically significant ( $p = 0.018$ ) difference for number of steps taken, with around twice the number of steps taken during ESD ( $2716 \pm 2760$ ) compared to the in-patient stay ( $1280 \pm 1482$ ) a difference matched by time spent standing (in-patient = 125.9mins, ESD = 201.3 mins,  $p = 0.035$ ). The high variation in these values is typical of a heterogeneous population.

**Conclusion:** ESD to the home setting promotes physical activity. Further analysis of these results is necessary to understand why. A larger sample may allow us to identify specific groups that have more to gain with ESD as suggested by the high variability.

### WSC-0322

#### Multidisciplinary Clinical Rehabilitation Measuring the 45-minute quality standard of therapy intensity using data from the UK Sentinel Stroke National Audit Programme (SSNAP)

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**Introduction:** The National Institute for Health and Care Excellence (NICE) Quality Standard (QS) Statement 7 states, '45 minutes of physiotherapy, occupational therapy and speech and language therapy should be provided every weekday if the patient requires that amount and can tolerate it.'

**Aims:** As previous research has shown an association between intensity of therapy and patient outcome, the aim was to investigate if hospital stroke services were meeting the 45-minute standard.

**Methods:** A continuous, prospective national (England, Wales and Northern Ireland) clinical audit of stroke care (Sentinel Stroke National Audit Programme [SSNAP]), collected data from stroke patients discharged from hospital between 1 July and 30 September 2013.

A proxy measure for meeting the NICE QS-7 was calculated by combining percentage of patients requiring therapy, percentage of days each therapy received, and the number of therapy minutes received per day.

**Results:** Data on 15,109 stroke patients from 164 hospital or stroke unit teams were analyzed to calculate the intensity of treatment provided by 3 therapy professions (see Table 1).

**Table 1** Key indicators for therapy professions

Key indicator	Occupational therapy	Physiotherapy	Speech and language therapy
Patients requiring therapy at least once during inpatient stay n (%)	12040 (79.7)	12719 (84.2)	6926 (45.8)
Median number of minutes per day on which therapy is received	40	30	30
Median % of days as an inpatient when therapy is received	46.8	56.1	28.8
Proxy for NICE QS 7: % of the minutes of therapy required (according to NICE QS 7) which were delivered	58	51.9	24.6
Performance score* achieved by each team/unit, n (%)			
A,	33 (20)	15 (9)	8 (5)
B	19 (12)	42 (26)	11 (7)
C	61 (37)	33 (20)	27 (16)
D	22 (13)	50 (30)	17 (10)
E	29 (18)	24 (15)	101 (62)

\*'A' indicating the highest intensity of therapy provided.

**Conclusions:** Increasingly evidence shows that high levels of therapy intensity is desirable after stroke. This audit provides evidence of wide variation in intensity of therapy provided and between different types of therapy. SSNAP gives therapists an opportunity to understand the reasons behind these variation and evaluate their impact on patient outcomes.

### WSC-0215

#### Multidisciplinary Clinical Rehabilitation The prognostic value of the electrophysiologic parameters for the recovery of the motor functions in patients with stroke

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**Introduction:** We conducted this study to analyze correlations between baseline electrophysiological parameters and baseline motor and functional ones in patients with subacute stroke.

**Aims:** To identify the electrophysiological parameters with a predictive value for the motor and functional recovery after a 4-week rehabilitation.

**Methods:** We enrolled 60 patients with subacute stroke. Electrophysiological parameters include the SSEP, compound motor action potential (CMAP) and sensory nerve action potential (SNAP) amplitude ratio. Clinical parameters consisted of Korean-Modified Barthel Index (K-MBI), Motricity index (MI) and manual function test (MFT). After a 4-week rehabilitation, we re-evaluated the K-MBI, MFT and MI.

**Results:** Ulnar CMAP amplitude ratio had a significant correlation with all the clinical outcome indices. Additionally, a multivariate linear regression analysis revealed that the ulnar CMAP amplitude ratio was an independent predictor for the baseline MI of the upper extremity and K-MBI. The median SSEP amplitude ratio was an independent prognostic factor for the follow-up MI of the upper extremity, MFT and the follow-up K-MBI. **Conclusions:** Our results indicate *not only* that the median SSEP amplitude ratio was a prognostic factor for the motor functions and functional recovery *but also* that the ulnar CMAP amplitude might be an independent predictor in subacute stroke patients.

## WSC-1003

### Multidisciplinary Clinical Rehabilitation Brain-computer interface + exoskeleton of the hand is an effective rehabilitation tool for motor function recovering in poststroke patients

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**Introduction:** Using of “brain-computer” interface (BCI) and robots (orthoses, exoskeletons) in neurorhabilitation is a new and rapidly developing area. Neurophysiological prerequisites for the development of BCI are based on motor imagery and EEG reactions event-related desynchronization (ERD) and event-related synchronization (ERS), decreasing or increasing of  $\mu$ -rhythm in the in the brain’s regions that represent the hand.

**Materials and Methods:** Three patients were examined with the central arm muscle paresis after stroke. All had spastic hemiparesis with decreased strength to 2–3 points, the inability of active extension of the fingers. Cognitive functions were preserved. In all patients, MRI revealed cerebral infarction in the fronto-parieto-temporal region, in 1 – in the left hemisphere, in 2 – in the right hemisphere. Exoskeleton, consisting of five fingers, managed by independent pneumatic muscles placed on the paretic hand. Standard experimental protocol included registration of EEG and kinesthetic image detection by computer. In case of successful recognition, exoskeleton extended the fingers.

**Results:** All patients were successfully solved the problem of movement imagination. The average probability of correct recognition was 0.73, which is higher than in healthy subjects (0.65). A positive trend in move-

ment disorders in the form of reduced spasticity, increased voluntary movements, marked improvement in sensory functions.

**Conclusion:** combined with the exoskeleton BCI technology gives positive results of rehabilitation of patients with movement disorders after stroke. There were marked the increasing of amplitude motion in the joints of the paretic hand and reduction of spasticity, the restore of deep sensitivity of paretic arm.

## WSC-0713

### Multidisciplinary Clinical Rehabilitation Pilot study of respiratory muscle training (RMT) to improve cough and reduce the incidence of pneumonia in acute stroke (ISRCTN40298220)

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**Background:** Impaired cough is associated with higher incidence of aspiration pneumonia in acute stroke patients. RMT may improve respiratory muscle and cough function and reduce pneumonia risk.

**Aim:** To investigate whether RMT complements recovery to improve cough flow and respiratory muscle function in acute stroke patients.

**Methods:** We conducted a single-blind randomized placebo-controlled trial in stroke patients within 2 weeks of onset. Participants were masked to treatment allocation and randomized to 4 weeks of daily inspiratory, expiratory or sham training, using threshold resistance devices. Primary outcome was the change in Peak Expiratory Flow (PEF) of maximal voluntary cough from baseline to 4 weeks.

**Results:** Participants (n = 82, 49 men) had mean age of 64 (SD 14) years and median NIHSS score of 8 (range 3–25).

**Table 1** Study outcomes: mean (SEM) changes from baseline

	Inspiratory n = 27	Expiratory n = 29	Sham n = 26	p-Value for change from baseline	p-Value for comparison of interventions
Randomized					
PEF of voluntary cough (L/Min)	91 (42)	49 (27)	84 (34)	0.008	0.46
PEF of capsaicin-induced involuntary cough (L/Min)	-4 (28)	17 (19)	32 (18)	0.34	0.41
Maximal expiratory mouth pressure (cmH <sub>2</sub> O)	20 (4)	12 (3)	12 (4)	<0.001	0.35
Maximal inspiratory mouth pressure (cmH <sub>2</sub> O)	18 (4)	10 (3)	14 (3)	<0.001	0.40
Pneumonia within 4 weeks	3 (11%)	6 (21%)	4 (15%)	-	0.65

**Conclusion:** PEF of voluntary cough and maximal mouth pressures improved significantly in all groups, but there was no treatment effect of the interventions. RMT did not augment natural recovery of cough in stroke patients.

## WSC-0652

### Multidisciplinary Clinical Rehabilitation Trunk control test in acute stage of stroke – A predictive measure for functional outcome in stroke patients

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**Aims:** We examined the usefulness of trunk control test (TCT) in acute stage of stroke as a predictive measure for functional outcome.

**Methods:** Between April 2010 and July 2013, 235 stroke patients were admitted to our hospital within 7 days after the onset and were evaluated by TCT at the 7th day after admission. Item difficulty in TCT was examined using Rasch analysis and expressed by logit.

**Results:** At the 7th day after admission, the median NIHSS score, the median TCT score, and the median FIM score were 3 (IQR, 5–10), 67 (IQR, 24–100), and 75 (IQR, 37.5–90.5), respectively. Each item difficulties of TCT were -1.78 in “rolling to weak side”, -0.28 in “rolling to strong side”, 3.04 in “sitting up from lying-down position (“sitting up”), and -0.98 in “sitting in a balanced position”, respectively. The most difficult item in TCT was “sitting up”; and patients were divided into 3 groups according to the result. The median FIM scores at the 7th day after admission were 35.5 (IQR, 19–54) in unable to sit up group (unable group), 77 (IQR, 57–86) in able to sit up with nonmuscular help group (help group), and 92 (IQR, 69.5–108.3) in able to sit up normally group (normal group), respectively. The median modified Rankin scale at 3 months after stroke were 4 (IQR, 3–4) in unable group, 3 (IQR, 2–4) in help group, and 2 (IQR, 1–3) in normal group, respectively.

**Conclusions:** The most difficult item in TCT correlated well to ADL and functional outcome.

**WSC-0711****Multidisciplinary Clinical Rehabilitation  
Can combination therapy of conventional and Korean medicine improve poststroke aphasia? Comparative, observational, pragmatic study**S Kwon<sup>1</sup>, W Jung<sup>1</sup>, S Moon<sup>1</sup>, K Cho<sup>1</sup><sup>1</sup>Department of Cardiovascular and Neurologic Diseases, College of Korean Medicine, Kyung Hee University, Seoul, Korea

*Introduction:* Poststroke aphasia confers a melancholy feeling that appears to be caused mainly by being cut off from communication with society. Therefore, poststroke aphasia must be treated effectively.

*Aims:* The present study was to determine the effectiveness of Korean medicine therapy (acupuncture, moxibustion, and herbal complexes intake) on poststroke aphasia.

*Methods:* The outcome was measured as the delta value of the Aphasic Quotient score. Patients completed test at two time-points: baseline and discharge time. Patients who received conventional therapy and language therapy were grouped in the Only Language Therapy (OLT) group. Patients who received conventional therapy, language therapy, and an Korean medicine regimen were grouped in the Combined Korean Medicine Therapy (CKT) group. We compared the delta value of the Aphasic Quotient score between two groups.

*Results:* The CKT group (n = 47) exhibited a greater improvement than the OLT group in the total Aphasic Quotient score (17.2 vs 12.3, median value) and most subsection scores. In particular, there were statistically significant differences in total Aphasic Quotient score (p = 0.021) and subsections such as spontaneous speech (p = 0.049), content delivery (p = 0.024), comprehension (p = 0.009), auditory verbal comprehension (p = 0.019), and command performance (p = 0.031). Among severe aphasic patients, the improvement of the CKT group was better than that of the OLT group.

*Conclusions:* We suggest combination therapy with the administration of Korean medicine and language therapy can be helpful in the treatment of poststroke aphasic patients.

**WSC-0412****Multidisciplinary Clinical Rehabilitation  
Can balance, sitting, standing static or dynamic balance in persons with acute stroke be a predictor for hand/arm function 1 and 3 years poststroke?**B Langhammer<sup>1</sup>, B Lindmark<sup>2</sup><sup>1</sup>Sunnaas Rehabilitation Hospital, Oslo and Akershus University College, Oslo, Norway<sup>2</sup>Department of Neurosciences, Uppsala University, Uppsala, Sweden

*Introduction:* Balance is a prerequisite for independence in activities.

*Aim:* To examine the influence of postural control on arm and hand function at 1 year and 3 years poststroke.

*Methods:* A hierarchical multiple regression analysis, dependent variable arm and hand function (Motor Assessment Scale 8) 1 and 3 years poststroke and baseline Motor Assessment Scale item 3, Berg Balance Scale, item 12 and 14 as independent variables.

*Results:* Of 75 persons with first time ever acute stroke, 19 (24%) persons had reduced sitting balance, 37 (46%) reduced standing balance and 41 (51%) reduced dynamic standing balance. Potential fallers; 49 persons (65%) with Berg Balance Scale total score < 45. Walk length in 6 minutes: 28 persons; 0–10 m, 5 persons; 30–90 m and 42; 124–700 m. Hand function, Motor Assessment Scale item 8: 33 persons could not perform the task, 42 performed the task with varying scores between 1 and 6. Balance items MAS 3 item, BBS items 12 and 14 influenced significantly on arm/hand function (MAS 8) both 1 and 4 years after stroke. The

adjusted R<sup>2</sup> were 0.44, 0.48, 0.47, and 0.38, 0.42 and 0.42 for respective models. Main explanatory factor was sitting balance ( $\beta = 0.40/0.33$ ), static standing ( $\beta = 0.10/0.20$ ) and dynamic standing ( $\beta = 0.26/0.20$ ).

*Conclusion:* Arm and hand function 1 and 4 years poststroke is significantly associated with sitting balance, and dynamic and static standing. Sitting balance was the strongest predictor explaining approximately 40% of arm and hand function 1 and 4 years poststroke.

**WSC-0429****Multidisciplinary Clinical Rehabilitation  
A nine-institution (seven countries)-multicenter study on specialized stroke rehabilitation**B Langhammer<sup>1</sup>, S Sällström<sup>2</sup>, J K Stanghelle<sup>2</sup>, K S Sunnerhagen<sup>3</sup><sup>1</sup>Research Department, Sunnaas Rehabilitation Hospital, Nesoddtangen, Norway<sup>2</sup>Research Department, Sunnaas rehabilitation Hospital, Nesoddtangen, Norway<sup>3</sup>Department of Clinical Neuroscience, University of Gothenburg, Gothenburg, Sweden

*Background:* Persons with stroke may have severe complications and need of specialized rehabilitation. Services provided in specialized rehabilitation centers are not standardized or described. In-patient stroke rehabilitation services may differ widely from clinic to clinic, and from country to country.

*Purpose and Aim:* 1. A descriptive study of the content of stroke rehabilitation in specialized clinics in seven countries: procedures for admission to rehabilitation, services available and provided to patients, as well as length of stay and discharge routines. 2. An observational study of changes in regard to physical function, quality of life and psycho-social factors in stroke patients before and after specialized rehabilitation

*Material:* Patients with a primary diagnosis of stroke irrespective of age are invited to be consecutively enrolled in the study. Inclusion criteria are stroke patients in need of specialized rehabilitation and voluntary participation. Exclusion criteria are sub-arachnoid hemorrhage, tumor, or other severe medical conditions in combination with stroke.

*Methods/Outcome Measures:* A general description of centers, and particular description of the content of “specialized rehabilitation”, priorities for admission, time delay between stroke debut and admission etc. National Institutes of Health Stroke Scale, Modified Rankin Scale, Barthel Index alternatively Functional Independence Measure, Life Satisfaction Scale 11, and a semi – structured interview with focus on the social situation are registered before and after rehabilitation, 6 and 12 months postrehabilitation.

*Results:* The study is ongoing with patient enrolment until end of September 2013 and follow-up ending September 2014. Preliminary data will be presented at the conference.

**WSC-1611****Multidisciplinary Clinical Rehabilitation  
Gait analysis for assessment of gait rehabilitation system**M Lee<sup>1</sup>, W Song<sup>1</sup>, S Sagong<sup>1</sup>, J Seo<sup>1</sup>, S Eun<sup>2</sup><sup>1</sup>Rehabilitation Assistive Technology, Korea National Rehabilitation Center, Seoul, Korea<sup>2</sup>Motor and Cognitive Function Rehabilitation, Korea National Rehabilitation Center, Seoul, Korea

Therapeutic application of the gait rehabilitation robots for gait recovery is highly efficient in patients after stroke. It is also related in neural plasticity, especially involves developing new motor neurons [1]. However, the most commonly used gait rehabilitation robots such as Lokomat (Hocoma, Switzerland) price very high and occupies a lot of space, so

patients after stroke should visit the large hospitals for robotic treatments. In this study, we developed the low-price gait rehabilitation robots to commercialize the robotic treatments. The goal of this study was to assess the kinematic patterns of the gait rehabilitation system compared to treadmill walking and the gait rehabilitation robot (Walkbot, PNS Mechanics, Korea). Two healthy male subjects (age: 30.5 yr, height: 179.2 cm, weight: 74.2 kg) participated in this study. Participants had no evidence or history of lower-limb diseases nor any record of surgery to the lower limbs. A three-dimensional motion capture system (VICON, UK) was used to acquire joint movements (sampling rate: 120 Hz). Sixteen retro-reflective markers were attached with double-sided tape to the participants' lower limbs according to the Plug-In-Gait lower limb marker set. Participants walked to the beat of the metronome set at self-selected speed in treadmill walking to control the gait speed under 3 conditions. Gait cycles were normalized entirely from 0% to 100% of the gait. Spatiotemporal parameters and kinematics of pelvis, hip, knee, ankle joint were determined from each participant and sagittal plane motions were analyzed. Significant differences were observed in the gait patterns of ankle joint and mechanical supplement will be needed.



### WSC-0784 Multidisciplinary Clinical Rehabilitation Delay of rehabilitation and functional outcome: Role of demographic and neurological characteristics

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**Introduction:** Stroke is the principle cause of chronic incapacity in adults, whereas rehabilitation is associated with increased functional independence. Delay in initiating rehabilitation and demographic characteristics may be associated with worse functional outcome after treatment.

**Aim:** to evaluate the effect of demographic characteristics on time until initiating rehabilitation (delay of rehabilitation – DR) and impact on functional outcome.

**Method:** This is a retrospective study, with 96 diagnosed stroke patients, submitted to conservative treatment in the acute phase, between January of 2008 to 2012, accompanied in the Rehabilitation Sector of UNESP-Botucatu. The demographic variables were: age, sex and race. The outcome was: DR in days and functional incapacity by means of a modified Rankin Scale (mRS) after 90 days of treatment. The relation between independent variables and DR was assessed by the tests of Mann-Whitney, and outcome estimated by multiple logistic regression, considering  $p < 0.005$ .

**Results:** There was a relation between increase in DR and elevated risk of an individual presenting mRS 3–5 (OR = 1.006; (1.0006–1.0115);

$p = 0.030$ ), and reduction of risk of mRS 3–5 with diminished DR (OR = 0.99; (0.99–0.999);  $p = 0.030$ ). The median time until initiating rehabilitation was shorter among patients >60 years: (>60 years: 34 days VS <60 years: 48 days;  $p = 0.227$ ). Neither sex nor race was related to DR. **Conclusion:** DR had a positive impact on functional outcome, and individuals older than 60 years seek more rapid service.

### WSC-0783 Multidisciplinary Clinical Rehabilitation Effect of virtual rehabilitation on upper-limb function after stroke: A pilot study

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**Introduction:** After stroke, about 85% of individuals present hemiparesis, principally in an upper limb. Virtual rehabilitation therapy (VRT) has become a promising tool in the motor recuperation of these individuals by greater motor feedback during activities.

**Aim:** to evaluate the effect of VRT on upper-limb motor function in individuals after stroke.

**Method:** The study is interventional and includes individuals above 18 years old, with first stroke, and upper-limb motor function superior  $\geq 3$  by the Chedoke–McMaster Scale. VRT included games of Wii Sports: Tennis and Basketball, 30 minutes, for 20 sessions. Evaluation was performed before VRT and 30 days after the final session. The variables obtained were: National Institutes of Health Stroke Scale (NIHSS), Barthel Scale, Motor Assessment Scale (MAS), Box and Block test (BBT), Wolf Motor Function Test (WMFT) and Stroke Impact Scale (SIS). The moments were compared by the tests of Wilcoxon and McNemar, and considered statistically significant if  $p < 0.05$ .

**Results:** The sample was composed of 10 individuals: median age was 58 years, 70% were male and average ictus was 3 months. They presented significant reduction of NIHSS ( $p = 0.038$ ) and significant increase of BBT ( $p = 0.043$ ). There was no statistical difference in the other scales: Barthel ( $p = 0.102$ ), MAS ( $p = 0.068$ ), WMFT ( $p = 0.893$ ), SIS ( $p = 0.059$ ).

**Conclusion:** After VRT intervention, an improvement was observed in upper-limb dexterity, necessitating a larger sample size and control group for future comparison of data.

### WSC-1116 Multidisciplinary Clinical Rehabilitation Balance yourself! Walking aids that don't use hands: Orthotic garment improves gait and balance in chronic, previously cane using stroke patients

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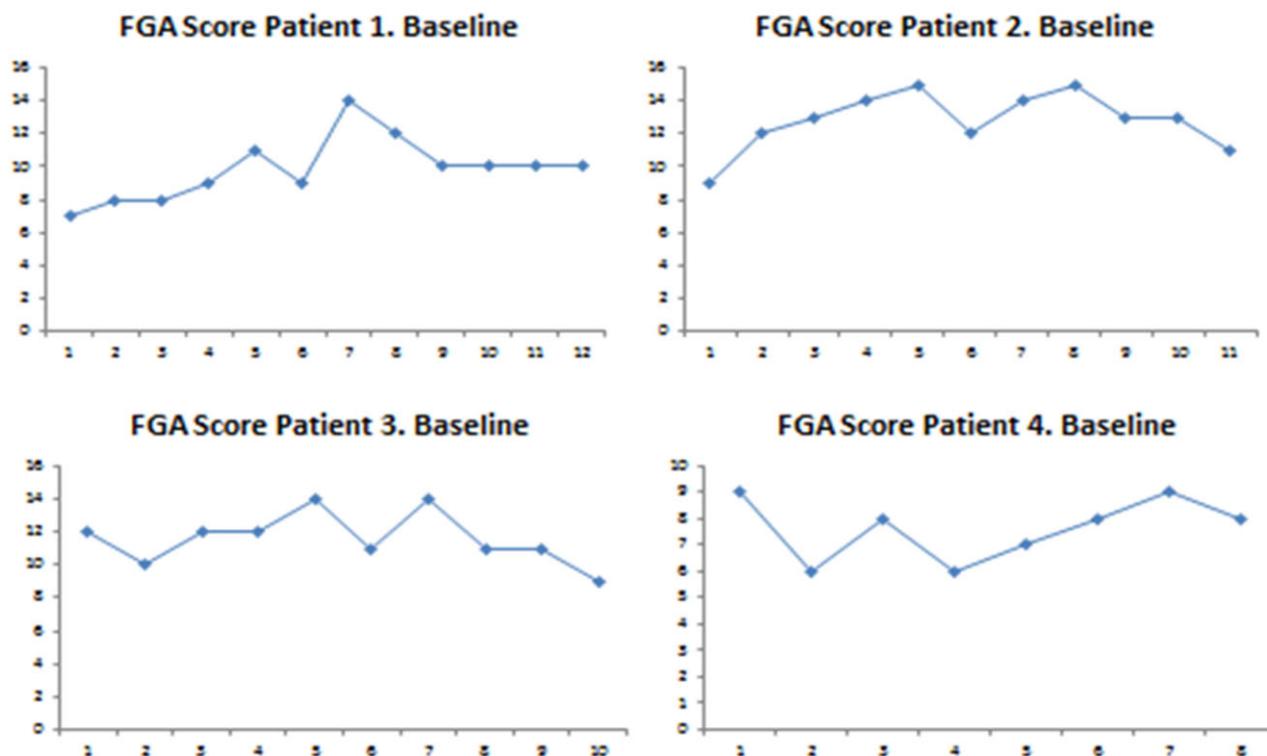
**Introduction:** Rehabilitation emphasizing activity of the hemiplegic side with high repetition increases ipsilesional cortical plasticity and improves functional outcomes. Canes are used daily and significantly reduce hemiplegic muscle activity. An orthotic garment TheraTogs significantly increases hemiplegic muscle activity during gait.

**Aims:** To investigate the effect of TheraTogs on gait function and dynamic balance when replacing canes as walking aids in chronic, cane using stroke patients.

**Methods:** Multiple single-subject ABC experiment. Primary Outcome: Functional Gait Assessment (FGA), Secondary Outcome: Dynamic balance as trunk sway using "SwayStar". All measurements done weekly. Phase A Baseline cane: Subjects randomly allocated from 9 to 12 weeks. Phase B TheraTogs: Subjects randomly allocated to 15 to 17 weeks walked using orthotic garment to facilitate hip extensor and abductor activity from dressing in the morning until evening. Phase C Follow-up: will be 9- to 10-week duration. During this phase participants will choose between walking 1. without assistive device 2. with TheraTogs 3. with cane.

**Results:** Subjects have begun phase B and have used TheraTogs from 2 to 4 weeks. Baseline values were stable showing no clinically significant change in FGA or dynamic balance. (See graph) At the beginning of phase B both outcomes show small improvements in all patients.

**Conclusion:** Preliminary results indicate trends of increasing gait function and balance as well as high levels of satisfaction in all patients.



Minimal Detectable Change 4.2 (clinically 5). Minimally Clinical Important Difference - 8 – stable baseline. (Lin et al. 2010)

Fig. 1 Primary outcome at baseline – Functional gait assessment.

## WSC-0941

### Multidisciplinary Clinical Rehabilitation Relationship between stroke location and respiratory muscle dysfunction

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**Introduction:** Respiratory muscle dysfunction (RMdys) is commonly observed after stroke. However, the pathophysiology mechanism and the extent to which stroke location can influence on RMdys remain uncertain.

**Aims:** 1) To assess prevalence of RMdys in subacute stroke patients; and 2) to study the relation, if any, between stroke site and RMdys

**Methods:** Cross-sectional study of 125 consecutive subacute stroke patients. Main outcomes: 1) respiratory muscle strength estimated with maximal inspiratory and expiratory pressures measured at mouth (P<sub>I</sub>max and P<sub>E</sub>max, respectively); 2) Oxford topographic classification (TACI, PACI, POCI, LACI). Statistical analysis: Chi square test or U-Mann Whitney test. A p-value < 0.05 was considered as statistically significant.

**Results:** One-hundred and fourteen (74.5%) patients presented some degree of RMdys. Significant differences between the values of P<sub>I</sub>max and P<sub>E</sub>max (in cmH<sub>2</sub>O) according to stroke location were observed: TACI: P<sub>I</sub>max 30.0 (SD 16.7), P<sub>E</sub>max 45 (SD 24.2); PACI: P<sub>I</sub>max 35.9 (SD 18.8), P<sub>E</sub>max 51.1 (SD 24.7); POCI: P<sub>I</sub>max 50.0 (SD 21.9), P<sub>E</sub>max 82.4 (SD 30.2); LACI: P<sub>I</sub>max 46.1 (SE 23.3), P<sub>E</sub>max 70.3 (SE 37.9).

**Conclusions:** Respiratory muscle weakness is a prevalent condition in subacute stroke patients. This dysfunction is more severe in patients with anterior circulation infarcts. More studies are required to establish the pathophysiological mechanism responsible for RMdys in stroke patients.

**WSC-0943****Multidisciplinary Clinical Rehabilitation  
Respiratory muscle dysfunction in dysphagic stroke patients**E Marco<sup>1</sup>, M Messaggi-Sartor<sup>2</sup>, A Guillen-Solà<sup>3</sup>, M Depolo<sup>3</sup>, C Barrera<sup>3</sup>, A Romeo<sup>3</sup>, M Alvarado<sup>3</sup>, F Escalada<sup>3</sup>, E Duarte<sup>3</sup><sup>1</sup>Physical Medicine and Rehabilitation Department, Parc de Salut Mar. Institut Hospital del Mar d'Investigacions Mèdiques, Barcelona, Spain<sup>2</sup>Rehabilitation Research Group, Institut Hospital del Mar d'Investigacions Mèdiques, Barcelona, Spain<sup>3</sup>Physical Medicine and Rehabilitation Department, Parc de Salut Mar. Institut Hospital del Mar d'Investigacions Mèdiques, Barcelona, Spain

**Introduction:** Respiratory muscle dysfunction (RMdys) is common in stroke patients. Respiratory muscle weakness may be responsible for impaired cough which results in greater incidence of bronchoaspiration and chest infections, especially in patients with oropharyngeal dysphagia. **Objectives:** The purpose of this study was to assess RMdys in subacute stroke dysphagic patients and to study the relation, if any, between dysphagia and respiratory muscle strength.

**Methods:** Cross-sectional study of 125 consecutive subacute stroke patients. Main outcomes: 1) respiratory muscle strength estimated with maximal inspiratory and expiratory pressures measured at mouth (PI<sub>max</sub> and PE<sub>max</sub>, respectively); 2) degree of dysphagia assessed with the Penetration-Aspiration Scale (PAS). Statistical analysis: Chi square test and correlation test (Pearson or Spearman coefficients according to normal distribution). A p-value <0.05 was considered as statistically significant.

**Results:** Patients with dysphagia presented lower values of respiratory muscle strength: %PI<sub>max</sub> 36.6 (SD 18.1) and %PE<sub>max</sub> 37.8 (SD 20.9) in front of %PI<sub>max</sub> 46.6 (SD 22.0) and %PE<sub>max</sub> 66.7 (SD 32.9), p < 0.05. There was a significant negative correlation between the severity of dysphagia and maximal respiratory pressures: PI<sub>max</sub> (r = -0.271, p = 0.027) and PE<sub>max</sub> (r = -0.252, p = 0.040).

**Conclusions:** Impairment of respiratory muscles is more frequently observed in dysphagic stroke patients. There is a significant correlation between the severity of dysphagia and respiratory muscle weakness. Further studies are required to establish if this RMdys is related with greater incidence of medical complications and worse prognosis in the medium and long-term.

**WSC-0355****Multidisciplinary Clinical Rehabilitation  
The demographic profile and language characteristics of Turkish patients with aphasia: The determinants of speech and language therapies**I Mavis<sup>1</sup>, B Togram<sup>1</sup>, M Tunçer<sup>1</sup><sup>1</sup>Speech and Language Therapy, Anadolu University Faculty of Health Sciences, Eskisehir, Turkey

It is 14 years that the profession of speech and language pathology began in Anadolu University, when first clients with SL impairments have been accepted to therapies at DILKOM, the Research and Training Center for Speech and Language Disorders. In the recent years, more patients with aphasia attended the therapy sessions only after people get more aware of the SL therapy services in Turkey.

The first part of the presentation includes the retrospective data of the 170 patients who were searched for stroke demographics such as gender, age, education, postonset, health story, cigarette smoking and alcohol consumption. The second part presents 205 aphasic patients attended DILKOM between 2006 and 2013. 112 of them were in between 0 and 59 years and 93 were above 60. Their educational background was studied in

three groups (24 illiterate, 149 educated up to 11 years, and 32 with more than 12-year education). According to the classification in types, 110 were nonfluent, 40 of them was fluent and 55 of them were global aphasics. Those participants were assessed in terms of their language characteristics (ADD; a standardized Language Assessment Battery by Mavis & Togram, 2009) to find the primary component, which determine their aphasia types.

According to the data, it seems that spontaneous speech differs significantly among three major types of aphasics. Interestingly, fluent and nonfluent aphasics speaking Turkish do not differ in auditory comprehension. All three types differ in naming and repetition. No significant difference was found between gender and age groups; however, education matters.

**WSC-0991****Multidisciplinary Clinical Rehabilitation  
Respiratory muscle training to improve inspiratory and expiratory muscle weakness in subacute stroke patients**M Messaggi-Sartor<sup>1</sup>, E Marco<sup>2</sup>, A Guillen<sup>2</sup>, M Depolo<sup>2</sup>, M Galindo<sup>2</sup>, D Rodriguez<sup>3</sup>, F Escalada<sup>4</sup>, M Orozco-Levi<sup>5</sup>, E Duarte<sup>2</sup><sup>1</sup>Institut Hospital del Mar de Investigacions Mèdiques, Rehabilitation Research Group, Barcelona, Spain<sup>2</sup>Physical Medicine and Rehabilitation, Parc de Salut Mar, Barcelona, Spain<sup>3</sup>Respiratory Disease, Parc de Salut Mar – Hospital del Mar, Barcelona, Spain<sup>4</sup>Physical Medicine and Rehabilitation, Parc de Salut Mar – Hospital del Mar, Barcelona, Spain<sup>5</sup>Respiratory Disease, Centro de Investigaciones Fundación Cardiovascular, Santander, Colombia

**Introduction:** Respiratory muscle weakness may be responsible for impaired cough which results in greater incidence of aspiration and chest infection in stroke patients. Inspiratory muscle training has shown to improve respiratory muscle function in neurological conditions, but its clinical benefit remains undetermined.

**Aims:** The purpose of this study was to evaluate the effectiveness, feasibility and safety of a 3-week respiratory muscle training (RMT) in subacute stroke patients.

**Methods:** Prospective, double-blind, randomized controlled trial was carried out in 109 subacute patients. Patients were randomly assigned to the RMT or sham-RMT groups. The training workloads were adjusted weekly to the respiratory pressures which allowed to performance of 10 consecutive maximal repetitions. Main outcomes were maximal respiratory pressures (PI<sub>max</sub> and PE<sub>max</sub>). A p-value <0.05 was considered as statistically significant.

**Results:** Ninety-nine patient presented impairment in respiratory muscle strength. Patients in the RMT group showed a significant improvement in both inspiratory and expiratory strength: PI<sub>max</sub> increased 49.1% compared with 28.8% in the control group (p = 0.004); PE<sub>max</sub> increased 37.6% in the RMT group compared with 28.5% in the sham-RMT (p = 0.003). No adverse effects occurred during the intervention

**Conclusion:** A 3-week RMT is shown to be an effective, feasible and safe tool to improve weakness of inspiratory and expiratory muscles. The key point of this study is to discuss immediate practical implications in terms of respiratory muscle dysfunction postulated as a potential prognostic factor and as an additional therapeutic target.

**WSC-0414****Multidisciplinary Clinical Rehabilitation  
Factor affecting the using short leg brace of  
hemiplegic patients after discharge**T Minakawa<sup>1</sup>, D Nishio<sup>1</sup>, Y Hirano<sup>1</sup>, H Takahashi<sup>2</sup>, O Nitta<sup>3</sup>,  
H Kigawa<sup>1</sup><sup>1</sup>Rehabilitation Center, Hanno-Seiwa Hospital, Hanno, Japan<sup>2</sup>Rehabilitation Medicine, Saitama Medical University  
International Medical Center, Hidaka, Japan<sup>3</sup>Physical Therapy, Graduate School of Human Health  
Sciences, Tokyo Metropolitan University, Tokyo, Japan

**Aims:** The purpose of this study was to consider the relationship between the physical function on the admission and walking ability with short leg brace (SLB) after discharge of the convalescence rehabilitation ward.

**Subjects:** Fifty-eight new stroke patients with severe hemiplegia took part in this study. Their age were 39–87 years old (means age: 63.4 ± 11.4). Their gender was 39 men and 19 women. Their primary disease was cerebral infarction in 39, cerebral hemorrhage in 14 and subarachnoid hemorrhage in 5.

**Methods:** We divided them into two group based on presence of independent walking of using SLB after discharge. The independent walking group (n = 33) walk with SLB at home and/or outside without assistance. On the other hand, The assistant walking group (n = 25) cannot walk with SLB without assistance. We compared clinical features (age, sex, disease, paretic side, duration from onset to admission), Mini-Mental State Examination (MMSE), Japan Stroke Scale (JSS), Trunk Control Test (TCT), muscle strength of nonparetic side leg in two groups. We also performed discriminant analysis on each group.

**Results:** Age, JSS, muscle strength of nonparetic side leg and TCT were found to be significantly different between the two groups. In this result of the analysis, age and TCT presence of walk walking with SLB without assistance after discharge could be discriminant with 77.6% accuracy.

**Conclusion:** We concluded that age and TCT are useful indicators for determining the functional prognosis that stroke patients can walk with SLB without assistance in their house and/or outside.

**WSC-0830****Multidisciplinary Clinical Rehabilitation  
Comparing the efficacy of botulinum toxin with  
tizanidine in upper limb poststroke spasticity**H Moshayedi<sup>1</sup>, S A F A Najmi<sup>1</sup>, M Yazdchi<sup>1</sup>, Z Gasemi<sup>1</sup><sup>1</sup>Neurology Department, Imam Reza University Hospital,  
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**Purpose:** To evaluate the efficacy of focal intramuscular injection of Botulinum toxin type A in comparison of with oral tizanidine in treatment of poststroke upper limb spasticity.

**Methods:** A double blind randomized clinical trial that 68 patients with poststroke upper limb spasticity were recruited. 34 were received BoNT (Dysport) injections in affected muscles of upper limb at week 0 and 12. 34 treated with tizanidine (Sirdalude) by gradual increase in dose of 2 mg/week to reach maximum 24 mg at week 12. Modified Ashworth Scores (MAS) and Action Research Arm Test were evaluated at baseline, week 12 and week 24 for all participants.

**Results:** The mean score of MAS from 3.32 and 3.13 at baseline to 1.79 and 1.56 at week 24 at elbow and wrist joints respectively (p value < 0.01). However, at TZD group there were just reduction from 2.79 and 2.77 to 2.32 and 2.31 (p value < 0.001). ARAT increased from 1.79 to 10.97 (p value < 0.001) in BoNT group. And in TZD group it just increased from 11.08 to 11.35 (p value = 0.026).

**Conclusion:** BoNT injection was safe and effective in reduction of post-stroke upper extremity spasticity. In addition, in comparing with TZD it seemed to be safer and more effective.

**WSC-1117****Multidisciplinary Clinical Rehabilitation  
Quality of life assessment of Turkish stroke patients**F K Mutluay<sup>1</sup>, I Zileli<sup>2</sup><sup>1</sup>Physical Therapy and Rehabilitation, Istanbul Medipol  
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**Purpose:** Quality of Life (QoL) as measured by SF-36 questionnaire and clinical evaluations of stroke patients were assessed in order to investigate possible relationships between observed clinical disability with patients perceived handicap levels.

**Methods:** Forty-nine stroke patients (age: 63.6 ± 12.8, 18 males) with poststroke duration 15.8 ± 11.8 months and 52% with right-side hemiplegia filled the SF-36 questionnaire; their Barthel Indices and upper and lower extremity Brunnstrom stages were also evaluated.

**Results:** All SF-36 population normalized QoL dimensional scores were one to two standard deviations (s.d.) below healthy Turkish population values; derived Physical and Mental Health Composite scores (PHC and MHC) were correspondingly lower by ~1.5 s.d. (p = 0). Barthel values correlated positively with Physical Function (PF), Bodily Pain, PHC and both Brunnstrom stage scores; the latter correlated also positively with PF, General Health and PHC (all p < 1%). Role Physical, Change in Health, PHC and Barthel scores were interrelated with poststroke duration (all p < 1%). No QoL dimensional nor clinical parameter (including lesion and hemiplegia sides) differences associated with age, gender, education level, marital status were statistically discernible. Surprisingly, all SF-36 scores of dominant side affected patients were better than those affected on their nondominant side although not significantly.

**Conclusions:** Results confirm expected direct relationships between observed clinical impairments and the declared disability as well as with patient perceived physical handicap levels while pointing to the seriously depressed mental state of hemiplegics. They also suggest observed QoL improvements during the poststroke period may result from gradual patient adaptation processes rather than actual health impairment reduction.

**WSC-1090****Multidisciplinary Clinical Rehabilitation  
Cross-cultural adaptation of the NIHSS into the Arabic  
language: A validation study of the NIHSS-A**M Nazzal<sup>1</sup>, F Alfwaress<sup>1</sup>, I M Nazzal<sup>1</sup>, S Aburahma<sup>2</sup>, A Alrefai<sup>2</sup><sup>1</sup>Rehabilitation Sciences Department, Jordan University of  
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Irbid, Jordan

**Introduction:** The National Institutes of Health Stroke Scale (NIHSS) is a clinical assessment tool to evaluate the initial stroke-related neurological deficits. Its language specific items have been developed to be used with the native English-speaking stroke clients. Healthcare providers in the Arabic world can only conduct the motor-specific components to their native Arabic-speaking clients.

**Aims:** This study aimed to establish the Arabic version of the NIHSS to allow healthcare providers to obtain a full assessment of the native Arabic-speaking stroke sufferers on both motor and language items and to validate this Arabic version.

**Methods:** Study was conducted into two phases. The first step included adapting the whole NIHSS scale and specifically conceptually translating the language-specific items to the Arabic language. The NIHSS-A followed the same format and rules when adapting the new language-specific items as set by the original NIHSS team. The original NIHSS-attached picture was also replaced by an Arabic culturally-accepted picture. The second

step was to validate the NIHSS-A and to establish its psychometric properties: Criterion validity, inter and intrarater validity.

**Results:** A full description of the cross cultural adaptation process was detailed, including justification and challenges. After conducting the validation phase of the study, NIHSS-A was revealed to be both valid and reliable tool as an initial assessment of stroke severity among Arabic-speaking stroke patients.

**Conclusion:** the new adapted NIHSS-A will allow healthcare providers in the Arab World to obtain a full assessment of the native Arabic-speaking stroke sufferers on both motor and language items.

## WSC-1200

### Multidisciplinary Clinical Rehabilitation Defining patient complexity in stroke rehabilitative practice

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**Introduction:** Stroke patients are admitted to rehabilitation programs with multiple medical/functional and psychosocial issues. Recent research and health policy documents have called for better understanding of complex patients and the development of models of care that meet their needs. With a lack of agreement on a single definition and not all definitions including nonmedical dimensions, applying the term 'patient complexity' can be challenging. In the absence of a unified definition, applied health researchers seek to understand the concept of 'patient complexity' in situ.

**Aims:** To understand how 'patient complexity' is defined by stroke rehabilitation clinicians, and to situate the findings within the extant conceptual literature.

**Methods:** Twenty three stroke rehabilitation clinicians participated in focus groups. Data were analyzed in an iterative format resulting in simultaneous data collection and analysis consistent with interpretive research approaches.

**Results:** Researchers identified five elements of patient complexity: i) medical/functional issues, ii) socio-economic factors, iii) health system factors, iv) personal characteristics and v) family/social support. Patient complexity was predominantly attributed to health system factors or the mismatch between the individual patient and the expected rehabilitation process or 'flow'. Shorter length of stays and the inability to discharge patients was central to defining complexity.

**Conclusions:** Study findings validate current conceptualizations of patient complexity, and provide deeper insight into the operationalization of complexity definitions in stroke rehabilitation. Most notably, the characteristics of complexity identified by participants were not unique to stroke patients, supporting the development and utilization of a single unifying definition or framework of complexity.

## WSC-1608

### Multidisciplinary Clinical Rehabilitation Voluncaring: The role of volunteerism in stroke rehabilitation

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**Introduction:** Providing optimal rehabilitative care is often challenged by increasing patient needs, time restrictions and financial constraints, necessitating the need to maximize the potential of all members of the healthcare workforce. Volunteers represent a resource that can contribute significantly to rehabilitation, bridging the gap between best practice care and the realities of an ever increasing workload. Today's hospital volun-

teers are more diverse than ever. They range from teenagers to retirees, come from a variety of backgrounds, and bring a multitude of professional and life experiences.

**Aims:** To understand the role of volunteerism in stroke rehabilitation; identifying their scope of practice within the rehabilitation team, as well as the facilitators and barriers to their involvement.

**Methods:** A case study approach was implemented. In addition to a document review and an environmental scan, fifty seven clinical team members, administrators and volunteers participated in interviews and focus groups.

**Results:** Patient oriented hospital volunteerism (voluncaring) is a valuable resource that can be leveraged to improve patient experience and outcomes. Four key elements of an exemplar 'voluncaring' initiative were identified: developing the right program, recruiting the right person (volunteer), providing the right training, and ensuring the program has the right administrative support. Human resource concerns may limit the role of volunteers in meeting rehabilitation goals and patient needs.

**Conclusions:** Volunteers are key human resources in hospital settings. Understanding how volunteers fit within the stroke rehabilitation team can support hospitals to provide high quality rehabilitative care in an era of fiscal constraint.

## WSC-0462

### Multidisciplinary Clinical Rehabilitation Physical function after stroke: The relationship with depression and health-related quality of life

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**Introduction:** Physical function is the most often used outcome to evaluate poststroke rehabilitation interventions. Psychosocial function, such as depression and quality of life, is an important consideration in health care. **Aim:** To determine the relationship between physical function, depression, and health-related quality of life in stroke survivors.

**Methods:** This was a cross-sectional study involving 60 stroke survivors (34 males and 26 females), with stroke duration of  $\geq 3$  months, recruited from teaching hospitals in Osun state, southwestern Nigeria. Stroke impact scale (SIS) 16 was used to assess physical disability as a physical function. Modified Barthel index (MBI) was used to assess activity of daily living as a physical function. Becks depression inventory (BDI) was used to measure the intensity, severity and depth of depression. Quality of life questionnaire SF-36 was used to assess health-related quality of life (HRQoL). Data were analyzed using descriptive and inferential statistics. Level of significance was  $p \leq 0.05$ .

**Results:** There were significant relationships between SIS 16 scores and HRQoL ( $r = 0.741$ ,  $p = 0.000$ ), MBI scores and HRQoL ( $r = 0.662$ ,  $p = 0.000$ ), and between SIS 16 scores and depression ( $r = 0.338$ ,  $p = 0.008$ ).

**Conclusions:** Limitations in physical function, decreased quality of life and depression occur in stroke survivors irrespective of the sex and stroke type. Physical function is related to health-related quality of life and depression in stroke survivors. Physical function, quality of life and depression should be assessed in all stroke survivors undergoing rehabilitation. The outcome should be incorporated in the multidisciplinary rehabilitative management of the patients.

**WSC-1357****Multidisciplinary Clinical Rehabilitation  
The effect of music and rhythmic auditory stimulation on upper motor strength rehabilitation of hemiparetic stroke patients in a tertiary hospital: A randomized controlled study**L Oiga<sup>1</sup><sup>1</sup>Section of Adult Neurology Department of Internal Medicine, The Medical City, Pasig, Philippines

**Objective:** This research paper aims to demonstrate the effect of music and rhythmic auditory stimulation through improvement in upper extremity motor strength after at least 6 sessions of rehabilitation in hemiparetic poststroke patients in a tertiary medical center.

**Methodology:** This is a randomized controlled study that included stroke inpatients in a tertiary medical center from July 2011 to July 2012. A total of 16 patients were randomized to the Control group (white noise background), the Rhythm group (metronome beat of 100 beats/minute), or the Music group ("Pomp and Circumstance"). Scores in the hand dynamometer and Functional Independence Measure tests were gathered and recorded at 0, 2, 4, 6 and 12 sessions.

**Results:** The Friedman's test results showed statistically significant difference in the FIM scores in the Rhythm ( $p = 0.044$ ) and Music groups ( $p = 0.002$ ). Post hoc analysis with Wilcoxon Signed Rank Test showed significant difference in the FIM scores from baseline until the 6<sup>th</sup> session in the Music group ( $p = 0.020$ ).

**Conclusion:** Music and rhythm might be beneficial to upper motor strength rehabilitation among hemiparetic stroke patients after at least 6 sessions. A trial with a bigger population and longer duration is recommended to support the findings of this study.

**WSC-0564****Multidisciplinary Clinical Rehabilitation  
Effects of navigated repetitive transcranial magnetic stimulation (rTMS) and Brunnstrom hand training on hand functions in stroke patients**M Özkeskin<sup>1</sup>, V Öztürk<sup>2</sup>, R Çakmur<sup>2</sup>, B Kara<sup>3</sup><sup>1</sup>Physiotherapy and Rehabilitation, Izmir University School of Health, Izmir, Turkey<sup>2</sup>Department of Neurology, Dokuz Eylül University Faculty of Medicine, Izmir, Turkey<sup>3</sup>Department of Neurological Physiotherapy and Rehabilitation, Dokuz Eylül University School of Physical Therapy and Rehabilitation, Izmir, Turkey

This study was designed to investigate the effects of navigated repetitive transcranial magnetic stimulation (rTMS) and Brunnstrom Hand Training (BHT) on hand functions of stroke patients.

Of the patients who presented to the Department of Neurology Dokuz Eylül University 21 who had a stroke at least 1 month ago were recruited to the study. The patients' assessments were performed upper extremity and hand functions. Assessment of the cases was conducted before the treatment, on the 10th day post-treatment and in the first and third months post-treatment. The patients in the treatment group received real rTMS (1 Hz rTMS at 90% resting motor threshold, 25 min) over the hand area of motor cortex in the healthy hemisphere determined with navigation. The cases in the treatment group (10 patients) received real rTMS for 10 days. Control group (11 patients) received placebo rTMS. The patients in both groups had BHT (25 min) and upper extremity exercises (20 min) received.

No significant differences were determined between the two groups in terms of their FMA total, upper arm and wrist scores at the four measurement times ( $p \geq 0.05$ ). When the FMA test for the three sub-groups (upper arm, wrist, hand) was checked with the repeated ANOVA test at

four different times, an improvement was observed in both groups over time. The improvement in the treatment group was significantly higher than that in the control group.

These findings indicate that BHT after the navigated rTMS led to improvements in the hand functions of stroke patients.

**WSC-0702****Multidisciplinary Clinical Rehabilitation  
EFFECTS OF NAVIGATED REPETITIVE TRANSCRANIAL MAGNETIC STIMULATION (RTMS) AND BRUNNSTROM HAND TRAINING ON HAND FUNCTIONS IN STROKE PATIENTS**M Özkeskin<sup>1</sup>, V Öztürk<sup>2</sup>, R Çakmur<sup>2</sup>, B Kara<sup>3</sup><sup>1</sup>Department of Physical Therapy and Rehabilitation, Izmir University School of Health, Izmir, Turkey<sup>2</sup>Department of Neurology, Dokuz Eylül University Faculty of Medicine, Izmir, Turkey<sup>3</sup>Department of Neurological Physiotherapy and Rehabilitation, Dokuz Eylül University School of Physical Therapy and Rehabilitation, Izmir, Turkey

**Aims:** This study was designed to investigate the effects of navigated repetitive transcranial magnetic stimulation (rTMS) and Brunnstrom Hand Training (BHT) on hand functions of stroke patients.

**Methods:** Of the patients who presented to the Department of Neurology Dokuz Eylül University 21 who had a stroke at least 1 month ago were recruited to the study. The patients' assessments were performed upper extremity and hand functions. Assessment of the cases was conducted before the treatment, on the 10th day post-treatment and in the first and third months post-treatment. The patients in the treatment group received real rTMS (1 Hz rTMS at 90% resting motor threshold, 25 min) over the hand area of motor cortex in the healthy hemisphere determined with navigation. The cases in the treatment group (10 patients) received real rTMS for 10 days. Control group (11 patients) received placebo rTMS. The patients in both groups had BHT (25 min) and upper extremity exercises (20 min) received.

**Results:** No significant differences were determined between the two groups in terms of their FMA total, upper arm and wrist scores at the four measurement times ( $p \geq 0.05$ ). When the FMA test for the three sub-groups (upper arm, wrist, hand) was checked with the repeated ANOVA test at four different times, an improvement was observed in both groups over time. The improvement in the treatment group was significantly higher than that in the control group.

**Conclusions:** These findings indicate that BHT after the navigated rTMS led to improvements in the hand functions of stroke patients.

**WSC-0953****Multidisciplinary Clinical Rehabilitation  
Analyzing the effects of navigated repetitive transcranial magnetic stimulation (RTMS) in upper extremity proprioceptive sense and spasticity in stroke patients**M Özkeskin<sup>1</sup>, V Öztürk<sup>2</sup>, R Çakmur<sup>2</sup>, B Kara<sup>3</sup>, F Küçük<sup>1</sup><sup>1</sup>Department of Physical Therapy and Rehabilitation, Izmir University School of Health, Izmir, Turkey<sup>2</sup>Department of Neurology, Dokuz Eylül University Faculty of Medicine, Izmir, Turkey<sup>3</sup>Department of Neurological Physiotherapy and Rehabilitation, Dokuz Eylül University School of Physical Therapy and Rehabilitation, Izmir, Turkey

**Aims:** The purpose of this study is to analyze the effects of rTMS in upper extremity proprioceptive sense and spasticity who undergone physical therapy in stroke patients.

**Methods:** Twenty-one stroke diagnosed patients included into the study. The first group was recognized as study group (n = 10) and the second group was control group (n = 11). A blind researcher evaluated the subjects upper extremity (hand, wrist, elbow, shoulder) proprioceptive sense by Brunnstrom sense assessment method and spasticity assessment with The Modified Ashworth Scale(MAS) pretreatment, on the 10th day of post-treatment and in the first and third months of post-treatment. The patients in the treatment group received real rTMS (1 Hz rTMS at 90% resting motor threshold, 25 min) over the hand area of motor cortex in the healthy hemisphere determined with navigation for 10sessions. Control group received placebo rTMS. The patients in both groups had upper extremity exercises (45 min).

**Results:** There were statistically significant differences in finger touch localization at first and third months of post-treatment, in wrist proprioceptive sense on the 10th day of post-treatment and in the first months of post-treatment, in finger proprioceptive sense all after post-treatment periods, in hand MAS on the third months of post-treatment according to the Mann-Whitney U test. When intragroup analysis were made by Friedman Analysis there weren't any statistically differences in proprioceptive sense and MAS score.

**Conclusion:** This study showed that both groups positively effects on finger touch localization and upper extremity proprioceptive sense. But we couldn't found any effects on upper extremity spasticity except hand section. The study must go on with more subjects.

### WSC-1431

#### Multidisciplinary Clinical Rehabilitation A case of rehabilitation treatment for spinal cord infarction leading to acquisition of practical walking ability

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**Introduction:** The incidence of spinal cord infarction is about 1–2% in patients with cerebral infarction, but the mechanism is largely unknown. Here we report a case of rehabilitation treatment leading to acquisition of practically useful walking ability.

**Case:** A 71-year-old female patient developed paraplegia and bladder rectum dysfunction at defecation, 3 days after reporting lumbago. The diagnosis was made based on MRI signal change at the level of the 10th thoracic vertebra. After conservative therapy at Okazaki Municipal Hospital, she was admitted to our hospital for rehabilitation. On admission, ASIA (American Spinal Injury Association) impairment scale was D. MMT (Manual muscle testing) score in both legs was 2–3. She exhibited sensory disturbance and bladder rectum dysfunction. Motor FIM (Functional Independence Measure) score was 62, and cognitive FIM score was 35. She could not walk and needed maximum support for standing. With the improvement of walking ability, we changed KAFO (Knee-Ankle-Foot Orthosis) to APS-AFO (Adjustable Posterior Strut-Ankle-Foot Orthosis®; Tomei Brace Co., Ltd.); walkers and canes were selected appropriately. Body weight-supported treadmill training was used to extend walking time. At discharge, she was able to walk with lostrand crutches without any leg braces. Walking speed improved from 0.04 m/sec (at 37 hospitalization days) to 0.27 m/sec (at 146 days), and total FIM score improved to 12.

**Conclusion:** Appropriate selection of aids and leg braces during rehabilitation training for this patient with spinal cord infarction effectively extended walking time and led to acquisition of practically useful walking ability.

### WSC-0695

#### Multidisciplinary Clinical Rehabilitation The ability of appointment to the questions of patients after stroke

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**Introduction:** Studies show that significant speech and language impairments had approximately one-third of all patients affected by stroke, in most cases as the result of damage to the left brain hemisphere.

**Aim:** To determine the relationship between body side impairments after stroke, with the ability of giving an adequate answer to the question.

**Methodology:** The sample included 176 stroke patients after neurological treatment.

We were investigated in a sample of 176 patients after the stroke and the neurological treatment. Patients were tested with Responsive Naming Subtest of the Boston Diagnostic Aphasia Examination (BDAE).

**Results:** The sample of average age of 70.13 years has been tested on average 30.85 days onset stroke. Brain lesions have been located at 54 locations.

In most cases, stroke IS preceded by two or more diseases, the most common combinations of heart disease, hypertension and diabetes mellitus. The most common type of a stroke is ischemic.

Average score on subtest was 77.31% of test materials.

All patients with right-sided body impairment had below average scores (66.34%), with left side body impairment 87.79% and patients with bilateral body impairment had score 94.16% of the subtest.

The group of patients with speech and language impairments had an average score of 59.46%, and group without speech and language impairments had success of 95.15% of the test.

**Conclusion:** Patient with right side body impairment had lower results on responsive naming subtest of BDAE than patients with the impairments to the left side of the body.

### WSC-0593

#### Multidisciplinary Clinical Rehabilitation Effects of mental practice using video footage for gait rehabilitation in patients with poststroke hemiparesis

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**Introduction:** After stroke, lots of survivors with hemiparesis need to undergo rehabilitation to regain independent walking.

**Aims:** To elucidate the effects of mental practice using video footage for gait performance in hemiparetic patients during the rehabilitation period.

**Methods:** Fifteen subjects with poststroke hemiparesis participated in the study during the subacute stroke stage. The video footage of the subjects' walking was taken and edited individually within 5 minutes or less. After having watched those videos, the subjects were instructed to recall good walking images. Walking ability was evaluated with ten-meter walk test (10MWT) and timed up and go test (TUG) that were carried out three times before and after the intervention. Other physical functional evaluation including Brunnstrom stages (Br. stage), leg extension torque, motor age test and stroke impairment assessment set were also estimated at the same time.

**Results:** The positive correlation between 10MWT and TUG became tighter after the intervention (Spearman  $r = 0.91$ ,  $p < 0.0001$ ) than before the intervention ( $r = 0.78$ ,  $p = 0.001$ ). There was a significant improvement in the 10MWT (10.67 vs 9.93 sec,  $p = 0.011$ ) and TUG (13.02 vs

11.96 sec,  $p = 0.005$ ) after the intervention. There was a negative correlation between Br. stage and 10MWT before ( $r = -0.52$ ,  $p = 0.009$ ) and after the intervention ( $r = -0.55$ ,  $p = 0.006$ ) and a negative correlation between Br. stage and TUG after the intervention ( $r = -0.40$ ,  $p = 0.043$ ).

**Conclusions:** These results suggest that mental practice using video footage is useful in the gait rehabilitation in hemiparetic patients and that this method may be feasible as a subsidiary method of enhancing routine rehabilitation.

### WSC-0689

#### Multidisciplinary Clinical Rehabilitation Understanding the commands at the patients after stroke

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**Introduction:** Stroke often results in a reduced ability of the auditory comprehension of speech.

**Aim:** We wanted to determine the relationship between the body side impairments and the presence speech and language impairments (SLI) with auditory ability to understand commands in stroke patients.

**Methodology:** We examined group of 176 patients during the four months with subtest Commands of Boston Diagnostic Aphasia Examination.

**Results:** The average age of respondents was 70.13 years. Brain lesions have been located at 54 locations.

The half of the study sample had communication disorders. Average success on comprehension of five commands of different complexity, at the group of patients with SLI is 62.72%, at group of patients without SLI is 93.86%.

Average successfulness of patients with right sided neurological body impairments is 67.38%; with neurological body impairments in the left side is 89.35%, with impairments on both sides is 90.00%.

Group of patients with SLI had the best results in the simplest first command (82.95%), and the group without SLI (100.00%). Group with SLI had the lowest results in the most complex orders (46.59%) and the group without significant SLI (81.82%).

The success in the range of 0–60% of the subtest had 26.13% of the sample. In this group, only three patients had lesions of the right side, 12 at the both sides and 31 patients at the left side of the brain.

**Conclusion:** Auditory comprehension commands depended on the location of brain lesions.

The best results had patients with right hemisphere damages.

### WSC-1573

#### Multidisciplinary Clinical Rehabilitation Neurorehabilitation of the upper extremities in stroke patients using a new robotic device; Wrist-RoboHab Robot

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**Introduction:** Increasing number of patients with disabilities followed by stroke and lack of therapists and caregivers make the robots to play an important role in recovery after stroke.

**Aims:** The main goal of this study was to introduce a new robotic device for upper limb rehabilitation 'wrist- RoboHab' and to report the pilot study.

**Methods:** This haptic robot was designed for bimanual movement therapy and evaluation in three operational states; forearm supination/pronation, wrist flexion/extension and ulnar/radial deviation. To provide effective feedbacks and motivation, visual games were set on the therapeutic modes. Five chronic stroke patients with moderate-to-severe upper-limb impairment participated in this study. Therapy consisted of 20 1-hour sessions over a period of 4 weeks. Spasticity, motor function and power grip were evaluated before, between and after the study.

**Results:** Data analysis showed decrease in spasticity in most of the patients and this change was greater in wrist flexors than elbow flexors. Improvements of motor function scores were seen in all patients, and were mostly related to distal joints. Other variable did not show noticeable changes.

**Conclusions:** Robotic therapy by means of wrist-RoboHab showed improvements in most of the outcome measures especially in motor recovery and spasticity of the distal limb.



**WSC-1460****Multidisciplinary Clinical Rehabilitation  
Combination of botulinum toxin injection and splinting  
improves recovery of the hemiplegic upper limb in  
stroke patients**A S Hamily<sup>1</sup>, M Amini<sup>2</sup>, B Forough<sup>3</sup>, R Kazemi<sup>4</sup>, M Qorbani<sup>5</sup><sup>1</sup>Occupational Therapy Department, Tabriz University of Medical Sciences, Tabriz, Iran<sup>2</sup>Occupational Therapy Department, Iran University of Medical Sciences, Tehran, Iran<sup>3</sup>Physical Medicine & Rehabilitation Department, Iran University of Medical Sciences, Tehran, Iran<sup>4</sup>Stroke, Tabassom Rehabilitation Centre, Tehran, Iran<sup>5</sup>Public Health Department, Alborz University of Medical Sciences, Karaj, Iran

**Introduction:** Spasticity or increase in muscle tone is one of the problems following stroke. Due to this increase in muscle tone, patients are confronted to problems in motor control and difficulties in activities of daily living and complications such as shortness and contracture.

**Aims:** The aim of this study was to examine the effects of combined use of both splinting and botulinum toxin injection (BTX) on spasticity, range of motion and upper extremity motor recovery in a 3-month period.

**Method:** The study was a comparison between 3 groups of interventions. At first 60 patients with chronic stroke were selected and based on the inclusion criteria, a total of 39 stroke patients were assigned to study groups; splint or botulinum toxin injection or combined splint/botulinum toxin injection. Range of motion, spasticity and motor recovery for upper limb were evaluated monthly for 3 months.

**Results:** All outcome measures improved within each group but the differences between groups were not significant in most outcomes during each month evaluations. The results also show that the changes in elbow flexors spasticity {p (v) = 0.05}, wrist flexors spasticity {p (v) = 0.007} and upper extremity function {p (v) = 0.04} were obvious between the groups before and after the 3 months. The difference in the group of combined use of botulinum toxin and splint was more than others.

**Conclusion:** In this study, each method was beneficial to improve recovery of upper limb after stroke but there was no significant difference between the interventions in 3 months.

**WSC-1422****Multidisciplinary Clinical Rehabilitation  
Effectiveness of mirror therapy on motor recovery,  
spasticity and power grip of the hemiplegic upper  
limb in the chronic phase after stroke**A Shamily<sup>1</sup>, N Nakhostin Ansari<sup>2</sup>, M Abdolvahab<sup>3</sup>,M Hejazi Shirmard<sup>1</sup>, P Raji<sup>3</sup><sup>1</sup>Occupational Therapy Department, Tabriz University of Medical Science, Tabriz, Iran<sup>2</sup>Physical Therapy Department, Tehran University of Medical Science, Tehran, Iran<sup>3</sup>Occupational Therapy Department, Tehran University of Medical Science, Tehran, Iran

**Introduction:** Inducing a visual illusion via mirror therapy is a new topic in rehabilitation of upper extremity in patients with chronic stroke.

**Aims:** The purpose of this study was to investigate the effectiveness of mirror therapy on the affected upper limb in patients with chronic stroke.

**Methods:** This interventional study was conducted in a pretest-posttest design. Seventeen patients (9 men and 8 women) aged 35–68 (mean + SD: 51.17 ± 9.93) with chronic stroke (more than 6 months) were included. After initial assessments they participated in the intervention program for a month (12 sessions). An exercise protocol was performed using the mirror therapy method and under the direct supervision of the therapist

in 45–60 minutes each session. Assessments of motor recovery, dexterity, spasticity, range of motion and grip strength were collected before and after the month of treatment.

**Results:** significant improvements in motor recovery, spasticity, active range of motion and grip strength were found (p < 0/05), but passive range of motion and dexterity did not improve significantly (p > 0/05).

**Conclusions:** The results showed that mirror therapy alone within 1 month can improve motor recovery, spasticity, active range of motion and power grip of the upper extremity in patients with chronic stroke. In future, research has to determine the optimal practice intensity and duration for improvements to affect other functional domains.

**WSC-1566****Multidisciplinary Clinical Rehabilitation  
Canis-therapy (dog-assisted therapy) as the  
rehabilitation method for male patients with stroke  
and poststroke depression**M N Maltseva<sup>1</sup>, E V Melnikova<sup>2</sup>, A A Shmonin<sup>3</sup>, A A Skorometz<sup>2</sup>, G E Ivanova<sup>4</sup><sup>1</sup>Department of Neuroscience, ANO the Association of Support and Development Dog Therapy, St. Petersburg, Russia<sup>2</sup>Department of Neurology and Neurosurgery, First St. Petersburg Pavlov State Medical University, St. Petersburg, Russia<sup>3</sup>Department of Neurology and Neurosurgery, Federal Almazov Medical Research Centre Center, St. Petersburg, Russia<sup>4</sup>Department of Rehabilitation, Institute of Cerebrovascular Disease and Stroke of Pirogov Russian National Research Medical University, Moscow, Russia

**Introduction:** The Dog-Assisted Therapy (DAT) is one of the modern rehabilitation methods for patients after stroke with using specially trained dogs in the form of the game.

**Aim:** The aim of the study was to evaluate the efficacy of the DAT in male patients with poststroke depression and movement disorders.

**Materials and Methods:** The study included 15 patients (60–70 e.o.) who had had an ischemic cerebral stroke for 80–90 days prior to the study, with the proved poststroke depression and standard drug therapy and rehabilitation.

For the control 12 patients were chosen. As a placebo they simply communicated with the dogs without special games and exercises. For evaluation of the disorders the Rankin scale, Bartel scale, Rivermid mobility ratio, Bek depression scale, MMSE were used.

**Results:** Before therapy starting the basic group and the placebo group had been identical. After the therapy, the disability degree evaluated with the Rankin scale was lower in the DAT group (n = 0,000058). Bartel ratio was higher in the DAT group (n = 0,000004). The best Rivermid ratio values were registered among the DAT patients (n = 0,000003). DAT reduces the depression events (n = 0,000001) as per Bek scale. The positive dynamics was also registered with the MMSE scale. In 3 months after DAT completion the resulting evaluation of both groups was done. In the dog therapy group the effect keeps stable

**Conclusions:**

1. The DAT is an effective method of the rehabilitation for male patients with movement disorders and poststroke depression
2. The DAT is based on the principles of the increasing complexity of task for the patients who are performed with the help of the dog-assistant.

**WSC-1510****Multidisciplinary Clinical Rehabilitation  
Virtual reality environments development for aphasic clients**C Sik Lanyi<sup>1</sup>, V Szücs<sup>1</sup>, J Stark<sup>2</sup><sup>1</sup>Department of Electrical Engineering and Information Systems, University of Pannonia, Veszprem, Hungary<sup>2</sup>Department of Linguistics and Communication Research, Austrian Academy of Sciences, Vienna, Austria

Most common cause of aphasia is – about 23–40% of stroke survivors – acquired aphasia. The rehabilitation of aphasia is a medical and special treatment (speech therapy).

Virtual Reality (VR) therapy is a new way in the stroke rehabilitation. VR environments have been recognized as motivational tools in stroke rehabilitation in the last decade.

We present these VR environments and their developing process at the conference.

The development of a virtual therapy room for use with aphasic clients based on the Virtual ELA®photo series (Stark). The options the supervising therapist can build up any situation she/he wants, and can control it (Geiszt *et al.*).

The rationale for the development and the process of creating the Virtual ELA® (Everyday Life Activities)-House are described. The Virtual ELA®-House is an innovative therapy program designed for use with clients with language and speech disorders and/or with other cognitive neuropsychological disorders, which result from brain damage, e.g. aphasia, apraxia of speech, neglect, etc. (Horvath *et al.*)

The main design principle was playability, usability, holding the patients' attention. Other design principle was that the patients enjoy the challenges and they need the feedback.

The software were tested not only by aphasic clients but mental deficient children too.

One result of our test is that the software are useful device not only in the education of aphasic but children with heavy mental deficient too.

**References**

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Horvath *et al.* Virtual Reality House of Aphasic Clients, Transaction on Edutainment III, LNCS 5940:231–9.

Stark. Everyday life activities photo series.

**WSC-1086****Multidisciplinary Clinical Rehabilitation  
The effects of inpatient physiotherapy on balance and functionality in acute stroke patients**M Soysal Tomruk<sup>1</sup>, T Kahraman<sup>1</sup>, B Kara<sup>1</sup>, V Öztürk<sup>2</sup><sup>1</sup>School of Physical Therapy and Rehabilitation, Dokuz Eylül University, Izmir, Turkey<sup>2</sup>Department of Neurology, Dokuz Eylül University Faculty of Medicine, Izmir, Turkey

**Introduction:** Stroke results in muscle weakness, abnormal movements, gait and balance disturbances, and loss of function. The fastest recovery after acute stroke occurs in the first days and weeks. Thus, physiotherapy within the first weeks of stroke can lead to enhanced and faster improvements.

**Aims:** The aim was to determine the effects of inpatient physiotherapy on balance and functional status in acute stroke patients.

**Methods:** Thirty acute stroke patients ongoing medical treatment participated in this study. All the patients had the Mini Mental State Examination scores higher than 23. The physiotherapy program included repetitive task training, trunk control and balance exercises and mobilization which were

individually determined for each patient's needs. 45- to 60-minute sessions were applied once a day. The outcome measures were the Berg Balance Scale (BBS) for the balance, the Functional Independence Measure (FIM) and the Functional Mobility Profile (FMP) for the functional status. The measures were applied at the beginning of the physiotherapy program and before the discharge.

**Results:** 16 patients (53.3%) were female. The mean age was  $62.3 \pm 13.7$  years. There were 13 patients with anterior and 17 patients with posterior cerebral circulation disorder. The number of therapy sessions was  $4.8 \pm 2.7$  times. BBS, FIM and FMP scores improved significantly after the inpatient physiotherapy program ( $p < 0.001$ ).

**Conclusion:** Despite a few number of physiotherapy sessions, the inpatient physiotherapy applied to the acute stroke patients had good improvements on balance and functionality. Further studies should be done in patients with higher disability and cognitive impairment levels.

**WSC-1208****Multidisciplinary Clinical Rehabilitation  
Mastering the urban jungle: Preparation for the real world from inpatient rehabilitation**E Sutton<sup>1</sup><sup>1</sup>Rehabilitation Care Centre, St Vincent's Hospital Melbourne, Melbourne, Australia

The impact of a stroke – the loss of speech, mobility, the ability to recognize and interpret the world around them, loss of previous life roles and participation in everyday tasks can lead to isolation. It is common in the literature for people poststroke to report lack of preparation for the real world from inpatient rehabilitation. Inpatient rehabilitation needs to decrease the patients feelings of isolation and prepare them for what they will encounter once they are released from the hospital cocoon. This paper explores the benefits and successful outcomes of using a range of therapeutic techniques in the inpatient rehabilitation setting in a metropolitan hospital to equip the patient for the real world. This includes the early use of power wheelchairs with severely impaired patients particularly those with neglect whilst a person is learning to walk. Patients are very early on in their rehabilitation stay engaged in a graded individualized program of therapeutic activities in one on one therapy sessions to increase their confidence and skills. They may begin by accessing the local park across the road and the hospital cafe, then may graduate to going further afield to local cafes and shops and then to catching public transport or to the museum and then into the city center itself. The urban environment becomes the therapeutic arena instead of the contrived environment of the hospital. An urban therapy blog is used to educate therapists about the range of places they can take their patients in rehabilitation sessions.

**WSC-1434****Multidisciplinary Clinical Rehabilitation  
Gait-directed training associated with virtual reality-based therapy increases gait speed of individuals with chronic stroke: A systematic review with meta-analysis**L F Teixeira-Salmela<sup>1</sup>, L R Nascimento<sup>1</sup>, J M I Rodrigues-Baroni<sup>1</sup>, T L Hirochi<sup>2</sup>, L Ada<sup>3</sup><sup>1</sup>Physical Therapy, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil<sup>2</sup>Occupational Therapy, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil<sup>3</sup>Discipline of Physiotherapy, The University of Sydney, Sydney, Australia

**Introduction:** Previous systematic reviews failed to demonstrate the efficacy of the addition of virtual reality (VR) to conventional gait training on

walking speeds of individuals with stroke, or were unable to perform meta-analyses.

**Aims:** To systematically review the available evidence on the efficacy of the directed-gait training associated with VR in patients with stroke. The specific questions were: Is directed-gait training associated with VR effective in increasing walking speeds? Is this type of intervention more effective in increasing gait speed than non-VR-based walking interventions?

**Method:** A systematic review with meta-analysis of randomized clinical trials was conducted. Searches were performed in the MEDLINE, PEDro and EMBASE databases, and quality of trials was examined using the PEDro scale. Participants were adults with chronic stroke and the experimental intervention included directed-gait training associated with VR to increase walking speed. Data regarding gait speed were extracted from the eligible studies and combined using a meta-analysis approach.

**Results:** Seven trials of moderate quality (mean PEDro score of 6.1), representing eight comparisons, were included. VR-based training increased gait speed by 0.17 m/s (95% CI = 0.08–0.26,  $I^2 = 0\%$ ), compared to placebo/nothing or nonwalking interventions and by 0.15 m/s (95% CI = 0.05–0.24,  $I^2 = 0\%$ ), compared to non-VR walking interventions.

**Conclusions:** This review provided evidence that directed gait training associated with VR training showed to be effective in increasing walking speeds after stroke, and led to better results, than non-VR interventions.

### WSC-1432

#### Multidisciplinary Clinical Rehabilitation Higher doses of virtual reality therapy are required to induce changes in upper limb function and quality of life after stroke

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**Introduction:** Virtual reality therapy (VRT) and interactive video gaming have emerged as new treatment approaches in stroke rehabilitation, but the ideal doses have not yet been established.

**Aims:** To determine the most effective doses of VRT, required to obtain positive effects on upper limb (UL) function and quality of life (QOL).

**Methods:** Twelve subjects (10 men) with a mean age of 51 years and a mean time since the onset of the stroke of 21 months, received 40 1-hour sessions of VRT with the Nintendo Wii™ videogame. UL motor recovery, as determined by the Fugl-Meyer scale; UL function, as assessed by the Wolf Motor Function Test (WMFT); grip strength; manual dexterity, using the Box and Blocks Test (BBT), and QOL, as measured by the stroke-specific quality of life (SSQOL) scores, were obtained at baseline and after 15, 30, and 40 sessions of VRT.

**Results:** The significant improvements observed in all outcomes depended upon the doses of the intervention. Improvements in the Fugl-Meyer were observed after 15 sessions and were continuous over time. For the WMFT, grip strength and BBT, significant gains were observed only after 30 sessions and the addition of more therapy did not result in further benefits. For the SSQOL, significant improvements were found only after 40 sessions.

**Conclusions:** Although previous studies reported the benefits after 15 hours of VRT, the present findings demonstrated that higher doses were required to result in significant improvements in UL function, strength, dexterity, and QOL in subjects with chronic stroke.

### WSC-0468

#### Multidisciplinary Clinical Rehabilitation Dose-response relationship between EMGBFB-assisted muscle training and muscle strength in people with chronic stroke

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**Introduction:** Electromyographic biofeedback (EMGBFB) has been used for muscle training to improve motor function in stroke rehabilitation, but the dose-response relation of such therapy is unclear.

**Aims:** The purpose of this study was to investigate the effects of different doses of EMGBFB-assisted tibialis anterior (TA) muscle training on TA muscle strength in people with chronic stroke.

**Methods:** Forty participants were randomly assigned to one of the three exercise programs: high-EMGBFB, low-EMGBFB, or control. Each program was 4–6 weeks in length, 30 minutes/session, and 2 or 3 sections per week. Each subject in the high-EMGBFB group practiced a total of 1440 trials (80 trials per session for 18 sessions), and the low-EMGBFB group practiced only 240 trials (20 trials per session for 12 sessions) of isotonic contractions in the affected TA muscle. The control group received regular physical therapy emphasizing the upper extremity movement. Affected TA muscle strength was evaluated by a hand-held dynamometer at baseline, post-training, 2 weeks and 6 weeks after training.

**Results:** The high-EMGBFB group showed significant improvement on affected TA muscle strength ( $p = 0.004$ ) compared with the low-EMGBFB and the control groups at post-training and follow-up. There was no significant improvement for either the low-EMGBFB or the control group.

**Conclusions:** Higher dose of EMGBFB-assisted TA muscle training led to immediate and long-term improvement in muscle strength in chronic stroke patients. Future study will search for the minimal effective dose of EMGBFB-assisted TA muscle strength training in order to enhance the cost-effectiveness of this program.

### WSC-0576

#### Multidisciplinary Clinical Rehabilitation Usefulness of the scale for the assessment and rating of ataxia (SARA) in evaluating stroke patients

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**Introduction:** Usefulness of the Scale for the Assessment and Rating of Ataxia (SARA) in evaluating stroke patients has not been clarified. It has been shown that the National Institutes of Health Stroke Scale (NIHSS) score does not reflect the severity of posterior circulation stroke. Here, we examined this issue.

**Methods:** A total of 57 adult patients who underwent physical therapy for ataxia after a posterior circulation stroke were examined between June 2011 and March 2014. SARA, NIHSS score, and Barthel Index (BI) were examined at 7 days after onset and at discharge. Length of hospital stay (LOS) was also recorded. The validity was examined by Spearman correlation and multiple linear regression analysis. The standardized response mean (SRM) was used to examine responsiveness.

**Results:** SARA score at 7 days after onset had moderate predictive validity for BI at discharge ( $p < 0.001$ ,  $r = -0.542$ ), and with LOS ( $p < 0.001$ ,  $r = 0.690$ ). The NIHSS score revealed low predictive validity with BI at discharge ( $p = 0.012$ ,  $r = -0.330$ ), and with LOS ( $p < 0.001$ ,  $r = 0.481$ ).

Multiple linear regression analysis revealed that BI at discharge was significantly associated with SARA at 7 days after onset and chronic renal failure ( $R^2 = 0.56$ ,  $p < 0.001$ ).

The change in responsiveness of the SARA score was large from 7 days after stroke onset to discharge (SRM = 0.95), whereas the change in NIHSS score was moderate (SRM = 0.46).

**Conclusions:** SARA score was sensitive and useful in evaluating patients with ataxia due to posterior circulation stroke.

## WSC-0669

### Neurocritical Management Clinical characteristics of stroke patients requiring mechanical ventilation: An experience from tertiary care center in North India

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**Introduction:** Mechanical ventilation and intensive care may be needed during treatment of stroke.

**Aims:** This study was conducted to examine the characteristics of stroke patients requiring mechanical ventilation.

**Methods:** We retrospectively collected data on 45 patients admitted to 12 bedded general purpose ICU suffering stroke from a period of 2011–2013. Patients with subarachnoid hemorrhage, subdural hematomas and age <18 years were excluded. Data recorded included age, sex, co-morbidities, GCS, SOFA score and APACHE-II score, neurological care, length of ICU stay, status at discharge, and neuroimaging.

**Results:** There were 14 females and 31 male patients. Their mean age was  $52 \pm 15$ . Majority of patients (70%) were intubated for low GCS (<6). Other reasons for intubation were rapidly worsening sensorium, and aspiration. Admission APACHE II was  $17 \pm 5$ , SOFA  $8 \pm 4$ . Majority of patients were admitted after 24 hours of stroke. None of the patient with ischemic stroke received thrombolytic therapy. Diabetes and hypertension were the most common co-morbidities (80% & 70%) followed by CAD, COPD & CKD. There were 35 cases (78%) of ischemic stroke and 10 cases of hemorrhagic stroke (22%). Carotid territory was involved in 83% of patients. Length of ICU stay was  $28 \pm 17$  days. 36 patients (80%) underwent tracheostomy within first week of ICU admission. None of the patients needed any surgical intervention. There were 26 survivors (57%) and 19 nonsurvivors (43%). All the survivors at discharge had GCS  $\geq 12$ .

**Conclusions:** Patients with stroke requiring ventilatory support have high mortality. Timely referral and establishing stroke units can improve outcome.

## WSC-0998

### Neurocritical Management Continuous electroencephalogram for detecting vasospasm in subarachnoid hemorrhage: A case report

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**Background:** Continuous electroencephalogram (cEEG) can be helpful to detect for vasospasm and delayed cerebral ischemia in aneurysmal subarachnoid hemorrhage (SAH). We describe a patient with vasospasm detected very early using real-time cEEG in aneurysmal SAH and treated by successful chemical angioplasty.

**Case Report:** A 50-year-old woman without any past medical history presented with a severe bifrontal headache, which was found to be due to SAH with ruptured aneurysm on anterior communicating artery (Fisher grade 3). On bleed day 6, she developed sudden global aphasia and left hemiparesis because of vasospasm and neurologic deterioration was detected early before developing permanent ischemia using the regular checking-up of the real-time quantitative cEEG. Stat chemical angioplasty was performed and she recovered without any significant neurologic deficit and discharged at home.

**Conclusions:** Real-time and protocol based cEEG can reduce the detection time of vasospasm in aneurysmal SAH and also improved clinical outcome.

## WSC-0164

### Neurocritical Management The effect of aqueous extract of aloe vera on choline acetyltransferase expression after spinal cord compression in adult rats

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**Introduction:** Increases of accidents and trauma to spinal cord injuries (SCI) often cause disability in people, especially young adults., the design of alternative therapies like usage of herbs with pharmacological properties looks ideal.

**Aims:** The studies identified that one of these plants, Aloe Vera, has neurotrophic and neuroprotective properties. This study was conducted to further research the effect of this plant on the SCI of adult rats.

**Methods:** In this experimental investigation, 32 adult male rats were divided randomly into 4 groups: 1 – laminectomy and intraperitoneal injection of saline, 2 – laminectomy and intraperitoneal injection of aqueous extracts of Aloe Vera, 3 – laminectomy and induction of spinal mechanical pressure with intraperitoneal injection of aqueous extract of Aloe Vera 4 – Laminectomy and induction of spinal mechanical pressure with saline injected intraperitoneally. After 4 weeks of daily intraperitoneal injection, the rats were killed. Morphometric study and spinal motor neurons count was performed using Cresyl Fast Violet staining and the enzyme choline acetyltransferase evaluation by using immunohistochemical techniques.

**Results:** Results of morphometric study showed a decline in number of spinal motor neurons in the groups with mechanical stress versus groups without stress. ( $P < 0.05$ ) usage of aqueous extract of Aloe Vera showed a reduction in death of motor neurons. ( $P < 0.05$ ) it also increased the enzyme choline acetyltransferase extract after the SCI. ( $P < 0.001$ )

**Conclusions:** Aloe Vera with neuroprotective effects can reduce neuronal cell death and increased expression of the enzyme choline acetyltransferase after compression injury to the spinal cord.

## WSC-0163

### Neurocritical Management Synaptic changes in injured spinal motoneurons in rat

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**Introduction:** Spinal Cord Injury (SCI) causes a majority of disability and costly human condition with worldwide incidence of 10–40 cases per million. Neurobiological disability depend on mechanical pressure.

**Aims:** In order to distinguish spinal cord injury (SCI) caused by compression model, we demonstrated ultrastructural and morphometric changes in synaptic lesion after SCI.

**Methods:** Seventy-two female Sprague Dawley rats weighing 250–300 g, were randomly divided into four groups (N = 18). The sham groups were

only subjected to laminectomy all administered 2.5 mg/kg Deprenyl (CIPLA/India, dissolved in 1 cc saline) or equal volume of saline. At the time of operating for sham or SCI surgery groups daily injection were done and continued till they were sacrificed: group A: SCI + Deprenyl, group B: SCI + vehicle, group C: Sham + Deprenyl, and group D: Sham + vehicle. In every group, after 1, 2, 4 weeks six animals were sacrificed.

**Results:** SCI caused motoneuron decreased in Anterior horn of spinal cord with hole and hemorrhage. Deprenyl decreased this reduction. The most pattern of synaptophysin in group A which received Deprenyl, were cytoplasmic and partial. Synaptic and neuronal mitochondria changes were analyzed in a blinded manner for qualitative ultrastructural changes. In group B, synaptic pathological changes including irregularity of the synaptic membrane and synaptic cleft with displacement of synaptic vesicles and irregularity of mitochondria were seen beside synaptophysin reduction.

**Conclusion:** Deprenyl reduced motoneuron changes in synaptic lesion after spinal cord injury in rats.

### WSC-0485

#### Neurocritical Management

#### Early occurrence of sinking skin flap syndrome: In a state of intracranial hypertension

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**Introduction:** Paradoxical herniation after the removal of cerebrospinal fluid in a patient with a large craniectomy defect, which is unusual and fatal, has been described. We report a case of successful treatment by in playing delayed cranioplasty and the simultaneous ventriculoperitoneal shunt in the situation of brain swelling and accompanying communicated hydrocephalus.

**Methods and Results:** A 46-year-old female underwent a large craniectomy after aneurysmal rupture. Intracranial hypertension had been being controlled by extraventricular drainage, lumbar drainage and hypertonic solution. Ten days after the operation, her mentality suddenly deteriorated and the brain computer tomography showed depressed skin flap, contralateral midline shifting to craniectomy site, and the transtentorial herniation. We took a step to stop inducing intracranial hypotension. We performed a delayed cranioplasty and the simultaneous ventriculoperitoneal shunt. Then the patient was neurologically fully awake up.

**Conclusions:** Paradoxical herniation can occur under the situation of intracranial hypotension with large craniectomy. We conclude that paradoxical herniation can be rapidly reversed and successfully treated by avoiding intracranial hypotension and early cranioplasty.

### WSC-0260

#### Neurocritical Management

#### Neurogenic pulmonary edema in subarachnoid hemorrhage

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**Introduction and Aims:** Neurogenic pulmonary edema (NPE) is rare but could complicate the clinical course of patients with subarachnoid hemorrhage (SAH). Exact incidence, risk factors and clinical course have not been fully elucidated in the literatures.

**Methods:** We retrospectively analyzed consecutive patients with acute onset (within 24 hours) SAH and reviewed their chest x-rays taken within 24 hours after admission. Patients with other causes for acute bilateral pulmonary infiltration were also excluded. Clinical data of patients with NPE were analyzed.

**Results:** Total 15 patients (4.5%) of 317 patients with SAH had NPE on the day of admission. Male to female ratio was 7:8 and mean age was 52.1 year (range: 32–77 year). Onset time was within 6 hours (n = 13, 86.7%), 12 hours (n = 1) and 24 hours (n = 1) after ictus. Hunt-Hess grade was 3 in 1 patient, 4 in 5 patients and 5 in 9 patients. Most NPE improved within 48 hours and resolution on chest x-ray was evident in 9 hours to 6 days (mean 2.4 days). However, clinical outcome of those patients with NPE was so poor that 33.3% (n = 5) expired within 3 days and 33.3% (n = 5) were discharged hopelessly. Five patients (33.3%) who survived from initial ictus had variable clinical outcome.

**Conclusions:** NPE itself had a good prognosis but initial insult from SAH which resulted in NPE led poor neurological outcome. It should be kept in mind that poor grade SAH might have NPE on presentation.

### WSC-1004

#### Nursing

#### A pilot study on delay factors of access to medical care for patients with acute ischemic stroke

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**Introduction:** Acute ischemic stroke is the leading cause of adult disability. If prompt medical care is given, disability incidence can be largely reduced for patients. Thus it is important to understand the delay factors of access to medical care for patients with acute ischemic stroke.

**Objectives:** Through investigating the time interval from symptom-onset of stroke to hospital for acute ischemic stroke patients, we tried to analyze the factors of delaying access to medical care.

**Methods:** A cross-sectional study was undertaken and the self-designed questionnaire was applied on 232 patients with acute ischemic stroke in China.

**Results:** The median of time interval (n = 232) from symptom-onset to diagnosis is 7.0 hours. 100 patients (43.1%) arrived in hospital within 5 hours after onset of symptom and 132 patients (56.9%) delayed (>5 hours). On average, 53.01% of patients with symptom-onset in daytime can be hospitalized within 5 hours, only 18.18% at night (P < 0.001). Patients with mild and moderate stroke arriving hospital were more likely delayed than patients with severe stroke (60.51% versus 35.1%, P < 0.05). 77.6% of patients who live in rural area were delayed and 50% of patients were delayed in urban. 74.42% of patients choosing ambulance as transport method could get medical care within 5 hours after symptom-onset, this number changed to 35.98% for patients choosing other transport methods.

**Conclusion:** Onset-time of stroke symptoms, stroke degree, residential positions and transport method were main relative delay factors of access to health care for patients with acute ischemic stroke.

### WSC-1536

#### Nursing

#### Needs of caregivers of patients hospitalized in a neurology clinic

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**Aims:** The aim of this study was to identify the needs of caregivers of patients hospitalized in a neurology clinic.

**Material and Methods:** The study used a descriptive design. All caregivers completed included information about their socio demographic status (20 item), and Questionnaire form (13 item) included three subject such as *special problems* (e.g. *prevention infection, communication with patients with speech disorders, prevention pressure ulcer etc.*) *self care* (e.g. *oral care, bed bath making, changing bed lining etc*) and *stress and coping strategies* (e.g. *anger management, relaxation techniques etc*). Data were analyzed by using descriptive statistics.

**Results:** A total of 152 caregivers participated in the study; the mean age was 46.99 years (SD = 13.6), the majority (71.7%) were female and had completed their primary school education (38.8%). The mean age of patients was 54.6 years (SD = 18.4) and 48.0% of the patients had stroke. The top needs about which information was desired were: prevention infection (31.6%), oral care (45.4%), and relaxation techniques (46.7%).

**Conclusion:** Based on these findings, appropriate nursing information and assistance focusing on caregivers' needs should be provided to patients of caregivers performing informal care to ensure that both patients and caregivers have the best possible quality of life.

### WSC-0481

#### Nursing

#### Effect of implication of interdisciplinary rehabilitation model on the adherence of rehabilitation regime of family caregivers of stroke survivors in east of Iran

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**Background:** Stroke effects on physical functioning and can lead to changes in lifestyle and inability to manage self, which requires long-term support and care. Findings indicated that only about 10% of caregivers were in good levels of adherence to the rehabilitation regimen; and about 25% of them were weak.

**Aim:** The aim of this study was to implicate of interdisciplinary Rehabilitation Model on the Adherence of Rehabilitation Regime of family caregivers of stroke survivors.

**Methods:** This is a semi-experimental study, conducted on 60 family caregivers of stroke patients selected by convenience sampling and randomly divided into two groups of case and control ( $n = 30$ ). The control group received only routine discharge plan and the experimental group ( $n = 30$ ) received routine discharge plan plus an implication of interdisciplinary Rehabilitation Model consisting of four steps; need assessment, educating families based on patients' needs individually and in groups, follow-ups by short phone interviews, and referral service. The data were collected via a demographic data form and 'Adherence to the rehabilitation regimens' Questionnaire. Data were assessed and analyzed with SPSS version 18.

**Findings:** Study findings showed that the levels of adherence to the different components of the rehabilitation regimens, including rehabilitations, medications and dietary regimen are significantly higher in the experimental group compared to the control group ( $P < 0.001$ ).

**Conclusion:** Implication of interdisciplinary Rehabilitation Model will be useful to manage of physical, mental and spiritual health situations of stroke patients by empowering family caregiver and improving their adherence of rehabilitation regimens.

### WSC-0397

#### Nursing

#### Early motivational interviewing on poststroke depressive symptoms: PILOT Randomized controlled trial of the good mood intervention program

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**Introduction:** Depression is a frequent consequence of stroke that can adversely affect recovery; however, it is often undetected or treated inadequately. This randomized controlled trial (RCT) evaluates a new brief and early intervention, the Good Mood Intervention program.

**Aims:** The aim of the study is to investigate if early motivational interviewing (MI) during acute hospitalization improves patients' mood poststroke.

**Methods:** This single-blinded, prospective, RCT recruits eligible participants (>18 years of age, acute ischemic/hemorrhage stroke) during acute hospital admission. Participants are randomized to intervention or control groups. Intervention group patients receive early MI, provided by trained nurses and social workers during acute hospitalization. MI comprises of three, 30-minute individual sessions: 1) Setting agenda and encouraging patient to talk about how they are feeling after having a stroke; 2) Eliciting concerns about recovery, and adjusting to stroke; and 3) Identifying patient's mood, optimism and self-efficacy, and identifying solutions to problems. Data is collected at baseline, 4-week and 12-week follow-up. Primary outcome measures include anxiety and depression (Hospital Anxiety and Depression Scale) and quality of life (Quality of Life Index).

**Results:** Preliminary results will be presented. Twenty-six participants have been recruited since September 2013: 14 men and 12 women, average age 69 years. Twelve participants have received the intervention and fourteen have received standard care.

**Conclusions:** This study aims to demonstrate that early motivational interviewing can improve patients' mood after stroke. MI can be incorporated readily into usual care within the acute setting by health professionals, with minimal training in the technique.

### WSC-0634

#### Nursing

#### Improving the completeness of the swallowing training for stroke patients among nurses

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**Introduction:** Dysphagia is a common symptom soon after stroke, and it could increase the risk of pneumonia, malnutrition, and etc. Early swallowing training (ST) has been proved to be an effective strategy for the recovery from swallowing dysfunction, and it should be regularly monitored and reassessed by health professionals according to NICE clinical guidelines. However, only few stroke patients with dysphagia regularly performed ST, and rarely nurses instructed and monitored their performance.

**Aims:** The aim of the project was to enhance the completeness of ST for stroke patients among nurses, and improve the execution rate of ST among patients.

**Methods:** A situation analysis was conducted to investigate the difficulties of performing ST among patients and the barrier of nurses. Five major causes were identified as follows: (i) insufficient knowledge and skill of nurses; (ii) the absence of training programs and audit mechanism; (iii) a

lack of pamphlets and video; (iv) unawareness of the importance of ST among patients; (v) fear of choking among patients. We proposed approaches included: arranging in-service training program for nurses, establishing an instruction checklist, developing ST pamphlets and a DVD, cooperating with language therapist and doctor to monitor the ST performance and process among patients.

**Results:** The project is in progress. Descriptive statistics will express as frequencies and percentage. The completeness of ST for stroke patients among nurses and the execution rate of ST among patients will be examined.

**Conclusions:** The project is expected to be effective to enhance the completeness of ST for patients among nurses.

## WSC-1359

### Nursing

#### Development of a randomized controlled trial to evaluate the effectiveness of a self-efficacy enhancing stroke self-management program for stroke survivors

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**Introduction:** Enabling stroke survivors to attain effective self-management of poststroke life challenges is crucial. Stroke self-management programs are complex interventions consisting of multiple interacting components including the program dose and contents.

**Aim:** To develop and evaluate a nurse-led self-efficacy enhancing stroke self-management program on stroke survivors' recovery.

**Methods and Results:** The study consisted of two phases. A systematic review was conducted in Phase one to identify the theoretical framework underpinning the self-management programs, the best strategies to deliver the programs, and its contents. All programs examined in the 14 included studies empowered stroke survivors to practice problem-solving and goal setting. Opportunities to interact with healthcare providers and peers were highly appreciated by the stroke survivors. The review findings were used to inform the design of a nurse-led self-efficacy enhancing stroke self-management program. A single-blinded, randomized controlled trial will be conducted on 160 community-dwelling stroke survivors who have a stroke in the past year. The proposed program includes one individual home visit, two group sessions, and two follow-up phone calls. Bandura's self-efficacy theory will underpin the program design and implementation. The outcomes include self-efficacy, outcome expectation, self-management behaviors, quality of life, depressive symptoms, and community reintegration. Data will be collected at baseline and 1 month after program completion. Generalized estimating equations will be performed to evaluate changes in outcomes over time by treatment condition.

**Conclusion:** The study results will be important to inform future design and evaluation of best approaches to deliver stroke self-management programs for stroke survivors to enhance their recovery.

## WSC-1360

### Nursing

#### Psychometric properties of the Chinese version of the stroke self-efficacy questionnaire in community-dwelling stroke survivors

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**Introduction:** Self-efficacy is a significant factor influencing stroke survivors' participation in self-care tasks. The Stroke Self-Efficacy Question-

naire (SSEQ) (Jones, 2009) is a stroke-specific assessment of stroke survivors' self-efficacy in performing activities and self-management behaviors. The SSEQ was translated into Chinese and blind back-translated in this study.

**Aim:** To examine the reliability and validity of the Chinese version of Stroke Self-Efficacy Questionnaire (SSEQ-C) in stroke survivors.

**Methods:** A cross-sectional, descriptive study was conducted. A convenience sample of 135 stroke survivors were recruited from three community centers and a stroke support group in Hong Kong. Content validity was reviewed by an expert panel of seven members: two physicians, one nurse academic, one nurse manager, one advanced practice nurse, and two registered nurses. Internal consistency analysis was performed. Pearson's correlation coefficients were calculated between SSEQ-C, General Self-Efficacy Scale (GSES) and Frenchay Activities Index (FAI) to determine the convergent validity. The GSES was chosen as it is a generic measure of self-efficacy. FAI was chosen because self-efficacy was found to be a factor influencing social participation.

**Results:** The SSEQ-C had high internal consistency (Cronbach's alpha = 0.92). Content validity index of SSEQ-C was 0.97. Significant positive correlations were found between the subscales scores of SSEQ-C and GSES total scores ( $r = 0.43$  to  $0.55$ ,  $p < 0.01$ ), and FAI total scores ( $r = 0.44$  to  $0.53$ ,  $p < 0.01$ ).

**Conclusion:** The findings supported the content and convergent validities as well as the reliability of the SSEQ-C among Chinese stroke survivors. Factor structure of SSEQ-C will be further tested to determine its validity.

## WSC-0918

### Nursing

#### Fatigue after stroke: A micro ethnographic study of the importance of fatigue during hospital rehabilitation

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**Introduction and Aim:** A review over the literature shows that there is an increase in the number of articles regarding experience of living with fatigue after stroke but there is a need for more knowledge about what fatigue after stroke means for the patient's participations in rehabilitation during the sub-acute phase.

**Methods:** In two rehabilitation sections, an explorative study using participant observations, informal ethnographic interviews and interviews on the basis of Spradley's ethnographic method were conducted. Data was analyzed through a domain analysis; taxonomic analysis, componential analysis and finally, themes were derived through a constant targeted comparison.

**Results:** It was clear, through the analysis that the four themes *the experience of fatigue, the possibility of sleep and rest, coping strategies and the hospital's structure and framework* together affect patients participation in rehabilitation. It seems that the nurse becomes a key figure in terms of helping the patient to handle fatigue to be able to participate in rehabilitation.

**Conclusion:** Patients fatigue in the sub-acute phase does not appear to differ significantly from experience described in the later course. However, it appears that the focus in the sub-acute phase is on physical rehabilitation. The phase is characterized by an optimism, which might have a positive effect on the motivation, despite the fatigue. For those patients who suffer from an overwhelming fatigue and those most affected from their stroke, it seems that the nurse's approach and motivation are important for the patient to actively participate in their rehabilitation.

**WSC-0842****Nursing****An international study on the uptake of the on-line resources from the Quality in Acute Stroke Care (QASC) Trial**S Middleton<sup>1</sup>, D Bruch<sup>1</sup>, C Martinez-Garduno<sup>1</sup>, S Dale<sup>1</sup><sup>1</sup>Nursing Research Institute, St Vincent's & Mater Health Sydney – Australian Catholic University, Sydney, Australia

**Background:** The QASC Trial demonstrated that patients cared for in stroke units with supported implementation of clinical protocols to manage fever, hyperglycemia and swallowing dysfunction (FeSS protocols) following stroke, resulted in decreased death and dependency at 90 days poststroke by 16% ( $p=0.002$ ). Following publication, the FeSS protocols and implementation resources were made freely available to download.

**Aims:** To investigate the international uptake of the QASC resources.

**Method:** A cross-sectional, on-line survey administered to those who downloaded the QASC resources between 2011 and 2013.

**Results:** A total of 159 responses (56%) were received from our initial sample of 309 people from 21 countries who downloaded the QASC resources. The majority ( $n=97, 64\%$ ) downloaded the resources for clinical practice purposes. Of the clinicians who reported successful implementation of any of the FeSS protocols ( $n=27, 54\%$ ) only 33% ( $n=9$ ) indicated they had undertaken an audit to assess implementation success. The main barriers to implementation reported were the potential increase in nursing work load ( $n=28, 56\%$ ) and the lack of medical engagement ( $n=27, 54\%$ ). High level of job autonomy was associated with successful implementation of the swallow protocol ( $P=0.012$ ) and implementation (fully or partly) of all three protocols ( $P=0.038$ ). Successful implementation of the fever protocol ( $P=0.017$ ) was associated with being part of a metropolitan hospital.

**Conclusion:** This study demonstrates the complexities of successful uptake of trial results even if all resources are made available. Rigorous strategies to evaluate and drive implementation are necessary to assist practice change.

**WSC-1598****Nursing****Eating difficulties in patients with stroke: Preliminary results**Z Tulek<sup>1</sup>, S Altin<sup>2</sup>, A Bozkurt<sup>2</sup>, H Kucukoglu<sup>2</sup>, S Baybas<sup>2</sup><sup>1</sup>Florence Nightingale Faculty of Nursing, Istanbul University, Istanbul, Turkey<sup>2</sup>Department of Neurology, Bakirkoy Mental and Neurological Diseases Hospital, Istanbul, Turkey

**Introduction:** Eating difficulties are common in patients with stroke. Eating difficulties predict malnutrition and need for assistance when eating.

**Aims:** This preliminary study aims to determine frequencies and associations between eating difficulties, assisted eating and nutritional status in patients with stroke in acute care.

**Methods:** This observational cross-sectional study has been carried out in a mental and neurological hospital. 36 consecutive patients with acute stroke were recruited and observed when eating their lunch by use of Minimal Eating Observation Form (developed by Westergren *et al.*). Patients have been assessed by Mini-Nutritional Assessment, Barthel index and modified Rankin Scale. For data analysis SPSS program (version 16.0) was used. Relevant statistical tests were used.

**Results:** During admission, 42% had swallowing difficulty and 30% needed to modify consistency of food. While almost all patients were eating independently this ratio reduced after stroke, 25% were totally dependent for eating and 45% needed assistance. 86% of patients had one or more

eating difficulties. The most common difficulties, in decreasing order, were low food consumption, difficulties in manipulating food on the plate, difficulties in maintaining sitting position, transport of food to mouth and reduced appetite. 5.6% of the patients had malnutrition and 61% risk of malnutrition. The correlations between eating abilities and nutritional status and assisted eating were found to be statistically significant.

**Conclusions:** Three components of eating (ingestion, deglutition and energy) were associated with assisted eating, and also with malnutrition. Observation of eating may contribute to prevention of malnutrition.

**WSC-0935****Nursing****Nursing care for stroke patients: A survey of current practice in Europe**Z Tulek<sup>1</sup>, I Poulsen<sup>2</sup>, K Gillis<sup>3</sup>, A C Jönsson<sup>4</sup>,

on behalf of EANN (European Association of Neuroscience Nurses)

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**Introduction:** The European Association of Neuroscience Nurses (EANN) participated in the update of the European Stroke Strategies (ESS) at the Helsingborg Declaration Conference in 2006.

**Aim:** Aim of this study was to conduct a survey of the clinical nursing practice in relation to the ESS.

**Method:** This study was conducted as a descriptive cross-sectional survey. A questionnaire based on ESS and evidence-based nursing practice was distributed to EANN representatives, who sent the questionnaires to nurses in stroke care.

**Results:** This is a summary of the main nursing perspectives in acute stroke care. Ninety-three nurses in stroke care in 13 countries participated in the survey. A majority of the nurses ( $n=74$ ) were working in stroke units, 10 in neurological clinic and 4 in neurointensive care, 42 were nurse specialists, 25 head nurses, 2 clinical lecturers and 22 bed-side nurses. A majority (91%) had interdisciplinary stroke teams. Update of education in stroke care for staff was available for 69%. Stroke patients were monitored the first 48h after stroke onset (95%), and 93% were mobilized when the patients were stable, usually within 24h. Assessment of swallowing was performed for 81% within 24 hrs (84 respondents), change of position for immobilized patients was monitored for 72%, residual volume urine was measured for 85%, and oral health was assessed daily for 87%.

**Conclusion:** Most European countries participating in this survey have developed stroke care in accordance with the ESS guidelines. However clinical nursing practice for stroke patients need to be further developed in some countries.

**WSC-1428****Nursing****A questionnaire-based survey of nursing practice and challenges in caring for patients with stroke in Turkey**S Memis<sup>1</sup>, Z Tulek<sup>2</sup>, A Ozakgul<sup>2</sup>, Z Durna<sup>3</sup><sup>1</sup>Aydin School of Health, Adnan Menderes University, Aydin, Turkey<sup>2</sup>Florence Nightingale Faculty of Nursing, Istanbul University, Istanbul, Turkey<sup>3</sup>Faculty of Health Sciences, Bahcesehir University, Istanbul, Turkey

**Introduction:** To improve nursing care in stroke, it is important to understand practices and challenges of nurses who care for these patients.

**Aim:** To determine nurses practices and challenges they faced in caring for patients with stroke in Turkey.

**Methods:** The sample consisted of ninety-seven nurses from ten university hospitals from different geographical areas. Data were collected by a form developed by the researchers.

**Results:** Mean age was  $31.21 \pm 6.98$ . 58.3% had bachelor degree and were working in neurology for  $6.50 \pm 6.67$  years. The majority of the nurses (72.2%) were working in day and night shifts. They were working for  $15.27 \pm 4.54$  hours without a break in night shift. They reported  $10.58 \pm 3.61$  patients per nurse for day and  $18.39 \pm 7.85$  for night. Average time spent for care practices in an-8-hour shift was  $5.21 \pm 1.86$  hours and most commonly applied nursing intervention was oral care. The most time-consuming non-nursing practice was use of drug prescription/order system. Half of the sample reported some challenges, high patient-nurse ratio and heavy workload, limited time was the most pronounced barrier for professional development. Only 16% of nurses joined congress/symposiums, 18% followed publications in their field and joined a research.

**Conclusion:** Although many nurses caring for patients with stroke have bachelor degree, lack of time (because of heavy workload) is a big challenge for their professional development. The nurses reported that they spent time less than they desired for direct nursing care. Facilitating educational programs and establishing job description National Association of Neurological Nursing may contribute to overcoming these problems.

## WSC-1589

### Nursing

#### Factors affecting the burden on caregivers of stroke survivors in Turkey: Social support and sleep quality

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**Aim:** The aim of our study was to identify the factors affecting the burden on caregivers of patient with stroke, to examine the relationship between caregiving burden and age, social support and sleep quality.

**Material and Methods:** A total of 206 caregivers completed the Caregiving Burden Scale, the Multidimensional Scale of Perceived Social Support, and Pittsburgh Sleep Quality Index in outpatients unit at a large University Hospital, in West Turkey. Data were analyzed by using descriptive statistics, student t-test, one-way variance analysis and Pearson's correlation test.

**Results:** The mean age was 30.52 (SD 7.84). Hundred and thirty caregivers (63.1%) were male and most were married. The mean caregiver burden score, the mean social support score and the mean sleep quality score were 70.17 (SD 4.14), 26.58 (SD 3.59), and 18.43 (SD 1.68) respectively. There were significant differences between the mean caregiving burden scores and the number of children they have ( $p < 0.05$ ) There were no significant differences between the mean caregiving burden scores and some socio-demographic characteristics (sex, marital, employ, educational status, to have chronic disease, and degree of dependency of patient) ( $p > 0.05$ ). There wasn't significant correlation between the mean caregiving burden scores and the social support scores, the sleep quality scores ( $p > 0.05$ )

**Conclusion:** Caregivers being children's number are important factors related to the caregiver burden in our population. Strategies to reduce caregiver burden should be developed based on understanding of these factors.

## WSC-1586

### Nursing

#### The relationship between fatigue and social support in caregivers of patient with stroke

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**Aim:** The aim of the study was to examine the relationship between fatigue and social support in caregivers of patients with stroke.

**Material and Methods:** A total of 105 caregivers completed the Fatigue Severity Index and the Multidimensional Scale of Perceived Social Support Scale. Data were analyzed by using descriptive statistics and Pearson's correlation test.

**Results:** The half of the caregivers were male (52.4%) with mean age 41.64 years (SD: 13.81). Most of the participants were married (69.5 Most participants (63.8%) reported that they had no health problems of their own. Sixty-six of caregivers had one with whom to share their caregiving responsibilities. The mean fatigue score, the mean social support score and the mean Glasgow coma scale score were 4.75 (SD 1.73), 65.94 (SD 16.30), and 9.54 (SD 3.36) respectively. There was a negative weak significant correlation between the mean fatigue scores and social support scores. ( $r = -0.30$ ,  $p = 0.000$ ) and Glasgow coma scale scores of patient ( $r = -0.22$ ,  $p < 0.05$ ).

**Conclusions:** The results of the study showed that fatigue of caregivers can be reduced by increasing social support.

## WSC-1106

### Nursing

#### Management of the external ventricular drains

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**Introduction:** External ventricular drains (EVDs) are temporary measures allowing drainage of the cerebrospinal fluid (CSF) from the brain lateral ventricles. We aimed to study management of EVD and factors causing EVD infections.

**Methods:** In a period of 12 months (starting with April 2013) we performed a prospective observational study of all patients with inserted EVD admitted to the neurological intensive care unit. In all patients the distal end of the EVD was tunneled under the skin. We followed several factors possibly related to EVD infections: antibiotic prophylaxis, venue of surgery, duration and number of EVDs, manipulation with catheters and systems, CSF sampling and patients' dressing. We followed the reason for EVD removal as well.

**Results:** Of total 84 EVDs in 72 patients the bacteria of cerebrospinal fluid (CSF) were isolated in 8 patients (9.2%). Venue of surgery was not related to EVD infection. The most important factor related to increased frequency of CSF infections was duration of EVD insertion. In our 8 patients the duration of ventricular catheterization was  $\geq 10$  days. The most common causes for removal of EVD were no further clinical indication (41.8%), followed by EVD blockade (22.6%), mainly due to blood in CSF. **Conclusion:** The data of our prospective study demonstrated that our current protocol of EVD management which includes EVD tunnelization, antibiotic prophylaxis, and common CSF sampling, increases patients' security. This is expected also to reduce economic costs.

**WSC-0257****On-going Clinical Trials****The mandibular advancement device is equally effective as nasal continuous positive airway pressure in treating mild to moderate obstructive sleep apnea**J K Adam<sup>1</sup>, A Madaran<sup>1</sup><sup>1</sup>*Biomedical and Clinical Technology, Durban University of Technology, Durban, South Africa*

**Introduction and Purpose:** The first line treatment for OSA patients is continuous positive airway pressure (CPAP) therapy. However, despite CPAP being so effective, it is not readily accepted by patients, making compliance a very problematic aspect. The Mandibular advancement device (MAD), often recommended to patients who refuse treatment with CPAP, works on the same principle as that of CPAP. Therefore, the objective of this study is to compare CPAP and MAD as treatment modalities for OSA.

**Method:** Patients aged between 20 and 79 yrs with OSA, newly diagnosed by a polysomnogram (PSG), were recruited for the study, with inclusion criteria, (an AHI between 10–100 events per hour, snoring and excessive daytime sleepiness, low level of compliance to CPAP after one night trial), and exclusion criteria, (patients with ENT anatomy complications, patients with inadequate dental structure/temporomandibular joint disease, contra-indicating MAD treatment, patients with co-existing sleep disorders other than OSA). Patients were titrated for one night with CPAP, thereafter, patients who reported being noncompliant to CPAP were referred for MAD treatment. Vital parameters were recorded post 7 days of titration with each treatment.

**Results:** The findings suggested that, in the case of compliance problems with CPAP, the combination of CPAP with MAD may give a useful solution to the problem and ultimately give a greater overall success rate in the treatment of OSA.

**Conclusion:** Although it was unable to prove a definite hypothesis, it has given a possible indication as to a treatment option worth exploring for the betterment of all OSA sufferers.

**WSC-1578****On-going Clinical Trials****The relationship between mild traumatic brain injury and insomnia**E Basha<sup>1</sup>, B Zllami<sup>2</sup>, S Llazo<sup>3</sup>, F Jaho<sup>1</sup>, J Kruja<sup>4</sup><sup>1</sup>*Department of Neurology, University Hospital of Trauma, Tirana, Albania*<sup>2</sup>*Department of Neurology, American Hospital, Tirana, Albania*<sup>3</sup>*Department of Anesthesiology, UHC "Mother Theresa," Tirana, Albania*<sup>4</sup>*Department of Neurology, UHC "Mother Theresa," Tirana, Albania*

**Objective:** Evaluation of the insomnia's frequency in patients with mild traumatic brain injury (MTBI).

**Background:** Traumatic brain injury (TBI) is one of the leading causes of morbidity and the mortality especially in young people. One of the most common comorbidities of MTBI and postconcussion syndrome is insomnia.

**Methods:** 128 patients (16–65 years old), mean age 35.7, SD 33.5. 39 females and 89 males with MTBI were included in a prospective analysis. The evaluation is done 1–3 months after TBI. 49 patients were classified in Category 0, (Glasgow Coma Scale – GCS score 15), 39 patients in Category I, (GCS score 15), 13 patients in Category 2 (GCS score 15), 27 patients in Category 3 (GCS score 13–14). The classification was done according to the EFNS guideline on MTBI (2002). All patients completed a form answering various questions about their hours and quality of sleep.

**Results:** There were 39 (30.4%) females and 89 (69.6%) males. The study demonstrates that 96 (75%) had sleep problems, 33 (84.6%) of 39 women and 66 (74.1%) of 89 men. 28 of the patients had difficulty of falling asleep, 29 of them woke up after having slept a few hours, and 39 of them you have nightmares and poor quality of sleep.

**Conclusion:** In patients with MTBI, insomnia is highly prevalent. It is associated with gender, being most common in female patients. The most frequent disorder, according to our data, was the poor quality of sleep accompanied by nightmares.

**WSC-0870****On-going Clinical Trials****Podcast: Prevention of decline in cognition after stroke trial: A factorial randomized trial of blood pressure and lipid lowering**P M W Bath<sup>1</sup>, K Krishnan<sup>1</sup>, S Utton<sup>1</sup>, K H Whittamore<sup>1</sup>, P Scutt<sup>1</sup><sup>1</sup>*Stroke – Division of Clinical Neuroscience, University of Nottingham, Nottingham, United Kingdom*

**Rationale:** Stroke and dementia are common, economically costly to society, and devastating to patients and their family. Elevated BP and cholesterol are common after stroke and may be associated with increasing cognitive decline. Although BP-lowering poststroke may reduce cognitive decline, there is little evidence that lipid lowering is effective in preventing cognitive decline. Critically, it is unknown whether BP and cholesterol should be lowered intensively, or moderately as per current guidelines. The trial aim is to determine if intensive BP and/or lipid lowering therapy after stroke is better in preventing cognitive decline, compared to current guideline treatment.

**Design:** PODCAST is a prospective, randomized, open-label, blinded end-point, controlled, partial factorial, phase IV trial. The start up phase will assess feasibility of the study over 3 years in approximately 100 patients. The target Systolic Blood Pressure is <125 mmHg for the intensive BP lowering group and <140 mmHg for the guideline group. For the intensive lipid lowering group the target Low Density Lipoprotein-Cholesterol (LDL-C) is <1.4 mmol/L and <3 mmol/L for the guideline group. The primary outcome is Addenbrooke's Cognitive Examination. Secondary outcomes include vascular events, quality of life, functional outcome, depression and death.

**Trial Status:** The trial has recruited 83 patients to date from 19 centers and is now closed to new recruits.

**Funding:** The start-up phase is funded jointly by The Stroke Association UK and Alzheimer's Society UK.

**WSC-0874****On-going Clinical Trials****Triple antiplatelets for reducing dependency after ischemic stroke (TARDIS): A Randomized controlled trial**P M W Bath<sup>1</sup>, K Krishnan<sup>1</sup>, S Utton<sup>1</sup>, H Foster<sup>1</sup>, T Payne<sup>1</sup>, M Adrian<sup>1</sup>, S Grant<sup>1</sup>, A Durham<sup>1</sup>, K Robson<sup>1</sup><sup>1</sup>*Stroke – Division of Clinical Neuroscience, University of Nottingham, Nottingham, United Kingdom*

**Rationale:** The risk of recurrence is greatest immediately after stroke or TIA. Existing prevention strategies (antithrombotic, lipid/blood pressure lowering, endarterectomy) reduce, not abolish, further events. Dual antiplatelet therapy – aspirin & clopidogrel (AC) for ischemic heart disease, aspirin & dipyridamole (AD) for stroke, is superior to aspirin monotherapy. We hypothesize that triple antiplatelet therapy (ACD) will be superior to current guideline therapy (AD or C) in patients at high-risk of recurrence, providing bleeding does not become excessive.

**Design:** TARDIS is a multicenter, parallel-group, prospective, randomized, open-label, blinded-endpoint, controlled trial. In the start-up (3 years) phase, we assessed the safety, tolerability and feasibility of intensive antiplatelet therapy (ACD) versus guideline therapy given for 1 month in 902 patients with acute stroke/TIA. The main 5-year phase will assess the safety and efficacy of intensive or guideline therapy in up to 4,100 patients. The primary outcome is ordinal stroke severity (fatal/severe nonfatal/mild/TIA/none) at 90 days. Secondary outcomes include death, myocardial infarction (MI), vascular events, function, bleeding, serious adverse events; sub-studies will assess cerebral emboli and platelet function.

**Trial Status:** The main phase of the trial commenced on 1<sup>st</sup> October, 2012, and will run for 5 years. As of 2nd April, 1681 patients have been recruited from 86 centers (UK, Denmark, New Zealand).

**Funding:** The National Institute of Health Research, Health and Technology Assessment Programme.

## WSC-0828

### On-going Clinical Trials

#### Ongoing trial of very early stroke rehabilitation (AVERT)

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**Background:** Early frequent out of bed activity starting within 24 hours of stroke may be an important component of stroke unit care. We hypothesize that early rehabilitation will reduce death and disability and be cost effective, compared to standard care. We report trial progress, demographics and data quality.

**Methods:** AVERT is a multicenter, single blind RCT. Randomization is stratification by site and stroke severity. Included: Patients admitted to a stroke unit within 24 hours, rtPA patients with physician approval. Excluded: patients with severe premorbid disability, or fail safety criteria. Very early mobilization commences within 24 hours and continues for 14 days. Patients in the control group receive standard care. Primary outcome: modified Rankin Scale (mRS) at 3 months. Sample size is 2104 patients (n = 1052 per group) to detect 7% or greater reduction in death/disability. Analyses are intention to treat.

**Results:** At April 2014, 1896 patients recruited (40,065 screened) from 56 hospitals. Mean age: 70.5 (SD12.9) years; male: 61.7%; first stroke: 81.8%; rt-PA 23.6% (Australia 24.2%, NZ 18.3%, Malaysia 3.7%, Singapore 5.0%, UK 34.2%). Stroke severity: mild 55.1%, moderate 30.7%, severe 14.2%. Oxfordshire stroke classification: TACI 21.7%, PACI 31.6%, POCS, 9.7%, LACI, 24.8%, intracerebral hemorrhage 12.2%. 1788 patients have completed 3 month follow up. Primary outcome (mRS) completion: 99.4%. Secondary outcome completion: 80.1–99.6%. The Data Monitoring Committee has met 14 times with no safety issues identified.

**Summary:** Recruited patients are broadly representative of recruiting countries. The trial is meeting data quality targets. We aim to complete recruitment by December 2014.

## WSC-1166

### On-going Clinical Trials

#### Development and evaluation of strategies to provide longer-term health and social care for stroke survivors and their carers

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**Introduction:** The early stages of the stroke care pathway are becoming more prescribed, but despite policy recommendations, strategies for longer-term care are not developed in the UK.

**Aims:** The proposed program of research aims to develop and evaluate key aspects of a replicable system of longer-term service delivery 'care strategy'. The emphasis will be on improving quality of life by addressing unmet needs and enhancing participation.

**Methods:** Five studies will be completed as a part of this program:

1. Interviews with stroke survivors and their carers to discuss with them factors influencing unmet needs and things that have helped or hindered their daily lives. A literature review to identify any effective interventions will also be completed.
2. A survey of stroke services to identify who might provide longer-term care and support.
3. Techniques of intervention mapping will be used to develop a care strategy, supporting materials and training programs, using the information we have obtained from the first and second studies.
4. Case studies will be used to refine the content and test implementation of the care strategy in three stroke services.
5. A feasibility cluster randomized trial will be completed to refine procedures for a future large scale trial.

**Results:** The first two studies have now been completed and the care strategy will be developed for testing by the end of 2014.

**Conclusion:** This research will address the gap in the stroke care pathway and provide a replicable, evidenced and theory based system of longer-term stroke service delivery.

## WSC-0629

### On-going Clinical Trials

#### Computerized tomography (CT) or magnetic resonance imaging (MRI) in work up for i.v. thrombolysis: A single-center quasi randomized trial

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**Introduction:** The issue if CT or MRI is 'best' in i.v. thrombolysis work-up has been discussed by stroke scientists for more than a decade. MRI is superior in detecting acute ischemia and CT is quicker; but the effect of

choice of imaging modality on overall efficacy and safety remains to be determined in spite of completion of more than 74,000 i.v. thrombolysis treatments in Europe.

**Aim:** The aim of this study is to determine if choice of primary imaging modality (CT vs MRI) affects efficacy and safety of i.v. thrombolysis.

The following items will be compared:

**Safety:** Exclusion of other causes of symptoms than acute cerebral ischemia, contraindications to scanning method (contraindications to use of contrast or magnetism).

**Effect:** Delay to treatment, acquisition of imaging in diagnostic quality and identification of stroke mechanism.

**Applicability:** Patient experience, experience of decision support for treating physician, deviation from radiological Standard Operational Plan (SOP) and use of resources.

**Methods:** An open single-center quasi-randomized trial, where imaging allocation is based on the date of admission. Inclusion & exclusion criteria: Clinical suspicion of acute cerebral ischemia, symptom-onset <4.5 hours, NIHSS $\geq$  1, admission in the daytime at weekdays and informed consent by patient or proxy.

**Results:** Inclusion of patients was initiated in December 2013 and is expected to comprise 600 patients. By April 2014, 98 patients have evaluated for i.v.-thrombolysis work-up and of those have 53 patients diagnosed with stroke or TCI been included.

**Funding:** The trial is founded by a grant from the Danish Tryg Foundation.

## WSC-1492

### On-going Clinical Trials

#### Efficacy of mirror therapy on upper limb motor recovery in chronic stroke patients: A pilot study

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**Introduction:** Motor recovery of the upper extremity in chronic stroke patients is an important goal of rehabilitation. A high percentage of these patients show a hypofunctional upper limb, being unable to perform their daily activities.

**Aims:** Test the potential of Mirror Therapy for improving upper limb motor recovery, as well as to find out the appropriate sample size to demonstrate the efficacy of the effect.

**Methods:** We selected 10 patients, aged 40–75, randomly distributed between the *mirror* (n = 5) and *control* (n = 5) groups. Both were subjected to the same training program, the first applying Mirror Therapy, the second without it: 24 minutes of exercise once a week at the hospital, under the supervision of physiotherapists, and 24 minutes of exercise twice a day, 6 days a week, at home. Improvement of motor function was evaluated using the Fugl-Meyer Assessment, the Action Research Arm Test (ARAT), and the Wolf Motor Test.

**Results:** The mean change score and 95% confidence interval (CI) of the Fugl-Meyer Assessments (13.80; 19.52–8.08, p = 0.003 vs. 3.4; 8.34–1.54, p = 0.128), the ARAT (6.00; 13.90–(–1.90), p = 0.103 vs. –0.6; 3.48–(–4.68), p = 0.7), and the Wolf Motor Tests (13.60; 22.40–4.79, p = 0.013 vs. 2.60; 5.46–(–0.26), p = 0.065) showed an improvement of motor function in the *mirror* group of patients with respect to the control group after the training program. Our sample size was 30 patients.

**Conclusions:** Mirror Therapy is a useful tool for upper limb motor recovery in chronic stroke patients. Fugl-Meyer is the most sensitive scale we tried out, to evaluate changes in motor function.

## WSC-1335

### On-going Clinical Trials

#### The predictive value of GGT on etiology and disability in stroke patients who do not drink alcohol

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**Introduction:** Gamma-glutamyl transferase (GGT) is a biomarker used in liver and especially in alcoholic liver diseases with a high sensitivity. Recently, GGT has been shown to have an active role in oxidative and inflammatory mechanisms as well as atherosclerotic pathogenesis. In addition, GGT has a prognostic role in cerebrovascular disease (CVD).

**Aims:** The aim of our study is to identify the differences in GGT levels in different types of CVD and to evaluate the relationship between GGT and disability, GGT and etiology.

**Methods:** This is a retrospective cohort study. Data were obtained from the medical records of the nondrinker patients (n = 100) who admitted to Neurology Clinic for 5 months with the diagnosis of stroke. GGT levels were measured on the first day of stroke. National Institutes of Health Score Scale (NIHSS), Barthel Index (BI) and Modified Rankin Scale (mRS) were performed to determine the degree of disability.

**Results:** Patients whose ages range from 29–93 (71.9  $\pm$  12.5) were included in the study. There was no statistically significant difference between age (p:0.90) and gender (F/M:52/48, p = 0.32) groups. There was no difference in etiology between different TOAST groups and in GGT levels between NIHSS, BI and mRS classifications.

**Conclusions:** Our findings show that GGT levels have no predictive value on etiology and disability in nondrinker CVD patients. Gender and age have no effect on GGT levels. Unlike the results of previous studies, we believe that measurement of GGT levels in acute term do not provide any additional benefit to CVD patients.

## WSC-1449

### On-going Clinical Trials

#### The International Study on Primary Angiitis of the Central Nervous System (INTERSPACE) – More study sites are needed!

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**Introduction:** Primary Angiitis of the CNS (PACNS) is a diagnostic challenge. PACNS is rarer than several potential mimickers. No clinical mani-

festations or noninvasive test results is specific. Diagnosis is often presumptive from a combination of manifestations and test results otherwise unexplained. CNS biopsy can confirm PACNS but is invasive and associated with  $\geq 30\%$  false-negative results. PACNS is also a therapeutic challenge. The optimal therapeutic regimen is unknown, monitoring of therapeutic response is difficult, and predictors of treatment failure and recurrent PACNS are unknown.

**Aims:** To describe clinical manifestations, investigation results, diagnostic processes, misdiagnoses, current treatments, and outcomes of PACNS. Primary objective: To identify predictors of death or dependence (modified Rankin Scale: 3–6) after  $>1$  year of clinical follow-up.

**Methods:** Patients aged  $\geq 16$  years with acquired neurological dysfunction and CNS vessel imaging or CNS histopathology consistent with PACNS are eligible following exclusion of PACNS mimickers. Patients without study consent or treated with immunosuppressive agents before obtaining CNS MRI or for  $>180$  days before study enrolment are excluded. Study data are collected at baseline and during clinical follow-up. PACNS diagnosis and outcome events (treatment failures and recurrences) are adjudicated.

**Results:** Assuming death or dependence at the end of follow-up in 60/200 adjudicated PACNS patients, 6 outcome predictors may be integrated to a multivariable model. In 17 months, 13 study patients were enrolled from 9 active sites. Assuming recruitment of 0.5 participant/site/year, 66 additional sites are needed to complete enrolment of 200 patients in 5 years.

**Conclusions:** Become an INTERSPACE investigator! Please contact: sylanthier@gmail.com.

## WSC-0810

### On-going Clinical Trials

#### Headpost: Head position in stroke trial

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**Introduction:** There is insufficient evidence to recommend a specific head position in patients with either acute ischemic stroke (AIS) or acute intracerebral hemorrhage (ICH). Observational data indicates potential beneficial effects of the lying flat position in AIS, and conversely the sitting up head position in patients with ICH. Any potential benefits may be offset by an increased risk of aspiration pneumonia, cardiac failure or increased intracranial pressure.

**Aims:** To compare the effects of lying flat ( $0^\circ$ ) head position with sitting up ( $\geq 30^\circ$ ) applied in the first 24 hours of admission, for patients presenting with AIS, on poor outcome (death or disability) at 90 days. Key secondary: To determine whether lying flat is superior to sitting up on poor outcome at 7 days in AIS and whether sitting up is superior to lying flat on these outcomes in acute ICH.

**Methods:** A multicenter, prospective, cluster randomized, crossover, blinded outcome assessment study through a global network of investigators in Australia, Europe and South America. Eligibility criteria will

evaluate the treatment effect in a broad range of patients with AIS and ICH.

**Conclusions:** Given the uncertainty over the balance of benefits/risks, and variability regarding the ideal head position for these patients around the world, reliable randomized evidence is required to standardize clinical practice recommendations.

## WSC-1480

### On-going Clinical Trials

#### The effects of low frequency repetitive transcranial magnetic stimulation on poststroke lower limb spasticity and motor neuron excitability

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**Introduction:** Spasticity is a common motor impairment after stroke, which can have serious implications.

**Aims:** To evaluate the effect of low frequency, repetitive transcranial magnetic stimulation (rTMS) on the lower limb spasticity and motor neuron excitability in patients after stroke.

**Methods:** This pretest-posttest clinical study included 7 patients with chronic stroke aged 42–78 years (mean  $\pm$  SD:  $56.7 \pm 12.7$ ). Inhibitory, low frequency rTMS at 1 Hz was applied for 20 minutes to the intact leg motor cortex for five treatment sessions. Primary outcome measures were the Modified Ashworth Scale (MMAS) and the  $H_{max}/M_{max}$  ratio. Measurements were taken at baseline, after the last treatment (5th) session, and 1 week after the end of treatment.

**Results:** The ankle plantar flexor spasticity improved significantly after treatment. Knee extensor spasticity assessed with the MMAS scored 0 after treatment and 1 week after rTMS therapy. The  $H_{max}/M_{max}$  ratio did not improve significantly after treatment.

**Conclusions:** Inhibitory, low frequency rTMS of the intact leg motor cortex in patients after stroke can be effective in improving the lower limb spasticity.

## WSC-0944

### On-going Clinical Trials

#### The attend trial-family-led rehabilitation after stroke in India: A modified version of early supported discharge with a caregiver delivered home based poststroke rehabilitation

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**Introduction:** Global Disability Adjusted Life Year (DALY) rank for stroke moved up from 5 in 1990 to 3 in 2010. As the stroke epidemic hits low and

middle income countries (LMICs) like India, we need to look at cost-effective models of care to limit poststroke disability and improve quality of life.

**Methods:** Multicenter (across 12 or more centers in India), randomized (within 7 days of hospital admission), blinded outcome assessment, controlled trial (PROBE design) of Early Supported Discharge with a trained family-led caregiver-delivered, home-based stroke rehabilitation compared to routine care, in 1200 stroke patients of any recent stroke with residual disability. Universal Trial Number (UTN): U1111-1138-6707.

**Results:** A total of 58 patients were recruited from January 13<sup>th</sup> 2014 till April 7<sup>th</sup> 2014. Patients will be seen at 3 and at 6 months by a blinded independent assessor and the primary and secondary outcomes will be obtained at each follow-up. Primary outcome is the modified Rankin Scale score at 6 months and secondary outcomes include quality of life, depression and anxiety, and health costs.

**Conclusions:** We expect to understand in greater breadth and depth the impact of stroke on the patient and family in LMIC settings, and to evaluate the novel concept of trained caregiver acting as the 'multidisciplinary team' delivering stroke rehabilitation as a cost-efficient model of care. the ATTEND Trial Collaborators.

## WSC-0649

### On-going Clinical Trials

#### Effect of sonolysis on a risk reduction of brain infarction during cardiac or carotid interventions: A prospective study

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**Introduction:** Sonolysis is a new therapeutic option for acceleration of arterial recanalization.

**Aims:** The aim was to confirm risk reduction of brain infarction during carotid or coronary interventions using sonolysis.

**Methods:** All consecutive patients with internal carotid artery stenosis >70% indicated to carotid endarterectomy (94 patients) or stenting (124 patients) and patients indicated to coronary artery bypass graft (61 patients) were enrolled to the prospective study after informed consent signing. Patients were randomized into: Group 1 with sonolysis during intervention and Group 2 without sonolysis. Neurological examination, cognitive tests and brain MRI were performed before and 24 h after intervention. Occurrence of new brain infarctions, 30-day mortality/morbidity and changes in cognitive tests were statistically evaluated.

**Results:** Out of the 279 patients included in the study, 133 patients (83 males, mean age 65.8 ± 7.3 years) were randomized to sonolysis group (Group 1) and 146 patients (86 males, mean age 66.3 ± 7.8 years) were randomized to control group (Group 2). New ischemic brain infarctions on follow-up MRI were found in 43 (32.3%) patients in Group 1 and 61 (41.8%) patients in Group 2 ( $P = 0.05$ ). New ischemic brain infarctions  $\geq 0.5 \text{ cm}^3$  were found in 7 (5.3%) patients in Group 1 and in 23 (15.8%) patients in Group 2 ( $P = 0.002$ ). Symptomatic stroke occurred in 2

patients in Group 1 and 4 patients in Group 2 ( $P > 0.05$ ). No significant differences in cognitive tests were detected between both groups.

**Conclusions:** Sonolysis might be effective in prevention of brain infarctions during carotid or coronary interventions.

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## WSC-0957

### On-going Clinical Trials

#### TICH-2 trial – Tranexamic acid for intracerebral hemorrhage 2

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**Rationale:** To assess in a pragmatic phase III prospective double blind randomized placebo-controlled trial whether tranexamic acid is safe and reduces death or dependency after primary intracerebral hemorrhage (PICH). The results will determine whether tranexamic acid should be used to treat PICH, which currently has no proven therapy.

**Design:** Patients will be randomized (1:1) to receive either tranexamic acid or placebo (0.9% saline) within 8 hours of acute primary intracerebral hemorrhagic stroke. Randomization will be computerized and minimized on key prognostics age; sex; time since onset; systolic blood pressure; stroke severity (NIHSS); presence of intraventricular hemorrhage and known history of antiplatelet treatment. Patients randomized to placebo will receive intravenous normal saline. Patients, investigators and outcome assessors will be blind to treatment allocation. The primary outcome is death or dependency (modified Rankin Scale, mRS) and telephone follow-up is at day 90.

**Trial Status:** The start-up phase of the trial commenced on 1 March 2013 and ran for 1 year, and the main phase commenced 1st April 2014. The recruitment target is 300 participants in the start up phase and 2,000 in the main phase. As at 2nd April, 2014 381 patients have been recruited from 53 centers (UK, Italy). The objective is to have 80 UK centers and 40 international centers.

**Funding:** The National Institute of Health Research, Health and Technology Assessment Programme.

## WSC-0958

### On-going Clinical Trials

#### A European, multicenter, phase III, clinical trial of hypothermia for acute ischemic stroke: EUROHYP-1

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**Background:** Systematic review of animal studies modeling ischemic stroke suggests that cooling is the most promising neuroprotective intervention identified to date. In these animal studies, cooling to 35°C reduced infarct size by about one third. Cooling awake patients with ischemic stroke to 35°C has been shown feasible and safe, but whether this is safe and effective has not been tested in a large clinical trial.<sup>2</sup>

**Aims:** To determine whether systemic cooling to target temperature of 34–35°C, started within 6 hours of symptom onset and maintained for 24 hours, improves functional outcome at 3 months in patients with acute ischemic stroke.

**Methods:** Open, randomized, phase III, multicenter, international clinical trial with masked outcome assessment testing the safety and efficacy of

therapeutic cooling in 1500 awake adult patients with acute ischemic stroke. Cooling will be initiated within 6 hours of symptom onset with an intravenous infusion of 20 ml/kg cooled normal saline (4°C) over 30–60 minutes, followed by either surface or endovascular cooling to 34–35°C, maintained for 24 hours. Shivering and discomfort will be prevented and treated with anti-shivering drugs. All patients will receive best medical treatment, including alteplase, if indicated. The primary outcome is centrally adjudicated modified Rankin Scale (mRS) at 90 days (shift analysis). A trial with 750 patients per arm has 90% power to detect a 7% absolute improvement in the mRS at the 5% significance level.

**Conclusion:** Trial set up is on-going in the UK, ethical approval has been received with recruitment expected to begin mid 2014.

### On-going Clinical Trials

#### Early strokes after cardiac surgery: Comparison of atrial fibrillation versus diabetes mellitus patients

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**Background and Purpose:** Often the patients that undergo to cardiac surgery are with more than one other chronic disease. Each of them can be an independent risk factor for stroke.

We compare two major risk factor for stroke, AF and diabetes mellitus on patients early after cardiac surgery.

**Method and Evaluation:** Are seen 50 patients ongoing cardiac surgery. They are screen about the age, other diseases. They are evaluated for specific time of surgery, type of anesthesia, on pump or off pump surgery. Mean age 65 ± 7; Hypertension 66%; Diabetes 42%; Carotid disease 36%; Peripheral vascular disease 22%; 88% on pump; 12% off pump. After surgery complication low cardiac output 26%; Myocardial infarction 6%; AF 10%; 15% have prior TIA, AVC.

**Results:** After the surgery 8 patients (n 8), 16% had strokes. 5 from the AF patients and 3 from the diabetes patients; 3 of the patients had prior TIA or CVA; 4 of the AF patients had more than 1 stroke; 1 patient was dead a due to pulmonary thromboembolism; 1 was dead due to the status epilepticus. 3 patient from diabetes patients had strokes;

**Conclusion:** AF and diabetes are both major risk for stroke. At the early phase after cardiac surgery patients with AF have more strokes, often multiple; the main surgery at the AF patients that is related to stroke was valve surgery; the mortality also was higher at the AF patients.

Diabetes mellitus patients have strokes related to CABG surgery, and are seen later in time than FA patients strokes.

### WSC-0677

#### On-going Clinical Trials

#### Early strokes after cardiac surgery: Comparison of atrial fibrillation versus diabetes mellitus patients

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**Background and Purpose:** Often the patients that undergo to cardiac surgery have often multiple chronic disease. Each of them can be an independent risk factor for stroke.

We compare 2 major risk factor for stroke, AF and diabetes mellitus on patients early after cardiac surgery.

**Method and Evaluation:** Are seen 50 patients ongoing cardiac surgery. They are screen about the age, other diseases and are evaluated for specific time of surgery, type of anesthesia, on pump or off pump surgery. Mean age 65 ± 7; Hypertension 66%; Diabetes 42%; Carotid disease 36%; Peripheral vascular disease 22%; 88% on pump, 12% off pump. Myocardial infarction 6%; AF 10%; 15% have prior TIA, AVC

**Results:** After the surgery 8 patients (n 8), 16% had strokes. 5 from the AF patients and 3 from the diabetes patients; 3 of the them had prior neurological events TIA or CVA; 4 of the AF patients had more than one stroke. 3 were female, 2 males; 1 patient was dead due to pulmonary thromboembolism; 1 was dead due to the status epilepticus. 3 patient from diabetes patients had strokes; All patients that had strokes were male; The strokes were moderate to large at size at MCA territory;

**Conclusion:** At the early phase after cardiac surgery patients with AF have more strokes, the main surgery at the AF patients that is related to stroke was valve surgery; the mortality was higher at the AF patients.

Diabetes mellitus patients have strokes related to CABG surgery, are seen later in time than FA patients strokes.

### WSC-0772

#### Outcomes and Quality of Care

#### An assessment of quality of life of stroke survivors in selected hospitals in South Western Nigeria

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There is a growing global interest in Quality of Life (QoL) in Stroke Survivors (SS) as a predictor of patients' outcome therapeutic intervention and the efficacy of the interventions. This study assessed QoL in relation to physical health, psychological health, social relationship and environment of Nigerian SS undergoing rehabilitation. The study also investigated the influence of socio-demographic variables on the QoL domains.

Sixty nonaphasic SS (35 males and 25 females) who had suffered stroke for a minimum of 3 months and receiving physiotherapy in five selected hospitals in South Western, Nigeria participated in this study. Motor function was assessed using Modified Motor Assessment scale while pre and poststroke QoL was rated using WHO QoL-BREF. Data were analyzed using descriptive and inferential statistics at 0.05 alpha level.

Comparison of pre and post-QoL across physical health (77.68 ± 12.64 vs. 38.99 ± 17.33), psychological health (79.65 ± 12.13 vs. 36.67 ± 16.23), social relationship (89.31 ± 14.64 vs. 45.28 ± 26.10) and environment (84.01 ± 12.12 vs. 51.30 ± 15.67) domains showed significant differences with reduction in poststroke QoL across all the domains (p = 0.001). All poststroke QoL domains scores were not significantly influenced by gender and laterality (p > 0.05). However, educational attainment had positive influence on the poststroke physical and psychological domains of QoL (p < 0.05). There was no significant correlation between motor function and QoL domains (p > 0.05).

It was concluded that stroke has a significantly negative impact on QoL of Nigerian Stroke Survivors while higher educational attainment has a positive influence. Educational level/attainment should therefore be considered in the assessment of QoL during rehabilitation.

## WSC-1180

### Outcomes and Quality of Care The burden of caregiving in primary caregivers of stroke survivors in Abeokuta, Nigeria

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**Introduction:** The long-term care of stroke patients is made possible by the resilience of caregivers. Caregiver needs can be objectively met if the factors associated with caregiving are known.

**Aim:** This study sought to describe the profile of caregiving burden, identify caregiver and patient's factors contributing to burden of caregiving among caregivers of stroke survivors in Abeokuta, Nigeria.

**Methods:** A cross-sectional study of 94 adult primary caregivers of stroke survivors was undertaken between May and July 2012. Data on caregivers, patients and family support were collected with interviewer-administered questionnaire and three standardized tools. The Caregiver Strain Index measured caregiver burden; Perceived Social Support – Family Scale measured caregiver family support while the Barthel Index measured degree of disability in patients.

**Results:** The mean age of caregivers was  $39.5 \pm 14.7$  years. Sixty one caregivers (64.9%) were females. Fifty-six caregivers (59.6%) were children of stroke survivors while 28 (29.8%) were spouses. Majority of caregivers [ $n = 75(79.8\%)$ ] experienced high burden. The areas of burden most often reported bothered on finance [ $n = 81(86.2\%)$ ], time demand [ $n = 81(86.2\%)$ ] and work disruption [ $n = 79(84\%)$ ]. Higher levels of burden were associated with female gender ( $p = 0.028$ ), marital separation and being widowed ( $p = 0.013$ ). Higher degree of disability and lower cognitive function in the patients were inversely correlated with caregiver burden. Linear regression identified degree of disability in patients and caregiver marital status as the significant independent determinants.

**Conclusion:** There is high caregiver burden in this sample of caregivers of stroke survivors. Associated factors include female gender, marital status, disability and cognitive dysfunction.

## WSC-0416

### Outcomes and Quality of Care Serum uric acid level as an early mortality predictor in acute ischemic stroke patients

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**Introduction:** Stroke is a leading cause of death and serious long term disability in the world. It is defined as neurologic deficit syndrome focally or globally caused by loss of brain circulation. Besides risk factors which are widely studied before, uric acid's role as mortality predictor in acute stroke was still unclear.

**Aim:** To acknowledge the role of uric acid level as an early mortality predictor in acute ischemic stroke.

**Methods:** Structured PubMed search was conducted which yields 93 articles and after applying inclusion and exclusion criteria, 3 articles remained. After reading the full texts, those articles are appraised concerning validity and relevance.

**Results:** Odds ratio and 95% confidence interval of uric acid level as an independent predictor of early mortality in acute stroke patients are 1.37 and 1.13–1.67 respectively, in first appraised articles. Also, in second appraised articles, hazard ratio is 1.27 per additional 0.1 mmol/L with 95% confidence interval 1.13–1.67. But, in third appraised articles did not explicate whether uric acid level was independent predictor of mortality in acute stroke.

**Conclusion:** Serum uric acid level is an independent predictor of early mortality in acute stroke patients.

## WSC-0230

### Outcomes and Quality of Care Correlation between two major predictors of stroke outcome: Carotid atherosclerotic load and volume of infarct

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**Introduction:** One of the important parameter in ischemic stroke outcome is volume of infarct which can be measured by magnetic resonance imaging (MRI) technique.

**Aims:** The aim of this study was to assess the validity of this outcome parameter in ischemic stroke population and to find its correlation carotid atherosclerotic load measured by carotid intima media thickness (CIMT) and carotid plaque.

**Methods:** Volume of infarct determined by MRI in the 92 ischemic stroke patients were followed up in this prospective study at 1, 3 and 6 months and mortality was noted in them. Patients were also evaluated by carotid sonography using high resolution 7.5 MHz technique to assess the CIMT and presence of plaque according to Mannheim Carotid Intima-Media Thickness Consensus.

**Results:** The average volume of infarct was found to be  $60.83 \pm 16.80$  ml in all stroke patients of this cohort. Significant association was found between increased volume of infarct and mortality at 1-, 3- and 6-month duration. But the correlation between CIMT and carotid plaque was lacking in this study.

**Conclusions:** Definitely we can say that imaging using MRI technique could help to assist the measurement of ischemic stroke volume which in prospective studies had been linked to increase mortality as seen in this study. But the association of carotid studies is not found to be with volume of stroke suggesting these two factors are independent markers in stroke mortality.

## WSC-1439

### Outcomes and Quality of Care Stroke management at the Bamenda Regional Hospital

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**Introduction:** Unlike poor countries, progress had been made in stroke management in developed countries, leading to significant reduction of morbidity and mortality.

**Aims:** This study was designed to describe the first 6 months stroke management in the neurology department of the regional hospital of Bamenda.

**Methods:** Data were prospectively collected from patients, family members and medical records.

**Results:** From January 2013 to September 2013, a total of 93 patients were enrolled, ischemic strokes counting for 66.6%. The majority of patients (53.8%) have a monthly income less than 40 Euros while the average cost per hospital stay was 346 Euros. Eleven percent of patients arrived at the emergency department within 3 hours of symptoms onset. Five percent of patients underwent brain imaging within the first 24 hours. Inpatients mortality concerned 41.9% patients. At 6 months from the first ever stroke, 54.8% of patient have already died and 54.7% of patients still alive cannot carry out their daily activities without any help. Only 55.5% succeeded to carry out all assessments technically available with a mean delay of 6.5 days. Among inpatients, 22.2% couldn't afford all the drugs prescribed. The mean time to physiotherapy was 8.6 days with 69% defaulters.

**Conclusion:** Far from standard, the quality of stroke management at the regional hospital Bamenda needs to be improved. Strong actions are needed to build a comprehensive and effective stroke management system.

### WSC-0537

#### Outcomes and Quality of Care

#### Sorcan Iscore can be a useful quality measure of the effectiveness and safety of rTPA in a new small stroke unit

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**Introduction:** For those presenting with acute ischemic stroke (AIS), thrombolysis with rTPA is associated with improved functional outcomes.

**Aim:** To compare the outcomes following rTPA use in a new small stroke unit with a web based prediction program 'Sorcan Iscore'.

**Methods:** SDH stroke unit opened in 2008 and started rTPA in 2009. Data was collected prospectively on all patients prescribed rTPA; from this we calculated the IScore. Iscore is a 12 domain web based decision analysis which uses clinical data to predict death, disability and hemorrhagic complications from rTPA. The score recommends the clinician proceed (score <130), proceed with caution (score 130–200) or use caution (score >200) when prescribing rTPA.

**Results:** 28 patients received rTPA between January 2010 and March 2014. Mean age was 67 yrs (range 37–87 yrs), 57% were male, mean NIHSS was 13.3 (4–41). 13 patients had a discharge MRS 0–2. Mean Iscore was 155 (110–239); 8 patients were in the proceed group, 15 patients were in the proceed with caution group and 5 in the caution group. 0/8 in the proceed group, 5/15 in the proceed with caution and 2/4 in the caution group died or needed institutional care. 1 patient (caution group) developed symptomatic ICH.

**Conclusion:** We show that this decision tool may predict the likely outcome in patients treated with rTPA in a new small stroke unit. Iscore reliably identified the outcome in low and high risk patients treated with rTPA. This score may be a useful quality measure for new stroke units.

### WSC-0921

#### Outcomes and Quality of Care

#### Decompressive surgery for malignant middle cerebral artery infarct: Outcome at 3 years

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**Introduction:** Randomized trials showed that decompressive surgery (DS) reduces mortality and improves the 1-year functional outcome in patients with malignant middle cerebral artery (MCA) infarcts. A recent analysis of the HAMLET trial showed that the benefit of DS was still present at 3 years. We showed previously that the 1-year outcome in patients treated in the Lille University Hospital were similar to those obtained in the surgical arm of trials.

**Aim:** The objective of this study was to evaluate the vital and functional outcome after 3 years.

**Methods:** We prospectively included and followed over a 3-year period patients with malignant MCA infarcts treated by DS. The primary outcome was a modified Rankin scale (mRS) score of 4 or less, and secondary outcomes were mRS of 3 or less, and death at 3 years.

**Results:** Of 91 patients who underwent DS for malignant MCA infarct, 43 were treated more than 3 years ago. The 3-year mRS was 4 or less in 33 patients (76.7%) and 3 or less in 23 patients (53.5%). The 8 deaths (18.6%) occurred during the first year.

**Conclusions:** Fifty percent of patients who underwent DS for malignant MCA infarct survived with a mRS of 3 or less 3 years later, suggesting that the benefit remains present over time. Beyond mortality and global functional outcome, the quality of life and the social outcome should now be explored.

### WSC-0906

#### Outcomes and Quality of Care

#### Derivation and external validation of a model to predict 30-day mortality after stroke using variables which can be routinely collected on admission

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**Background:** Comparisons of the outcomes between stroke care providers need to take into account differences in case mix. We aimed to derive and externally validate a case mix model for acute stroke.

**Methods:** Data for model derivation and internal validation were drawn from the national stroke register of stroke in England and Wales (SSNAP), for patients admitted for stroke from Jan–June 2013 (n = 27169). Data were split into derivation and internal validation datasets. General estimating equations were used to fit a multivariable logistic model of 30-day mortality after stroke. External validation was carried out in patients

admitted with stroke from 2005–2012 in the South London Stroke Register, a population based stroke register (n = 1470).

**Results:** The derivation dataset included 9000 patients: mean age of 77 years, 89.5% ischemic stroke, 10.5% primary intracerebral hemorrhage (PICH). Two casemix models were fitted. Model A included age (<60, 60–79, 70–79, 80–89 and ≥90), NIHSS score, atrial fibrillation and stroke type (ischemic or PICH). Model B included age (same categories), NIHSS consciousness component, atrial fibrillation and stroke type. Both models showed good discrimination (Table 1) and calibration in internal and external validation datasets.

**Conclusions:** Two simple, four variable models were accurate predictors of 30-day mortality after stroke. In settings where the full NIHSS is not collected on admission, recording of consciousness level provides almost as accurate predictions as the full NIHSS.

**Table 1**

	C-statistic (95% CI)
A – Internal validation	0.86 (0.85–0.88)
A – External validation	0.87 (0.84–0.89)
B – Internal validation	0.82 (0.81–0.83)
B – External validation	0.86 (0.83–0.89)

### WSC-1059

#### Outcomes and Quality of Care

##### A home health care unit surveillance: Evaluation of poststroke patients

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**Purpose:** Home-health care system has been operative in Turkey since 2005, in our hospital since May 2011 and a total of 859 patients get health support from this unit. The purpose of this study was to evaluate (physical ability, nutritional status) stroke patients and measure caregiving burden. **Methods:** Between November 2013 and March 2014, patients with chronic neurologic diseases (CND) were asked to answer a questionnaire including modified Rankin scale (mRS), Barthel index, Zarit burden scale and mini nutritional assessment (MNA) during our visits and 202 CND patients were classified as poststroke (Group I) and other CND (Group II). The results were statistically evaluated ( $p < 0.05$ ).

**Results:** The mean age of Group I (61 M : 51 F) was  $76.6 \pm 9.1$  years and Group II (28 M : 62 F) was  $80.96 \pm 12.34$  years. The mean age of Group I was significantly lower than Group II ( $p = 0.005$ ) and male patients were higher in Group I ( $p = 0.001$ ). Presence of risk factors like hypertension, diabetes mellitus, alcohol consumption and family history were significantly higher in Group I ( $p = 0.0001$ ,  $p = 0.009$ ,  $p = 0.008$ ,  $p = 0.005$ ). There were no differences in education status, duration of illness, duration of being in need of care. There were also no differences in Zarit burden scale, Barthel index and mRS ( $p = 0.535$ ,  $p = 0.473$ ,  $p = 0.976$ ). The presence of malnutrition (MNA < 17) was lower in Group I ( $p = 0.007$ ).

**Conclusions:** Home-health care provides medical care to disabled and have difficulty to get to a hospital. To improve the outcome and quality of life in poststroke patients we need to run a multidisciplinary approach and further social projects.

### WSC-0587

#### Outcomes and Quality of Care

##### Access to psychology services in Australian rehabilitation hospitals: Understanding disparities based on location and impacts on care in hospital

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**Background:** Neuropsychological (cognitive, behavior and mood) impairments following stroke are common. Early detection and management of neuropsychological impairment can improve outcome.

**Aims:** To describe access to psychology services in hospital and impacts on length of stay.

**Methods:** National Stroke Foundation National Audit of Acute Services (2013) and Rehabilitation Services (2010) data were used. Clinicians from participating hospitals retrospectively audited up to 40 consecutive stroke admissions. A hospital organizational survey was also completed. Descriptive statistics and multivariable median regression with adjustment for known confounders (i.e. age, gender and stroke severity) and other factors associated with length of stay was undertaken.

**Results:** Among acute hospitals completing the 2013 survey (n = 177), only 25% had a protocol for referral to psychology services and 19% had access to a psychologist/neuropsychologist (4% in rural locations). Among the acute hospitals providing audit data (n = 124), only 6% of patients with mood impairment were assessed by psychologists. In sub-acute hospitals (2010, n = 96), clinical audit data from 2985 patients (64% male; median age 76) revealed that 84% had neuropsychological impairments, but only 20% received a psychological assessment (4% in rural locations). Median time to receive a psychology assessment in sub-acute hospitals was 11 days (Q1 7; Q3 22) and patients with neuropsychological impairments who received psychology assessments had an 8-day longer length of stay (95% CI 5–11 extra days).

**Conclusion:** Access to psychology services for patients with neuropsychological impairments is limited in Australia, especially for rural patients. Delays in accessing assessments may increase length of stay.

### WSC-0585

#### Outcomes and Quality of Care

##### Piloting the establishment of performance benchmark methods for acute stroke care in Australian hospitals

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**Background:** When assessing the quality of hospital stroke care, achieving 100% adherence may be unrealistic for some performance indicators and estimating the true 'gaps' in care is difficult.

**Aims:** To pilot different benchmark methods proposed in the literature to assess their utility for Australia.

**Methods:** Data from the Australian Stroke Clinical Registry (AuSCR) from January 2012 to December 2013, restricted to Queensland hospitals that had registered >30 patients, were used. Two benchmarking methods were compared: a) crude benchmark where top adherence score = n adherence/N eligible; and b) Hall and colleagues method where an Adjusted Performance Fraction (APF) score is calculated  $[(n \text{ adherence} + 1) / (N \text{ eligible} + 2)]$  and the mean top APF scores for hospitals that represent at least 15% of the sample is the benchmark (2013: doi:10.1093/intqhc/mzt069). The difference between the crude and APF benchmarks for eight nationally endorsed stroke performance indicators were calculated.

**Results:** 3897 patients (mean age 73 years, 55% male) available from 20 hospitals (sample sizes: min 45, max 314). Benchmarks varied between 1% (received intravenous thrombolysis: crude 17% versus APF 18%) to 14% (Care plan on discharge: crude 96% versus APF 82%). For 6/8 indicators the difference was <5%. There was no variation for discharged on anti-platelets if an ischemic event (97%). Differences between methods were least when the crude benchmark was derived from a hospital with a large sample.

**Discussion:** Our findings illustrate the importance of comparing benchmark methods and the need to account for small individual hospital samples when setting achievable short-term benchmarks for Australia.

## WSC-1051

### Outcomes and Quality of Care Seizures occurring within the first 30 days after acute ischemic stroke and long-term functional outcome

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**Background:** Seizures are a complication of acute ischemic stroke (AIS) but their relationship with long-term outcome has not completely determined.

**Aims:** We aimed to describe the factors associated with seizures after AIS and its impact on functional outcome at 12-month follow up.

**Methods:** We studied a cohort of 1246 AIS patients included in a multi-center Mexican registry (PREMIER), who received long-term follow up after a first-ever or recurrent brain infarction. Multivariate analyses were performed to evaluate factors associated with seizures occurring within the 30 days after AIS and the functional outcome at 12-month follow-up.

**Results:** The frequency of seizures was 8.1% [95% CI: 6.7–9.8%]. In a binary logistic regression model, risk factors significantly associated with seizures were a scoring of the NIHSS >10 [OR: 2.21, 95% CI: 1.40–3.47], recurrent ischemic stroke (OR: 2.17, 95% CI: 1.34–3.53) and age <65 years (OR: 1.69, 95% CI: 1.09–2.62). After Cox proportional hazards model and Kaplan–Meier analyses, the presence of seizures was significantly associated with risk of severe functional disability or death (a modified Rankin scale >3) at 12 months [HR 1.37, 95% CI: 1.04–1.83], as well as NIHSS >10 (HR: 4.47, 95% CI: 3.53–5.65), age ≥65 years (HR: 1.74, 95% CI: 1.38–2.20), heart failure (HR: 1.61, 95% CI: 1.22–2.13) and atrial fibrillation (HR: 1.35, 95% CI: 1.05–1.74).

**Conclusions:** The frequency of acute seizures after AIS in this cohort was 8%. Age <65 years and severity of the brain infarction are the main factors associated with seizures. Acute seizures represent a modifying factor of AIS outcome in the long run.

## WSC-0418

### Outcomes and Quality of Care Impact of stroke team implementation in a philanthropic hospital

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**Introduction:** Cerebrovascular diseases are among the leading causes of death in Brazil. According to DATASUS there was an increase of 32% in death for stroke from 2007 to 2013. In 2013, in São Paulo stroke was responsible for 21% of deaths. To provide the best care for people with stroke the Hospital Alemão Oswaldo Cruz created its Acute Stroke Unit in 2013.

**Aim:** To compare treatment rates of acute ischemic stroke (AIS) patients before and after the implementation of stroke team and unit.

**Methods:** The study included patients hospitalized with primary diagnosis of AIS admitted to the hospital in 2011, compared with those admitted after the implementation of the Stroke Team and Unit, from March 2013 to February 2014.

**Results:** A total of 64 patients previous and 102 patients after stroke team/unit implementation were included in the study. Mean age and gender distribution were similar for pre and postimplementation (70,8 vs. 73,1 years; 45,3% vs 58,8% female, respectively). The main results are presented in Table 1.

**Conclusions:** After the implementation of a Stroke Team there was an improvement on the stroke quality and safety indicators, with a reduction on intrahospital delay, mortality rates and intrahospital pneumonia, and an increase on thrombolysis use rates.

**Table 1** Impact of a stroke team and unit implementation

Year	2011	2013–14	%
Patients	64	102	37,3
Time door-to-medical attendance (min)	42	31,2	25,7
Time door-to-CT (min)	174	78,3	21,7
Mortality rate	5,7	1,9	66,7
Intrahospital pneumonia	9,4	2,9	69,1
Statin prescription at discharge	70	92,6	24,4

## WSC-1187

### Outcomes and Quality of Care Ischemic stroke and cancer

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**Aims:** Ischemic stroke and cancer, which are major public health problem, are related to each other in many ways such as age, hypercoagulability and poor prognosis. In this study, we evaluated patients hospitalized with a diagnosis of ischemic stroke, who had a history of cancer or determined cancer during the etiologic scanning.

**Methods:** In this study, thirty patients with ischemic stroke and with cancer history were evaluated retrospectively. All patients' demographic characteristics, stroke type, localization, NIH and Rankin scores, cancer type, duration was recorded.

**Results:** Thirty patients (18 M/12 F) were evaluated in the study. The mean age of patient was 64.7. According to the TOAST classification, atherothrombotic stroke in 14 patients (26.6%), cardioembolic in 8 (26.6%), cryptogenic in 8 (26.6%) were determined. The mean NIH score was 8.86 (1–24) on admission. There was the ancient cancer history in 25 patient. The cancer was detected in only 5 patients when evaluating for stroke etiology. Eight patient had lung cancer, 4 colon, 3 prostate, 2

stomach, 2 cervix, 2 lymphoma, 2 glioma, 1 rectal, 1 larynx, 1 thyroid, 1 endometrial and 1 breast cancer. The average duration of cancer was 26.7 month.

**Conclusion:** In the etiology and prognosis of ischemic stroke, it is important to kept in mind in the presence of cancer in addition to classical stroke risk factors.

## WSC-1196

### Outcomes and Quality of Care

#### The assessment of swallowing function after ischemic stroke: Preliminary study

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**Aims:** Dysphagia and associated pulmonary aspiration especially in stroke patients is an important reason of mortality and morbidity. In this study, we aim to evaluate the swallowing functions of the patients after ischemic stroke.

**Methods:** Forty-nine hospital-referred patients followed for acute stroke was taken for the study. All the patient's age, gender, type of stroke, NIH and RANKIN scores, risk of aspiration, feeding method were recorded. Swallowing scores were evaluated with the assessment of dysphagia with neurological examination and the bedside clinical evaluation of swallowing function.

**Results:** Forty-nine (20 F/29 M) patients were included in the study. The mean age of patient was 68.2. While 17 patient was anterior, 31 patient was posterior, one patient was anterior and posterior circulation stroke together. According to the TOAST classification, 34 patient was atherothrombosis (63.2%), 11 patient was cardioembolic (22.4%), 4 patient was cryptogenic stroke (8.2%). The mean NIH score was  $8.2 \pm 6.6$  on admission. While 34 patient (69.4%) was feeding oral, 7 patient with NG (14.3%), 7 patient with PEG (14.3%), one patient was feeding with parenterally (2%). On admission, in 22 patient had the risk of aspiration and follow-up, in 14 patients was observed aspiration pneumonia. 35 patient (71.4%) had normal neurological dysphagia score. Thirty-one patient had normal bedside clinical evaluation of swallowing function (63.2%). According to the assesment of swallowing score; while 13 patients had moderate-severe dysphagia, 6 patients had mild dysphagia.

**Conclusion:** In patient who are examined at hospital after ischemic stroke while evaluating the risk of aspiration and dysphagia, the bedside clinical evaluation of swallowing function is a fast and reliable method.

**Methods:** We searched Medline, EMBASE and Cochrane Central Register, 19 accredited journals in Korean, and China Integrated Knowledge Resources Database in Chinese. Relevant clinical trials were manually selected based on the following criteria: (1) patients were diagnosed with Stroke, (2) acupuncture was studied versus placebo or other conventional therapy, and (3) the study was a RCT. The two investigators assessed the risk of bias. All statistical analyses were performed with the Reviewer Manager Software 5.0 (Cochrane Collaboration, Oxford, UK).

**Results:** One RCT in English, 2 in Koreans, and 2 in Chinese were included. Assessments were performed primarily with Modified Ashworth Scale (MAS). Meta-analysis showed that acupuncture or electroacupuncture significantly decreased spasticity after stroke (weighted mean difference: MAS scale, 0.72, 95% CI = 0.29–1.14,  $p < 0.001$ ,  $n = 268$ ). In sub-analysis, wrist, knee, and elbow spasticity in poststroke patients significantly decreased. Heterogeneity could be explained by the differences of control, acupoints, and the average number of month when patients were included after stroke occurrence.

**Conclusions:** Acupuncture could be very effective to decrease the spasticity after stroke, but long-term studies are also needed to determine the longevity of treatment effects.

## WSC-0402

### Outcomes and Quality of Care

#### Acupuncture for poststroke spasticity: A systematic review and meta-analysis of randomized controlled trials

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**Introduction:** A few randomized controlled trials (RCTs) showed that acupuncture or electro-acupuncture decreased spasticity after stroke. This systematic review is aimed to find out how effective acupuncture or electro-acupuncture is in treating poststroke patients with spasticity.

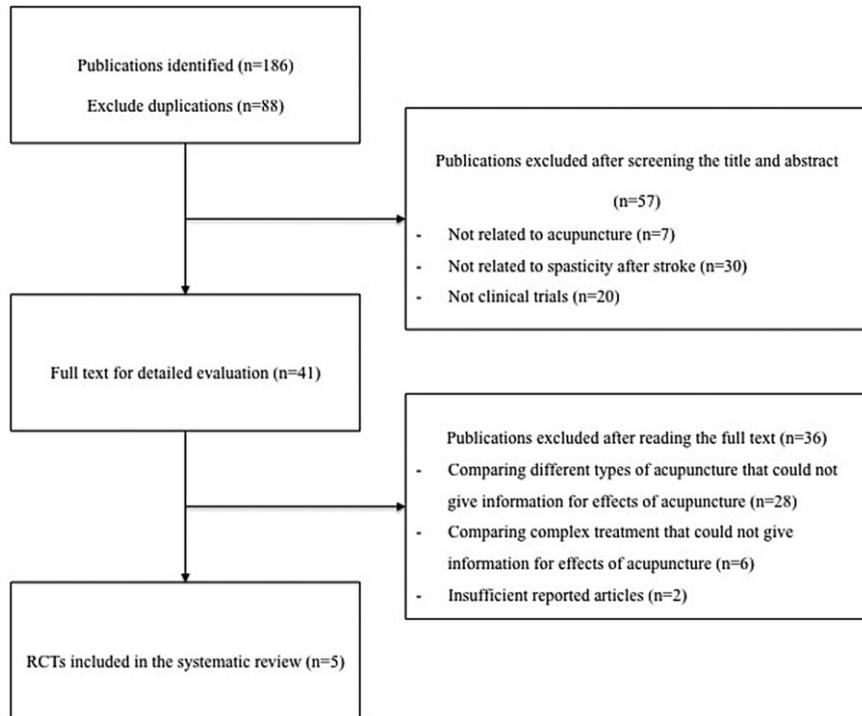


Fig. 1 Flow chart of the trial selection process.

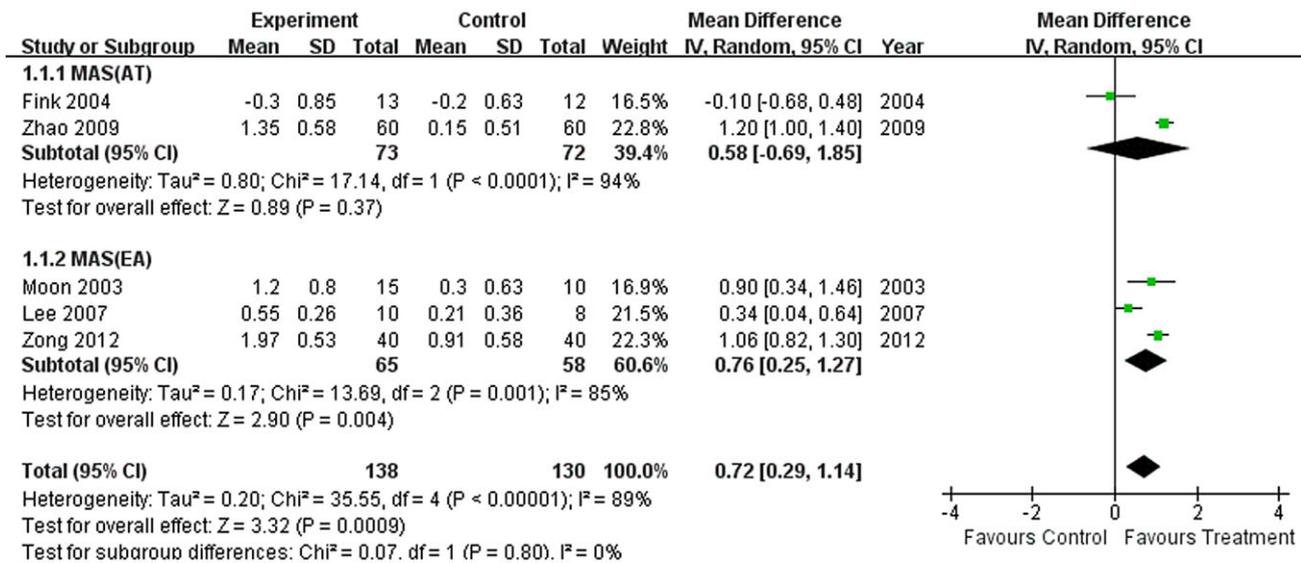


Fig. 2 Meta-analysis of acupuncture for poststroke spasticity.

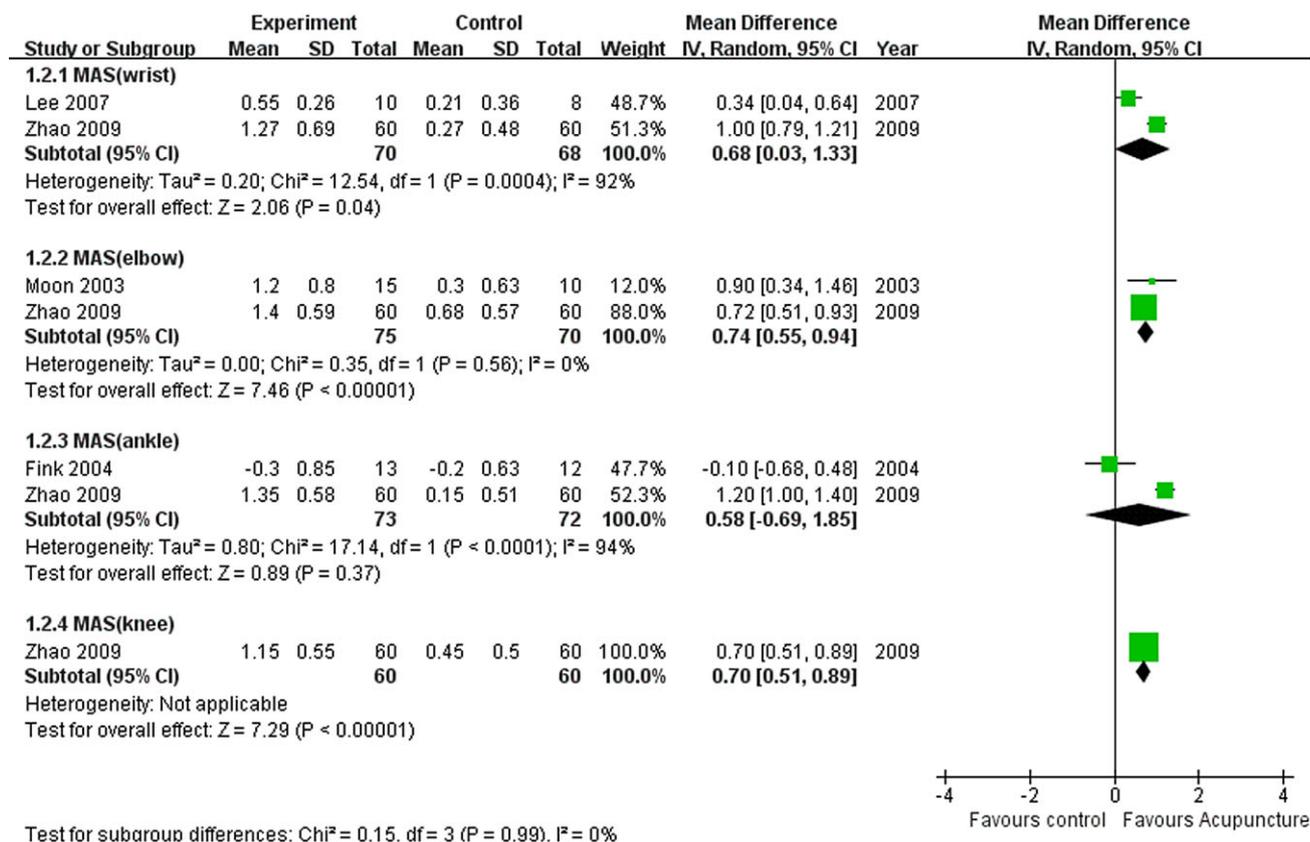


Fig. 3 Meta-analysis of acupuncture for poststroke spasticity according to region.

WSC-0892

Outcomes and Quality of Care  
Validation of the thrive score in a stroke cohort with moderate neurological deficits

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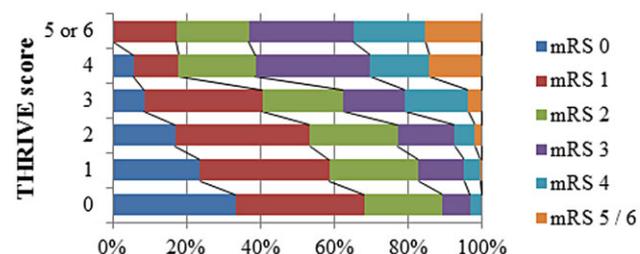
**Introduction and Aims:** The Totalled Health Risks in Vascular Events (THRIVE) score was developed and validated to predict outcome following stroke. We aimed to validate the THRIVE score in an Asian stroke cohort with moderate neurological deficits and evaluate the spectrum of the THRIVE score in predicting outcome across the 3-month modified Rankin scale (mRS) range.

**Methods:** We studied patients in the CHIMES trial, a randomized, placebo-controlled study of traditional Chinese medicine MLC601

involving Asian ischemic stroke patients with moderate neurologic deficits (NIHSS 6–14). Informed consent was obtained from study subjects. The THRIVE score includes points for the NIHSS, age, hypertension, diabetes and atrial fibrillation.

**Results:** We studied 1099 patients, 1002 (91%) had 3-month mRS data. In the Receiver Operating Characteristic curve of the THRIVE score predicting mRS > 2, the AUC was 0.69 (95% CI 0.66–0.73). Using a THRIVE cut-off of >1, the negative predictive value of mRS > 2 was 84%. Higher THRIVE scores were associated with distribution of mRS towards poorer outcome (p < 0.001) (Fig. 1). Increasing THRIVE score predicted worsened chance of good outcome (r<sup>2</sup> 0.3822; p < 0.0001).

**Conclusion:** The THRIVE score was validated for Asian ischemic stroke patients with moderate neurological deficits with similar AUC and NPV to published literature. It was also useful for predicting outcome across the mRS range, and not only for prediction of dichotomized poor versus good outcome.



**WSC-1254****Outcomes and Quality of Care  
A home-based telerehabilitation system for patients  
with stroke in Tashkent**S Gazieva<sup>1</sup>, N Tolibova<sup>1</sup>, A N N A Prokhorova<sup>1</sup><sup>1</sup>Neurology, Tashkent Medical Academy, Tashkent, Uzbekistan

Evidence suggests that greater duration and intensity of rehabilitation therapy improves outcomes for patients with stroke. Delivery of care is often limited, due to systems of care delivery, cost or difficulty travelling. The current study addressed this unmet need by examining the feasibility of a home-based telerehabilitation system. Entry criteria included age >18 years, 12- to 26-week poststroke, and arm motor deficits (Fugl-Meyer (FM) score 22–55) that were stable. Each subject received 28 d of daily home-based telerehabilitation using a fixed system that we delivered. Each day consisted of 1 structured hour (BP check, individualized exercises and stroke prevention education) plus up to 1 hour of free play on dozens of games. Each week, subjects had a 1 videoconference with a therapist. Enrollees were 54 ± 17 yr (mean ± SD), 6 M/6 F, with baseline FM = 39 ± 12. Compliance was excellent, with subjects engaging in therapy 329 of 336 assigned days. Arm motor status improved (FM change 4.8 ± 3.8 points from baseline to 1). The stroke education module was associated with significant gains in stroke prevention knowledge. BP was recorded by the patient, and results automatically transmitted to lab, on 97.9% of assigned days. Therapist videoconferences detected PHQ-2 scores consistent with depression in 3/12 patients.

Results of this pilot study support the utility of a home-based system to effectively deliver telerehabilitation, improve patient education, screen for complications of stroke, and as well as to provide a means for patient interaction with medical personnel. The use of a computer-based interface offers many opportunities to monitor and improve the health of patients after stroke.

**WSC-1156****Outcomes and Quality of Care  
Addressing palliative care issues in dying stroke  
patients**O. Ntlholang<sup>1</sup>, S. Walsh<sup>1</sup>, J Harbison<sup>1</sup><sup>1</sup>Department of Medical Gerontology, Trinity College Dublin, Dublin, Ireland

Stroke leads to high mortality and morbidity but often there is a conflict between need for palliative care and avoidance of 'therapeutic nihilism' We aimed to elicit the palliative care needs of stroke patients at the end of their lives in our unit with low overall mortality rate (1 month: 8.8%, Inpatient: 12.9%).

**Methods:** We selected consecutive stroke patients who died. Their medical notes were used for data collection.

**Results:** Of 54 deaths, 33 (61.1%) were female, mean (SD) age at death was 79.3 ± 12.9 years. 41 (75.9%) died after first stroke, 9 (16.7%) were inpatient strokes, 7 (13.0%) thrombolysed and 7 (13.0%) had strokes as treatment complication. There were clear statements recorded in 26 (48.1%) that patients were dying and death was due primarily to brain lesions in 24 (44.4%).

Palliative needs identified included dyspnea 21 (38.9%), pain 17 (31.5%), respiratory secretions 17 (31.5%), agitation 14 (25.9%) and psychological distress 1 (1.9%). Symptoms were due to premorbid diseases in 6 (11.1%). Palliative care expertise were sought in 13 (24.1%) and morphine infusion was used in 18 (33.3%) to control symptoms. 4 (7.4%) subjects underwent cardiac arrest calls and 9 (16.7%) deaths occurred in ICU/HDU.

The median Stroke-Death was 20 (range 0–389) days. DNR order was in place in 86.8%. The median DNR-Death was 7 (range 0–311) days with 7-day DNR-Death mortality of 53.2% and 30-day 78.7% of the total deaths.

**Conclusion:** Dyspnoea, pain and respiratory secretions were identified as the main palliative care needs. Palliative needs are complex following stroke and skills in assessing appropriateness and delivering such care are essential.

**WSC-0469****Outcomes and Quality of Care  
The effect of personalized care on long term loss to  
follow-up in a stroke register**U Hoang<sup>1</sup>, A Sheldenkar<sup>1</sup>, J Leon<sup>1</sup>, E Emmett<sup>1</sup>, C Mckevitt<sup>1</sup>, C Wolfe<sup>1</sup><sup>1</sup>Division of Health and Social Care Research, King's College London, London, United Kingdom

**Introduction:** Studies involving long term follow-up of participants, face the problem of attrition which can reduce their sample size, introduce bias and affects the validity of outcomes. Previous studies suggest that a personalized approach to care and follow-ups during a study can increase engagement in research and reduce loss to follow-up (LTF).

**Aims:** To investigate long term LTF from a randomized control trial (RCT) testing the provision of personalized care in a stroke population.

**Methods:** STOP STROKE was a RCT investigating the effect of personalized care on stroke recurrence for participant sampled from the South London Stroke Register (SLSR) between 2003 and 2006.

We used a  $\chi^2$  test to compare the rate of LTF at 3 months and annually up to 6 years post-stroke in participants who received personalized health plans and in controls who did not receive personalized health plans.

**Results:** 237 people were randomized to receive personalized plans, while 283 received usual care. There were no differences between participants' characteristics at baseline. Participants who received personalized care plans were significantly less likely to be LTF in the first year ( $p = 0.02$ ), see Table 1. By the second year the intervention had no effect on LTF rates.

**Conclusions:** Whilst there is evidence that personalized care helps with participant retention and reduces attrition in the short term, this study did not demonstrate that personalized care improved participant retention in the medium or long term. Long term follow-up studies need to combine personalized care with other strategies to maximize participant retention.

**Table 1** Number and percentage of participants lost to follow-up poststroke

Time following initial stroke	Assigned to personalized care		P-value
	No (n = 283)	Yes (n = 237)	
3 months poststroke	68 (25.00%)	26 (11.21%)	<0.001
1 year poststroke	54 (21.86%)	31 (14.29%)	0.035
2 years poststroke	61 (26.64%)	69 (32.86%)	0.154
3 years poststroke	59 (27.19%)	54 (28.42%)	0.782
4 years poststroke	53 (25.73%)	43 (25.00%)	0.871
5 years poststroke	52 (27.23%)	44 (27.33%)	0.983
6 years poststroke	64 (36.16%)	48 (32.21%)	0.455

**WSC-0216****Outcomes and Quality of Care  
Clinical implications of prestroke antiplatelet agent in first-ever ischemic stroke**J Jin-Man<sup>1</sup>, W K Seo<sup>2</sup>, K M Oh<sup>2</sup>, S W Yu<sup>3</sup>, K H Cho<sup>3</sup>, D W Kwon<sup>1</sup><sup>1</sup>Neurology, Korea University Ansan Hospital, Ansan-si, Korea<sup>2</sup>Neurology, Korea University Guro Hospital, Seoul, Korea<sup>3</sup>Neurology, Korea University Anam Hospital, Seoul, Korea

**Aims:** Our study's aim was to investigate whether prestroke antiplatelet agent (PA) use was associated with initial stroke severity and short-term outcome at discharge.

**Methods:** This study was based on the data in a prospectively collected hospital-based stroke registry (Korea University Stroke Registry). A total of 3,025 patients who were admitted with a diagnosis of first-ever ischemic stroke within 5 days of symptom onset were included. Stroke severity and short-term outcome were measured with the National Institutes of Health Stroke Scale (NIHSS) and modified Rankin Scale (mRS), respectively. NIHSS scores  $\leq 7$  at admission were categorized as mild stroke. Discharge mRS scores  $\leq 1$  were regarded as favorable outcome. Patients from the PA group were matched with those from the non-PA group by their estimated propensity score at a ratio of 1:1. For matched datasets, stepwise multiple logistic regression analyses were performed on patients with initial mild stroke and favorable outcomes at discharge.

**Results:** The patients' mean age was  $66.3 \pm 13.0$  years old, and 1,850 were male (61.5%). A total of 748 patients had been taking antiplatelet agents prior to stroke onset; 646 patients (86.3%) were taking a single antiplatelet agent. Among them, aspirin (83.7%) was most common. A multivariable analysis after propensity score matching demonstrated that PA use was associated with initial mild stroke (odds ratio, 1.570; 95% confidence interval, 1.150–2.157) but not with favorable outcome at discharge.

**Conclusions:** PA use was associated with initially decreased stroke severity, suggesting that it has beneficial effects.

**WSC-0721****Outcomes and Quality of Care  
Functional status and patient-reported outcome 10 years after stroke: The Lund stroke register**A Jönsson<sup>1</sup>, H Delavaran<sup>2</sup>, S Iwarsson<sup>1</sup>, A Ståhl<sup>3</sup>, B Norrving<sup>2</sup>, A Lindgren<sup>2</sup><sup>1</sup>Department of Health Sciences, Lund University, Lund, Sweden<sup>2</sup>Department of Clinical Sciences Neurology, Lund University, Lund, Sweden<sup>3</sup>Department of Technology and Sociology, Lund University, Lund, Sweden

**Introduction and Aim:** Population-based long-term studies after stroke are scarce. Our aim was to study functional status and patient-reported outcome 10 years after first-ever stroke.

**Methods:** Ten-year survivors ( $n = 145$ ) from a population-based group of 416 patients included in Lund Stroke Register, Sweden, between March 1, 2001 and February 28, 2002 were followed up. The Barthel Index was used to assess functional status and the modified Rankin Scale to assess level of disability. For self-reports regarding health outcome the EQ-5D was used and the first question of the SF-36 questionnaire was used to estimate overall health status. A question on physical activity was also included.

**Results:** A large majority (60%) of the 145 survivors were 75 years or older ranging up to 97 years at the 10-year follow-up. Seventy-three percent were assessed as independent and 71% had no or slight disability. Close to half (49%) reported no problem with mobility and self-care, 61% no problem with usual activities, 57% no pain/discomfort, and 71% did not feel anxious/depressed. Overall health outcome was reported in positive terms by 86%. Only 10% of the survivors rated their health status as bad.

Almost half of the sample reported the same level of physical activity as before stroke onset, i.e. four times weekly or more.

**Conclusions:** For those stroke patients that survived up to 10 years after stroke (about one third of the initial cohort), the functional status and overall health at follow up was favorable in the vast majority of the patients.

**WSC-0561****Outcomes and Quality of Care  
Prognosis of acute stroke patients treated with intravenous thrombolysis according to the transcranial Doppler (TCD) findings – Serbian experience with thrombolysis in ischemic stroke (SETIS) register**D R Jovanovic<sup>1</sup>, M Stefanovic Budimkic<sup>1</sup>, L J Beslac Bumbasirevic<sup>1</sup>, P Stanarcevic<sup>1</sup>, V Padjen<sup>1</sup>, I I Berisavac<sup>1</sup>, M Ercegovic<sup>1</sup>, for SETIS group<sup>1</sup><sup>1</sup>Clinical Center of Serbia, Neurology Clinic, Belgrade, Serbia

**Introduction:** Early recanalization after acute ischemic stroke (AIS) is related to clinical improvement. The aim of this study was to investigate the relation between the TCD findings and outcome of thrombolysed stroke patients.

**Methods:** Data were obtained from the SETIS register. According to the TCD findings, two groups of patients were defined – those without or with partial or complete intracranial artery occlusion. The outcome at 3 months of two groups has been evaluated by the modified Rankin score (mRS). Multivariable analysis has been performed to determine predictors of stroke outcome.

**Results:** Out of 889 SETIS patients, in 393 (44.2%) TCD was performed within median 3 days after AIS. The proportion of patients with excellent functional outcome (mRS 0–1) among those without and with TCD findings of occlusion were 67% and 47.4% ( $p < 0.001$ ) and with good functional outcome (mRS 0–2) were 77% and 57.4% ( $p < 0.001$ ). Multivariate logistic regression, after adjustment for age, sex, initial National Institutes of Health Stroke Scale score, presence of early signs of ischemia, leucoaraiosis or hypertension, type and causes of stroke, has shown a strong tendency of TCD findings on excellent ( $p = 0.077$ ; OR 1.54, 95% CI 0.95–2.47) or good functional outcome ( $p = 0.057$ ; OR 1.64, 95% CI 0.99–2.72) of thrombolysed stroke patients.

**Conclusion:** Early performed TCD may be a good prognostic tool of functional outcome of patients with AIS treated with intravenous thrombolysis.

**WSC-0457****Outcomes and Quality of Care  
Accuracy of a 2D video system for measuring upper limb movement in stroke survivors**A Kerr<sup>1</sup>, Y Cheng<sup>2</sup>, V Stanokovic<sup>2</sup>, P Rowe<sup>1</sup><sup>1</sup>Biomedical Engineering, University of Strathclyde, Glasgow, United Kingdom<sup>2</sup>Electrical and Electronic Engineering, University of Strathclyde, Glasgow, United Kingdom

**Introduction:** Upper limb recovery is poor after a stroke. Necessary research is compromised by blunt, subjective, outcome measures. 3D motion analysis offers a solution but is costly, requires space and lacks portability.

**Aim:** To test the accuracy of a cheap, portable, single camera movement analysis system.

**Method:** A concurrent validity study compared a motion analysis (MA) system (Vicon, Oxford, UK) and a 2D video system (2DVS) using a single digital camera (EX-FH20 Exilim, Casio). Participants were healthy adults (HA) ( $n = 6$ , aged  $32 \pm 11.4$ , weight  $77.2 \text{ Kg} \pm 8.3$ , height  $1.79 \pm 0.9$ ) and

stroke survivors (SS) ( $n=5$ , aged  $55.2 \pm 8.2$ , weight  $74 \text{ Kg} \pm 16.4$ , height  $1.64 \text{ m} \pm 0.6$ ). Each participant reached to pick up a cup placed on a table in front of them while the two systems (MA and 2DVS) tracked movement of the torso and upper limb.

**Results:** The saggital plane angular displacements for trunk, shoulder and elbow, derived from both systems, were compared using limits of agreement through the whole motion. There was generally good agreement. Trunk tilt had a mean difference (MD) of  $2.38^\circ$  (CI;  $-5.9$ – $10.6$ ) for HA and  $7.67^\circ$  (CI;  $-3.5$ – $18.9$ ) for SS, the shoulder had a MD of  $-3.08^\circ$  (CI;  $-11$ – $5.16$ ) for HA and  $-1.68^\circ$  (CI;  $-10.76$ – $7.39$ ) for SS, finally the elbow had a MD of  $-4.02^\circ$  (CI;  $-15.78$ – $7.72$ ) for HA and  $-7.26^\circ$  (CI;  $-20.91$ – $6.37$ ) for SS.

**Conclusion:** A cheap, motion analysis system using a single digital camera was tested against a state of the art system. Results suggest the 2DVS may be suitable for detecting changes in motor control, however this would need further investigation.

### WSC-0293

#### Outcomes and Quality of Care

#### Off-hour effect on 3-month functional outcome after acute ischemic stroke: A prospective multicenter registry

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**Introduction:** The time of hospital arrival may have an effect on prognosis of various vascular diseases.

**Aims:** We examined whether off-hour admission would affect the 3-month functional outcome in acute ischemic stroke patients admitted to tertiary hospitals.

**Methods:** We analyzed the 'off-hour effect' in consecutive patients with acute ischemic stroke using multicenter prospective stroke registry. Work-hour admission was defined as when the patient arrived at the emergency department between 8 AM and 6 PM from Monday to Friday and between 8 AM and 1 PM on Saturday. Off-hour admission was defined as the rest of the work-hours and statutory holidays. Multivariable logistic regression was used to analyze the association between off-hour admission and 3-month unfavorable functional outcome defined as modified Rankin Scale (mRS) 3–6.

**Results:** A total of 7075 patients with acute ischemic stroke were included in this analysis: mean age,  $67.5 (\pm 13.0)$  years; male, 58.6%. In multivariable analysis, off-hour admission was not associated with unfavorable functional outcome (OR, 0.89; 95% CI, 0.72–1.09) and mortality (OR, 1.09; 95% CI, 0.77–1.54) at 3 months. Moreover, off-hour admission did not affect a statistically significant shift of 3-month mRS distributions (OR, 0.90; 95% CI, 0.78–1.05).

**Conclusions:** 'Off-hour' admission is not associated with a unfavorable 3-month functional outcome in acute ischemic stroke patients admitted to tertiary hospitals in Korea. This finding indicates that the off-hour effects could be overcome with well-organized stroke management strategies.

### WSC-0518

#### Outcomes and Quality of Care

#### Trends in stroke admission and mortality and impact of multidisciplinary stroke team on stroke outcome in Ile-Ife, Nigeria

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**Introduction:** Stroke, a major cause of morbidity and mortality and is on the increase with increasing morbidity. Stroke unit has been found to reduce stroke mortality and improve outcome, however there is no information from developing countries

**Aims:** To compare the yearly frequency of stroke admission and mortality in Obafemi Awolowo University Teaching Hospital, Ile Ife, Osun state, Nigeria and to determine the impact of commencement of a multidisciplinary stroke team in December 2010 on stroke outcome.

**Methods:** This was a prospective study involving 205 stroke admissions (103 males and 101 females, with a male to female ratio of 1.01:1) over a 4-year period 2010–2013.

**Results:** There were two hundred and five stroke admissions over 103 males and 101 females, mean age 63 (SD 13), range 31–92, with a male to female ratio of 1.01:1) over a 4-year period 2010–2013 comprising 103 males and 101 females, with a male to female ratio of 1.01:1. The risk factors for stroke were as follows: Hypertension (76%), Diabetes (20%), Cigarette smoking (6%), Alcohol (21%), Previous stroke (18%), family history (3%), Sickle cell disease (1%), Out of the 159 (78%) with CT, 38(24%), were normal 46(30%) had hemorrhagic stroke while 75(47%) had ischemic stroke. There was a reduction in the yearly mortality of stroke from 40% in 2010, to 26% in (2011), 28% in 2012 and 31% in 2013.

**Conclusions:** The Multidisciplinary Stroke team has reduced the yearly mortality of stroke in a low income country.

### WSC-0622

#### Outcomes and Quality of Care

#### Relation of serum phosphorus level to clinical outcomes in patients with acute ischemic stroke

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**Introduction and Aims:** Serum phosphorus levels have been associated with atherosclerosis, especially in cardiovascular disease. But the relationship to stroke is uncertain. The aim of our study was to examine the association of serum phosphorus levels with stroke prognosis in the general population.

**Methods:** We studied the association between serum phosphorus levels and clinical outcomes in 100 patients with acute ischemic stroke. National Institutes of Health Stroke Scale (NIHSS) and modified Rankin Scale (mRS) were used to assess the severity of neurological deficit and clinical disability respectively. The mean follow up was 12 months. Patients were categorized into 4 groups based on serum phosphorus level ( $<2.50$ ,  $2.51$ – $3.5$ ,  $3.51$ – $4.50$  and  $>4.50$  mg/dL). Simple linear and logistic regression models were used to examine the association between serum phosphorus and clinical outcomes.

**Results:** Among 100 patients with acute ischemic stroke (mean age, 66.26 years), mean phosphorus level was 3.216 mg/dL. Serum phosphorus was mildly inversely correlated with NIHSS ( $P=0.009$ ) and mRS scores ( $P=0.013$ ). Also there were 8 stroke recurrence or death during 1 year follow-up period. Patients with serum phosphorus levels of 2.5 to 3.5 mg/dL had increased risk of stroke recurrence or death. But serum phosphorus level was not statistically significant in long term prognosis.

**Conclusions:** Our study shows an association between serum phosphorus levels and functional outcome after ischemic stroke. These results suggest that serum phosphorus level may use a useful serologic marker for prognosis after ischemic stroke with further investigation in the long term prognosis.

### WSC-1338

#### Outcomes and Quality of Care

#### Acute-phase fatigue predicts bodily pain and poorer general health in patients with first ever stroke – A longitudinal study over 18 months

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**Introduction:** Poststroke fatigue has been shown to predict long-term physical health.

**Aim:** To determine the association of acute-phase fatigue with four aspects of physical health 18 months after first clinical stroke: physical function, role function (physical), bodily pain, and general health.

**Methods:** Ninety-six patients with first-ever stroke were recruited on admission at two hospitals in Norway. They were assessed within 2 weeks after admission (acute-phase) and at 18-month follow-up. Measures included the Fatigue Severity Scale and Beck Depression Inventory II. The SF-36 was used to assess self-reported physical function, role function (physical), bodily pain, and general health, which are combined into a summary measure of physical health. Relationships between acute-phase fatigue and later health outcomes were evaluated using multivariate regression analysis controlling for relevant covariates and acute-phase physical health.

**Results:** Acute-phase fatigue was associated with all four aspects of physical health at 18-month follow-up. However, after adjusting for other potential predictors of health outcomes, including age, gender, cohabitation status, acute-phase physical health and depressive symptoms, acute-phase fatigue remained a significant predictor of later bodily pain and general health, but not of later physical or role function. Examining the reverse relationships, only acute-phase general health predicted fatigue at 18 months.

**Conclusions:** Our study suggests that acute-phase fatigue is an independent risk factor for both bodily pain and general health 18 months after

stroke. The finding indicates that effective treatments for poststroke fatigue both in the acute-phase and later in the recovery period may contribute to better physical health in stroke rehabilitation.

### WSC-1601

#### Outcomes and Quality of Care

#### Effects of an early poststroke co-managed visit on 1-year readmissions: A retrospective study from a stroke unit registry

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**Introduction:** Guidelines recommend poststroke clinics but few data supports their effectiveness on reducing readmissions. According to our protocol all patients are referred to a visit co-managed by geriatricians and psychiatrists within 90 days (mean-time 51.34 days  $\pm$  22.84) after discharge from SU. Only 49.3% of patients attended the scheduled visit.

**Aims:** The primary outcome is the adjusted rate of all-cause rehospitalization in the period from 90 days to 1 year after discharge.

**Methods:** Univariate statistics compared the characteristics of 144 consecutive patients discharged in 2010–11 grouped according to the visit attendance. Rehospitalization was estimated with Kaplan–Meier estimates and compared using log-rank test. Cox proportional hazard models were fitted for the outcome adjusting for demographic/social/neurological conditions, functional status, risk factors, discharge setting.

**Results:** Univariate model showed an high prevalence of dementia and Atrial Fibrillation and a low prevalence of dyslipidemia in the group not attending the visit. The Kaplan–Meier estimate showed a lower 1-year readmission in those attending the visit [Log-Rank Chi-square 9.00,  $p$  .003]. (Fig. 1). In the Cox proportional hazard model adjusted for all the covariates, the visit was related to a reduction in 1-year all-cause hospitalization [OR 0.06 (95% CI: 0.01–0.61)  $p$  0.017]. Significant covariates were Dementia and AF.

**Conclusions:** A poststroke co-managed visit seems related to a lower all-cause 1-year rehospitalization but the role of two important covariates like dementia and AF needs further studies.

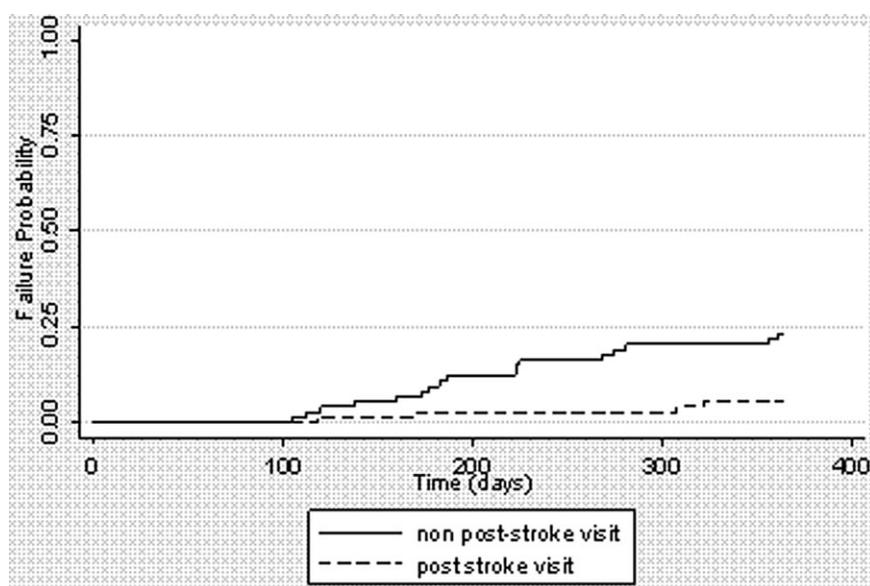


Fig. 1 Rehospitalization (all causes).

**WSC-1535****Outcomes and Quality of Care****The positive impact and potential of an interprofessional stroke education program**

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**Introduction:** Stroke units save lives. An important feature of such units is the provision of co-ordinated treatment and rehabilitation by the inter-professional team (IPT). It is also key that the IPT receives ongoing specialist education. However, there is a lack of comprehensive stroke-specific training programs.

**Aims:** An education program covering the entire patient pathway was developed to address this educational deficiency.

**Method:** An Inter-Professional Stroke Course, run by Nottingham University Hospitals & Health Education East Midlands, was delivered to IPT stroke staff and consistently evaluated throughout 2013–14. Education was provided by stroke physicians, physiotherapists, occupational and speech therapists, stroke survivors, psychologists, early-supported discharge teams and palliative-care staff. Delegates also received teaching regarding anatomy, physiology, pharmacology, thrombolysis, NIHSS, stroke recognition and treatment, complications and the role of hyper-acute and rehabilitation nurses.

**Results:** Of respondents to a delegate questionnaire, 94.1% said their professional practice was influenced by the course. Qualitative data indicated that professional practice had altered in terms of IPT communication and issues surrounding direct patient care. Furthermore over 70% said their knowledge, confidence, job satisfaction and patient, carer and IPT communication improved as a result of the course. Course attendee numbers increased throughout 2013.

**Conclusions:** The positive effects of educating IPT members can potentially impact on stroke patient outcomes. The increasing number of delegates and positive feedback from attendees indicates the courses' high quality and professional reputation. Education of IPT staff and empowering staff with the necessary knowledge is the key to successful, holistic and dignified care of stroke patients.

**WSC-1570****Outcomes and Quality of Care****Validity of the modified Tardieu Scale in measuring wrist flexor spasticity after stroke**

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**Introduction:** Spasticity is a common motor disorder after upper motor neuron syndrome such as stroke. The Modified Tardieu Scale (MTS) is a clinical measure to assess muscle spasticity.

**Aims:** To investigate the validity of the Modified Tardieu Scale (MTS) in assessing wrist

flexor spasticity after stroke.

**Methods:** Twenty patients with stroke (mean age of 52.7 ± 10.86 years) were included. The wrist flexor spasticity on the affected side were assessed clinically with the MTS to obtain

the R2-R1. The H-reflex tests of H<sub>max</sub>/M<sub>max</sub> ratio and H<sub>slp</sub>/M<sub>slp</sub> ratio were also measured as

indices of alpha motor neuron excitability.

**Results:** The median (interquartile range) MTS grades of quality of muscle reaction was

“2” (0–2). The mean ± SD of R2-R1 was 21.30 ± 18.20. The mean ± SD of H<sub>max</sub>/M<sub>max</sub> ratio

and H<sub>slp</sub>/M<sub>slp</sub> ratio were 0.37 ± 0.17 and 1.02 ± 0.6, respectively. There were no significant

correlations between the MTS and H-reflex tests.

**Conclusions:** The findings of the present study question the validity of the MTS for the

measurement of muscle spasticity after stroke.

**WSC-0162****Outcomes and Quality of Care****Neurological complications in hematologic diseases**

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**Aim:** Sixteen patients surveyed at Hematology Service for neurologic impairment 10 F,6 M aged from 21 to 88 (median 50,31) years old were analyzed.

**Materials:** Hematologic dealing diagnosis made by serum blood levels and bone marrow puncture was: iron deficiency 25%; AML (acute myeloid leukemia), hemophilia and sickle cell disease with 12,5% respectively; CML (chronic myeloid leukemia), HL (Hodgkin Lymphoma), Favism and Hemolytic anemia, KID, transitory hypereosinophilia and MM (Multiple Myeloma) equally observed with 7,5% among all patients.

**Results:** All patients were examined by neurologist with neurologic examination and imaging. The established diagnosis was: ischemic stroke 31,25% (iron deficiency and sickle cell disease); hemorrhagic stroke 37,5% (ICH 25%, HSA 7,5%, mixed ICH+IVH+HSA 7,5%) found in hemophilia, KID, iron deficiency, CML, DVT (HL); confusion with agitation 12,5% (AML and hemophilia); peri brain vessel infiltration and plasmocitoma in MM and primary headache attack in hemophilia of respective participation with 7,5%.

According to the localization of ischemic stroke; 12,5% thalamic lacunar, BG, left PICA, right MCA, left ACA territory stroke with 7,5% respectively. In addition, the hemorrhagic stroke as massive lobar hematoma occurred in the underlined hematologic syndromes such as; hemophilia, KID, HL, while of truncal localization in AML and CML.

Among neurologic nosologies they presented; epilepsy 18,75% (NCSE-facial myoclonus in the HSA case with iron deficiency and KID with mixed brain hemorrhage; or versive vascular seizures in sickle cell disease with 7,5%); intracranial hypertension syndrome 43,75%; motor weakness or conscience impairment with 18,75% respectively.

Finally outcome resulted with death or slight improvements of similar half occurrence.

**Conclusion:** Stroke showed a common neurologic complication as one of the high risk cause of death among hematologic illness outcome.

**WSC-0766****Outcomes and Quality of Care  
Comparison of outcome between lacunar infarction  
and branch atheromatous disease in lenticulostriate  
artery territory from the viewpoint of ADL and QOL**M Niimi<sup>1</sup>, M Abo<sup>1</sup>, S Miyano<sup>2</sup><sup>1</sup>Department of Rehabilitation Medicine, The Jikei University  
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**Introduction:** Branch atheromatous disease (BAD) is differentiated from lacunar infarction (LI). BAD is often associated with clinical worsening of symptoms and causes severe hemiparesis in the acute stage, but patients with BAD show gradual motor recovery.

**Aims:** We aimed to explore prognosis and outcome of BAD in lenticulostriate artery (LSA) territory in comparison with those of LI.

**Methods:** We retrospectively investigated the patients who were admitted within 3 days after acute ischemic stroke between April 2010 and December 2013. They underwent daily rehabilitation during hospitalization. BAD in LSA territory was diagnosed by the presence of lesion representing over three consecutive horizontal slices in MRI. Patients having atrial fibrillation, taking anticoagulants, or having more than 50% stenosis of large artery in magnetic resonance angiography were excluded. We retrieved data on clinical characteristics and evaluation from medical records.

**Results:** Subjects were 41 BAD and 35 LI patients. There was little difference in clinical characteristics. NIHSS was significantly higher in BAD patients ( $p < 0.05$ ), and Barthel index and Brunnstrom recovery stage were lower in BAD patients at hospital admission ( $p < 0.05$ ,  $p < 0.05$ ). Hospital stay was significantly longer in BAD patients ( $p < 0.01$ ), but Barthel index at hospital discharge was not different. In order to ambulate, 8 BAD and 1 LI patients depended on orthosis ( $p < 0.05$ ), and 21 BAD and 7 LI patients used canes ( $p < 0.01$ ).

**Conclusions:** BAD patients can obtain ADL similar to LI patients. However, many BAD patients require canes and/or orthosis.

**WSC-0452****Outcomes and Quality of Care  
Factors influencing burden on caregivers of stroke  
patients with hemiplegia at home**D Nishio<sup>1</sup>, Y Hirano<sup>1</sup>, T Minakawa<sup>1</sup>, H Kigawa<sup>1</sup>, H Takahashi<sup>2</sup><sup>1</sup>Rehabilitation Center, Hanno-Seiwa Hospital, Hanno, Japan<sup>2</sup>Department of Rehabilitation Medicine, Saitama Medical  
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**Purpose:** The purpose of this study was to clarify the factors influencing burden on caregivers of stroke patients with hemiplegia who live at home by family's care.

**Methods:** Subjects were 20 stroke patients with Brunnstrom Recovery Stage at discharge scored less than 4 who live at home at 6 months after discharge and also had Barthel Index (BI) at 6 months after discharge scored less than 100. Their caregivers also took part in this study. Age, gender, number of caregivers, BI, frequency of use of nursing-care service and frequency of voluntary training were evaluated as independent variable, Zarit Burden Interview (ZBI) was evaluated as dependent variable. Stepwise regression analysis was used as statistical analysis.

**Results:** Patient's mean age was  $68.2 \pm 10.8$  years. Patient's gender was 15 males and 5 females. Primary caregiver's mean age was  $63.9 \pm 13.9$  years. Primary caregiver's gender was 2 males and 18 females. Number of caregivers was  $1.3 \pm 0.5$ . BI was  $66.3 \pm 27.4$  score. Frequency that patients used nursing-care service was  $3.4 \pm 2.3$  times a week. Frequency of voluntary training was  $2.4 \pm 3.0$  times a week. ZBI was  $25.1 \pm 17.0$  score. Adopted independent variable were frequency of use of nursing-care service, number of caregivers, patient's gender and frequency that patients trained voluntarily.

**Conclusion:** Voluntary training of high frequency and many caregivers reduce the burden on caregivers of stroke patients. In the stroke patients with high dependence to nursing-care service, the burden on caregivers was thought to be heavy.

**WSC-1259****Outcomes and Quality of Care  
Assessment of environmental mobility disability of  
stroke survivors in selected hospitals in Osun,  
Southwestern Nigeria**A O Obembe<sup>1</sup>, O Omoniyi<sup>1</sup>, A Ogundele<sup>2</sup>, M O B Olaogun<sup>1</sup>,  
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**Introduction:** Reduced mobility is a common occurrence following stroke which invariably affects walking pattern and restrict community participation in stroke survivors.

**Aims:** To assess environmental mobility disability among stroke survivors and to determine associated factors.

**Methods:** Forty (27 males and 13 females) community dwelling stroke survivors with stroke duration of  $\geq 3$  months were recruited from selected physiotherapy outpatient clinics in Osun, southwestern Nigeria. Gait speed and cadence were assessed by observational gait analysis. Modified Ranking scale (MRs) was used to categorize disability. Environmental Analysis of Mobility Questionnaire (EAMQ) was used to assess frequency of encounter and avoidance of environmental features during community walking (environmental mobility disability). Descriptive and Inferential statistics were used for data analysis.

**Results:** The ages of the participants ranged from 38 to 78 years (mean =  $58.65 \pm 11.08$  years). The EAMQ<sub>total</sub> score ranged from 14 -72 (mean =  $65 \pm 18.99$ ). Male stroke survivors had higher EAMQ<sub>encounter</sub> scores than females ( $p = 0.012$ ), while the female stroke survivors had higher EAMQ<sub>avoidance</sub> scores than males. There were significant relationships between EAMQ<sub>encounter</sub> score and age ( $r = 0.467$ ,  $p = 0.002$ ), gait speed ( $r = 0.533$ ,  $p = 0.0001$ ), cadence ( $r = 0.495$ ,  $p = 0.0001$ ), and level of disability ( $r = -0.346$ ,  $p = 0.029$ ).

**Conclusions:** Stroke survivors avoid specific environmental features more than they encounter them. Female stroke survivors avoid environmental mobility more than males. Environmental disability is related to age, level of disability, gait speed and cadence. Environmental mobility disability should be assessed in community dwelling stroke survivors. The outcome should be taken into consideration during stroke rehabilitation.

**WSC-1469****Outcomes and Quality of Care  
Health related quality of life in first stroke is related  
to physical function, level of disability and depression  
among stroke survivors in Southwestern Nigeria**A Obembe<sup>1</sup>, M K Ibitoye<sup>1</sup>, M O B Olaogun<sup>1</sup>, M Odetunde<sup>2</sup>,  
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**Introduction:** Disability has substantial impact on physical and psychosocial functions of stroke survivors. Health-related Quality of Life (HRQoL) is an important consideration in health care.

**Aim:** To determine the relationship between HRQoL and physical function, depression, and level of disability in stroke survivors.

**Methods:** This was a cross-sectional study involving 83 stroke survivors (51 males and 32 females), aged 40–81 years (mean = 61.83 ± 10.12 years) with stroke duration of ≥3 months. Participants were recruited from hospitals in Osun, southwestern Nigeria. The Medical Outcomes 36-Item Short-Form Health Survey (SF-36) was used to assess HRQoL, Stroke Impact Scale 16 (SIS-16) was used to assess physical function, modified Barthel index (MBI) was used to assess activity of daily living (ADL) as a physical function, and Beck's depression inventory (BDI) was used to measure depression. Modified Rankin scale was used to categorize the disability of the participants. Data were analyzed using descriptive and inferential statistics.

**Results:** There were significant relationships between HRQoL and the following; SIS-16 scores ( $r = 0.784$ ,  $p = 0.0001$ ), ADL ( $r = -0.720$ ,  $p = 0.0001$ ), level of disability ( $r = -0.695$ ,  $p = 0.025$ ) and depression ( $r = -0.404$ ,  $p = 0.0001$ ). In a multiple regression analysis, SIS-16 scores, ADL and level of disability were predictors of HRQoL ( $R^2 = 0.648$ ,  $p = 0.0001$ )

**Conclusions:** Health-related Quality of Life is related to physical function, level of disability and depression in community-dwelling stroke survivors. Psychosocial functions should be assessed and managed in all stroke survivors undergoing rehabilitation, and the outcome should be incorporated in the rehabilitative management of patients.

## WSC-0463

### Outcomes and Quality of Care Impact of an educational package on stroke survivors' knowledge of stroke rehabilitation

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**Introduction:** Education should be an essential component of poststroke management, yet the inadequacy of the education provided to stroke patients is widely acknowledged.

**Aim:** To determine the impact of an educational package on stroke survivors' knowledge of stroke rehabilitation.

**Methods:** This quasi-experimental study involved sixty two (38 males and 24 females) stroke survivors in selected hospitals in south western Nigeria. A fact sheet on stroke rehabilitation by the National Institute of Neurological Disorders and stroke was used to develop an educational leaflet. Knowledge of stroke rehabilitation was assessed with a self-administered questionnaire developed for this study. Modified Rankin scale was used to categorize disability of participants. Data were analyzed using descriptive and inferential statistics. Level of significance was  $p \leq 0.05$ .

**Results:** There was a significant difference between the pre intervention and postintervention scores ( $p = 0.0001$ ). There was, however, no significant difference ( $p > 0.05$ ) in postintervention score between groups (sex, stroke type, side of affectation) and among groups (level of disability, level of education). There was a significant correlation between the pre intervention scores of stroke survivors and the postintervention scores ( $r = 0.451$ ,  $p = 0.000$ ).

**Conclusions:** This study concluded that the use of an educational package can improve stroke survivors' knowledge of stroke rehabilitation regardless of sex, stroke type, level of disability, side of affectation and level of education. Educational materials should be used to improve knowledge on stroke rehabilitation among stroke survivors in hospitals. Better knowledge of stroke rehabilitation may enhance patients' cooperation with therapists, and promote patients' recovery.

## WSC-1020

### Outcomes and Quality of Care Dysphasia and prognosis of nutrition intake in patients with putaminal hemorrhage at acute stage

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**Introduction and aims:** Dysphagia is usually found in acute stroke patients. However most studies have focused on ischemic stroke. In this study we investigate the relationship between the first bedside swallowing assessment (BSA) and prognosis of swallowing function in patients with putaminal hemorrhage in acute stage.

**Subjects and methods:** Subjects were 183 patients with acute putaminal hemorrhage. We assessed swallowing function with BSA on admission and clinical background such as age, hematoma volume, and Canadian neurological scale (CNS). Additionally, we checked the type of nutrition (Regular food, Dysphagia food, and enteral feeding) at discharge as a prognosis of swallowing function. After then we investigate the relation between BSA, clinical background and the type of nutrition.

**Results:** 133 patients (72.7%) had BSA abnormality on admission and 50 patients could eat regular food at discharge. Patients who could eat regular food were younger and had smaller hematoma volume. Type of nutrition had strong relation between CNS and the result of BSA.

**Conclusion:** Bedside swallowing screening is the essential first step in identifying risk of dysphagia. In addition, we suggest that assessment of hematoma volume and neurological examination is also important to investigate the prognosis of swallowing function for the patients with putaminal hemorrhage in acute stage.

## WSC-0832

### Outcomes and Quality of Care Performance measures for thrombolytic therapy and functional outcome at 3 months after ischemic stroke

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**Introduction:** Evidence that better adherence to stroke performance measures yields improved patient-oriented outcomes is insufficient.

**Aims:** To determine whether performance measures for thrombolytic therapy relate with outcome in acute ischemic stroke (AIS)

**Methods:** In 4,061 AIS patients who admitted in 2011–10 tertiary stroke centers participating in a prospective, web-based stroke registry to calculate performance in real-time, we calculated rate ratios (RR) between the observed rate and the estimated rate of favorable outcome (modified Rankin Scale, 0 to 2) at 3 months after AIS in each center. The estimated rate was calculated by using the iScore validated to predict outcome in the same stroke population. We examined whether performances of three indicators for measuring quality of thrombolytic therapy are associated with the RR for the favorable outcome.

**Results:** Overall, 63.2% (n = 2,565) of patients had a favorable outcome at 3 months after AIS. The observed rates of the favorable outcome varied between participating centers (47.3–72.6%), whereas range of the estimated rates was 34.6–44.1%. Performances of indicators for thrombolytic therapy were as follows (the lowest to highest): 1) consideration of rt-PA (87.5–100%), 2) administration of rt-PA (78.6–100%), 3) initiation of

rt-PA infusion within 60 minutes of patient arrival (50–90.1%). The sum of the performance rates for thrombolytic therapy correlated with the RR for the favorable outcome measured in each center (Spearman  $\rho = 0.855$ ,  $p = 0.002$ ).

**Conclusions:** Better performance measures for thrombolytic therapy are associated with favorable outcome in patients with AIS.

### WSC-0619

#### Outcomes and Quality of Care CT angiogram as a predictor of outcome in symptomatic ICA occlusion

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**Introduction:** In patients with symptomatic internal carotid artery (ICA) occlusion, the status of collateral circulation can influence the outcome after acute ischemic stroke.

**Aim:** To study if collateral circulation as assessed by CT angiogram can predict the severity of stroke at onset and the outcome in patients with symptomatic ICA occlusion.

**Methods:** Study cohort comprised of patients with symptomatic ICA occlusion from January 2011 to December 2013. CT angiogram was assessed for the collateral vessels (ophthalmic artery, anterior and posterior communicating artery and the leptomeningeal vessels). Stroke severity was assessed using NIHSS and outcome at 90 days defined as good if modified Rankin scale (mRS)  $\leq 2$ .

**Results:** Seventy three patients had symptomatic ICA occlusion of which 6 patients with tandem M1 occlusion were excluded. The mean age was  $57 \pm 11.6$  (range 32–80) and 92% were males. The median NIHSS at presentation was 10 (range 0–22).

The absence of ophthalmic artery on symptomatic side and reduced leptomeningeal collaterals correlated with the severity of stroke (NIHSS  $\geq 5$ ) and results were statistically significant ( $p \leq 0.05$ ). Good flow through symptomatic side ophthalmic artery and posterior communicating artery,  $\geq 2$  collaterals and good leptomeningeal flow were predictors of good outcome (mRS  $\leq 2$ ) at 3 months. But in multivariate analysis only the presence of symptomatic side ophthalmic artery was a predictor of good outcome ( $p = 0.02$ , OR 6.4, CI 1.35–30.42).

The only factor which could predict the presence of good leptomeningeal collaterals was the etiology of stroke ( $p = 0.03$ ). Among the 47 patients with good leptomeningeal collaterals, 34 patients (72%) had atherosclerotic ICA occlusion while 13 patients (28%) had dissection. The 2 patients with embolic ICA occlusion had very poor leptomeningeal collaterals and both died in hospital. The presence of vascular risk factors, age, gender and the occurrence of previous neurological events were not associated with leptomeningeal collateral flow.

**Conclusion:** Assessment of collateral circulation using CT angiogram can help in predicting the outcome of patients with symptomatic ICA occlusion.

### WSC-0210

#### Outcomes and Quality of Care Outcome of patients with primary intracerebral hemorrhage in a single center in the Philippines

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**Objective:** The study described the outcome of patients with primary intracerebral hemorrhage (ICH) admitted in a single center from January 2011 to December 2011.

**Methods:** This descriptive study retrospectively reviewed all medical records of patients admitted as a case of primary ICH. Neuroimaging in the form of cranial CT scan and cranial MRI were done in all patients to confirm diagnosis. Functional outcomes were assessed using modified Rankin scale (mRS) after discharge, after 30 days and 3 months after. Case-fatality rate and all-cause mortality rates were computed.

**Results:** There were 514 patients registered in the Stroke Databank. Twenty three percent were ICH from all causes and eighty four percent of which were primary intracerebral hemorrhage. Most of the patients were males (63%) and mostly between 51 and 60 years old (31%). Most common location of ICH was basal ganglia (50%), followed by thalamus (16%) and then cerebellum (14%). ICH volume was mostly below 10 cc (35%) as computed by Kothari method. ICH score upon admission varied but mostly with a score of 0 and 1. Sixteen percent of patients had surgical intervention. All-cause mortality during admission was computed at 14%. Case mortality was 11%. There was improvement in the modified Rankin Scale (mRS) scores of patients upon discharge, after 30 days and after 3 months.

**Conclusion:** Outcome of patients with primary intracerebral hemorrhage varied greatly and dependent upon several factors. Older age and higher ICH score upon admission were identified to be important factors for poor outcome.

### WSC-0606

#### Outcomes and Quality of Care Long-term seizure outcomes and risk factors of poststroke epilepsy

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**Aims:** Poststroke epilepsy (PSE) is a common complication after stroke. Many studies have reported seizure outcomes after stroke and risk factors of PSE; however, little is known about recurrence of PSE. We sought to determine the risk factors of seizure recurrence and long-term outcome of PSE patients.

**Methods:** We recruited consecutive 166 patients with PSE admitted to our stroke center between January 2011 and July 2013. Among them, patients who were followed up until February 2014 were analyzed in terms of clinical, neurophysiological and radiological findings, and of PSE recurrence rate. Cumulative risks were estimated with Kaplan-Meier analysis. Independent predictors of recurrent PSE were assessed with Cox proportional-hazards analysis.

**Results:** A total of 104 patients (71 men; age,  $72.1 \pm 11.2$ ) were analyzed. PSE recurred in 31 (30%) patients during a median follow-up of 357 days (IQR:160–552). Using log-rank analysis, the significant factors affecting recurrence of PSE were history of previous PSE, monotherapy with valproate sodium (VPA), polytherapy with antiepileptic drugs, frontal cortical involvement and higher modified Rankin Scale score at discharge (all  $p < 0.05$ ). In a multivariate Cox proportional-hazards model, independent predictors of recurrent PSE included age  $< 74$  years (HR 2.38, 95% CI 1.02–5.90), VPA monotherapy (HR 3.86, 95% CI 1.30–12.62), and presence of convulsions at admission (HR 3.87, 95% CI 1.35–12.76).

**Conclusions:** Approximately one-third of patients with PSE develop another bout of seizures within 1 year. The predictors of recurrent PSE are younger age, VPA monotherapy and presence of convulsions

**WSC-1306****Outcomes and Quality of Care****What symptoms do the stroke experts focus on recognizing severity of patients with acute stroke? Changes of the decade**Y Terayama<sup>1</sup>, M Kin<sup>1</sup>, H Ohba<sup>1</sup>, S Narumi<sup>1</sup>, T Natori<sup>1</sup><sup>1</sup>Department of Neurology and Gerontology, Iwate Medical University, Morioka Iwate, Japan

**Introduction:** We have reported the relative importance of 12 neurological findings corresponding to the severity of acute stroke patients in developing a novel, weighted, quantifiable stroke scale using conjoint analysis (*Stroke* 2001; 32:1800–7). The relative importance indicates the impact on determining the stroke severity. However, the importance, the physicians' sense of values, may change among decades and may vary among nations.

**Aims:** The purpose of the present study is to check the changes of the sense of values of stroke severity by comparing the relative importance of neurological findings for 10 years in Japan.

**Methods:** Ranking of the 27 computed virtual patients with different combinations of 12 variables was undertaken by 76 board-certified neurologists and neurosurgeons caring for stroke patients at the 6 institutes from March 1 to May 4, 2010. The relative importance of each neurological findings were calculated and compared with those calculated in 2001.

**Results:** Changes of the relative importance of 12 variables between 2001 and 2010 were as follows; consciousness (49.8–46.9%), language (9.9–11.8), neglect (3.7–5.2), hemianopsia (2.2–3.4), gaze (5.6–5.3), pupillary abnormality (6.8–6.3), facial palsy (2.4–3.1), plantar reflex (2.2–1.2), sensation (2.1–1.6), and weakness (hand: 3.7–2.3, arm: 4.3–3.2, leg: 7.3–9.7).

**Conclusions:** The present study suggested that the relative importance indicating the physician's sense of values of stroke severity were generally unchanged for the last 10 years in Japan.

**WSC-0908****Outcomes and Quality of Care****Influence of age on acute care of first-ever ischemic stroke**H J Lin<sup>1</sup>, H C Shen<sup>1</sup>, M C Tseng<sup>2</sup><sup>1</sup>Division of Neurology Department of Internal Medicine, Chi Mei Medical Center, Tainan, Taiwan<sup>2</sup>College of Management, National Sun Yat-Sen University, Kaohsiung, Taiwan

**Introduction:** Ageing of population will have an impact on the organization and delivery of health care.

**Aims:** We aimed to explore the differences in characteristics, outcomes, and healthcare expenditure in different age groups of acute stroke patients.

**Methods:** We analyzed the data from a hospital-based stroke registry enrolling patients hospitalized within 10 days after onset. Patients with first-ever ischemic stroke were categorized into four age groups: <65, 65–74, 75–84, and ≥85. We collected patient demographics, clinical data, and outcomes at discharge. Medical resource utilization and expenditure were assessed using the hospital claims data.

**Results:** Of 1,638 eligible patients (mean age 67 ± 13 years, male 59%), 686 (42%) were <65 years, 492 (30%) 65–74 years, 364 (22%) 75–84 years, and 96 (6%) ≥85 years. Comorbidities increased in patients ≥65 years. The prevalence of most vascular risk factors decreased as age increased, except that heart disease became more prevalent in the elderly. Large artery atherosclerosis and cardiac embolism were the main subtypes in the older patients, while small vessel occlusion was more common in the younger patients. Stroke severity, complication, healthcare expenditure, and in-hospital mortality were higher in patients ≥75 years. These patients were less likely to receive antithrombotic and lipid-lowering medications.

Stroke survivors aged ≥75 years were more likely to be functionally dependent at discharge, and discharged to nursing home.

**Conclusions:** Clinical characteristics, outcome, and healthcare expenditure in patients with first-ever acute ischemic stroke vary across age groups. Tailored healthcare services targeting different age groups may help improve stroke care.

**WSC-1057****Outcomes and Quality of Care****Stroke outcome in very old patients with leukoaraiosis**M Vukicevic<sup>1</sup>, T Jaramaz Dacic<sup>1</sup>, S Trajkovic Bezmarevic<sup>1</sup>, B Georgievski Brkic<sup>2</sup>, A Bezmarevic<sup>3</sup>, S Djokovic<sup>3</sup>, G Milenkovic<sup>2</sup>, N Basurovic<sup>2</sup>, I Krdzic<sup>3</sup><sup>1</sup>Stroke Department, Hospital for Cerebrovascular Diseases Sveti Sava, Belgrade, Serbia<sup>2</sup>Radiology, Hospital for Cerebrovascular Diseases Sveti Sava, Belgrade, Serbia<sup>3</sup>Stroke, Hospital for Cerebrovascular Diseases Sveti Sava, Belgrade, Serbia

**Introduction and purpose:** Leukoaraiosis is a common finding in stroke patients, particularly in elderly.

Leukoaraiosis is a feature of the small vessel cerebrovascular pathologies that lead to stroke, including hypertensive arteriopathy or cerebral amyloid angiopathy, but it is seen on brain neuroimaging in older person, and is present as an incidental finding in patients with large territorial brain infarction.

The purpose of this study was to find a relationship between leukoaraiosis and outcome in very old stroke patients.

**Methods:** We tested 98 patients, older than 80 years (average 84,24) who admitted in our Hospital due to stroke, 63 female (64,3%), 35 male (35,7%).

All of them had had clinical evident stroke (88 ischemic, 1 TIA and 9 hemorrhagic). We used findings of CT scan to evaluate leukoaraiosis and stroke. 71 (69,58%) patients had large territorial infarction.

For statistical analysis we used Chi-square test.

**Results:** We have found some degree of leukoaraiosis in 61 patients (59,78%), 36.1% of that number had a lethal outcome.

There wasn't statistically significant difference between leukoaraiosis in very old stroke patients and stroke outcome (p 0,658).

We observed the following co-morbidities in our patients: 91 patients (92,9%) had arterial hypertension, 49 (50%) had atrial fibrillation, 38 (38,8%) had cardiomyopathy, 13 (13,4%) had diabetes, 13 (18,3%) had hypercholesterolemia, and only 11 had high degree of carotid stenosis.

**Conclusion:** Leukoaraiosis in older has no effect on stroke outcome, which indicates a need to explore other potential pathomechanisms.

**WSC-0666****Outcomes and Quality of Care****The collateral circulation on day 2 CT angiography is a reliable predictor of functional outcomes in acute ischemic stroke**X Tan<sup>1</sup>, V Ong<sup>2</sup>, W P Goh<sup>3</sup>, P Paliwal<sup>4</sup>, V K Sharma<sup>4</sup>, L Yeo<sup>4</sup><sup>1</sup>Preventive Medicine Residency Programme, National University Health System, Singapore, Singapore<sup>2</sup>Division of Respiratory and Critical Care Medicine, National University Hospital Singapore, Singapore, Singapore<sup>3</sup>Division of General Medicine and Therapeutics, University Medicine Cluster, National University Hospital Singapore, Singapore, Singapore<sup>4</sup>Division of Neurology, University Medicine Cluster, National University Hospital Singapore, Singapore, Singapore

**Introduction:** Effective collateral circulation can reduce ischemic injury in acute ischemic stroke (AIS). We compared existing methods for quantifi-

cation of collaterals on day 2 CT-angiography (CTA) in thrombolysed patients to predict functional outcomes at 3-months.

**Methods:** Consecutive AIS patients treated with IV-tPA during 2007–2013 were included. Intracranial collaterals were evaluated by 2 neuroradiologists using 4 existing methods: Miteff's system grades MCA collateral branches with respect to the sylvian fissure; Maas system that compares collaterals against the unaffected side; modified-Tan's scale where collaterals in  $\geq 50\%$  of the MCA territory are classified as good; and a 20-point collateral grading scale corresponding to ASPECTS methodology. Good functional outcome at 3-months was determined by mRS scores of 0–1.

**Results:** Day 2 CTA was performed in 209 patients with anterior circulation AIS treated with IV-tPA. Median age 64 yrs, median NIHSS 19 points and median onset-to-treatment time 160 minutes. 98 (46.8%) patients had good functional outcome at 3-months. On univariable analysis, younger age, NIHSS scores, atrial fibrillation, good collaterals by ASPECTS scoring and good collaterals by Maas methodology were significantly associated with good functional outcome. On multivariable logistic regression, only lower NIHSS (OR 1.162 per NIHSS point; 95% CI 1.042–1.261,  $p = 0.001$ ), younger age (OR 1.049 per year; 95% CI 1.011–1.082,  $p = 0.010$ ), good collaterals by Maas methodology (OR 3.015 95% CI 1.320–8.250,  $p = 0.001$ ) and good collaterals by ASPECTS methodology (OR 1.190 per pt ; 95% CI: 1.032–1.428,  $p = 0.013$ ) were found as independent predictors of good outcome.

**Conclusion:** Of the existing intracranial collaterals scoring systems, only the ASPECTS and Maas methods are reliable predictor of favorable outcomes.

## WSC-0659

### Outcomes and Quality of Care Recruit and failure of the collateral circulation in acute ischemic stroke

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**Introduction:** Collaterals provide alternative pathways in acute ischemic stroke (AIS). However, the knowledge of the relationship between evolution of collateral channels and its effects remains limited. We assessed the effects of collateral recruitment and failure with IV rTPA in AIS.

**Methods:** We included 209 patients with CTAs performed before and after IV rTPA. Intracranial collaterals were evaluated by 2 blinded neuroradiologists via 5 predefined criteria: Miteff's system; Maas system; modified Tan's; Alberta Stroke Program Early CT score (ASPECTS) methodology and internal cerebral vein asymmetry and its resolution. Good outcomes at 3-months were determined by modified Rankin scale (mRS) scores of 0–1.

**Results:** On univariate analysis NIHSS score, older age, AF, Collateral recruitment on the Tan system, collateral recruitment by the ASPECTS grading system, Miteff grading system collateral improvement by 1 or 2 grades and Maas Grading system collateral improvement by 3 grades at 24 hours were associated with mortality. On multivariate analysis higher NIHSS (OR 1.143 per point; 95% CI 1.057–1.235,  $p = 0.001$ ), collateral recruitment by (a) Tan grading system (OR 5.893; 95% CI 1.857–18.705,  $p = 0.003$ ), (b) Miteff system by 1 grade (OR 3.375; 95% CI 1.010–11.283,  $p = 0.048$ ) or (c) 2 grades (OR 7.042; 95% CI 2.257–21.970,  $p = 0.001$ ), (d) Maas system by 3 grades (OR 7.587; 95% CI 2.218–25.937,  $p = 0.001$ ) and (e) ASPECTS methodology (OR 1.160 per patient; 95% CI 1.026–1.312,  $p = 0.017$ ) were significantly associated with mortality. Large

collateral recruitment at 24 hrs also showed was associated with poorer outcomes (MRS 2–6) and showed a trend towards symptomatic intracranial bleeds.

**Conclusion:** Substantial collateral recruitment on the follow-up CTA at 24 hours was significantly associated with increased mortality and poorer outcomes at 3 months.

## WSC-0899

### Pediatric Stroke Childhood stroke in Singapore: Infection is a significant causation

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**Aim:** Stroke is increasingly being recognized in children. This study aims to characterize the etiologies and outcome of stroke in Singapore children.

**Method:** We conducted a retrospective study of children with stroke aged 30 days to 18 years managed at KK Women's & Children's Hospital between 2000 and 2009 with approval from Institutional Research Board. Outcome was defined as *favorable* (return to pre-morbid status/minimal functional handicaps), or *poor*, (severe motor cognitive impairments).

**Results:** The cohort comprised 90 children: Hemorrhagic Stroke HS fifty-two (58%), Ischemic Stroke IS thirty-eight (42%), 47 Male, 43: female, median age 7 years. HS etiologies: commonest factor was vascular abnormality 22 (42%), bleeding disorders 5, brain tumors 4, shaken child syndrome 4, and infections 3. IS etiologies: commonest factor was infection 11 (28%), cardioembolic disorders 7 (18%), moyamoya disease 6 (16%), vasculitis 2, and mitochondrial disease 2. Overall, fourteen cases (16%) were attributable to infections. No etiology was identifiable in twenty-one (23%). Thirteen children (14%) died in the acute phase, eight of fourteen children with infection. Seventy of seventy-seven survivors were followed up for a mean of 17 months. Thirty-three (47%) had poor outcome; stroke recurred in nine.

**Conclusion:** Our study highlights the considerable mortality and morbidity from childhood stroke, with motor and cognitive disabilities affecting many survivors. Etiological factors are diverse. Infection is a major causative and an adverse outcome factor. Further research is needed on the acute and preventative treatment of childhood stroke.

## WSC-0512

### Pediatric Stroke Systemic juvenile lupus erythematosus long lasting remission of severe neurological symptoms after treatment with Rituximab

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**Introduction:** Systemic Lupus erythematosus (SLE) has a much higher incidence in Asian and African populations than in western countries. Up to 50% of patients suffer from neuropsychiatric symptoms of different pathogenesis.

**Case presentation:** We report a 13-year-old girl who was diagnosed with SLE with rheumatic symptoms. She rapidly developed confusion, focal epileptic seizures with secondary generalization and left sided hemiparesis

combined with high fever and tachycardia. Initial showed right hemispheric cortical DWI-positive lesions in the MCA territory. During the following 8 weeks extensive progression of MRI lesions to subcortical regions in both hemispheres with additional microbleeds could be demonstrated, no arterial occlusion, no typical vasculitic changes, no meningeal enhancement. CSF was without significant pathology. Aggressive treatment with high-dose corticosteroids and iv Immunoglobulin G was started, followed by one cycle of iv cyclophosphamide and plasma exchange. The patient deteriorated with respiratory failure, increase of liver enzymes, severe thrombopenia and anemia, colitis and secondary infectious complications. After stabilization of vital functions and weaning from the respirator Rituximab was given with no side effect. The patient recovered tremendously without any persistent motor dysfunction, she was able to resume schooling and has no neuropsychological deficits except occasional headache and fatigue. A second dose of Rituximab was applied 6 months later after an increase of CD 20 lymphocytes. Under a low dose corticosteroid treatment the patient has been free of new somatic and neuropsychiatric SLE manifestation since 2 years.

**Conclusion:** Rituximab was well tolerated and longterm effective in this case of juvenile SLE with life threatening cerebral lupus vasculopathy. Further studies have to establish the therapeutic significance of Rituximab in severe neuropsychiatric Lupus.

### WSC-0630

#### Pediatric Stroke

#### Treatment of juvenile patients with moyamoya disease based on noninvasive measurement of cerebral perfusion with mri

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**Introduction:** We have been using dynamic susceptible contrast magnetic resonance imaging (DSC-MRI) to treat juvenile patients with moyamoya disease (MMD) in recent years (Ishii *et al.*). Recently, far more noninvasive arterial spin labeling (ASL) MRI is available for routine use. We retrospectively analyzed how the use of MR perfusion technique changed the treatment protocol for juvenile patients with MMD.

**Method:** From 1979 to 2013, 310 juvenile patients (≤18 years old) with MMD were treated in our institute. 145 of them, who were treated after 2001, underwent DSC-MRI and/or ASL-MRI for the initial evaluation and for follow-up. We analyzed how the trend of treatment changed in comparison to the other 165 who were treated before 2000.

**Results:** Treatment result was compared in the earlier and latter period and was listed in Table 1. 1) Rate of patients conservatively followed up increased. 2) Rate of patients who received operation in unilateral hemisphere increased. The need for additional operation against the worsening of initially nonoperated hemisphere was almost in the same level. 3) Operation against the posterior third of the cerebrum increased. 4) Appearance of perioperative symptomatic infarction per operation was almost in the same level 5) Postoperative frequent follow up with ASL-MRI revealed that amelioration of CBF began at 1 month after the operation after indirect bypass surgery.

**Conclusions:** Measurement of cerebral hemodynamics of MMD with MRI and surgical treatment using indirect bypass technique based on them was useful in selecting surgical candidates and in performing effective surgery to ameliorate cerebral blood flow.

**Table 1**

	Earlier (1979–2000)	Latter (2001–2013)
Total (patient)	165	145
Operateid case	156 (95%)	107 (74%)
Unilateral Ope	26/156 (17%)	45/107 (42%)
Additional Contralateral Ope	12/26 (46%)	20/45 (44%)
Oper to Posterior third	3/156 (2%)	19/107 (18%)
Perioperative Infarction per hemisphere	6/200 (3.0%)	8/300 (2.7%)

#### Reference

Ishii *et al.* Neurosurgery 2014.

### WSC-0770

#### Pediatric Stroke

#### The importance of cervical spine imaging in vertebral artery dissection: A case report

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**Introduction:** Vertebral artery dissection (VAD) is a rare cause of childhood stroke. In the past, most cases have been attributable to trauma or spontaneous occurrences. With the advance of imaging, bony abnormalities of the cervical spine have been identified to account for some cases of VAD. Our case emphasizes the importance of not overlooking this association.

**Case:** A 15-year-old boy presented with an acute history of headache, neck pain, vomiting and dizziness. There was no preceding history of trauma. He had marked unsteadiness on standing but no evidence of focal neurological deficit. A brain MRI demonstrated right cerebellar infarction and MR angiography revealed a right vertebral artery dissection. He was commenced on anticoagulation and made full recovery. Further CT imaging of his neck demonstrated a segmentation anomaly of his C2/3 vertebrae and the presence of an accessory ossicle located next to the occluded V3 segment of the vertebral artery. He remains under neurosurgical surveillance at present.

**Discussion:** Cervical spine abnormalities are a recognized cause of VAD. However, literature has shown that cervical spine imaging in VAD is often overlooked. A review of 68 reported cases of VAD in children identified that cervical spine imaging was only undertaken in 20 children, out of which 10 had bony abnormalities. Surgical management may need to be instituted based on the clinical setting.

**Conclusion:** When VAD has been identified as a cause of stroke, cervical spine imaging should be undertaken, especially if the dissection occurred spontaneously or after minor trauma.

**WSC-1186****Pediatric Stroke****Transcranial Doppler in patients with sickle cell disease: A multicenter prospective registry**G Silva<sup>1</sup>, D L Gomes<sup>1</sup>, R Macedo<sup>1</sup><sup>1</sup>Neurology, Federal University of São Paulo, Sao Paulo, Brazil

**Introduction:** Transcranial Doppler (TCD) is the key test in determining the need for blood transfusion to prevent stroke in children with sickle cell disease (SCD). Unfortunately TCD has been underutilized for this indication, mostly due to exam unavailability.

**Aim:** Our aim was to characterize children with SCD and their TCD results in eight different centers in Brazil.

**Methods:** We prospectively studied patients with SCD screened with TCD from January 2013 to December 2013. TCD exams were performed on SCD patients following the STOP protocol. Attention was focused on the highest mean flow velocities (TAMM). We collected epidemiological characteristics, TCD results, and data on transfusion therapy.

**Results:** We evaluated 397 patients (mean age was  $9.97 \pm 5.02$  yr, 52.7% males). Most patients had hemoglobin SS disease (69.50%), followed by hemoglobin SC (10.95%) and S Beta thalassemia (7.61%), and 11.94% had an unknown subtype. TCD was abnormal in 4.8%, conditional in 12.6%, inadequate in 5.3%, abnormally low in 1% and normal in the remaining patients. The TAMM velocity was  $121 \pm 23.83$  cm/s in the left and  $124 \pm 27.21$  cm/s in the right MCA. A total of 28.8% (mean age  $9.19 \pm 5.92$  yr) were evaluated for the first time with TCD. Twenty patients (5.3%) were treated with transfusion therapy.

**Conclusions:** Patients with SCD are evaluated with TCD at an old age, representing a missed opportunity for stroke prevention. TCD screening in patients with SCD allows for the detection of patients at high risk for stroke and implementation of transfusion therapy.

**WSC-0423****Pediatric Stroke****Inhibitor of histone deacetylase – Sodium butyrate reduces brain damage and stimulates neurogenesis after neonatal hypoxia/ischemia**T ZALEWSKA<sup>1</sup>, M Ziemka-Nalecz<sup>1</sup>, J Jaworska<sup>1</sup><sup>1</sup>NeuroRepair, Mossakowski Medical Research Centre, Warsaw, Poland

Neonatal hypoxia-ischemia (HI) causes neuronal cell damage, however it also stimulates neural stem cell proliferation and differentiation in neurogenic area – the dentate gyrus (DG) of the hippocampus. Induction of these progenitors after injury may represent an endogenous mechanism for brain regeneration. Mounting evidence indicates that histone deacetylase inhibitors (HDACi) exert stimulation of endogenous neurogenesis. Therefore in this study we investigated the influence of HDACi- sodium butyrate (SB) on the generation of neurons and oligodendrocytes after neonatal hypoxia-ischemia. We utilized an established model of HI induced in rats of postnatal day 7 (PND7). After ligation of the left common carotid artery the animals were exposed to hypoxia (7.6% oxygen for 60 min). Sham-operated rats were used as controls. SB (300 mg/kg) was injected subcutaneously for 5 consecutive days starting immediately after HI. To estimate the proliferation profile and phenotype of newborn cells, animals were injected with BrdU (50 mg/kg). At 3–14 days after HI the presence of BrdU-positive cells was seen in both hemispheres (ipsi- and contralateral) with the strongest proliferation level occurring at 3–6 days after the injury. Depending on the time after HI we observed changes in the density of BrdU(+) cells in the hilus and subgranular zone of DG. To confirm that BrdU-positive cells represent newly generated neuroblasts and oligodendrocyte progenitors, we used double staining BrdU/DCX and NG2/BrdU, respectively. We found that admin-

istration of SB stimulates the generation of neuroblasts and progenitors of oligodendrocytes and leads to reduced volume of brain lesion after HI. Supported by NSC grant 2012/05/B/NZ3/00436.

**WSC-1362****Preventive Stroke Strategies****Predictors of therapy discontinuation in stroke secondary prevention**S Al AISHAIKH<sup>1</sup>, J Dawson<sup>1</sup>, R Fulton<sup>1</sup>, M Walters<sup>1</sup>, P Bath<sup>2</sup>,A Shuaib<sup>3</sup>, for the VISTA Collaborators<sup>1</sup><sup>1</sup>Institute of Cardiovascular and Medical Sciences, University of Glasgow, Glasgow, United Kingdom<sup>2</sup>Division of Clinical Neuroscience, The University of Nottingham, Nottingham, United Kingdom<sup>3</sup>Division of Neurology, University of Alberta, Edmonton, Canada

**Introduction:** Secondary preventative strategies are prescribed to reduce recurrence following ischemic stroke. We investigated factors that may predict discontinuation of preventative strategies after stroke.

**Methods:** We used data from the Virtual International Stroke Trials Archive (VISTA). We included patients with ischemic stroke who were prescribed secondary preventative medication. We measured rate of discontinuation of major drug classes and used regression analysis to identify independent predictors of discontinuation of at least one drug class.

**Results:** A total of 10304 patients were included. The mean age of participants was 69.4 (SD 12.4) years. When prescribed, percentage discontinuation was 12% for anti-coagulants, 18.7% for anti-platelets, 13.3% for lipid-modifying agents and 22% for anti-hypertensive medications. Older age (OR 0.98; 95% CI 0.97–0.99 per year), nonwhite ethnicity (OR 0.75; 95% CI 0.59–0.96;  $p = 0.02$ ), higher baseline NIHSS score (OR 0.93; 95% CI 0.91–0.94 per unit increase), smoking (OR 0.87; 95% CI 0.78–0.97), polypharmacy (OR, 1.02; 95% CI 1.00–1.03, per drug) previous treatment with anti-coagulants (OR 0.46; 95% CI 0.35–0.61) or anti-platelets (OR 0.71; 95% CI 0.59–0.86) and cortical involvement (OR 0.70; 95% CI 0.52–0.94) were significant predictors of discontinuation. A regression model including these variables accounted for only a fraction of variance in treatment continuation (R-squared 0.07).

**Conclusion:** Discontinuation of preventative medications after stroke is common. Although we identified several factors associated with stopping treatment, these were poorly predictive and further work is needed to better identify patients at risk of not being on preventative measures.

**WSC-0203****Preventive Stroke Strategies****Is sodium valproate, an HDAC inhibitor, associated with reduced stroke risk? A nested case-control study**D Alex<sup>1</sup>, C D A Wolfe<sup>1</sup>, M C Gulliford<sup>1</sup>, H S Markus<sup>2</sup><sup>1</sup>Primary Care and Public Health Sciences, King's College London, London, United Kingdom<sup>2</sup>Clinical Neurosciences, University of Cambridge, Cambridge, United Kingdom

**Aims:** This study aimed to evaluate whether treatment with sodium valproate (SV) was associated with reduced risk of stroke or myocardial infarction.

**Methods:** Electronic health records data were extracted from Clinical Practice Research Database (CPRD) for participants ever diagnosed with epilepsy and prescribed antiepileptic drugs (AEDs). A nested case control study was implemented with cases diagnosed with incident nonhemorrhagic stroke and controls matched for sex, year of birth, and study start date (ratio of 1:6). A second nested study was implemented with myocardial infarction (MI) as outcome. The main exposure variable was SV therapy assessed as: ever prescribed, current treatment, number of SV prescriptions, and cumulative time on SV drug therapy. Odds ratios were estimated using conditional logistic regression adjusting for covariates.

**Results:** Data were analyzed for 2,002 stroke cases and 13,098 controls. MI analyses included 1,153 cases and 7,109 controls. Current treatment with SV (28%) was associated with increased stroke risk (odds ratio 1.22, 1.09, 1.38,  $P < 0.001$ ). No association was observed between ever being prescribed SV (34%) with ischemic stroke (1.01, 95% CI: 0.91–1.12,  $p = 0.875$ ). Patients in the highest quartile of SV treatment duration had lower odds of ischemic stroke (OR = 0.57, 95% CI: 0.44–0.72,  $p < 0.001$ ) and MI (OR = 0.29, 95% CI: 0.20–0.44,  $p < 0.001$ ) but this pattern of association was also observed for other AEDs.

**Conclusion:** SV exposure was inconsistently associated with the risk of ischemic stroke and MI. Longer exposure to SV was associated with lower odds of stroke but this might be explained by survivor bias.

**WSC-0621**

**Preventive Stroke Strategies  
The role of stress-limited therapy in the prevention of stroke**

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**Introduction:** The main stroke prevention strategy is high risk strategy. The chronic stress is one of the facultative risk factors. So stress-limited therapy (SLT) may be useful for the prevention of the stroke.

The aim of the study was to value the influence of SLT to the stroke risk in chronic cerebral ischemia (CCI) without previously stroke.

**Methods:** 100 patients with CCI from 35 to 55 were observed. All of them were in the high risk group due to the suffering of arterial hypertension or atherosclerosis or both of them. All the patients treated by traditional therapy: constant doses of hypotensive and hypolipidemic drugs and two courses for a year of the vinpocetin and pyracetam. 50 patients of the main group received SLT (deltasleepinduced peptide and glicin intranasal) twice in year in addition. We compared the relative risk of the stroke and TIA with the traditional therapy group.

**Results:** The frequency of the stroke and TIA during of the year observation were 18% in the control group, frequency of TIA was 12% in the main group, there was not any stroke in the main group. The relative risk of the stroke and/or TIA in the main group was 1.08 ( $p = 0.03$ ).

**Conclusions:** SLT is a perspective medicine, which should be include in the complex prevention of stroke.

**WSC-1532**

**Preventive Stroke Strategies  
Silent brain infarctions in patients with paroxysmal atrial fibrillation**

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**Introduction:** Absolute risk of stroke averages 3–4% per year in patients with AF. Prevalence of silent brain infarcts (SBI) ranged from 8% to 28% in population-based studies. The aim of the present study was to investigate the association between paroxysmal AF and SBI.

**Materials and methods:** A total of 48 patients with PAF subjects were examined. None of patients had history of stroke. We evaluated brain magnetic resonance imaging findings and CHADS<sub>2</sub>Vasc scores of subjects. We noted that demographic characters and vascular risks all patients.

**Results:** Among our study population; the mean age was 56,40 ± 8,99; 36 patients were female. The leading vascular risk factor was hypertension (45.8%). Six patients had increased carotid intima-media thickness, only 2 patients had carotid atheroma plaque on carotid Doppler ultrasound, 40 patients were presented normal carotid Doppler ultrasonography. 41

(85.4%) patients CHADS<sub>2</sub> Vasc scores detected 0–2, 7 (14.6%) patients CHADS<sub>2</sub> Vasc score detected 3. SBI were showed 17 patients (35%) on MRI, 11 patients had multiple SBI. There were no significant relations between vascular risk factors and SBI. Of 17 patients who showed SBI, 7 patients CHADS<sub>2</sub> Vasc scores were 1; 7 patients CHADS<sub>2</sub> Vasc scores were 2; 3 patients CHADS<sub>2</sub> Vasc scores were 3.

**Conclusions:** These results showed that it can be seen SBI in patients with PAF even if patients had low CHADS<sub>2</sub>Vasc scores and low vascular risk factors.

**WSC-1071**

**Preventive Stroke Strategies  
Newly detected PAF in relation to duration of monitoring: Results from prolonged monitoring of cardiac rhythm for detection of AF after cerebral ischemic event**

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**Introduction:** Previous studies have reported frequent detection of PAF and atrial tachyarrhythmia in patients with ischemic stroke when prolonged invasive or noninvasive methods of cardiac rhythm monitoring are employed. However there is heterogeneity between studies about optimal duration of monitoring.

**Methods:** Prospective study of patients older than 40 years with TIA and acute stroke between September 2012 and September 2013 where Spider Flash-t™ monitors were attached to the patients for prolonged monitoring.

**Results:** Between Sept 2012 and September 2013, 102 patients were evaluated. Atrial Fibrillation of any duration was seen in 43/102 (42.2%) patients. PAF was of more than 30-second duration in 12/102 (11.76%) patients and less than 30 seconds in 31/102 (30.39%) patients. Mean duration of monitoring was 13.26 ± 5.35. Mean days to detection of first PAF was 4.40 ± 3.73 days. Around two third 32/43 (74.4%) patients had first event in first week of cardiac monitoring; the yield was 10/43 (23%) in second week and only 1/4 (2.3%) in third week.

**Conclusions:** Using prolonged cardiac rhythm monitoring in patients with a recent ischemic stroke, we detected occult PAF in majority in first week of monitoring. This study emphasizes the need of further studies to clarify about optimal duration of monitoring required for detection of occult PAF.

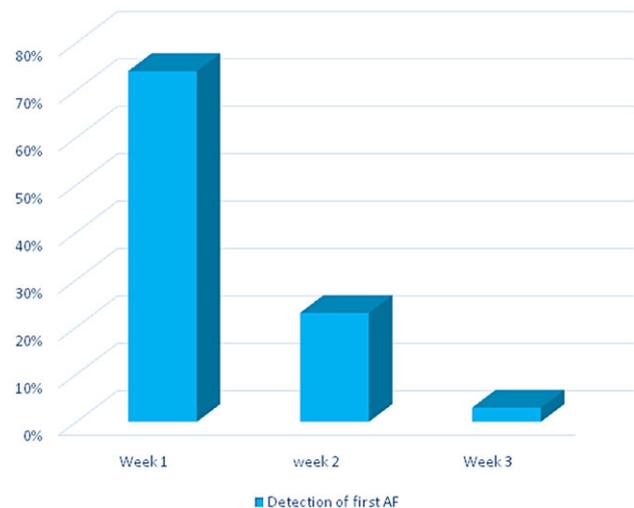


Fig. 1 Detection of first AF.

**WSC-0743****Preventive Stroke Strategies  
Trends over 15 years in the prestroke use of vitamin K  
antagonists for atrial fibrillation**J Bembenek<sup>1</sup>, M Karlinski<sup>1</sup>, A Kobayashi<sup>2</sup>, A Czlonkowska<sup>1</sup><sup>1</sup>2nd Department of Neurology, Institute of Psychiatry and Neurology, Warsaw, Poland<sup>2</sup>Interventional Stroke Treatment Centre, Institute of Psychiatry and Neurology, Warsaw, Poland

**Introduction:** Effective anticoagulation with vitamin K antagonists (VKAs) is the standard of stroke prevention in patients with nonvalvular atrial fibrillation (AF). Although everyday practice is becoming increasingly guideline-driven, proper anticoagulation is still underused.

**Aims:** We aimed to investigate changes in the use of VKAs for stroke prevention in patients with AF admitted due to acute stroke over a period of 15 years.

**Methods:** We analyzed consecutive acute stroke patients admitted to our center between June 1995 and December 2010. Data were prospectively collected in detailed stroke registry. We distinguished between three periods: 1995–2000, 2001–2005 and 2006–2010.

**Results:** AF rate prior to stroke was similar in ischemic stroke patients (1995–2000: 25%, 2001–2005: 24%, 2006–2010: 24%) but increased in patients with intracerebral hemorrhage (ICH) (6%, 11%, 19%,  $p = 0.003$  since 2006). The proportion of patients with AF using VKAs before stroke has become higher in ischemic stroke (10%, 16%, 28%,  $p < 0.001$  since 2006), with nonsignificant trend in ICH (0%, 33%, 45%). The proportion of ischemic strokes occurring in patients with AF using VKAs with non-therapeutic INR  $< 2$  tended to increase over time (58%, 83%, 80.3%). There was also increasing proportion of ICHs occurring in patients with AF over treated with VKAs (INR  $> 3$ ).

**Conclusions:** The prescription rate of VKA for stroke prevention improves. However, due to a high proportion of patients on nontherapeutic INR, the proportion of cardioembolic ischemic strokes remains stable. It may suggest that everyday use of VKAs is still far from optimal.

**WSC-0975****Preventive Stroke Strategies  
The use of TCD bubble test in University Clinical  
Center Ljubljana**V Beznik<sup>1</sup>, D Music<sup>1</sup>, J Pretnar-Oblak<sup>1</sup><sup>1</sup>Vascular Neurology, University Medical Centre, Ljubljana, Slovenia

**Introduction:** Right-to-left shunting (RLS), usually through a patent foramen ovale (PFO), has been associated with cryptogenic stroke, migraine and some other diseases. TCD bubble test is frequently used as a screening test for RLS because of its high sensitivity and specificity, non-invasiveness and low cost. However, the prevalence of PFO within healthy subjects is high and diagnostics in those who are being considered for transcatheter closure is sensible.

**Aim:** The aim of this analysis was to determine the correct use of this test and the prevalence of RLS in subgroups of patients.

**Methods:** TCD bubble test with a contrast agent was performed according to the standardized International Consensus Protocol. Valsalva maneuver was used to provoke RLS.

**Results:** In 2 years (2012/13) TCD bubble test was performed in 632 patients (mean age  $46.1 \pm 14.2$  years). The main referral diagnosis was cryptogenic stroke (386 pts; 61%), leukoaraiosis (71 pts; 11%), migraine (23 pts; 4%) and other (152 pts; 24%). RLS based on positive TCD bubble test was found in 45% of cryptogenic stroke pts, 38% of leukoaraiosis pts, 39% of migraine pts and in 51% of other pts.

**Conclusions:** In our clinical setting TCD bubble test is used mainly as a part of the stroke workup and for patients being considered for PFO

closure. The frequency of RLS in the group of cryptogenic stroke patients is comparable to the literature.

**WSC-0716****Preventive Stroke Strategies  
Metabolic health is more closely associated with  
prevalence of stroke than obesity**A Byun<sup>1</sup>, S Kwon<sup>2</sup>, K Shim<sup>1</sup>, H Lee<sup>1</sup>, S Lee<sup>1</sup>, H Chun<sup>1</sup><sup>1</sup>Department of Family Medicine, Ewha Womans University, Seoul, Korea<sup>2</sup>Department of Cardiovascular and Neurologic Disease, College of Korean Medicine, Kyung Hee University, Seoul, Korea

**Introduction:** The relationship between the healthy obese phenotype and the risk of stroke events remains unclear.

**Objective:** We retrospectively investigated the association between the obesity phenotype and the prevalence of stroke.

**Methods:** We studied 3,745 subjects, aged 40–88 years at baseline from the fifth Korea National Health and Nutrition Examination Survey 2012. Participants were divided into two groups and six subgroups based on BMI (body mass index) and the metabolic syndrome (MetS) components: healthy group (none of the five MetS components) (subgroups: healthy-normal weight (BMI  $< 23$  kg/m<sup>2</sup>), healthy-overweight (BMI 23–24.9 kg/m<sup>2</sup>), and healthy-obesity (BMI  $\geq 25$  kg/m<sup>2</sup>)) and unhealthy group (one or more MetS component) (subgroups: unhealthy-normal weight, unhealthy-overweight, and unhealthy-obesity). The prevalence of stroke was identified by medical doctors' diagnosis.

**Results:** In the healthy group ( $n = 593$ ), there was 4 stroke patients (0.7%). In the unhealthy group ( $n = 3152$ ), there was 78 stroke patients (2.5%). The prevalence of stroke was significantly different between the two groups ( $p = 0.006$ ). In the healthy group, 4 stroke patients were detected only in the healthy-obesity group. However, the prevalence of stroke was not significantly different among healthy three subgroups ( $p = 0.210$ ). In the unhealthy group, there were 25 (2.0%), 31 (3.5%), 22 (2.1%) stroke patients in each subgroups (unhealthy-normal weight ( $n = 1236$ ), unhealthy-overweight ( $n = 881$ ), and unhealthy-obesity ( $n = 1035$ )). However, the prevalence of stroke in these groups demonstrated no statistically significant difference ( $p = 0.232$ ).

**Conclusions:** We suggest that metabolic health is more closely associated with prevalence of stroke than obesity (BMI).

**WSC-1172****Preventive Stroke Strategies  
Strokes in AF – Failure of anticoagulation with  
warfarin and change-over to NOACs**D. Collas<sup>1</sup>, S. Gill<sup>1</sup><sup>1</sup>Stroke Medicine, Watford General Hospital, Watford, United Kingdom

**Introduction:** AF is a common but avoidable cause of stroke, and anticoagulation is underprescribed due to fear of bleeding and inconvenience.

**Aims:** to quantify the extent of this and describe our response – a change from warfarin to NOAC (novel oral anticoagulants)

**Methods –** analysis of database of all stroke admissions in 2012–2013 recording type of stroke (ischemic IS, hemorrhagic ICH), presence of AF, use of anticoagulation and INR on admission.

**Results:** Over 2 years 1939 stroke patients (mean age 83) were admitted and only 101/419 in AF (24%) were on anticoagulants, of whom only 19/85 ischemic strokes were within the therapeutic range for INR. Of 299 not on anticoagulants 27 had stopped taking them, 6 within 2 weeks their stroke, all for a procedure. The mean CHADS-VASC score was 4.0, 3 scored 0, 22 scored 1. For hemorrhagic strokes 6/16 (37%) strokes

occurred above a therapeutic INR. In view of this local agreement was reached to implement NICE guidance and AF patients were prescribed a NOAC. Initial objections from general practitioners was overcome by sending them specific letters with risk scores, answers to frequently asked questions and documentation of informed consent. GI bleeds occurred in 5/170 NOAC cohort representing 89 patient years, after a median of 25 days. 2 upper GI, one major requiring clipping of oesophageal ulcer and 3 lower, inc. one newly diagnosed cancer.

**Conclusions:** Under use and subtherapeutic INR contribute to many strokes, and change-over to NOACs can be accomplished with careful communication without unacceptable bleeding.

## WSC-0897

### Preventive Stroke Strategies Allopurinol and change in blood pressure in adults with hypertension

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#### Introduction:

Hypertension is a key risk factor for stroke and new treatments are needed. Allopurinol lowers blood pressure (BP) in adolescents but whether it does so in older adults is unknown.

**Aims:** To explore change in BP after allopurinol initiation using data from the UK Clinical Practice Research Datalink.

**Methods:** Data on patients with hypertension aged >65 years who were prescribed allopurinol with pre and during treatment BP readings were extracted. Data from comparable controls were also extracted. The change in BP in patients with stable BP medication was the primary outcome and was compared between groups. Regression analysis was used to adjust for potential confounding and a propensity-matched sample was generated.

**Results:** 365 patients who received allopurinol and 6678 controls were included. BP fell in the allopurinol group compared to controls (between group difference in systolic and diastolic BP 2.08 mmHg (95% CI -0.59 to 4.75) and 1.72 mmHg (95% CI 0.38-3.07) respectively). Allopurinol use was independently associated with a fall in both systolic and diastolic BP on regression analysis ( $p < 0.001$ ). Results were consistent in the propensity-matched sample. There was a trend toward a greater fall in BP in the high dose allopurinol group (fall in systolic BP in low dose 0.94 (95% CI -4.71 to 2.82), fall in high dose -4.19 (95% CI -9.46 to 1.08).

**Conclusions:** Allopurinol use is associated with a small fall in blood pressure in adults. A clinical trial of the effect of high dose allopurinol on BP in patients with recent stroke is planned.

## WSC-0839

### Preventive Stroke Strategies Significant treatment gap exists in nonvalvular atrial fibrillation for primary and secondary stroke prevention: A hospital based study from Eastern India

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**Background:** Cardio-embolism is an important cause of ischemic stroke where Nonvalvular atrial fibrillation (NVAF) is the commonest and is largely preventable with proper use of anti-coagulation as a standard of care. Despite this fact, anticoagulation is underused for primary and secondary prevention in NVAF.

**Objective:** To study the prevalence and profile of cardioembolic stroke in hospitalized patients, premorbid diagnosis of cardio-embolic source and status of anti-coagulation therapy with assessment of treatment gap in NVAF.

**Methodology:** All patients admitted to our stroke unit in last 2 years were included. They underwent CT/MRI Brain, Neck vessel Doppler &

Echocardiography. Other investigation like MR/CT Angiography, 24 h-Holter and atypical stroke screening were done as and when required. CHADS<sub>2</sub>/CHADS<sub>2</sub>VASc were assessed for all.

**Results:** Among 330 cases of ischemic stroke, 65(19.69%) patients had cardioembolic source, commonest being NVAF, accounting for 53 cases (81.50%) followed by LV thrombi 4 (6.15%), paradoxical emboli 3 (4.61%), valvular heart disease 2 (3.07%) and others. Out of 53 cases of NVAF, 21 (39.6%) were premorbidly diagnosed and among them 18 (85%) had CHADS<sub>2</sub>/CHADS<sub>2</sub>VASc  $\geq 2$  of which only 4 cases (22.3%) were on anticoagulation before the index stroke.

**Conclusion:** Cardioembolic stroke comprised 19.69% of all ischemic stroke. In previously known cases of NVAF, at least 14 (77.7%) cases had been undertreated (not initiated on oral anti-coagulant despite proper indication) showing a huge treatment gap in our practice for primary and secondary stroke preventions in NVAF. We need to aware cardiologist, neurologists and general physicians about proper use of anticoagulation.

## WSC-0306

### Preventive Stroke Strategies Effect of early carotid artery revascularization on periprocedural hemodynamic depression

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**Introduction:** Carotid endarterectomy (CEA) and carotid artery stenting (CAS) are frequently complicated by hemodynamic depression (HD) which can increase risk of stroke, myocardial infarct, or vascular death.

**Aims:** The present study aimed to compare the incidence of hemodynamic depression between early and late procedural groups.

**Methods:** We reviewed data of patients performed CEA or CAS between January 2011 and September 2013. HD was defined as bradycardia (heart rate less than 60 beat per minute) or hypotension (systolic blood pressure less than 90 mmHg) within first week after procedure. We compared HD and baseline characteristics between early (within 2 weeks) and late (after 2 weeks) procedural groups. We also analyzed HD in CEA and CAS subgroup, respectively.

**Results:** Among 71 procedures, HD occurred in 53 (74.6%). HD were 14(73.7%) in early group and 39 (75%) in late group ( $P = 0.91$ ). In patients performed CEA, HD were 3 (60%) in early group and 17 (63%) in late group ( $P = 1.00$ ). In patients performed CAS, HD were 11 (78.6%) in early group and 22 (88%) in late group ( $P = 0.64$ ).

**Conclusions:** Early carotid artery revascularization was not associated with periprocedural hemodynamic depression. In the point of HD of periprocedural complications, early CAS may be safe as recommendation of early CEA in guidelines.

## WSC-1476

### Preventive Stroke Strategies Successful occlusion of left atrial appendage percutaneously for stroke prophylaxis: A single center experience of a tertiary cardiology clinic

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**Introduction:** Transcatheter closure of left atrial appendage (LAA) has been developed recently for patients with nonvalvular atrial fibrillation (NVAF) who were at high risk of cardioembolic events and ineligible for

warfarin therapy. In this study we aimed to demonstrate our single center experience with this therapy regarding the success rate and safety considerations.

**Method:** We collected the medical records of patients who underwent percutaneous occlusion of LAA between 01 March 2014 and 10 April 2014 in our clinic. Baseline laboratory and echocardiographic findings of the patients were recorded. We also assessed the success rate, and safety of the therapy regarding the complications.

**Results:** Three patients who were all female underwent this therapy. The baseline characteristics, and echocardiographic findings were demonstrated in Tables 1 and 2. All were ineligible to warfarin therapy, had NVAf, hypertension, and ischemic stroke recently. Watchman (Boston Scientific, Natick, Massachusetts) device was successfully deployed in all of the cases. No complication occurred during the procedure. At the follow-up period no residual blood leak or device thrombosis occurred.

**Conclusion:** Percutaneous closure of LAA has been a novel therapeutic approach in patients with NVAf. Most of the studies have demonstrated a higher initial rate of procedural adverse events due to operator experience; however there were no periprocedural complication occurred at the first three cases in our clinic. We have experienced that the procedure was effective and could be safely performed. However more cases are seem to be required to conclusively evaluate the efficiency and safety of this procedure.

**Table 1** Baseline characteristics and laboratory findings of the patients

	Patient I	Patient II	Patient III
Age (yrs)	76	79	80
Heart Rate (per min)	78	84	72
Systolic Blood Pressure (mmHg)	140	146	142
Diastolic Blood Pressure (mmHg)	90	94	90
Glucose (mg/dl)	138	90	106
Creatinine(mg/dl)	0.5	0.6	1.1
Hemoglobin (g/dl)	10.2	11.7	10.0

**Table 2** Baseline echocardiographical findings of the patients

	Patient I	Patient II	Patient III
Left ventricular ejection fraction (%)	50	60	58
Left atrium (mm)	43	50	45
Interventricular septum (mm)	12	13	15
Posterior Wall (mm)	11	12	12
Degree of mitral regurgitation	1	2	2
Degree of aortic regurgitation	2	1	2
Degree of tricuspid regurgitation	2	1	2
Pulmonary artery systolic pressure (mmHg)	30	25	35

## WSC-1019

### Preventive Stroke Strategies

#### Noxious house-hold consumption: Modifiable stroke risk factor

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**Introduction:** in the "8–12 District project" we examined aspects of stroke epidemiology (SE) of two districts of Budapest with different life standards. The average income in District 8 is half than in District 12. In District 8 people get stroke 7 years earlier, and men are 12 years younger in case of fatal outcome. The unfavorable SE is mainly determined by life

style risk factors. One of them is the consumption of food products. It was proved in the above mentioned project. Now we analyzed the same consumption patterns in settlements around Budapest.

**Patients and method:** We used the so-called "House hold Consumption Index" which demonstrates the popular consumption of the investigated goods (cereals, meat, fat, potato, sugar, vegetable, fruit, hard drinks, wine, beer, tobacco). The amount of salt was calculated from the consumption of spice and seasonings. We evaluated the values in relation to the house hold income. We compared the number of hospital admission and the number of inhabitants (person/stroke-case).

**Results:** The unfavorable SE correlated with remarkably higher consumption of salt, tobacco, moderately with cereals, fat, potato and sugar. However the population of healthier villages did not consume more vegetables and fruits (are they produced on site?). Consumption of strong drinks was about the same high level everywhere.

**Conclusions:** the unfavorable consumption patterns of certain rural settlements also mirror, that it is connected with higher risk for stroke. However some aspects of consumption of these population differs from that seen in the Capital.

## WSC-0487

### Preventive Stroke Strategies

#### Exercise stress testing after stroke or transient ischemic attack (TIA)

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**Aim:** To investigate exercise stress testing after stroke/TIA regarding feasibility, safety, and test performance.

**Methods:** We performed a retrospective analysis of 414 ECG-monitored treadmill stress tests with respiratory gas analysis. Participants (67% male) were 63.5 ± 10.5 years old and 7.3 ± 5.7 months poststroke/TIA with NIHSS scores of 3.6 ± 4.5. Slow, regular and fast ramp protocols were used in 13%, 42% and 13% of the tests, respectively, and individualized protocols with body weight support in 32%. Linear and logistic regression analyses were used to identify participants' characteristics associated with aerobic capacity and factors associated with attainment of predicted maximal HR.

**Results:** Participants attained VO<sub>2</sub>peak of 18.3 ± 5.4 mL.kg<sup>-1</sup> min<sup>-1</sup> (75.4 ± 22.6% of predicted), peak HR of 91 ± 14% of predicted, peak RER of 1.12 ± 0.12 and peak RPE<sub>0-10</sub> of 5.7 ± 1.8. Personnel terminated testing due to reaching predicted maximal HR in 49% of tests, abnormal BP response (6%) and ECG abnormalities (4%). Participants terminated testing due to general fatigue in 33% of tests and other symptoms (leg discomfort/fatigue, dizziness) in 8%. ECG abnormalities were found in 16.9% of tests, over half of which required further investigation. Regression analyses revealed (i) %predicted VO<sub>2</sub>peak achieved was associated with 6-minute walk, age, NIHSS, and number of comorbidities (all PPP). **Conclusion:** Treadmill stress testing after stroke/TIA is feasible and safe, and provides critical information for exercise prescription. Neurologic and mobility impairments are important factors in predicting stress test performance after stroke/TIA.

## WSC-0536

### Preventive Stroke Strategies The pretreatment with statins on ischemic stroke severity

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**Introduction:** The prevention and adequate treatment of ischemic stroke is one of the actual problems of Neurology in Armenia.

**Aims:** The aim of this study to examine the effect of pretreatment with statins, at high(80 mg/d) and nonhigh (<80 mg/d) doses, on ischemic stroke (IS) severity in clinical practice.

**Methods:** Prospective study of IS admissions our Department during a 3-year period (2010–2012). Basal data, previous treatments (including statins), stroke severity (NIHSS), stroke subtype, in-hospital complications, length of stay and functional status at discharge(mRS) were collected. Mild stroke severity was defined as NIHSS ≤ 5 on admission. Good outcome was defined as mRS ≤ 2 at discharge. Multivariable regression models and matched propensity score analyses were used to quantify the association of statins pretreatment, at high and nonhigh doses, with a mild stroke severity.

**Results:** Of 759 IS patients, 25% were using nonhigh doses and 4.4% high doses of statins before the stroke. The frequency of mild stroke on admission was higher in the statin groups (57.9% for nonstatins, 63.2% for nonhigher doses of statins and 77.5% for high doses of statins,  $p = 0.026$ ). After multivariable adjustment, pretreatment with statins was associated with higher odds of mild stroke severity and this effect was greater at high doses (OR = 1.637, 95% CI 1.156–2.319 for the nonhigh doses and OR = 3.297, 95% CI 1.480–7.345, for the high doses of statins).

**Conclusion:** Pretreatment with statins is associated with lower stroke severity and this effect could be greater at higher doses.

## WSC-1531

### Preventive Stroke Strategies Stroke risk profile among patients with hypertension in primary care setting

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**Introduction:** Stroke is regarded as a major public health concern. It is crucial to explore the lifetime risk of stroke in primary care practice, particular in hypertensive patients as hypertension is the most significant modifiable risk factor.

**Aims:** We aimed to evaluate the stroke risk profile among hypertensive patients in primary care setting, and examine its relationship to nonconventional cerebrovascular risk factors.

**Methods:** This is a sub-analysis of a study on prevalence and determinants of left ventricular hypertrophy (LVH) in 328 hypertensive patients. Individual 10-year risk of stroke was computed using a modified General Framingham prediction of risk of stroke in primary prevention based on age, systolic blood pressure, antihypertensive treatment, smoking, diabetic status, atrial fibrillation, coronary heart disease and LVH (Echocardiography). Patients were classified into Q1 group (<33.3% risk), Q2 group (33.4–66.6%) and Q3 group (>66.6%). Multivariate regression analysis was used to assess the correlation between stroke risk score and nonconventional risk factors.

**Results:** The mean age of the participants was  $59.1 \pm 7.5$  years and mean blood pressure was  $136/82 \pm 14/8$  mmHg. The mean 10-year risk score for stroke was  $10.9 \pm 7.6$  percent. In the Multivariate Regression Analysis, nonconventional risk factors such as retiree, alcohol consumption, higher waist circumference, lower estimated glomerular filtration rate and the presence of diastolic dysfunction were each significantly associated with higher risk score.

**Conclusions:** This study had demonstrated potential importance of controlling nonconventional cerebrovascular risk factors in stroke prevention among hypertensive patients.

## WSC-0671

### Preventive Stroke Strategies Analysis of time in therapeutic range (TTR) to evaluate the efficacy of warfarin for patients with atrial fibrillation

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**Introduction:** Warfarin is the first-line oral anticoagulant for primary and secondary prevention against stroke and Transient Ischemic Attack (TIA) associated with Atrial Fibrillation (AF). Individuals must be monitored to minimize International Normalized Ratio (INR) results outside the therapeutic range, thus reducing associated complications (e.g. TIA, ischemic stroke, intracranial hemorrhage). The All Wales Medicines Strategy Group advises that Time in Therapeutic Range (TTR), calculated between 3 and 9 months after initiation if therapy, be >58% for Warfarin to be considered an effective intervention.

**Aims:** To analyze the TTR for patients commenced on Warfarin (for Atrial Fibrillation) by the INR clinic at Nevill Hall Hospital between January and June 2012.

**Methods:** Data collected retrospectively from the DAWN AC Anticoagulation Software for the monitoring period between 3 and 9 months after initiation.

**Results:** Forty-eight patients were included in the study. Mean INR value was 2.4 (range 1.0–5.6) and mean number of INR checks over the 6-month period was 9.7 (range 3–18). TTR ranged from 27% to 100%, with mean TTR of 63%. However 42% ( $n = 20$ ) of patients had a TTR below the recommended value of 58%.

**Conclusion:** A significant proportion of patients on Warfarin for AF have a TTR outside the recommended range. It is deemed that Warfarin is not an effective intervention for these patients and a NOAC (New Oral Anticoagulant) should be considered. There is no system currently in place to identify this sub-group of patients and they are not being advised accordingly.

## WSC-1053

### Preventive Stroke Strategies Nurse-led, telephone-based secondary preventive intervention after stroke or TIA Improves blood pressure after 12 months of follow-up

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**Introduction:** Intensified follow-up is needed to improve adherence to target blood pressure (BP) values set by current guidelines.

**Aim:** We aimed to analyze if nurse-led, telephone-based follow-up after stroke or transient ischemic attack (TIA) was more effective than usual care in improving BP at 12 months after discharge.

**Methods:** Between January 1st 2010 and June 30th 2012, 537 patients were randomized to either nurse-led, telephone-based follow-up (intervention) or usual care (control). BP measurements were performed at 1 (baseline) and 12 months after discharge. Patients in the intervention group not reaching set target values at 1 month received titration of medication to reach the treatment goal (BP < 140/90). BP values for controls where forwarded to the patient's GP for assessment and left without further action from the study team.

**Results:** At 12 months, 34 patients had ended their participation and 18 patients had died, leaving 242 and 243 patients in the intervention group and control group, respectively. Mean systolic and diastolic BP was 3,3 (95% CI 0,3–6,3) and 2,3 (95% CI 0,5–4,2) mmHg lower in the intervention group, in which a significantly larger proportion reached the treatment goal for systolic BP (68,5 vs 56,8%,  $p = 0,008$ ). The proportion of patients reaching the target for diastolic BP did not differ significantly between groups (84,6 vs 81,1%,  $p = 0,297$ ).

**Conclusions:** Nurse-led, telephone-based secondary preventive follow-up was significantly more effective than usual care in improving BP levels at 12 months after discharge.

## WSC-0400

### Preventive Stroke Strategies

#### Applied effect of appropriate technologies of community rehabilitation and self-management of risk factors for stroke survivors in Beijing demonstration community

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**Introduction and aims:** The study was to develop appropriate technologies of community rehabilitation and self-management of risk factors for stroke survivors and to assess the effect of its implementation.

**Methods:** We defined demonstration and control communities with a total population of approximately 50000 people, respectively. In the demonstration community, 3-month rehabilitation practices and 6 month trainings of self-management of risk factors were implemented among stroke survivors during 2008–2012. Both self control of patients with stroke in the demonstration community and external control of patients with stroke in the control community were used to assess the applied effect.

**Results:** Through 3-month rehabilitation practices, motor function at Fugl-Meyer Assessment, Activity of daily living (ADL) at Barthel Index and social activities at Functional Activities Questionnaire in 110 cases of patients with stroke were improved with statistically significance. Through 6-month trainings of self-management of risk factors, the recruited patients with stroke had better level of knowledge on risk factors, early warning symptoms and rehabilitation skills for stroke, and had better control for blood sugar and adherence to rehabilitation practices in the demonstration community than controls in the control community. ADL at Barthel Index in 108 cases of patients with stroke in the demonstration community were better than that in 107 cases of patients with stroke in the control community by the end of the program.

**Conclusions:** The appropriate technologies of community rehabilitation and self-management of risk factors for stroke survivors are easy to master, and stroke survivors' quality of life has been improved.

## WSC-0600

### Preventive Stroke Strategies

#### New single sweep three-dimensional carotid ultrasound in evaluation of carotid plaque volume changes

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**Introduction:** Carotid plaque volume (CPV) is considered a reliable indicator of atherosclerosis.

**Aims:** This is an observational, follow up study aiming to determine whether changes in CPV could be detected by single sweep three-dimensional ultrasound (3DUS).

**Methods:** Consecutive patients with a history of Stroke or transient ischemic attack (TIA), clinically indicated for carotid ultrasound, were recruited for this study. Follow up period was 6 month. Patients with internal carotid artery (ICA) occlusion or plaques extending beyond the ICA and with poor images were excluded.

Recently our group has published the methods used for acquisition and measurements. Interobserver reproducibility was  $5.6\% \pm 6.02\%$ . Based on this, a change in plaque volume is considered real if it exceeds 12%.

**Results:** 3D images were obtained from 43 patients, 19 female, mean age  $68.32 \pm 9.54$ , for a total of 71 arteries being imaged.

At baseline, the mean PV was  $0.44 \pm 0.29$  mL (0.05–1.32 mL) and at follow up  $0.34 \pm 0.21$  mL, (0.07–0.96 mL), the mean difference =  $0.1 \pm 0.04$ ,  $p = 0.029$ , (Independent-Samples T test). The largest volume regression was  $-0.92$  mL (0.4–1.32 mL) and the largest progression 0.61 mL (0.68–0.07 mL).

The regression (>12% reduction) of CPV was detected in 39 arteries (55%). Only 12 arteries (17%) showed progression (>12% increase) and 15 arteries (21%) showed no real change (<12%) in plaque volume. Five arteries (7.0%) showed new plaque.

**Conclusions:** Using single sweep 3DUS technique, it is possible to detect plaque regression and progression at 6-month follow-up. This offers a great potential for more personalized and targeted medical treatment in these patients.

## WSC-0978

### Preventive Stroke Strategies

#### Predictive factors of hypertension after discharge in patients with mild ischemic stroke: A prospective observational study

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**Introduction:** Hypertension is a major risk factor for stroke recurrence. However, the predictors of hypertension in patients with mild ischemic stroke (MIS) after discharge are still unclear.

**Aims:** We aimed to identify the predictors of hypertension at 3 months after discharge in MIS patients.

**Methods:** We performed a single center registry, prospective observational study. Acute MIS patients with modified Rankin Scale of 0–2 were consecutively enrolled in this study. Baseline examination was conducted during hospitalization, including sex, age, mini-mental state examination, stroke subtype, cerebral white matter lesions, blood pressure, ankle brachial index, blood laboratory tests, medications, body mass index, metabolic syndrome, sodium reduction behavior, smoking, alcohol consumption, physical functions and psychosocial factors. We also measured daily step counts, low-(<3 Metabolic Equivalents) and moderate to high-(≥3 Metabolic Equivalents) intensity physical activity time at 1 month after discharge. Home blood pressure was measured at 3 months after discharge, and hypertension was defined as systolic blood pressure (SBP) ≥140 mmHg. Multiple logistic regression analysis was performed to examine the independent predictors of hypertension.

**Results:** Of 117 MIS patients (84 men, 69.1 ± 9.3 years) who were successfully followed for 3 months, 43 (36.8%) patients had hypertension at 3 months. SBP during hospitalization (increment of 1 mmHg: OR = 1.051, 95% CI = 1.025–1.078,  $p < 0.001$ ), moderate to high-intensity physical activity time (increment of 1 minute: OR = 0.964, 95% CI = 0.932–0.997,  $p = 0.035$ ), habitual smoking before MIS (OR = 2.924, 95% CI = 1.015–8.427,  $p = 0.047$ ) were selected as independent predictors of hypertension.

**Conclusions:** Our findings suggest that lifestyle after MIS has a possibility to affect blood pressure control and, in turn, stroke recurrence in MIS patients.

## WSC-1263

### Preventive Stroke Strategies Efficacy and safety carotid endarterectomy and medical treatment in patients with severe asymptomatic carotid atherosclerosis: Randomized clinical trial

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**Introduction:** The role of modern medical therapy (statins, antihypertensive treatment, and aspirin) in the treatment of patients with severe asymptomatic carotid atherosclerosis (ACA) is undefined.

**Aims:** The aim of this randomized trial was to compare the efficacy of carotid endarterectomy and optimal medical therapy (CEA group) versus optimal medical therapy (OMT group) alone in patients with asymptomatic (70–79%) extracranial carotid stenosis.

**Methods:** 55 patients were randomly assigned to CEA group ( $n = 31$ ) or OMT group ( $n = 24$ ); all participants received aggressive lipid-lowering therapy (atorvastatin from 10 to 80 mg per day with a target level of LDL cholesterol <100 mg/dl), aspirin and antihypertensive therapy. Primary endpoints were analyzed using standard time-to-event statistical modeling with adjustment for major baseline covariates and on an intent-to-treat basis. The primary outcomes were nonfatal stroke and myocardial infarction (MI) and death during follow-up. The secondary outcomes were nonfatal stroke/MI, carotid/coronary revascularization and death during follow-up.

**Results:** There were 2 primary events in the CEA group and 8 events in the OMT group. The 3.0-year cumulative primary-event rates were 6.5% in the CEA group and 33.3% in the OMT group (HR 5.0; 95% CI, 1.4–17.7;  $p = 0.0124$ ). Secondary-event rates were 6.5% in the CEA group and 50.0% in the OMT group (HR 6.04; 95% CI, 2.1–17.5;  $p = 0.0009$ ).

**Conclusions:** As an initial management strategy in patients with severe ACA, CEA reduce the risk of death, stroke, myocardial infarction, carotid

and coronary revascularization events when added to optimal medical therapy.

## WSC-0192

### Preventive Stroke Strategies Influence of erythrocyte's features in the pathogenesis of different stroke variants

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**Aims:** To investigate the electrical and viscoelastic characteristics of erythrocytes (Er) in comparison with the structural changes of their membranes, levels of macroergic compounds to patients with stroke to identify different pathogenetic types.

**Methods:** A total of 292 males (45.7 ± 5.2 years old), of which 238 – rebare ischemic stroke, 54 – hemorrhagic (74 of them in the dynamics of the therapy); 35 men – comparison group. Parameters of Er were studied by dielectrophoresis, chromatography, <sup>31</sup>P NMR spectroscopy.

**Results:** We observed the differences in the Er parameters, associated with the pathogenic variants of stroke.

The patients with the metabolic syndrome had marked disturbances of the Er deformability, leading to the development of microcirculatory disorders and tissue hypoxia with a deficit of intracellular macroergs. We observed high levels of cholesterol fraction, index of cholesterol/phospholipids (PHL) in membranes against decrease in total lipids, easily oxidizable PHL, omega-3 index ( $p < 0,0001–0,03$ ).

Patients without traditional risk factors had Er with moderately reduced plasticity, energy shortages, but pronounced decrease in polarizability, susceptibility to destruction, aggregation. We revealed the deficit of easily oxidized phospholipid fractions, triglycerides and cholesterol esters in Er membranes ( $p < 0,01–0,05$ ). Most of these patients showed signs of dysplasia of connective tissue, markers of viral infections, liver function abnormalities ( $p < 0,05$ ).

We used a variety of therapeutic approaches in these groups and had a positive effect as the decrease of ischemic attacks.

**Conclusion:** Identification of the various pathogenetic variants of stroke can develop new approaches to therapy and prevention of cerebrovascular disease.

## WSC-0508

### Preventive Stroke Strategies The impact of metformin on severity of acute stroke patients with type 2 diabetes mellitus

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**Objectives:** Diabetes mellitus is one of major risks to develop cardiovascular disease. Although it has been reported that some particular hypoglycemic drugs (metformin, pioglitazone, acarbose, etc.) decrease the incidence of stroke, the association between these agents and neurological severity of acute stroke patients has been unclear. We therefore investigated the effect of these agents on stroke severity at onset in patients with type 2 diabetes mellitus.

**Methods:** We examined 395 stroke patients (272 males; 71 ± 11 years old) with diabetes mellitus admitted to Kyushu Medical Center from April 2010 to March 2014. The clinical characteristics, prestroke agents and neurological severity of the patients were assessed on admission. Neurological severity was evaluated by the National Institutes of Health Stroke Scale (NIHSS) score. Thus, concerning stroke severity at onset, we compared among patients with or without various glucose-lowering agents.

**Results:** NIHSS score was significantly lower in the group of patients with metformin than those without metformin (median, 1 [interquartile

range, 1–2.5] vs. 3 [interquartile range, 1–4],  $P < 0.001$ ), in spite of no significant difference in plasma glucose (178 mg/dl vs. 175 mg/dl,  $p = 0.77$ ) and glycosylated hemoglobin (7.5% vs. 7.5%,  $p = 0.89$ ) on admission among two groups. After adjustments for multiple confounding factors (gender, stroke subtype, glycemic control, admission modified Rankin Scale, and other agents, etc.), metformin use before stroke onset was independently associated with mild neurological symptom (NIHSS  $< 3$ ) (odds ratio, 2.26; 95% confidence interval, 1.17–4.35,  $p = 0.01$ ).

**Conclusion:** Administration of metformin to patients with type 2 diabetes mellitus before development of stroke affects a lower neurological severity of stroke.

## WSC-1388

### Preventive Stroke Strategies

#### Two soluble isoforms of receptors for advanced glycation end products in carotid atherosclerosis: The difference of sRAGE and esRAGE

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**Introduction and aims:** Advanced glycation end products (AGEs) promote atherosclerosis by binding to their receptor (RAGE). Soluble RAGE (sRAGE) and endogenous secretory RAGE (esRAGE) may suppress AGEs–RAGE signaling, we examined the usefulness of sRAGE and esRAGE as biomarkers of early-stage atherosclerosis.

**Methods:** Serum sRAGE and esRAGE levels were measured in 284 subjects with no history of atherothrombotic diseases. The subjects were divided into high-sRAGE and low-sRAGE groups and high-esRAGE and low-esRAGE groups based on respective median values. We investigated the relationships between these parameters and the following: number of metabolic components, maximum intima-media thickness of the common carotid artery (IMT  $C_{max}$ ), carotid plaque calcification, and asymptomatic cerebral white matter lesions.

**Results:** The low-sRAGE and low-esRAGE groups exhibited significantly more components of metabolic syndrome than the high-sRAGE and high-esRAGE groups, respectively. IMT  $C_{max}$  was significantly higher in the low-sRAGE and low-esRAGE groups. Low sRAGE levels were significantly associated with carotid plaque calcification. Multiple linear regression analysis identified body mass index (BMI), age, and high-sensitivity C-reactive protein as determinants of sRAGE, while only BMI as determinant of esRAGE.

**Conclusions:** We demonstrated that sRAGE and esRAGE are associated with atherosclerotic risk factors in early-stage atherosclerosis, suggesting that their levels evolve with metabolic components and inflammation. Interestingly, low sRAGE and esRAGE levels are associated with t IMT  $C_{max}$ , but only low sRAGE level is associated with carotid plaque calcification. Thus, sRAGE and esRAGE may reflect different aspect of atherosclerosis in the early stage.

## WSC-0635

### Preventive Stroke Strategies

#### Association between nonalcoholic fatty liver disease and ischemic stroke

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**Introduction:** Some studies in recent years showed that carotid intima-media thickness (IMT), indicator of the presence of atherosclerosis, was

higher in nonalcoholic fatty liver disease (NAFLD) in comparison with normal subjects. They concluded that NAFLD patients may be resulted in more cardiovascular events. So, we aimed to study the association of NAFLD and ischemic stroke.

**Methods:** For this reason 110 brain magnetic resonance imaging (MRI) confirmed ischemic stroke patients and 110 age and sex matched controls went through liver ultrasound to detect NAFLD and common carotid ultrasound to measure IMT. Demographic and vascular risk factors were detailed for all subjects.

**Results:** NAFLD was found in 47 (42.7%) of ischemic stroke patients and 25 (22.7%) of controls. By adjusting sex and age, odds ratio for NAFLD was 2.15 (95% confidence interval: 1.25–3.71) that was statistically significant ( $P$ -value: 0.006). However, after adjusting for other confounding risk factors (waist circumference, hypertension, diabetes mellitus, low-density lipoprotein, triglyceride, alanine aminotransferase (ALT), aspartate aminotransferase (AST), creatine, body mass index, cigarette smoking and ischemic heart disease), the odds ratio decrease to 1.68 (95% CI: 0.42–6.76) that was not statistically significant ( $P$ -value: 0.460). The odds ratio for IMT of right and left common carotid was 1.23 (95% CI: 0.48–3.15) and 1.24 (95% CI: 0.57–2.69) respectively that none of them were statistically significant.

**Conclusion:** Although the risk of occurrence of ischemic stroke is higher in NAFLD patients but

NAFLD is not associated independently with ischemic stroke.

## WSC-1207

### Preventive Stroke Strategies

#### Modified LDL (serum level of LOX-1 ligand containing ApoB) was associated with increased carotid intima-media thickness in Japanese community dwelling men especially with hypercholesterolemia

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**Introduction:** Lectin-like oxidized LDL receptor 1 (LOX-1) is the receptor for atherogenic modified LDL identified in endothelial cells.

**Aim:** To evaluate whether serum level of LOX-1 ligand containing ApoB (LAB) modifies or enhances atherogenicity of carotid artery in persons with or without hypercholesterolemia.

**Methods:** The association between LAB and intima-media thickness (IMT) of carotid artery was investigated in 992 community dwelling Japanese men aged 40–79 years. Serum LAB levels were measured by ELISAs with recombinant LOX-1 and monoclonal anti-apolipoprotein B antibody.

**Results:** Serum LAB levels [median (interquartile range),  $\mu\text{g/L}$ ] were 5,341  $\mu\text{g/L}$  (4,093, 7,125). Mean average of IMT for common carotid artery was highest in the 4th LAB quartile, which was 839  $\mu\text{m}$  compared with 800  $\mu\text{m}$  in the 1<sup>st</sup> quartile ( $p$  for trend = 0.01) after adjustment for age, BMI, hypertension, diabetes and smoking, although statistical significance disappeared by further adjustment for hypercholesterolemia. After stratification by the combination of median of LAB and hypercholesterolemia, the adjusted mean average IMT (95% confidence interval) in the high LAB/hypercholesterolemia group was 851  $\mu\text{m}$  (831–872); it was 815  $\mu\text{m}$  (787–843) in the low LAB/hypercholesterolemia group and 814  $\mu\text{m}$  (800–827) in the low LAB/normal cholesterol group, respectively.

**Conclusions:** Serum LAB was associated with an increased carotid IMT in Japanese men, especially under the existence of hypercholesterolemia. LAB provides a new insight into risk assessment for high risk individuals for stroke, which may lead to novel preventive strategy.

## WSC-0405

### Preventive Stroke Strategies

#### Antiphospholipid syndrome in ischemic stroke patients

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**Introduction:** Antiphospholipid antibodies is an independent risk factor for first-ever ischemic stroke, especially in young adults, and antiphospholipid syndrome (APS) patients with thrombotic stroke frequently have other, often conventional, vascular risk factors.

**Aims:** The purpose of the present study was to clarify the incidence of each of the antibodies, the interrelationships among them and concerning therapy for secondary prevention in ischemic stroke patients with APS.

**Methods:** The subjects comprised 250 patients with ischemic stroke. We measured anti- $\beta$ 2-glycoprotein I (anti- $\beta$ 2-GPI) antibodies, IgG anticardiolipin (IgG aCL), lupus anticoagulant (LA), phosphatidylserine-dependent anti-prothrombin antibody (PS-PT), antiphosphatidyl-serine antibody (PS), and antiphosphatidyl-inositol antibody (PI) in each patient at 1 month after the onset of stroke. And eligible patients were randomly assigned to either single antiplatelet therapy or a combination of antiplatelet and anticoagulation therapy for the secondary prevention of stroke.

**Results:** The incidences of  $\beta$ 2-GPI aCL, IgG aCL, LA, PS-PT, PS, and PI were 2.8%, 12%, 9.2%, 7.2%, 9.6%, and 8.8%. LA was more commonly detected than anti- $\beta$ 2-GPI aCL. About 80% of the patients with LA had anti PS-PT as well. And the cumulative incidence of stroke in patients with single antiplatelet treatment was statistically significantly higher than that in patients receiving the combination of antiplatelet and anticoagulation therapy.

**Conclusions:** LA is more common than  $\beta$ 2-GPI aCL in ischemic stroke, and is closely related to PS-PT. And our results indicate that combination therapy may be more effective in APS-related ischemic stroke.

## WSC-1310

### Preventive Stroke Strategies

#### Tashkent hospital based study of risk factors for different ischemic stroke subtypes

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**Objective:** To determine risk factors in different pathogenic subtypes of ischemic stroke in Tashkent hospital registry.

**Participants:** 100 adults aged 18 years or over who suffered first-ever acute ischemic stroke.

**Methods:** Mathematically significant differences and not significant differences but interesting from other point of view. Categorical variables are expressed as frequencies and percentages. Differences were regarded as statistically significant when the P value was less than 0.05 ( $P < 0.05$ ).

**Results:** Of 100 patients with acute first-ever ischemic stroke at the median age of  $62.63 \pm 4.68$  (interquartile range 25–92) years, 57% were men and 43% were women. Depending on etiology and stroke subtype, all the patients were divided into three groups: 42 patients with atherothrombotic stroke, 41 – with lacunar stroke, and 17 patients with cardioembolic stroke. Atherothrombotic stroke developed often in people over 60 years old, while lacunar stroke prevailed at the younger age. Stroke cases increased in people over 51 years old. Although men were more likely to suffer strokes than women, stroke incidence was equal in both sexes with

increasing of age (over 60 years old), especially in atherothrombotic stroke, testifying to that women live longer. Combination of cerebral atherosclerosis and hypertension was the most significant risk factor for stroke. Atherosclerosis was the main etiological factor for ischemic stroke, independently of its pathogenic heterogeneity. Diabetes mellitus was an independent risk factor for all stroke subtypes, which in most cases worsened the course and outcome of stroke. Hypertension was the leader etiological factor for lacunar stroke. In these patients, we also should consider the presence of other risk factors, e.g. severe large vessel obstructions, se-triglycerol  $\geq 2$  mmol/L, etc. Cardioembolic stroke developed mainly because of cardiac thrombosis and valve pathology, which were often associated with chronic diseases of other organs, worsening the course and outcome of stroke. Despite of high prevalence of myocardial infarction in men, women were more likely to develop cardioembolic stroke.

**Conclusions:** This study found simultaneous influence of many risk factors (multifactorial disease) in the development of ischemic stroke. The more course and influence of the underlying disease and risk factor, the higher stroke risk and severity, especially in the absence or inadequate previous therapy of underlying disease before the stroke index. We have noted a high prevalence of under-diagnosis of vascular risk factors at levels of primary and secondary care. We recommend for improved public awareness of vascular risk factors and better diagnostic and treatment facilities aimed at addressing those factors at levels of primary and secondary healthcare. Larger population-based studies may provide additional data on stroke incidence and outcome among Uzbeks.

## WSC-0239

### Preventive Stroke Strategies

#### The correlation among waist-circumference, BMI and conicity with cardiovascular risk factors in postmenopausal women

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**Introduction:** Changes in body fat distribution in menopause lead to increasing risk of cardio and metabolic diseases. The predicting of cardiovascular diseases by using related anthropometric indices is very important

**Aims:** The aim of this study was the assessment of correlation of waist circumference (WC), BMI and conicity with cardiovascular risk factors (serum glucose, insulin[diabetes], blood pressure[BP] and dyslipidemia)

**Methods:** In a cross-sectional study, 250 nonsmoking postmenopausal women, with BMI  $< 30$  were randomly selected. WC, BMI and conicity were measured and a 3-day food dietary recall and a food frequency questionnaire were completed from each woman. Fasting serum glucose, triglyceride, HDL-C, LDL-C and insulin were measured

**Results:** There were significant correlation between WC with systolic BP ( $r = 0.255$ ,  $p = 0.002$ ), WC with conicity ( $r = 0.67$ ,  $p = 0.0001$ ), BMI with conicity ( $r = 0.31$ ,  $p = 0.0001$ ), conicity with systolic BP ( $r = 0.31$ ,  $p = 0.009$ ) and BMI with systolic BP ( $r = 0.21$ ,  $p = 0.009$ ). There were significant correlation between systolic BP with diastolic BP ( $p = 0.002$ ), serum insulin with systolic BP ( $r = 0.21$ ,  $p = 0.008$ ), serum total cholesterol with systolic BP ( $r = 0.2$ ,  $p = 0.13$ ).

**Conclusion:** WC had significant association with systolic BP and diabetes, BMI had significant association with systolic BP and finally, conicity had significant association with systolic BP, serum triglyceride and glucose but no association with diabetes.

## WSC-1087

## Preventive Stroke Strategies

## Dense households and weak social networks increase risk of recurrent vascular events in the U.S.

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The 'aging of America' places substantial pressure on family/friend networks, as they are often caregivers for chronically ill older adults. Shifts in family/friend structure vary by race-ethnicity, suggesting that different networks than traditionally thought are being accessed to provide support to manage chronic disease. The Stroke Warning information and Faster Treatment (SWIFT) trial assessed the role of social support and social networks among stroke patients. We report that 24% live alone, 23% lived with spouse/partner only, and 21% live in dense households. In adjusted logistic models, poststroke vascular events were associated with dense households [RR 1.5 (95% CI: 1.1–1.9)], weak family networks [RR 1.9 (95% CI: 1.4–2.8)] and weak friend networks [RR 1.5 (95% CI: 1.0–2.5)]. The fact that dense households are associated with higher vascular incidence demonstrates that bigger network size is not always protective. Social isolation increases risk of vascular events poststroke; that different types of networks (friends versus family) may impact differentially on health behaviors (physical activity versus stroke preparedness); that living arrangements may be associated with vascular risk factors including hypertension and recurrent stroke risk; and that these effects vary across different race-ethnic groups. Our work has contributed to an expanding literature on social support/social networks, which has suggested the utmost importance social support/networks on the multiple dimensions of older adults' health.

## WSC-0836

## Preventive Stroke Strategies

## Seamless model of Secondary Stroke Prevention Self-Empowerment Program (SSPP) for transient ischemic attack (TIA) and minor stroke patients

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**Introduction:** Patients suffering from stroke and TIA are at risk of recurrent stroke attack and the recurrent rate is 9–17% at 3 months. Multidisciplinary management of risk factors through exercise, dietary intervention and medications are crucial for recurrent stroke prevention. We started service re-engineered to build centralized care coordination and share professional input from neurologist, nurse, physiotherapist, occupational therapist and dietitian. It emphasizes continuity of care through patient's perspective to enhance their participation and access to early, timely and comprehensive intervention.

**Aims:** To provide an effective intervention for secondary stroke prevention through seamless care.

To evaluate the poststroke 3-month outcomes of the participants

**Methodology:** The multidisciplinary SSPP was redesigned and implemented in April 2013. The target patients were TIA and minor stroke patients in United Christian Hospital. SSPP consisted of four half-day sessions plus one post-3-month follow-up. The content included risk factors stratification, dietary education and stroke knowledge, lifestyle modification, Health Qigong, stress management, weight management, structured exercise training and tailor-made home exercise.

**Results:** Total 46 patients completed the program. The stroke recurrent rate of participants was 5%. Results demonstrated significant improvement in various clinical outcomes:

Biomedical markers	Results
Cholesterol, LDL	Reduced ( $p < 0.05$ )
SBP/DBP	Reduced ( $p < 0.05$ )
Physical fitness	
The cardiopulmonary fitness and gait speed	Improved by 9.3% ( $p \leq 0.05$ ), 8.1% ( $p \leq 0.05$ ) as revealed by 6-minute walk test and 10-meter walk test
Life style/behavioral improvement	
The International Physical Activity Questionnaire score	Increased by 47.7% ( $p \leq 0.05$ )
Patients' stroke knowledge/Motivation in behavioral changes	Improved ( $p < 0.01$ ) and ( $p < 0.04$ ) respectively

**Conclusions:** This multidisciplinary SSPP is an effective strategy for risk factor management and life style promotion. Our dedicated coordination team provides comprehensive care delivery that breaks down barriers for patients.

## WSC-0495

## Preventive Stroke Strategies

## Economic crises and cerebrovascular mortality: A worldwide study

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**Introduction:** The global economic downturn has generated significant concern, being associated with unemployment rises, reduced health spending and worsened population health. Insights into the impact of economic downturns on specific conditions, however, remain limited.

**Aim:** To determine the effect of changes in unemployment and government healthcare expenditure on cerebrovascular mortality.

**Methods:** Data were obtained from the World Bank and World Health Organization. Multivariate regression analysis was used to assess the effect of changes in unemployment and government healthcare expenditure on cerebrovascular mortality. Country-specific differences in infrastructure and population were controlled for. One- to five-year lag analyses and robustness checks were conducted.

**Results:** Across 99 countries worldwide, between 1981–2009, every 1% increase in unemployment resulted in 187 excess deaths per 100,000 population (CI: 86.6–288,  $p = 0.0003$ ). For every 1% rise in government healthcare expenditure, per 100,000 population, 869 cerebrovascular deaths were prevented (CI: 383–1354,  $p = 0.0005$ ). The association between unemployment and cerebrovascular mortality remained statistically significant for at least 5 years subsequent to the 1% unemployment rise, while the association between healthcare expenditure and cerebro-

vascular mortality remained significant for 2 years. These relationships were shown to be independent of changes in GDP per capita, inflation, interest rates, urbanization, nutrition, education and out-of-pocket spending.

**Conclusions:** Rises in unemployment and reductions in healthcare expenditure are associated with significant increases in cerebrovascular mortality globally. At a policy level, austerity measures are likely to exacerbate cerebrovascular mortality, whereas initiatives that bolster employment and maintain public expenditure may minimize deteriorations in cerebrovascular mortality during economic crises.

## WSC-1572

### Preventive Stroke Strategies

#### Prevalence of hypertension in an Afro-Hispanic population in Honduras: A 4-year follow-up study

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**Introduction:** In 2010 we made a study of prevalence and incidence of hypertension and stroke in Afro-Hispanic population at Triunfo de la Cruz, in the Caribbean Honduras. We report a follow-up study 4 years later.

**Methods:** We evaluated periodically each 3 months a group of patients in Triunfo de la Cruz (n = 220 people), checking blood pressure in both arms and other topics according to JNC-8 recommendation. Additionally, we searched for new cases of stroke in population using TOAST scale and NIHSS.

**Results:** We diagnosed hypertension in 69 persons aged less than 60 years old and in 38 persons older than 60 years old. According to the recommendations of JNC-8, we prescribed calcium-channel blocker and thiazidic diuretics in most patients. Two new cases of stroke were reported in the community.

**Conclusion:** Hypertension is an important risk factor for stroke. The correct application of international guidelines will contribute in the reduction of new stroke cases.

## WSC-0656

### Preventive Stroke Strategies

#### Poststroke disease management – stroke card: Extending the standard care after stroke and high-risk TIA

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**Background/aims:** Several studies have pointed out the existing gap between clinical practice and evidence-based recommendations in secondary stroke prevention. We aim to evaluate the benefits and costs of an intensified poststroke follow-up care. This trial is an interdisciplinary collaboration conducted at the Department of Neurology, Medical University Innsbruck, Austria.

**Methods/design:** *Stroke-Card* is a prospective block-randomized open interventional trial with 12 months of follow-up and blinded outcome assessment. Patients with stroke or high-risk TIA are randomized to either standard care (control arm) or extended care (intervention arm). Both treatment arms comply with the current state-of-the-art. The extended care includes (1) educational lectures for patients and relatives, (2) access to self-administered online tools for risk factor monitoring and reinforcement of target level achievement, and (3) one additional standardized check-up after 3 months for assessment of medication adherence, risk factor control, poststroke complications, as well as intensive patient support and empowerment. The co-primary endpoint consists of a reduc-

tion of incident major cardiovascular events (composite of myocardial infarction, stroke, and vascular death) and an improvement of health-related quality of life. A health-economic evaluation will be performed. Over 2 years, 2400 patients will be enrolled, resulting in a total study time of 3 years.

**Discussion:** This trial will provide evidence about the efficacy of a structured program for intensified secondary stroke prevention. In case of positive evaluation (improved quality with little or no additional costs), *Stroke Card* will be implemented in clinical practice and may serve as a model for other disease management initiatives.

## WSC-1050

### Preventive Stroke Strategies

#### C-TCD in evaluation of efficacy of percutaneous PFO closure

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**Introduction and aims:** Patent foramen ovale (PFO) is related to prevalence of cryptogenic stroke in patients younger than 50 years. In this group of patients transcatheter PFO closure is considered. Transoesophageal echocardiography (TEE) remains „gold standard” in detection PFO. However contrast transcranial doppler (c-TCD) enable noninvasive detection of right-to-left shunt (RLS). Goal of our study was evaluation, based on c-TCD, efficacy of percutaneous PFO closure in patients treated in Silesian Centre for Heart Diseases in Zabrze.

**Methods:** C-TCD was performed before PFO closure and 6 months after the procedure. Study protocol included bilateral monitoring of flow in middle cerebral arteries, with saline contrast given. Detection of micro-embolic signals (MES) was performed at rest and after Valsalva maneuver. Degree of RLS was assessed in scale 0-III°. In patients with significant RLS (grade III) control TEE was performed.

**Results:** Our group consisted of 92 patients, mean age 42,5 ± 13,1 years, 38 men (41,3%), with history of stroke or TIA. In all patients RLS grade II-III was detected in preoperative c-TCD. In control c-TCD lack of MES was found in 68/73,9%/patients, RLS grade I and II in 6/6,5% and 13/14,1%, respectively. In 5/5,4%/patients RLS of III° was registered. These patients had control TEE performed, confirming residual leak in all patients.

**Conclusions:** C-TCD is a plausible method in noninvasive evaluation of efficacy of PFO closure. It allows limitation of control TEE to patients with significant residual leak and qualification to potential subsequent invasive procedure.

## WSC-1251

### Preventive Stroke Strategies

#### Carotid artery disease after neck irradiation in long-term survivors of Hodgkin disease in childhood

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**Purpose:** Some studies have shown carotid artery disease in pediatric cancer survivors treated with neck irradiation (RT), although with contradictory results. We compared parameters of carotid artery disease in patients (pts) treated of Hodgkin disease (HD) in childhood with neck RT and cardiovascular risk factors matched controls.

**Methods:** Fifty-six pts were treated of HD under the age of 16 in Slovenia; 24 survivors (8 females, 16 males) were included. They were 3–16 (med.

11) years old at diagnosis and had evaluation 27–38 (med 33) years later at the age of 29–48 (med. 43) years. They received neck RT with 20–42 (med. 30) Gy, 19 pts received chemotherapy. Aloka alfa 7 was used to determine plaque and intima media thickness in common carotid arteries. Carotid artery stiffness was measured by high-resolution echo tracking using duplex sonography. The following carotid stiffness indexes were calculated: local pulse wave velocity (PWVb m/s), strain pressure elasticity index (Ep) (kPa), beta index and augmentation index (Aix, %).

**Results:** The local carotid stiffness indexes were significant higher: beta stiffness ( $p = 0.03$ ), PWVb ( $p = 0.021$ ), Ep ( $p = 0.005$ ), Aix ( $p < 0.000$ ) and there were significant more arterial wall calcinations ( $p < 0.000$ ) in the group of survivors. The intima-media thickness ( $p = 0.285$ ) and the number of plaques ( $p = 0.55$ ) were not different in the two groups.

**Conclusions:** Our results revealed that mild arteriosclerotic changes of carotid arteries are more prevalent in long-term survivors after neck RT. Follow-up is needed to prevent stroke, associated with advanced carotid disease.

### WSC-0594

#### Preventive Stroke Strategies

#### Incident of coagulopathy in acute ischemic stroke

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In the United States, over 700,000 Strokes occur annually, out of that 33% are of undefined etiology (cryptogenic). Cryptogenic stroke is more common in younger age groups rather than older age groups. Cardio embolic etiology is presumed to be the common cause in cryptogenic stroke, however other causes may include vasculopathy and coagulopathy disorders, although coagulopathy disorders have not been clearly defined. In the last 5 years, review of our stroke directory indicated that 560 out of approximately 3000 cases occurred in patients under the age of 60. Of these patients, 335 cases were of cryptogenic origin. After reviewing the coagulopathy disorders among all cases, Lupus anticoagulants were present in 12% of cases, cardiolipin antibodies in 10%, Protein C and S deficiencies in 7%, AT3 deficiency in 5%, Factor V Leiden in 9%, and increased homocysteine in 18% of patients.

Converse, the risk of stroke has been increases by more than 40% with the presents of lupus anticoagulant, by 13.3% in patient with protein S deficiency, up to 15.9% in patients with factor V Leiden deficiency and close to 10.5% in patients with AT3 deficiency. Since long-term anticoagulation can reduce the risk of cerebrovascular accidents in patients with coagulopathies, these disorders should be specifically looked for in younger patients in order to prevent future morbidity and mortality.

### WSC-1031

#### Public Awareness/Advocacy

#### Barriers to calling 911 for acute stroke among minority women

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**Introduction:** Black and Hispanic patients are least likely to call 911 for acute stroke.

**Aims:** To identify barriers to 911 activation among minority women to inform intervention development.

**Methods:** As part of the formative development of a narrative communication intervention for increasing 911 activation for acute stroke we conducted English and Spanish focus groups and content analysis to assess barriers to 911 activation among 18 African American and 30 Hispanic adult women with and without a history of stroke, living in low-income New York City neighborhoods. Standardized probes explored stroke related knowledge, behaviors, and 911 activation. Recordings were transcribed and coded using Atlas.ti 7.1.8 for major themes.

**Results:** Barriers were categorized in themes that included 1) Selflessness; putting family responsibilities and commitments before their own needs, 2) Perceived priorities: not prioritizing stroke symptoms above competing tasks, 3) Denial; purposely ignoring symptoms 4) Perceived futility; that nothing could be done about symptoms. Women stroke survivors agreed that taking their symptoms more seriously at their onset would have led to earlier hospital arrival. No major racial differences were observed between groups. Overall, major themes revealed low perceived urgency likely related to the poor awareness of the time-sensitive nature of acute stroke treatments. Interestingly, poor recognition of symptoms did not represent a major theme.

**Conclusions:** Major barriers to calling 911 among minority women appear modifiable. Perceived symptom urgency and knowledge of time sensitive treatment benefits may be more valuable targets for interventions than stroke symptom knowledge alone.

### WSC-0685

#### Public Awareness/Advocacy

#### Making sense of early warning symptoms of impending stroke using a phenomenological approach

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**Introduction:** Patients with signs of stroke are urged to seek prompt medical attention to ensure optimal clinical outcomes. It is argued that delay in presentation may be further reduced if patients can act upon the early symptoms of stroke that precedes the classical warning signs.

**Aims:** This study sought to explore the cluster of symptoms prior to a stroke.

**Methods:** Fifty-eight stroke survivors' autobiographical narratives were identified and reviewed. Thematic analysis was conducted on their first handed near-stroke experience.

**Results:** Six patients had stroke without warning; others had experienced some nonspecific symptoms including intractable headache, dizziness, and extreme tiredness before the onset of stroke. These symptoms were taken as having flu, a cold, or not having adequate rest. Instead of contemplating on the possibility of having an impending stroke, they had managed these symptoms by sleep, self-medication, or willing it away. When the stroke signs and symptoms become more prominent, patients started to question the cause of the symptoms. When the seriousness of the problem was being recognized, some thought that was a heart attack, others started seeking help from others, and yet some denied their problem as they felt that they were too young, too healthy, having no risk factors, or not wanting to look stupid. In order to gain some insight on the severity of the problem, patients would perform tests on themselves. Instead of feeling panic, many patients felt calm at this juncture.

**Conclusions:** Primary preventive measures should expand to include the common, yet nonspecific symptoms preceding stroke to call for earlier medical attention.

**WSC-0754****Public Awareness/Advocacy  
Study of knowledge of risk factors of stroke in rural population of Western India**D Desai<sup>1</sup>, S D Desai<sup>2</sup>, U Thakar<sup>1</sup><sup>1</sup>Medicine, Pramukswami Medical College, Anand, India<sup>2</sup>Neurology, Pramukswami Medical College, Anand, India

*Introduction:* Limited data from India suggest poor knowledge about stroke risk factors in urban population. The awareness regarding these in rural population is likely to be low.

*Aims:* This study intended to study awareness of stroke risk factors in a rural based setting.

*Methods:* Amongst persons visiting Shree Krishna hospital, a rural teaching hospital located in Karamsad in Western India, 656 randomly selected persons aged between 18–87 [mean 46.7], [33.6% female, 66.4% male] were asked to respond to structured questionnaire assessing knowledge of stroke risk factors and personal risk factors amongst the interviewees.

*Results:* Amongst participants, only 223 [33.99%] were aware of at least one of the risk factors of stroke. Awareness about individual risk factors was only in 85 [12.9%] for hypertension, 74 [11.2%] for diabetes, 39 [5.94%] for smoking, 15 [2.2%] for alcohol, 33 [5.03%] for dyslipidemia, 14 [2.13%] for sedentary life, 5 [0.77%] for age. Also amongst the interviewed persons, 195 [29.8%] had hypertension, 135 [20.6%] had diabetes, 170 [26%] were smokers, 90 [13.7%] had family history of stroke, and 80 [12.2%] had dyslipidemia. 478 [72.8%] of the interviewed persons had a risk factor for stroke and were not aware about it. 255 [38.8%] of the interviewed persons had 2 or more risk factors for stroke but were not aware about it.

*Conclusion:* There is severe lack of knowledge of stroke risk factors and prevention, thus calling for urgent need for public campaigns for stroke primary as well as secondary prevention awareness, especially in rural India.

**WSC-0391****Public Awareness/Advocacy  
Study of knowledge of stroke, its warning signs and treatment in the rural population of Western India**S Desai<sup>1</sup>, D Desai<sup>2</sup>, U Thakar<sup>2</sup><sup>1</sup>Neurology, Pramukshwami Medical College, Anand, India<sup>2</sup>Medicine, Pramukshwami Medical College, Anand, India

*Introduction:* Limited data from India suggest poor knowledge about stroke, warning signs and treatment modalities in urban population. The awareness regarding these in rural population is likely to be low.

*Aims:* This study intended to study awareness of stroke warning signs and treatment in a rural based setting.

*Methods:* Amongst persons visiting Shree Krishna hospital, a rural teaching hospital, 656 randomly selected persons were asked to respond to structured questionnaire assessing knowledge of stroke, warning signs and treatment.

*Results:* 390 [59.5%] could identify that brain is the affected organ in stroke. 230 [35.06%] described limb weakness, 99 [15.09%] numbness, 65 [9.90%] headache, 20 [3.04%] difficulty in speaking as a warning signal of stroke. None considered dizziness/imbalance or difficulty in vision as a warning sign. 360 [55%] had no knowledge about any of the warning signs. No one had correct knowledge about all warning signals. Only 145 [22.1%] considered stroke as an emergency, only 120 [18.3%] knew that stroke victim should be hospitalized immediately. Only 50 [7.6%] were aware that the hospital where patient is shifted should have brain imaging facility in emergency. Only 40 [6.1%] knew of a clot busting therapy for stroke. 621 [94.7%] believe that medicines for treatment are to be taken for few months only. The rest [5.3%] thought to take medicines till recovery. No one was aware of the need of lifelong secondary prevention medicines after a stroke.

*Conclusion:* There is severe lack of knowledge of stroke warning signs and treatment, calling for urgent need for public campaigns for stroke awareness.

**WSC-1471****Public Awareness/Advocacy  
Young stroke: We are more than half**A Edmunds<sup>1</sup>, D Conner<sup>1</sup><sup>1</sup>Executive, YoungStroke Inc./Coastal Carolina University, Conway, USA

*Introduction:* Although stroke is generally perceived by the public as an elderly affliction, more than half of all strokes in South Carolina have occurred among adults under the age of 65 for the past 5 years. Despite current emphasis upon public engagement via social media, radio may provide an effective communication channel for a public health messages about young stroke within two rural communities of South Carolina lacking internet access.

*Aims:* To measure the effectiveness of a radio public service announcement campaign to educate at-risk, rural communities in Georgetown and Hemingway, South Carolina about stroke in young adults.

*Methods:* A three question quantitative survey was self-administered pre-campaign and postcampaign to measure awareness of young stroke among randomly selected adults. A 15 second and 30 second public service announcement was produced, distributed and aired on two local radio stations.

*Results:* To be confirmed by August 30, 2014.

*Conclusions:* Community awareness of stroke signs and symptoms is the critical first step toward effective care and treatment. For hard to reach populations, it is imperative to identify and implement cost effective channels of communication which are readily available without significant financial investment. Towards this end, radio may serve as a viable option.

**WSC-0302****Public Awareness/Advocacy  
BRUSHSTROKES: Changing views of stroke with art**A Edmunds<sup>1</sup><sup>1</sup>Health Promotion, Coastal Carolina University, Conway, USA

*Introduction:* African Americans residing within the Stroke Buckle of South Carolina experience America's highest rates of stroke mortality due in part to lack of awareness of stroke signs and symptoms. BRUSHSTROKES reshapes grassroots perceptions of stroke risk, prevalence and incidence by imposing provocative visual portraits local stroke survivors within local venues.

*Aims:* This project delivers culturally-sensitive visual health messages about stroke awareness among Gullah Geechee communities, the most vulnerable at-risk demographic within the Stroke Buckle of South Carolina.

*Methods:* Stroke survivors of Gullah Geechee descent were recruited to participate during January – March 2014. Standardized surveys containing six questions were used to capture survivorship stories. Personal photographs were collected and transformed via computer-based technology to illustrate lives before and after the stroke experience. Completed images are singularly displayed within venues, like libraries, malls, and hospital lobbies within the survivor's hometown communities. or combined with others to form murals for enhanced visual impact.

*Results:* Data collection is currently underway with completion anticipated by July 2014.

*Conclusions:* Utilizing art to convey health messages within Gullah Geechee communities of the Stroke Buckle may be an effective tool to raise awareness of stroke signs and symptoms and thereby reducing rates of mortality.

## WSC-1034

### Public Awareness/Advocacy Hip hop stroke: Fifth grade child recognizes hemorrhagic stroke and calls 911

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**Introduction:** Stroke-educated children may be under-utilized community awareness agents.

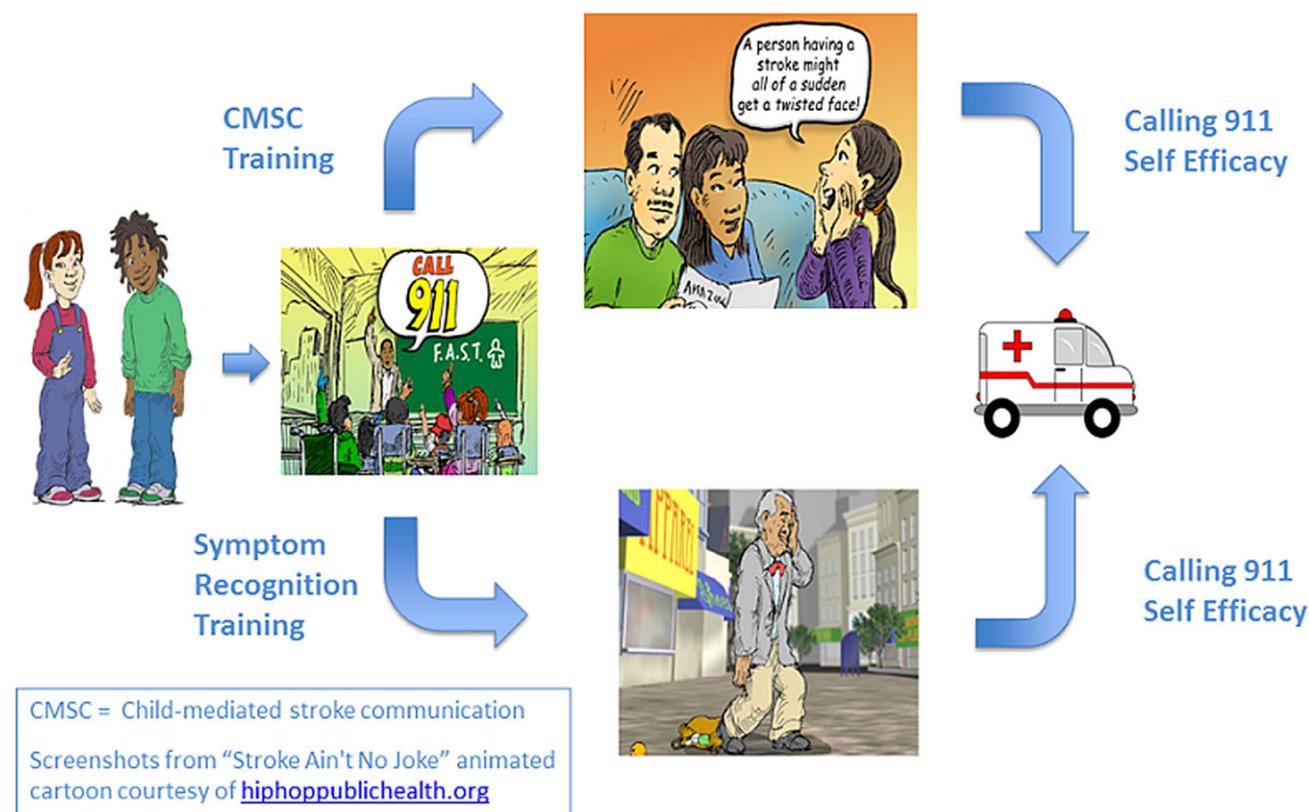
**Aim:** To report a case of a child first responder.

**Methods:** Hip Hop Stroke (HHS) is a behavioral intervention designed to increase stroke knowledge and 911 activation for suspected stroke. The 3-hour school-based intervention targets 4<sup>th</sup>–6<sup>th</sup> graders and their parents through homework assignments. Utilizing an implementation intentions strategy, HHS increases self-efficacy for calling 911 through role-play and

multimedia tools. Children are also taught stroke subtypes, renamed “dry” for ischemic and “wet” for hemorrhagic strokes.

**Case Report:** A 55-year-old African American grandmother developed sudden severe headache that was recognized as possible stroke by her 10-year-old grandson who had participated in HHS. He noticed his grandmother’s sudden discomfort as she clutched her head complaining of severe headache. She had slight speech slurring but no focal limb weakness. The child told his mother to call 911 because his grandmother may be having a “wet stroke.” The child’s mother did not share his alarm, and instead stated she would call her physician the next day. The child reiterated his concerns and convinced his mother before dialing 911 himself. The grandmother was transported to a local hospital and diagnosed with a nonlife-threatening, nonsurgical brain hemorrhage from which she eventually recovered.

**Conclusion:** Stroke-educated children can act as first responders in the chain of stroke recovery.



**Fig. 1** Hip Hop Stroke: A multimedia child-mediated stroke action intervention.

## WSC-1425

### Public Awareness/Advocacy A story from the front line I Kane<sup>1</sup>

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**Introduction:** Despite multiple public campaigns concerning stroke in the UK e.g. FAST (face, arms, speech, time) there is still a delay in patients presenting to hospital. Having presented some previous work on this I was keen to be involved in innovative local projects with an opportunity to raise the public awareness around stroke.

**Methods:** I took part in a groundbreaking local arts festival exploring the medical, mental and social challenges of life and death. As part of the SICK! Festival 2014 I was involved in the production of a graphic narrative around a patient who presented with an acute stroke to The Royal Sussex County Hospital in Brighton. A comic artist interviewed me (the doctor) and the patient and produced a graphic narrative telling the same story from very different perspectives. The work was presented in a large-scale light box installation in a public square in Brighton for 6 weeks. The footfall through the square over that time period was around 70 000 people.

**Results:** Figs 1 and 2 illustrate part of the completed work.

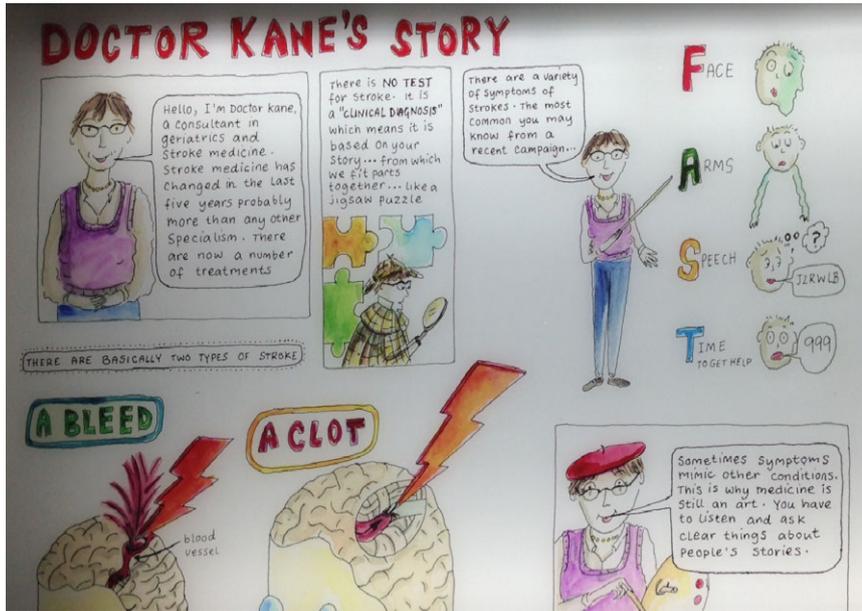


Fig. 1 The doctor's story.

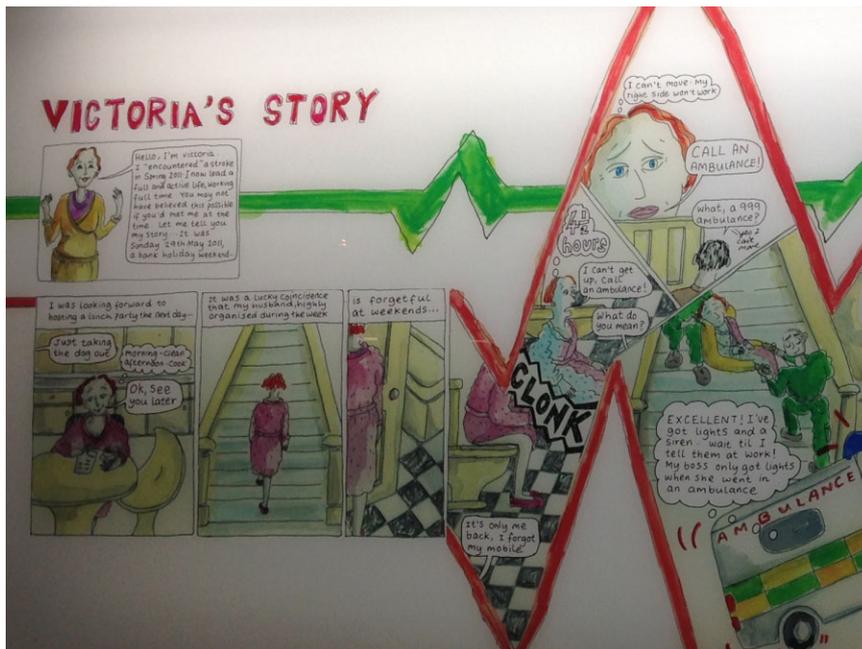


Fig. 2 The patient's story.

**Conclusions:** Presenting private stories of medical conditions in such a graphic and accessible way challenges how we understand health, illness and the medical professional. This format, in a large public space, allowed one particular story of stroke to be told and gave the opportunity for the public to interact with the work. There are plans to expand the Sick! Festival in 2015.

**WSC-0340****Public Awareness/Advocacy****Differences in awareness of stroke risk factors and warning signs between school pupils and teachers in Osun State, Nigeria – A World Stroke Day 2013 survey**M Komolafe<sup>1</sup>, A Obembe<sup>2</sup>, M Olaogun<sup>2</sup><sup>1</sup>Neurology, Department of Medicine, Ile Ife, Nigeria<sup>2</sup>Physiotherapy, Department of Medical Rehabilitation, Ile Ife, Nigeria

*Introduction:* Stroke, a significant health problem affecting adults is increasing among younger age groups.

*Aims:* To compare the awareness of stroke risk factors and warning signs between students and teachers in secondary schools in Osun state, Nigeria

*Methods:* This was a cross sectional survey involving 703 (589 students and 114 teachers) respondents in selected secondary schools in Ile-Ife and Ilesa. Information was collected with the aid of a structured questionnaire.

*Results:* Hypertension (69.4%) was the most commonly identified stroke risk factor, with more teachers (79.8%) identifying correctly than students (67.4%). Weakness (51.9%) was the most commonly identified warning sign of stroke with more students (53.8%) identifying correctly than teachers (42.1%). There were significant differences in the awareness of some risk factors (age, obesity, family history, alcohol use, diet, transient ischemic attack and hyperlipidemia), and warning signs (dizziness, weakness, and vision problems) between students and teachers. Predictors for adequate awareness of both stroke risk factors and warning signs were stroke in the family, being hypertensive and not being obese.

*Conclusions:* Stroke education should be focused with information about stroke risk factors for students and warning signs for adults.

**WSC-1503****Public Awareness/Advocacy****Low socioeconomic status is an independent risk factor for large vessel stroke: A case control study from North Indian population**A Kumar<sup>1</sup>, M Prasad<sup>1</sup>, P Kathuria<sup>1</sup><sup>1</sup>Neurology, All India Institute of Medical Sciences, New Delhi, India

*Introduction:* Stroke is a multifactorial disease and is influenced by complex environmental interactions.

*Aim:* The objective of this case control study was to determine the relationship of low economic status with ischemic stroke in North Indian population.

*Methods:* In a hospital based case-control study age and sex- matched controls were included. Economic status along with other demographic and risk factor variables was measured in person- interview in standardized case record form. Multivariate logistic regression model was used to estimate the odds ratio associated with stroke.

*Results:* 224 ischemic stroke patients and 224 controls were recruited from the period of February 2009 to February 2012. Mean age of cases and controls was 53.47 ± 14 and 52.92 ± 13.4 respectively. Low economic status was independently associated with risk of ischemic stroke after adjustment for demographic and risk factor variables (OR 2.3; 95% CI 1.15–4.9).

*Conclusion:* Significant interaction of low economic status with large vessel stroke (LVD) stroke risk was also observed. The result of this study showed independent association between low economic status and LVD stroke in north Indian population.

**WSC-0954****Public Awareness/Advocacy****Who is the target population for shortening prehospital delay?**Y Lee<sup>1</sup>, B Yip<sup>1</sup>, H Wang<sup>2</sup><sup>1</sup>Department of Neurology, National Taiwan University

Hospital Hsin-Chu Branch, Hsinchu, Taiwan

<sup>2</sup>Institute of Statistics, National Chiao Tung University, Hsinchu, Taiwan

*Introduction:* Prehospital delay is the main barrier of early administration of thrombolytic therapy in patients with acute ischemic stroke. The percentage of people who received thrombolytic therapy is still low even with public education and campaigns during these years. Many studies suggested that stroke awareness had a great impact on early arrival at hospital. *Aims:* Our purpose is to identify the target population to emphasize the importance of recognizing stroke symptoms and early arrival at hospital. *Methods:* A prospective study was conducted from August 2006 to October 2009 in a 550-bed regional hospital situated in Hsinchu city, Taiwan. Patients with ischemic stroke or transient ischemic attack were enrolled. Exact time of symptoms onset, initial symptoms and signs, initial GCS, NIHSS, and stroke risk factors were registered by doctors or nursing practitioners. We defined prehospital delay less than 2 hours as “early arrival group”.

*Results:* 558 patients with definite time of prehospital delay were included. Among all initial symptoms and signs, consciousness disturbance is the only symptom associated with early arrival. Within all stroke risk factors, diabetes mellitus and dyslipidemia were associated with late arrival, whereas heart disease was associated with early arrival. Logistic regression model revealing that the motor response is the most significantly factor in GCS to be correlated with prehospital delay.

*Conclusions:* Our analysis suggested that to shorten prehospital delay, people with diabetes mellitus and dyslipidemia are the priority populations, and stroke symptoms other than consciousness should be emphasized as well.

**WSC-1591****Public Awareness/Advocacy****Stroke awareness level of outpatients in Turkey**M Madan<sup>1</sup>, S Oruç<sup>2</sup>, A M Ulasli<sup>3</sup>, K Tunay<sup>4</sup>, U Dündar<sup>3</sup><sup>1</sup>Atatürk High Vocational School of Health Services & Ahmet Necdet Sezer Practice and Research Hospital Physical Therapy and Rehabilitation Unit, Afyon Kocatepe University, Afyonkarahisar, Turkey<sup>2</sup>Faculty of Medicine, Department of Neurology, Afyon Kocatepe University, Afyonkarahisar, Turkey<sup>3</sup>Faculty of Medicine, Department of Physical Medicine and Rehabilitation, Afyon Kocatepe University, Afyonkarahisar, Turkey<sup>4</sup>Faculty of Medicine, Department of Emergency Medicine, Afyon Kocatepe University, Afyonkarahisar, Turkey

*Introduction:* Awareness of stroke in the community is important especially in the prevention and control of the stroke. There isn't any study about level of awareness among patients in Turkey.

*Aims:* The first aim of the study was to evaluate stroke awareness among nonstroke patients. The second aim was to identify predictors of stroke awareness.

*Methods:* The study was performed in Afyon Kocatepe University Hospital. A stroke awareness questionnaire designed by researchers. It included 6 open-ended, 15 multiple-choice and 9 yes/no questions. Informed consent was obtained from the patients before participation. Questionnaire was administered in outpatient physiotherapy unit. 228 patients agreed to participate in the study.

**Results:** Patients' mean age was 50.4 (19–87), 72.8% (n = 166) were female, 59.2% were housewives, 77.6% were living in urban areas. 73% of participants reported that the mainly affected organ is the brain. 91.2% of respondents least one stroke sign marked correctly. The most well known stroke symptoms were sudden sensory loss (65.4%) and sudden weakness (45.2%). 83.8% of respondents least one, 26.6% least three stroke risk factors marked correctly. The most known stroke risk factor was hypertension (61.8%). 68.9% of patients believed that stroke can be prevented. First action; 79.8% of respondents would call 112 (Emergency call). Most important negative predictors of awareness are education level (being not-literate), working status (housewives and unemployed), respectively.

**Conclusions:** The study showed that stroke awareness is low among the patients. Awareness rate should be increased to prevent stroke and to reduce the effects causing disability. To increase the awareness should reach to the housewives and unemployed.

### WSC-1246

#### Public Awareness/Advocacy

#### Synergistic effect of the combination of mass media and distribution media on improvement of knowledge about early stroke symptoms

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**Introduction:** To promote early arrival at hospital after stroke onset, enough knowledge about early symptoms should be widely spread. Some previous studies have been suggesting that mass-media and distribution-media were effective for public education respectively.

**Aim:** To clarify the synergistic effect of mass-media and distribution-media on improvement of knowledge by a controlled study, for future multifaceted public education about stroke.

**Methods:** In March 2013, we conducted a telephone survey about knowledge for early symptoms of stroke in 4200 randomly selected residents aged 40–74 living in three areas in Japan (area1: mass-media only, area2: mass-media and distribution-media, area3: control area). Regarding the questions about early symptoms consisting of five correct answers and five dummy answers as multiple-choice items multiple answers were allowed. The postintervention survey was conducted by random-selection after 2-month intervention. Main outcome was defined to choose five early symptoms correctly. Multivariate logistic regression analyses were performed to calculate odds ratios (ORs) and 95% confidence intervals (CIs) in postintervention survey (reference: area3). The attributable fraction of improvement of stroke knowledge by each intervention means was calculated in area1 and area2.

**Results:** In preintervention survey, significant difference of stroke knowledge was not observed among three areas (area1: 56%, area2: 53%, and area3: 54%). In the postintervention survey, knowledge about early symptoms was significantly improved in area1 (OR: 1.16, 1.01–1.36) and area2 (OR: 1.40, 1.21–1.40). The effect of mass-media was largish in area2 than in area1 (0.034 and 0.020, respectively).

**Conclusion:** The synergistic effect of mass-media and distribution-media on improvement of stroke knowledge was observed. Multifaceted public education should be performed.

### WSC-0271

#### Public Awareness/Advocacy

#### Knowledge of stroke risk factors, warning signs and attitude towards them: A population-based study from a gender perspective

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**Introduction:** Stroke is one of the leading causes of death. Increase knowledge of stroke risk factors (SRF) and warning signs (WS) is important for stroke prevention and seeking care.

**Aims:** We conducted a study to determine whether gender differences exist in knowledge of SRF, WS and attitude towards them in a sample of adults.

**Methods:** In 2009, a representative sample of the region population was selected by double randomization. 2411 citizens were face-to-face interviewed. We used a structured questionnaire with open-ended and closed questions.

**Results:** 59.9% women; mean age (SD) 49.0 (18.7) years. 73% of women and men reported at least one correct WS (OR 1.01 (95% CI 0.84–1.21; p = 0.936)). The most frequently mentioned WS were weakness, dizziness and headache. No gender differences in types of WS named was found. We found higher knowledge of SRF for recall in women compared with men (OR 1.23 (95% CI 1.05–1.46; p = 0.001)). Women more often named hypertension as SRF whereas men more often named smoking, alcohol consumption and physical activity as SRF. In response to stroke, the decision to call an ambulance or go direct to hospital declined significantly in women (OR 0.69 (95% CI 0.60–0.85; p = 0.001)).

**Conclusions:** Stroke knowledge is suboptimal. We detected a better knowledge of SRF in women; and existing difference in type of SRF mentioned by men and women. There were significant gender differences in terms of intended response to stroke or WS. Further investigations on how to use these differences to improve public health campaigns are necessary.

### WSC-1012

#### Public Awareness/Advocacy

#### Unique challenges of racial-ethnic minority involvement in U.S. stroke clinical research

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<sup>2</sup>School of Education, University of Wisconsin-Madison, Madison, USA

**Introduction:** Racial-ethnic minorities compose 37% of the U.S. population, yet represent less than one tenth of clinical trial participants. The inclusion of racial-ethnic minorities in clinical research is imperative to confirm the generalizability of tested therapeutics.

**Aims:** The National Initiative for Minority Involvement in Clinical Trials (NIMICT) is examining barriers and best practices to recruitment and retention of racial-ethnic minorities in stroke clinical trials using qualitative and quantitative methods.

**Methods:** A 40-item survey was developed to capture coordinators' experiences in minority recruitment and retention. We report on 45 stroke clinical trial coordinators. The Institutional Review Board waived the need for informed consent.

**Results:** Only 33% of coordinators reported actively setting recruitment goals for the inclusion of minority populations; and 30% reported requiring recruitment staff cultural sensitivity training. Only 27% reported consultation with community members as part of research design. We asked about unique challenges of stroke trials. More than 85% of coordinators reported frequently treating adults unable to consent and expressed concern about the acute setting and patients' and family decision-making processes on trial participation. Finally, in a series of open-ended questions, the majority of coordinators expressed the complexity and difficulty of recruitment into stroke trials. They identified patient populations' changing and/or unstable subject status, language difficulties, shame and stigma, effects of medication, and requirement for intubation or sedation as challenges. Coordinators stated that minority recruitment and retention can require more time, expense, and additional scheduling.

**Conclusions:** The NIMICT survey contributes a new dimension to the rich literature as it highlights unique and minority specific recruitment challenges embedded in stroke clinical research.

## WSC-1005

### Public Awareness/Advocacy Identifying the structure of the international stroke clinical trials research collaboration network

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**Introduction:** Racial-ethnic minorities are approximately one-third of the United States population yet represent less than one-tenth of clinical trial participants.

**Aims:** The National Initiative for Minority Involvement in Neurological Clinical Trials (NIMICT) aims to aid researcher efforts to recruit and retain minorities in stroke clinical trials by developing a series of researcher "toolkits." We applied social network analysis to map and describe the structure of the stroke clinical trials collaboration network. Findings will inform future efforts to disseminate best practices.

**Methods:** We undertook a systematic scoping review of Medline and OvidSP to identify stroke clinical trials manuscripts published from 1995 to 2013. Second, manuscripts were systematically evaluated and screened to identify Phase III clinical trials. Next, an adaptive REDCap author-manuscript database was developed. Lastly, we applied author-manuscript affiliation and author-author adjacency structures. All analyses were conducted in R 3.0.2.

**Results:** The scoping review yielded 3887 peer-reviewed manuscripts, 192 met our inclusion criteria. Of these, 1596 distinct authors were identified. Each author published 1.33 (range = 1–12) manuscripts, on average. About 11 (range = 2–55) individuals, co-authored each manuscript. The author-author adjacency structure revealed a de-centralized global structure (degree = 0.091, closeness = 0.001, betweenness = .065, and eigenvector = 0.97). Locally, each author was linked to 20 (range = 1–166) additional authors, on average, through their published collaborations.

**Conclusions:** Our multidisciplinary endeavor explores the impact of the stroke clinical trial research collaboration structure on minority recruitment. Subsequent analyses will identify collaboration clusters for which dissemination of NIMICT best practices/toolkit might yield increased inclusion of minorities in stroke clinical trials.

## WSC-1017

### Public Awareness/Advocacy Stroke clinical coordinator identified tools and resources

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**Introduction:** Poor recruitment and retention of clinical trial participants continues to be a major contributor to the failure and early termination of many clinical trials. Clinical trial coordinators can be the link high recruitment and retention rates however coordinators face many challenges.

**Aims:** The National Initiative for Minority Involvement in Clinical Trials (NIMICT) study is examining barriers and best practices to recruitment and retention of racial-ethnic minorities in stroke clinical trials. As a deliverable NIMICT will develop, and test a series of recruitment "tool-kits" tailored to researchers.

**Methods:** NIMICT conducted a series of focus groups at international conferences with prominent stroke clinical coordinators (N = 40) to identify best practices to facilitate overall and minority trial participation. The Institutional Review Board waived the need for informed consent.

**Results:** Coordinators highlighted the following key themes, logistical issues, enhancing communication skills, and continuous coordinator training. Concerning logistics tools requested include how to develop a budget, plan, and recruitment materials to support minority recruitment and retention. Coordinator suggested resources, visual aids, infographs, and narratives to better explain clinical trial and neurological concepts and to communicate with patients and caregivers in an acute setting. Coordinators indicated that online case studies, examples of successful coordinators, education sessions at conferences are outlets to foster continuous coordinator learning and training.

**Conclusions:** NIMICT's qualitative research identified the need for coordinator engagement to better support participant recruitment and retention efforts in stroke clinical research. Currently, NIMICT is developing a dynamic toolkit and will synthesize, review and test strategies to improve overall, and specifically minority recruitment for stroke clinical trials.

## WSC-1329

### Public Awareness/Advocacy The relationship between meteorological conditions and ischemic stroke events treated with alteplase in Hiroshima, Japan

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**Introduction:** When we can predict a high-risk day of the ischemic stroke from the meteorological conditions, we will be able to prepare emergency therapy appropriately.

**Aims:** We tried to clarify the association between meteorological conditions and the frequency of the ischemic stroke.

**Methods:** We evaluated consecutive ischemic stroke patients (n = 299) treated with alteplase at 9 emergency hospitals in Hiroshima from September 2006 to August 2009. We trisected all the days within the period by mean daily temperature (low-temperature, <11.9°C; intermediate-temperature, 11.9–20.0°C; high-temperature, ≥20.1°C), mean daily atmospheric pressure (low-pressure, <1009.3 hPa; intermediate-pressure, 1009.3–1016.3 hPa; high-pressure, ≥1016.4 hPa), the changes of mean daily temperature (cooler, ≤0.40°C; unchanged, -0.40–0.52°C; warmer, ≥0.53°C) and the change of mean daily atmospheric pressure (decreased-pressure, ≤1.29 hPa; unchanged-pressure, -1.29–1.60 hPa; increased-pressure, ≥1.61 hPa) from a day before in 6 days prior to the onset day. The daily event rate of ischemic stroke was compared in each group using Poisson-regression-analysis.

**Results:** The frequency of the ischemic stroke was significantly higher in the day with low-temperature than with high-temperature (Risk Ratio [RR] 1.40; *P* = 0.022), while it was higher with high-pressure and intermediate-pressure than with low-pressure, but not significant. Similarly, it was significantly higher in the day with warmer than with unchanged (RR 1.45; *P* = 0.008), and higher with decreased-pressure than with unchanged-pressure (RR 1.50; *P* = 0.006). Additionally, it was significantly higher in the day with colder, and increased or decreased-pressure from 4 to 3 days before.

**Conclusions:** There was significant high risk for the ischemic stroke events treated with alteplase in the day with low-temperature, warmer and decreased-pressure from a day before.

## WSC-0328

### Public Awareness/Advocacy

#### Teaching materials of stroke enlightenment using an animated cartoon and a manga for school-based intervention in the world

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<sup>2</sup>Manga, Kyoto Seika University, Kyoto, Japan

**Background and purpose:** School-based intervention of stroke knowledge may not only promote primary prevention of stroke but also encourage hospital visit early after stroke onset. We could deliver stroke knowledge all over the world by using Manga, a part of the Japanese culture. The aim of this study is to develop education materials using Manga for the youth in the entire world.

**Methods:** We tried to produce 2 types of teaching materials, one was an elementary school type (10–12 y.o.) and the other a junior high-school type (13–15 y.o.). Each type of materials involved an animated cartoon and a Manga by using the “FAST” message derived from the Cincinnati prehospital stroke scale.

**Results:** In the junior high-school type, 3 stories were involved in a 10-minutes animated cartoon and a Manga. The first one was a case of acute ischemic stroke treated successfully with hyperacute thrombolytic therapy. The remaining 2 stories were cases of transient ischemic attack; a case of preventing stroke successfully with an appropriate action by his family, but the other case of suffering from a completed stroke caused by delay in hospital visit due to lack of stroke knowledge. In the elementary school type, stories were revised to ones understood more easily.

**Conclusions:** We could produce teaching materials of stroke knowledge for school-based interventions. We are going to verify whether our teaching materials would be beneficial for the youth in the whole world.

## WSC-1043

### Stroke Care Systems

#### Easing access to IV thrombolysis: The Telestroke Network of Catalunya

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**Background:** Telestroke eases access of stroke patients to IV thrombolysis in remote areas. In Catalunya (7.5 M inhabitants), a centralized Telestroke network covering the catchment areas of 10 community hospitals (1.3 M inhabitants) was rolled out in 2013.

**Aim:** To assess population-based thrombolysis rates and relevant performance measures pre/postimplementation of our Telestroke network.

**Methods:** We used prospectively collected registry data available for 2012 (pretelestroke) and 2013 (post-telestroke) concerning thrombolyses delivered among residents in the catchment areas formerly covered by PSCs and through telestroke (2013 on). We worked out pre/post-telestroke population-based thrombolysis rates as well as the following measures: onset-to-treatment and door-to-needle delays, proportion of patients developing symptomatic cerebral bleedings, proportion of patients achieving good outcome and case fatalities at 3 months.

**Results:** Population thrombolysis rates in the catchment areas of interest experienced a 2-point increase between 2012 (10.9\*100,000) and 2013 (13.1\*100,000). Such increase was due to a migration of thrombolyses from PSCs to community hospitals with telestroke. Median onset to thrombolysis time was 20 minutes shorter among patients treated at community hospitals despite longer door-to-needle times. Overall, clinical outcomes were in accordance to international standards: symptomatic cerebral bleedings: 1.2% (2012) and 7.7% (2013); good outcome: 51% (2012) and 40% (2013); mortality: 9.6% (2012) and 15% (2013). Outcomes differed between PSCs and community hospitals but differences were likely related to differences in baseline NIHSS scores.

**Conclusions:** One year after implementation, our telestroke network eases timely selection of acute ischemic stroke patients and effective delivery of IV thrombolysis.

## WSC-1295

### Stroke Care Systems

#### Stroke management in a fourth level hospital from a developing country

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**Introduction:** In 1996 the Clinica CARDIO VID (Former CARDIOVASCULAR) decided to open a Stroke Service with a stroke team: a

neurologist, a neuroradiologist and a neurosurgeon. This was the pioneer service in the area.

**Aims:** To share with the stroke community the development and achievements from 17 years of work.

**Methods:** We reviewed our presented papers in national/international meetings, our stroke data information and media information.

**Results:** (1) From 1998 to 2005 every September the "Stroke Month" was celebrated: educational activities in TV, radio and newspaper. Every weekend education and attention in stroke was done in medium size towns with no specialized health services. Since 2006 with the launch of the Stroke Day by WSO in partnership with Colombian Neurological Association (ACN) educational activities are done. (2) In 1997 we participated in the Colombian Stroke Guidelines development. (3) A SAH multidisciplinary management for surgical, neurointerventional or mixed was developed, today we are referral center. (4) In 2001 we participated in the creation of the Stroke Section of the ACN. 5- In 2002 the Colombian Consensus for Stroke Management was done and our service was invited to participate. (5) In 2007 we were invited to the Colombian Consensus on thrombolytic and reperfusion therapies and creation of the Colombian Thrombolytic Network, (6) We have presented our stroke experience management in several national and international meetings. (7) Today we are part of fellowship programs.

**Conclusions:** Despite the difficulties found in the developing world the group work without selfishness can produce benefit for patients and health systems.

## WSC-0231

### Stroke Care Systems

#### Cost-effectiveness analysis of tissue plasminogen activator for acute ischemic stroke in National Taiwan University Hospital Hsinchu Branch

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**Aims:** The aim of this study was to assess the efficacy and cost-effectiveness of intravenous tissue plasminogen activator for acute ischemic stroke in National Taiwan University Hospital Hsinchu branch.

**Methods:** The outcome of acute ischemic stroke patients treated with intravenous tissue plasminogen activator between 2006 and 2012 was compared to those admitted who were treated by conservative treatment. Primary outcome was functional independence at 3 months. Safety outcomes were symptomatic intracranial hemorrhage and in-hospital mortality. Health benefits were measured in quality-adjusted life-years (QALYs). The economic outcome was the difference in healthcare costs between the 2 treatment alternatives. The incremental cost-effectiveness ratio was calculated by dividing the cost difference by the difference in QALYs.

**Results:** A total of 54 thrombolysis and 54 nonthrombolysis patients were included. Thirty-three percent of the thrombolysis group achieved functional independence compared to 18.52% of nonthrombolysis group ( $P = 0.079$ ) without significant increase in-hospital mortality. Symptomatic intracranial hemorrhage increased in thrombolysis group. The administration of tPA compared with standard medical therapy, yielding an incremental cost-effectiveness ratio of NTD 19412.85 per QALY.

**Conclusions:** Intravenous tissue plasminogen activator for acute ischemic stroke seems efficacious and safe. Patients who received thrombolysis had better outcomes compared to nonthrombolysis cohort. Acute thrombolysis treatment might not be cost-saving in the short term compared with conservative treatment. In the long term, there are potentially large-scale health economic cost savings. Further cost-effectiveness research and the development of a public health strategy are warranted to optimize the use of rtPA in Taiwan.

## WSC-0977

### Stroke Care Systems

#### Dysphagia management poststroke: Three-year clinical findings

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**Introduction:** Dysphagia is a well-recognized complication of both acute ischemic and hemorrhagic stroke. Its prevalence varies depending on the method and timing of the evaluation, affecting between 37% and 78% of acute stroke patients. Poststroke dysphagia is associated with aspiration pneumonia, malnutrition, dehydration causing greater morbidity, mortality, and health-care costs, stroke patients should be taken into dysphagia screening immediately after admitted to hospital. Early detection of dysphagia in patients with stroke reduces not only these complications but also increases functional outcome and reduces length of stay.

**Aim:** To share the clinical management results from March 2010 and March 2014. Our clinical Dysphagia Protocol consisted of: bedside screening, VFMB and FEES. Management strategies included food/fluid alterations, swallowing techniques/exercises and neuromuscular electrical stimulation.

**Methods:** Patient descriptives (dysphagia symptoms, therapy techniques, food management) in three groups (acute, subacute and chronic CVA) were analyzed including dysphagia scores, and Barthell scores.

**Results:** Between March 2010 and March 2014, there were 1150 stroke patients ( $n = 306$ , acute:  $\leq 3$  mo poststroke;  $n = 480$ , chronic:  $>3$  mo poststroke, and  $n = 364$ , 2+ strokes last 10 years), age 19–92 years. Patient complaints were choking, inability to initiate swallow (especially with liquids), and coughing during and after swallows. After completion of 8 weeks of therapy, we discussed our results statistically, indicating patients dysphagia score (improved), amount of PO (increased), use of alternative means of nutrition. Functional disability reflected by Barthel score was significantly better after therapy.

## WSC-1154

### Stroke Care Systems

#### Comprehensive poststroke care and management: Decreasing risk factors, recurrence, and cost across the continuum of stroke care

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**Introduction:** As a leading cause of death worldwide and in the United States, stroke requires timely intervention at onset and innovative post-stroke care strategies to prevent recurrence. Poststroke recovery and recurrence prevention has become increasingly focused on the impact of family, caregivers, and the home environment.

**Aims:** Ochsner Neuroscience Institute (ONI) in New Orleans, Louisiana is testing a comprehensive stroke care initiative called Stroke Mobile that provides home-based care and education for 12 months postdischarge. Funded through a Centers for Medicare and Medicaid Services (CMS) Health Care Innovation Award (grant #1C1CMS331043; PI: Kenneth Gaines, MD), this program seeks to improve patient outcomes and care, decrease costs across the care continuum, and train a multidisciplinary team.

**Methods:** A Stroke Mobile Care Team, including a Registered Nurse and Lay Health Educator, visits patients at home once per month for 1 year in

two parishes in Louisiana to assess overall health, poststroke recovery management, existing comorbidities, and evaluation of risk behaviors. Comprehensive patient and caregiver/family education on stroke risk, poststroke recovery and recurrence, nutrition, exercise, tobacco and alcohol use/cessation, diabetes, hypertension, hyperlipidemia, heart disease, other comorbidities, caregiver support resources, and other materials are provided at each visit.

**Results/conclusions:** Over 200 patients have been enrolled in Stroke Mobile since February 2013; compared to historical controls, stroke recurrence rates have decreased by 11% and readmission rates have decreased by 15%. Patient and caregiver characteristics, staffing, education/training initiatives, and the impact of this program on stroke recurrence and cost of care will be described.

### WSC-0417

#### Stroke Care Systems

##### Impact of telestroke implementation in a Brazilian public hospital

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**Introduction:** In Brazil, cerebrovascular diseases were the main cause of death in 2013 – more than 100 thousand deaths. “Telemedicine for stroke” project was developed at the Hospital Alemão Oswaldo Cruz (HAOC) to give support to public hospitals in the qualified health care for all types of acute stroke. This project is part of the Program for the Institutional Development of the Brazilian Unified Public Health System (PROADI-SUS).

**Aim:** To present changes in quality and safety indicators for stroke care in a public hospital through Telestroke intervention.

**Methods:** HAOC (“Hub”) has begun Telemedicine consultations for acute stroke care, 24/7, in Hospital Municipal Pimentas Bonsucesso (“Spoke”) in December 2013. We have prospectively assessed quality and safety stroke indicators, in the period pretelestroke implementation (Sep–Nov, 2013) and post (Dec, 2013 to Mar, 2014).

**Results:** The comparison of pre (n = 38) and post (n = 23) telestroke consultations has shown an improvement in all stroke indicators, from emergency door to hospital discharge. The improvements observed included: decrease of 56% of time door-to-CT (from 27,7 to 12,2 minutes), increase of 150% in thrombolysis rates (from 40% to 100%), decrease of 47% of average length of stay (from 10,6 to 6 days), increase of 33% in prescription of secondary prevention (from 50% to 65%), and decrease of 94% in mortality due to all types of stroke (from 33% to 2,6%).

**Conclusion:** Telemedicine has rapidly changed the reality of the “Spoke” public Hospital, with the improvement of all stroke quality indicators.

### WSC-1345

#### Stroke Care Systems

##### Use of a stroke journey logbook to promote consumer involvement in care planning and rehabilitation

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**Introduction:** Detailed communication between stroke survivors, their families and health professionals is recommended, and identified as an area requiring improvement.

**Aims:** To develop and evaluate a Stroke Journey Logbook tool facilitating consumer involvement in planning of their care and rehabilitation.

**Methods:** The Logbook was created as a Clinical Practice Improvement project on goal setting. Feedback informed development of the present version comprising information about stroke and the stroke team, patient checklists, and sections for recording the stroke diagnosis, its impact, and rehabilitation goals. It includes visual aids, such as diagrams of parts of the brain. Trialing is underway at multiple Australasian sites. All stroke patients are eligible except patients receiving palliative care. If the patient is not able to utilize the tool, their family/carers are invited. A survey seeks general feedback and suggestions for further improvement.

**Results:** The trial has been accepted enthusiastically. Initial feedback suggests that uptake of the tool has been incomplete, requiring a single team member to be designated responsibility for distributing the Logbook. Perceived barriers include lack of staff time, and the large volume of information already provided. Some families have used the Logbook as a communication book. Suggestions include advice for communicating when dysphasia is present and on staying positive, family meeting prompts, and stories from stroke survivors.

**Conclusions:** Initial feedback suggests that the tool is regarded as valuable, but that revision of content will be necessary. It is hoped that with strong consumer involvement the resulting resource will be suitable to be shared widely.

### WSC-0497

#### Stroke Care Systems

##### Comprehensive stroke unit experience in a developing country

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**Background:** Despite evidence of Comprehensive Stroke Unit efficacy, most studies were carried out in developed countries, and data on Comprehensive Stroke Units care from developing world are scarce.

**Material and methods:** The first in the country Comprehensive Stroke Unit (CSU) with 15 beds was established at the Universal Clinic ‘Oberig’ in 2010. Both acute and subacute stroke patients were admitted. The patients were thoroughly investigated and serially evaluated with a battery of assessment scales, and the data were stored in a database. Based on the NIHSS the patients were classified by stroke severity. Activities of daily living and global stroke outcome was assessed using Barthel Index (BI) and modified Rankin Scale (mRS) respectively.

**Results:** In 2010 through 2013 we enrolled 361 patients, including 239 (66%) with acute stroke. Mean age 66 years, 159 males. Mean length of stay was 22 days. 197 were patients with acute ischemic stroke (22% mild, 56% moderate, 16% severe and 6% very severe) and 42 (18%) had ICH (10% mild, 38% moderate, 22% severe and 30% very severe). On admission 73% hemorrhagic stroke and 51%

ischemic stroke patients were fully dependent. Case fatality was 4%. 82% of patients were discharged home, and only 6% were readmitted at 1 year. At discharge 59% ischemic and 50% hemorrhagic stroke patients were fully independent. The rate of good, fair and poor outcome after ischemic and hemorrhagic stroke was 57%, 27% and 16% and 39%, 36% and 25% respectively.

**Discussion:** CSU has reproduced the main processes of care and outcomes observed in the Stroke Unit trials which proves that this model of stroke care is feasible and can be the core of stroke system in developing countries.

**WSC-0456****Stroke Care Systems****Stroke management: Informal caregivers' burdens and perception of effectiveness of physiotherapy for stroke survivors**C Gbiri<sup>1</sup>, C A Gbiri<sup>1</sup>, O A Olawale<sup>2</sup>, S O Isaac<sup>2</sup>, C A Gbiri<sup>2</sup><sup>1</sup>Psychiatry, University of Pretoria, Pretoria, South Africa<sup>2</sup>Physiotherapy, University of Lagos, Lagos, Nigeria

**Background and aims:** Stroke survivors live with varied degrees of disabilities and cares are provided largely by the informal caregivers. This study investigated informal caregivers' burden of caring for stroke patients and their perception of efficacy of physiotherapy for stroke patient.

**Method:** This study involved 157 (81 males and 76 females) informal caregivers of stroke survivors receiving care in all secondary and tertiary health institutions with physiotherapy services in Lagos State, Nigeria. Information was collected through self-administered questionnaire during clinic-hours. Data was analyzed using Spearman's Rank Correlation Coefficient ( $p \leq 0.05$ ).

**Result:** Participants' age was  $39.2 \pm 12.8$  years (range; 17–36 years). More (60.8%) participants reported moderate objective while 79.2% had mild subjective burdens. Closer intimacy, smaller number of caregivers, longer duration of stroke and more length of caregiving per day had positive significant correlations ( $p < 0.05$ ) with burdens of caregiving. Caregiving had significant influence ( $p < 0.05$ ) on social, emotional, health and financial status of the participants. Almost all (99.8%) participants had at least good perception of effectiveness of physiotherapy for stroke patients.

**Conclusion and recommendation:** Most informal caregivers of stroke survivors perceive burden due to care provision and the burdens increase with duration of stroke, intimacy, smaller number of caregivers and length of daily caregiving. Caring for stroke survivors poses significant social, emotional, health and financial constraints on the informal caregivers. Physiotherapy is perceived as been effective for stroke patients' functional recovery. Therefore, informal caregivers should be involved in the rehabilitation plan for stroke patients and their well-being should also be given adequate attention.

**WSC-0687****Stroke Care Systems****Accuracy of NIH stroke scale object identification in a non-American population**M. Burns<sup>1</sup>, K. Somers<sup>1</sup>, J. Harbison<sup>1</sup>, P. McElwaine<sup>1</sup><sup>1</sup>Department of Medical Gerontology, Trinity College Dublin, Dublin, Ireland

The NIH Stroke Scale was first developed in 1989 by US investigators as a means of standardizing and scoring clinical neurological examination in stroke patients in clinical studies. It has since been adopted internationally. The scale includes a test of identification of 6 objects ie a glove, chair, key, feather, cactuses and hammock as an assessment for nominative dysphasia. Our experience was that apparently normal patients in our population often struggled to identify some of these pictures.

**Methods:** We asked a population of 125 Irish subjects of varying ages with English as a first language and with no history of cognitive or language impairment to name each of the drawings as presented in the NIH Stroke scale. Responses were recorded.

**Results:** 125 subjects (59 women, mean age 55; 66 men, mean age 53,  $p = 0.5$ ) were interviewed. Proportion of correct identifications for each item were as follows; Chair: 124 subjects (99%), Key: 124 (99%), Glove: 118 (94%), Feather: 106 (85%), Cactuses: 104 (83%), Hammock 103 (82%). Older subjects ( $\geq 70$  years) were less likely to identify, feather (9/33 (27.3%) vs. 10/92 (10.9%)  $p = 0.02$ ), Cactuses (11/33 (33.3%) vs 10/92 (10.9%)  $p = 0.003$ ), Hammock (10/33 (30.3%) vs 12/92 (13.0%)

$p = 0.025$ ). Women were more likely to miss Feather (5/66 (7.6%) vs 14/59 (23.7%)  $p = 0.02$ ) and Cactuses (7/66 (10.6%) vs 14/59 (23.7%)  $p = 0.05$ ). **Conclusion:** Up to one third of older people in our sample were unable to name some items from the NIHSS. Internationally, it may be appropriate to identify alternative pictures familiar to local populations.

**WSC-0690****Stroke Care Systems****Can accuracy and consistency of object identification in the NIH stroke scale be improved?**K Somers<sup>1</sup>, M Burns<sup>1</sup>, J Harbison<sup>1</sup>, P McElwaine<sup>1</sup><sup>1</sup>Department of Medical Gerontology, Trinity College Dublin, Dublin, Ireland

A substantial proportion of our population are unable to identify some of the items from the object naming component of the NIH Stroke scale, particularly Hammock, Cactuses and Feather. We performed a study to determine if consistency of object naming could be improved by providing photographs of objects rather than drawings or if other objects with names of similar complexity would be more recognizable to our population.

**Methods:** Clear, copyright free, photographs of each item were shown to 125 cognitively intact, nondysphasic subjects after they viewed original line drawing. Subjects were asked which they found easier to interpret. Three further items, (Umbrella, Tractor and Elephant) were identified and drawings and photographs of these were also presented.

**Results:** Addition of photographs tended to improve recognition of items above drawings in identification of 'Glove' (124 vs 118 subjects  $p = 0.06$  Fishers Exact) and 'Feather' (116 vs 106,  $p = 0.07$  Chi square) but not 'Hammock' (104 vs 103, ns) or 'Cactuses' (108 vs 104) suggesting that subjects didn't know what cactuses or hammocks were. Of 1125 responses, subjects felt that the photo was easier to identify in 315 (28%) of cases drawing was easier in 37 (3%).

Recognition of drawings of three alternative objects, Tractor (98%), Umbrella (99%) and Elephant (99%) was superior to that of Feather (85%), Cactuses (83%) and Hammock (82%) (all  $p < 0.001$  Chi squared).

**Conclusion:** Subjects felt that substitution of photographs for drawings tended to make identification of objects easier. Object naming was more consistent when more familiar objects were substituted.

**WSC-0343****Stroke Care Systems****Clinical features of neuropsychological disorders among patients with acute cerebral stroke in the acute phase of acute coronary syndrome**G Izyumova<sup>1</sup>, D Izyumov<sup>2</sup><sup>1</sup>Neurology, Republican Scientific Centre of Emergency Medical Aid Khorezm Branch, Urgench, Uzbekistan<sup>2</sup>Neurology, Regional Multifield Medical Centre, Urgench, Uzbekistan

**Purpose:** To study the clinical features of neuropsychological disorders and factors affecting their development.

**Materials/methods:** Into study involved 38 patients with first cerebral stroke, 20 – with acute coronary syndrome, 37 (63.8%) men, 21 (36.2%) women. The mean age is  $57 \pm 4.3$  years. 5–7 days later, acute coronary syndrome arose in 3 cases after acute cerebral stroke.

Survey on Hamilton scale, hospital scale of anxiety and depression, the method of Luria (shortened and detailed versions) were methods of study.

**Results:** In the acute phase of disease were revealed psychopathological reactions to what is happening. Among patients with acute coronary syndrome in 9 cases prevailed somatic anxiety; in 4, guilt; and 7, depressive syndrome. During study of patients with stroke identified destructive

forms of emotional reactions – denial of what's happening in 13 cases; inadequate assessment of incident, 18 cases; anger to the world around, at 7. Hypochondriacal disorder occurred in 11 cases. Identified the cause of neuropsychological disorders: it was acute cerebral stroke leading to rapid disruption of interhemispheric relations. At multivariate analysis, in both groups the depressive disorders were associated with presence of acute emerged disease, they are related to the initial severity of neurological deficit. In 21 cases neuropsychological disorders emerged in acute period, in 17 – at early recovery phase of stroke.

**Conclusion:** The study results have not only practical importance for the diagnosis, management and control of medical and rehabilitation activities, but also expand fundamental knowledge of mechanisms/principles of interaction CNS structures in pathological conditions.

### WSC-0544

#### Stroke Care Systems

##### A comparison of the volume and timing of acute cardiac arrest and acute stroke alerts in an inner city university teaching hospital

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**Introduction:** Acute cardiac arrest alerts have been directed towards on-call nonconsultant hospital doctors (NCHDs) via a hospital switchboard-mediated paging system in our hospital for several years. Since the introduction of an acute stroke service, acute stroke alerts are also directed to NCHDs during on-call hours, and to NCHDs working on the stroke service during regular working hours.

**Aims:** To compare the volume of acute cardiac arrest and acute stroke alerts during regular and on-call working hours, and to hence assess the impact of these calls on on-call services within the hospital.

**Methods:** All acute cardiac arrest and stroke alerts received by the hospital switchboard during a 30-month period were recorded and divided into those occurring during regular and on-call working hours. The proportions and timing of alerts were analyzed using 95% confidence intervals (CI). Seasonal variation was analyzed using the Ratchet circular scan test.

**Results:** The majority of the 891 alerts recorded over the study period were for stroke (n = 544, 61%, CI 57–64%). Stroke alerts were significantly more common during both regular (66%, CI 61–70%) and on-call (56%, CI 52–61%) hours. There was a significant seasonal peak in stroke alerts from October to December (p < 0.01).

**Conclusions:** Acute stroke calls are significantly more common than acute cardiac arrest calls in our hospital. This therefore represents an important consideration in both the provision of adequate training in stroke medicine for on-call NCHDs, and in the implementation and planning of on-call services within the hospital.

### WSC-1451

#### Stroke Care Systems

##### A new support system using mobile device as a telemedicine for acute stroke in Japanese depopulated area

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**Introduction:** The social problem in Japan is the difference of medical quality between the urban and depopulated area. The telemedicine using mobile device between general physicians and stroke specialist with the increasing demand for rapid and correct diagnosis for the treatment of acute stroke became important.

**Aims:** We developed a telemedicine system for rapidly exchanging diagnostic images and clinical information in depopulated area to develop the standard thrombolytic therapy using alteplase for acute ischemic stroke.

**Methods:** A system was consisted of communicating patient data, imaging between the hospital system and participating staff members in and out of the hospital using a mobile devices. The system can transfer clinical data and large volume of CT and MRI, and expert opinion in real time. We developed the system (k-support) as a telemedicine in Kaifu area, which is typical depopulated area in Tokushima Prefecture, Japan from February 2013.

**Results:** K-support system was managed in 137 emergency patients during 1 year, 92 patients (67%) were classified as neurological disease, 42 (46%) in acute stroke. The detail of stroke was ischemia 46%, hemorrhage 12%. Four ischemic stroke patients were treated with intravenous thrombolysis therapy of alteplase using the k-support system and “drip-and-ship” paradigm. One patient using alteplase showed complete recanalization of middle cerebral artery.

**Conclusions:** The telemedicine system using mobile device as “k-support” system can use in anytime, anywhere and anyone. This system can communicate with the doctors between general physicians in depopulated area and specialists in urban area.

### WSC-0446

#### Stroke Care Systems

##### Real time blood pressure volatility embedded prediction model of early neurologic deterioration in acute ischemic stroke

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**Introduction:** Blood pressure (BP) affects the occurrence of early neurologic deterioration (END) and reflects the change of patient's condition.

**Aim:** We aimed to develop the real time BP embedded END prediction model.

**Methods:** Using prospective stroke registry, we identified consecutive ischemic stroke patients who admitted within 48 hours of symptom onset. Of them, stroke information and all BP data during hospitalization were

collected. Prediction model was set up for predicting the patient's risk at each BP measurement time with real time BP of irregular interval and predetermined patient's factors. A discriminative ability was calculated by receiver operating characteristic (ROC) curve, then decided the cut off value of high probability of END. When we defined alarm criteria as proportion of high probability of END at each time is more than 50% during prior 24 hours of END, its predictive values were analyzed.

**Result:** Of 1805 subjects, 18.3% experienced END. Prediction model was set up for age, sex, stroke history, time to arrival, baseline NIHSS score, initial glucose level, atrial fibrillation, leukocyte count, stroke subtypes, recanalization therapy, and the location of symptomatic vessel, mean of systolic BP and standard deviation of diastolic BP with consideration of irregular measurement interval. The area under curve of model was 0.71 and high probability of END at each measurement was set as >0.01 (sensitivity = 50% and specificity = 81%). Under criteria, about 70% of patients got alarms before 24 hours of END.

**Conclusion:** This realtime prediction model would predict and give warning of END.

### WSC-0867

#### Stroke Care Systems

#### The dissemination and conditions for endovascular treatments in acute ischemic stroke in Europe

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**Background:** Endovascular approaches are new emerging methods in the management of acute stroke. The aim of this study is to establish the organization of endovascular treatments for stroke in European countries. **Material and methods:** A structured questionnaire regarding stroke unit (SU) organization and usage of endovascular treatments for acute stroke in the years 2009–2011 was acquired from representatives of the European countries, mostly being members of the EFNS Stroke Scientist Panel or local opinion leaders.

**Results:** Data from 20/48 (42%) European countries was received. The number of comprehensive SU overall was 181 (mostly – 100 in Germany). Intraarterial thrombolysis was reimbursed in 14/20 and mechanical thrombectomy in 12/20 countries. 6301 procedures were performed (mostly in Germany – 4428 and none in Iceland and Cyprus). An estimate of 0.2% of stroke patients were treated and (highest in Slovenia – 0.92%). 90% of the procedures were done by neuroradiologists and only 1.4% by neurologists.

**Conclusions:** There is a lot of diversity in the use of endovascular procedures for acute stroke within Europe. The method is underused, but lack of evidence does not support the notion for widespread use. Neurologists involvement is insufficient, but current UEMS (European Union of Medical Specialists) guidelines support the training of neurologists in interventional neuroradiology.

### WSC-0633

#### Stroke Care Systems

#### A case of dress syndrome related with use of phenytoin

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**Introduction:** DRESS (drug reaction characterized with eosinophilia and systemic symptoms) syndrome is an acute hypersensitivity syndrome

related with medication which has an incidence of 1/1000–1/10000. The clinical picture is characterized with fever, cutaneous eruption, lymphadenopathy, internal organ involvement and hematological disorders which occur 1–8 weeks after intake of medication.

**Case:** A 72-year old male patient presented to emergency department with extensive maculopapular eruption and increased temperature (>38 °C). He had no chronic disease except for a history of cerebrovascular disease. It was learned that the patient had been using phenytoin because of epilepsy following stroke. He had no history of intake of another medication or food. His neurological examination was found to be normal except for left-sided central facial paralysis and left-sided hemiplegia sequela. Laboratory tests were as follows: CRP: 53,9 mg/L (0.0–5.0), eosinophil count: 7,7 K/μL (0.0–7.0), eosinophil percentage: 0.9 K/μL (0.0–0.7), WBC: 11.5 K/μL (4.6–10.2). Urinalysis revealed abundant bacteria and 50 leukocytes. DRESS syndrome was considered because of increased temperature, presence of eosinophilia, presence of urinary tract infection and the fact that phenytoin had been started 1 week ago. Phenytoin was tapered and valproic acid was started as anti-epileptic treatment. On the second day of discontinuation of phenytoin, the eruptions on the whole body regressed fully.

**Discussion:** Early diagnosis of DRESS syndrome is very important, since it has a mortality risk of 10–20%. Here, this rare side effect was emphasized in a patient who developed DRESS syndrome during use of phenytoin and whose findings regressed with change of treatment regime.

### WSC-1528

#### Stroke Care Systems

#### Stroke unit services across 32 countries: A survey of participants in the interstroke study

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**Introduction:** Stroke is a global healthcare problem. Most people experiencing stroke now live in lower income countries and this pattern is expected to increase. While many recent stroke service developments have taken place in high income countries, little is known about the international picture.

**Aims:** We studied stroke services across 32 countries among hospitals contributing to the INTERSTROKE multicenter study of risk factors for stroke.

**Methods:** In 2011 we developed, piloted and circulated a stroke service questionnaire which surveyed national and local healthcare systems, hospital and stroke service characteristics.

**Results:** Of 174 sites that had recruited participants to INTERSTROKE, 107 could provide data and 56 (52%) reported having a stroke unit. Stroke units were more commonly present ( $P < 0.001$ ) in high income countries and were usually described (by >85%) as being in a discrete ward, staffed by a specialist multidisciplinary team, with programs of education and protocols to guide patient management. They had a median number of 14 beds serving a median of 40 stroke patients admitted to hospital per month. Only 47 (44%) reported being able to routinely accommodate the majority of stroke patients. The proportion of units achieving guideline levels for staffing were 30 (57%) for medical, 18 (33%) for nursing and 41 (76%) for physiotherapy. Following management in hospital 50/107 (47%) hospitals reported no continuing specialist rehabilitation.

*Conclusions:* Access to stroke unit care and subsequent rehabilitation varies between contributing hospitals. Even when available, stroke units were often short of bed capacity or staff numbers.

### WSC-1530

#### Stroke Care Systems

#### Designated stroke coordinator for "code-stroke" significantly shortens response time for intravenous thrombolysis in hyperacute stroke patients in Hong Kong

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*Introduction:* The 'code-stroke' system was introduced in a Hong Kong regional hospital since October 2012, which is a stroke-coordinator-led protocol for hyperacute stroke patients presenting to the triage station less than 3.5 hours from symptom onset. This system aims to minimize in-hospital delays for intravenous (IV) thrombolysis, which may impact patient outcome.

*Aims:* This study evaluates the impact of the 'code-stroke' system on IV thrombolysis in hyperacute stroke patients.

*Methods:* All hyperacute stroke patients admitted via the emergency department who received IV thrombolysis between January 2010 and December 2013 were recruited. Those admitted after the 'code-stroke' system was implemented were categorized into the treatment group, while those before the protocol served as the control group. Comparison by statistical analysis was performed on their baseline demographics, door-computed-tomography-(CT)-time, door-stroke-team-assessment-time, door-needle-time, onset-needle-time, complication rate, mortality, change in National Institutes of Health Stroke Scale (NIHSS), and 3-month modified Rankin scale (mRS).

*Results:* Thirty-eight patients received IV thrombolysis with the 'code-stroke' system, and 40 were in the control group. There was significant improvement in mean door-CT-time from  $35.1 \pm 16.7$  to  $17.0 \pm 9.3$  min ( $p < 0.001$ ); door-needle-time from  $100.2 \pm 32.7$  to  $76.0 \pm 31.2$  min ( $p = 0.001$ ); and onset-needle-time from  $170.6 \pm 49.6$  to  $141.9 \pm 47.6$  min ( $p = 0.01$ ). Mean NIHSS-on-discharge improved from 14 to 8.6 ( $p = 0.03$ ), and NIHSS improvement after thrombolysis increased from 3 to 9 ( $p = 0.001$ ). There was no significant change in 3-month-mRS, mortality, rate of hemorrhagic transformation, and symptomatic bleeding.

*Conclusion:* A designated stroke-coordinator-led protocol for thrombolysis significantly shortens in-hospital delays and effectively improves stroke severity.

### WSC-1496

#### Stroke Care Systems

#### Factors impacting for discharge to home in patients with cerebral hemorrhage in a convalescent rehabilitation ward

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*Purpose:* A convalescent rehabilitation ward is a special ward to support early discharge to home with intensive rehabilitation. To support discharge to home, it's necessary to make distinct discharge planning based on prognostic prediction for a convalescent rehabilitation ward. This study was the important factor for returning home in convalescent rehabilitation ward and what is the indication of the ward in patients with cerebral hemorrhage.

*Methods:* A total of 102 patients with cerebral hemorrhage (47 putamen, 24 thalamus, 11 cerebellum, 2 pons, 18 subcortex) were included in this study. Their ages varied from 13 to 89 years old. Mean duration from stroke onset to our hospital was  $29.2 \pm 11.6$  days, and mean length of stay was  $62.5 \pm 33.0$  days. Subjects were divided into home discharge group and hospital/nursing home transfer group. We compared in age, hematoma volume, neurological findings, ADL evaluated by functional independence measure (FIM), and number of family members living together.

*Results:* Eighty-four patients were discharged to home and eighteen patients were discharged to hospital/nursing home. Patients who had high ADL score (motor FIM > 70 and cognitive FIM > 24) could return home even if they were living alone before stroke.

*Conclusion:* Although the major factor that determines the propriety of house leaving hospital is ADL at the time of leaving hospital, when it is the solitude before the illness, it is important for it that the both sides of a physical action and a cognitive function are maintained. Similarly, family members were one of the important factors in the point of understanding and participation for goal setting.

### WSC-1036

#### Stroke Care Systems

#### Prognosis of eating and swallowing disturbance caused by putaminal hemorrhage in a convalescent rehabilitation ward

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A high percentage of dysphagia is seen during the acute phase of cerebral hemorrhage, but there are only rare reports of dysphagia focused on cerebral hemorrhage after acute phase. We focused on putaminal hemorrhage in a convalescent rehabilitation ward and examined the relationship between the prognosis of dysphagia and acute information such as hematoma volume. There were 76 subjects included out of 166 patients with cerebral hemorrhage that visited our rehabilitation hospital. Patients were excluded if they had a history of dementia, stroke, confusion, epileptic seizure, or tracheotomy. The relationship between intake condition at the time of hospital admission and discharge, type of hematoma, and hematoma volume were examined. Dysphagia was found in 51% of the subjects with putaminal hemorrhage. Existence of a swallowing disorder was related to hematoma type and hematoma volume. A general diet was possible in 77.8% of subjects. Hematoma type and volume related to a subject's ability to have a general diet at the time of hospital admission but didn't relate at the time of hospital discharge. Age and cognitive function related to a subject's ability to have a general diet at the time of hospital discharge.

### WSC-0549

#### Stroke Care Systems

#### The first stroke unit in UAE: 6 years of experience

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*Introduction:* Organized stroke inpatient care in a multidisciplinary setting, (stroke unit), has a positive impact on reduction of mortality and dependency and improve outcome of stroke patients. Al Ain is the second largest city in the Emirate of Abu Dhabi, with a population of 568,229. Al Ain Hospital has the first and only stroke unit in Al Ain and in the emirate of Abu Dhabi since 2007.

*Aims:* We aim to elaborate our experience so other centers can take head start from us for opening further stroke facilities in the region.

*Methods:* We looked at the Stroke Unit database over the last 6 years and observed patient characteristics, stroke subtypes, risk factors and outcomes.

**Results:** We admitted 1770 patients, of various ethnic origins until end of October 2013. There were 25% Emirati/Omani, 24% Arabs, 49% of Asian origin, and other nationalities 2% patients. 76% were male, 41% were <50 years old. Ischemic stroke patients was the most common type seen; 61%, followed by 15% of hemorrhagic stroke and transient ischemic attacks accounted for 12% patients. Stroke mimics were 12%). 74.9% were discharged with modified Rankin Scale (mRS) of  $\leq 2$ , mortality was 3.8%. 58% were hypertensive, 39% diabetes mellitus, 19% smoking, 22% hyperlipidemia and 17% with cardiac diseases.

**Conclusion:** Stroke unit is essential for every hospital in this region and a dedicated team should look after these patients to improve morbidity and mortality. Hypertension was the most common risk factor. Patient outcome was excellent. Intravenous thrombolytic therapy was successfully implemented.

### WSC-1093

#### Stroke Care Systems

#### Telestroke units serving as a model of stroke care in rural areas: 10 years experience of the Telemedical Project For Integrative Stroke Care (TEMPIS) network

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**Background:** Stroke Unit care improves stroke prognosis and is recommended for all stroke patients, therefore. In rural areas, population-covering implementation of Stroke Units is challenging. TEMPIS was established in 2003 as a TeleStroke Unit network in order to overcome this barrier in Southeast Bavaria/Germany. Evaluations during the implementation phase had revealed improved process quality and clinical outcomes compared to matched hospitals without TeleStroke Units.

**Aims:** To analyze sustainability of network effects evaluated during implementation phase.

**Methods:** Effects on the stroke system of care are analyzed by using data from official hospital reports. Prospective registry data from 2003 to 2012 describe processes and outcomes of consecutive stroke and TIA patients treated in TEMPIS spoke hospitals. Quality indicators are given for diagnostics, treatment and prophylactic therapy. Rate and timelines of intravenous thrombolysis as well as data on teleconsultations are reported over time.

**Results:** Within the covered area, network implementation increased the number of stroke and TIA patients treated in hospitals with (Tele-)Stroke Units substantially from 19% to 78%. Between February 2003 and December 2012, 54,804 strokes and TIAs were treated in initially 12, recently 15 regional hospitals and 31,864 teleconsultations were performed. Intravenous thrombolysis was applied 3,331 times with yearly rates increasing from 2.6% to 15.5% of all ischemic strokes. Median onset-to-treatment times decreased from 150 (IQR 127–163) to 120 minutes (IQR 90–160) and door-to-needle times from 80 (IQR 68–101) to 40 minutes (IQR 29–59).

**Conclusion:** TeleStroke Units offer a way to provide high quality stroke care in rural areas.

### WSC-1035

#### Stroke Care Systems

#### Prognosis of activity of daily living after putaminal hemorrhage in postacute rehabilitation hospital

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**Introduction:** Predicting levels of activity of daily living (ADL) from after putaminal hemorrhage is important for rehabilitation and acute treatment as well. However, how the type of hematoma effect ADL during postacute rehabilitation hospital is still unclear.

**Aims:** The aim of this study was to examine the relationships between the type of hematoma and levels of ADL in putaminal hemorrhage patients who received rehabilitation in a postacute rehabilitation hospital.

**Methods:** Subjects were 75 patients (28 females and 47 males, Mean age  $62.8 \pm 11.3$  years, Mean time from onset to admission  $32.5 \pm 18.2$  days, Mean length of stay  $70.4 \pm 34.5$  days). Patients were classified using CT classification. We measured Functional Independence Measure (FIM) for ADL on admission and at discharge. FIM gain and FIM efficiency were also measured.

**Results:** FIM score was highest for type I, second highest for type II, third highest for type III, fourth highest for type IV and lowest for type V at admission and at discharge. FIM gain was highest for type III, second highest for type II, third highest for type IV, fourth highest for type I and lowest for type V. FIM efficiency was higher for type I, II and III.

**Conclusions:** We found that the type of hematoma at onset effect prognosis of ADL in putaminal hemorrhage patients.

### WSC-1504

#### Stroke Care Systems

#### Acute hematoma information and dysphagia after thalamic hemorrhage in postacute rehabilitation hospital

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**Introduction:** Dysphagia is one of the common symptom after stroke. A study reported dysphagia after thalamic hemorrhage in acute hospital and concluded that dysphagia is associated poor prognosis for early hospital discharge. However, how the type and amount of hematoma effect the prognosis of dysphagia in postacute rehabilitation hospital is still unclear.

**Aims:** The aim of this study was to examine relationships between the type and amount of hematoma and dysphagia in thalamic hemorrhage patients who received rehabilitation in a postacute rehabilitation hospital.

**Methods:** Subjects were 44 patients (18 females and 26 males, Mean age  $67.0 \pm 9.7$  years, Mean time from onset to admission  $28.1 \pm 15.3$  days, Mean length of stay  $64.0 \pm 28.7$  days). Patients were classified using CT classification (Type I: hematoma located in thalamus, Type II: extending into internal capsule, Type III: extending into midbrain) and amount of hematoma at onset was also measured. We investigated the type of diet (regular diet, dysphagia diet or enteral feeding) for levels of dysphagia on admission and at discharge.

**Results:** Ratio of patients who ate normal diet was 50% on admission and 75% on discharge. Among type of hematoma, type III was higher ratio of enteral feeding compared to type I and type II. Between amount of hematoma and type of diet, enteral feeding patients had larger hematoma compared to normal diet and dysphagia diet patients on admission and discharge.

*Conclusions:* Information of type and amount of hematoma at onset can be one of good indicator for prognosis of dysphagia in thalamic hemorrhage patients.

### WSC-1477

#### Stroke Care Systems

#### Games applied for therapy in stroke tele-rehabilitation

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Virtual Reality (VR) based computer games have been recognized as a motivational tool in stroke rehabilitation in the last decade. The traditional rehabilitation exercises for repetitive movements are boring; moreover, the therapist's supervision is required. The VR based games are more and more popular, using different new input devices like 3D cameras, Wii remote controller and balance desk, Kinect or other Sensors. In spite of the fact that these devices are developed rapidly, the number of adequate games for stroke rehabilitation in telemedicine systems are moderate. Patients with disabilities enjoy playing with video games and play video games often (Flynn *et al.*).

We present the most popular VR games and analyze their advantages and disadvantages.

The number of repetitions and accelerometers activity counts of movements of the weak upper extremity of individuals with chronic stroke while playing video games to participants in traditional therapy was compared at the Tel Aviv University (Rand *et al.*). They found that video-games facilitate multiple repetitions of fast purposeful movements.

Cognitive activities, through web-based games that attempt brain functions often disrupted by stroke, have become more accessible for home users (Connor *et al.*). Unfortunately, there are barriers to training including physical and cognitive limitations, as well as time and fatigue management.

We present the games developed under the umbrella of StrokeBack project too.

The main design principle was playability, usability, holding the patients' attention. The patients enjoy the challenges and they need the feedback.

#### References

Connor *et al.*: [http://www.icdvrat.reading.ac.uk/2012/papers/ICDVRAT\\_2012\\_S02N3\\_Connor\\_Standen.pdf](http://www.icdvrat.reading.ac.uk/2012/papers/ICDVRAT_2012_S02N3_Connor_Standen.pdf)

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### WSC-1198

#### Stroke Care Systems

#### The development and validation of Australian aphasia rehabilitation best practice statements

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*Background/objectives:* Clinicians need to make daily decisions about how to manage their clients with aphasia. However, there is a lack of high-

quality, detailed recommendations for aphasia rehabilitation (Rhodes *et al.* 2012). The NHMRC CCRE in Aphasia Rehabilitation aimed to address this issue with the development and validation of best practice statements for use in poststroke aphasia rehabilitation.

*Method:* The RAND/UCLA Appropriateness Method (RAM) was used to combine best available scientific evidence from a literature review and synthesis with the collective judgment of a national panel of aphasia experts. Nine panel members represented the geographical diversity of speech pathologists and clinical and research expertise across the continuum of aphasia rehabilitation. All panelists rated the best practice statements in two rounds via email and then in a face to face meeting. Each statement was rated on a scale of 1–9, with 9 being the most appropriate. Statements that achieved a high level of agreement and an overall median score of 7–9 were rated as 'appropriate'.

*Results:* Seventy four best practice statements were rated across eight areas of care (e.g., receiving the right referrals, providing intervention). At the end of round 1, 71 of the 74 statements were rated as appropriate, no statements were rated as inappropriate and three statements were rated as uncertain. All 74 statements were then rated again in the second, face to face round. Thirteen statements were added through splitting existing items or adding new statements. Seven statements were deleted leaving 80 statements. Agreement was reached for 79 of the final 80 statements.

*Conclusions:* The development of national evidence-based and expert-endorsed best practice statements for aphasia rehabilitation is an important and significant step towards improving the quality and consistency of rehabilitation care for people with aphasia.

### WSC-1347

#### Stroke Support Organization

#### Growing the services and programs of the Singapore National Stroke Association (SNSA)

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The SNSA was registered in 1996 and is only national stroke support group in Singapore. Our main mission is supporting stroke survivors and their caregivers. As SNSA strives to expand our outreach, we are committed to growing these support services.

Stroke Clubs provide a platform to gather information on various aspects of stroke through talks, as well as opportunities to share and provide peer-support. We recently organized social integration activities with visits to various places of interest with provision of transport and mobility assistance. New initiatives lined up including music therapy sessions and an in-depth self-management program. Our befriending program, in which our volunteers meet with recent stroke patients at acute and rehabilitation hospitals to provide a listening ear, support and encouragement, has expanded to support an additional hospital and we are working to support even more. We are revamping our website to be a one-stop resource of information and links for stroke survivors and their families in Singapore.

Funding is often a key issue in expansion of services. In this past year, we have worked towards overcoming this by achieving status for tax-exempt donations, being awarded dollar-to-dollar matching for donations from our government, securing a grant and kind donations, as well as holding our inaugural charity gala in 2013.

Another key issue in maintaining and growing support services is volunteer management and manpower. Volunteer recruitment, retention and appreciation are priorities for the SNSA. In addition, we have hired additional paid staff to provide ongoing organization administration and communications liaison.

**WSC-1456****Stroke Support Organization****Stroke self-care management workshop – Pilot project of the Singapore National Stroke Association (SNSA)**

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Self-care management was identified as an area of need among stroke survivors based on feedback from SNSA's stroke club sessions. In response, SNSA has planned a 2-day skill-based workshop to train and equip the local healthcare providers to implement and run self-management courses for stroke survivors using a proven model of approach. The long term aim is to establish a stroke self-care management network at national level.

This workshop is being led by healthcare providers from the Hong Kong Society for Rehabilitation (HKSR), who have developed and run such programs for over 10 years with proven effectiveness from evidence-based research and feedback. It is in collaboration with various hospitals, the Agency for Integrated Care and the Society for the Physically Disabled. SNSA is grateful for the funding support from a national grant as well as a kind donation from the JC Trust Foundation.

The care model being adopted is modified from the Stanford Model on Chronic Disease Self-Management. A group approach will be adopted in order to leverage on group support, to establish social support networks and to save costs. There will be step-by-step training how to organize poststroke self-care which includes stroke literacy, emotional management, knowledge of social and community resources, self-evaluation as well as tracking self-care management and progress. The participants will visit the relevant supporting agencies to understand stroke rehabilitation and poststroke activities and services in Singapore. There will be roundtable discussions to learn about the challenges and to seek advice from the HKSR experts.

**WSC-1620****Stroke Support Organization****Influencing advancements in stroke systems and survivor outcomes by a health charity in a federal context**

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*Introduction:* The Heart and Stroke Foundation (the Foundation) is one of Canada's largest and most effective health charities. Over the last 60 years it has invested more than CDN\$1.35 billion in heart and stroke research, making it the largest contributor in Canada after the federal government. In that time, the death rate from heart disease and stroke has declined by more than 75 per cent.

*Aims/methods:* The Canadian Stroke Strategy was a partnership between the Foundation and the Canadian Stroke Network. The Strategy was a catalyst for transforming stroke services across the country by supporting provincial efforts to improve prevention, care delivery and rehabilitation services.

*Results:* Between 2009 and 2013, a subset of 303 surveyed hospitals demonstrated improvements in stroke services: 51 more hospitals were designated as stroke centers; 31 more have designated stroke units; 12 more have tPA capability; and 48 more have telestroke capacity. Other data sources suggest more than 80 per cent of Canadians who have a stroke and make it to hospital now survive.

*Conclusions:* There is much yet to be done. Future priorities of the Foundation will focus on two major areas: facilitating effective, integrated,

healthcare systems based on best practices to improve stroke response and treatment; and informing and educating Canadians to take action for optimal stroke health outcomes.

The presentation demonstrates barriers and key enabling factors to influence stroke system advances. Particular emphasis is on the roles of a national health-based charity. Key system-level indicators to assess and drive performance are also highlighted.

**WSC-1632****Stroke Support Organization****What "new" can do – Serbian stroke association**

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In Budapest in 2011, on the SAFE annual meeting, we got our first knowledge of founding organizations against stroke and we got some ideas to start the fight. Then, we came home and started to work. We had different problems (some of the problems we expected, some of them we didn't expect, but there were some we could never dream of. . .): Organizational, legal, financial, human resources. . .

We spent many hours working and thinking, using our knowledge from Budapest, using the Internet to find the answers to our questions, consulting with lawyers, etc.

On 2 August 2012 we officially started our mission.

Through the interaction with many different people (friends, patients, our families. . .), we had realized we are the ones who have to take and call for action.

We made website, Facebook page and we issued our first leaflet with an acronym HITNO- URGENT (it is something like FAST in Serbian language). In a year the leaflet became synonym for story about stroke in Serbia. It is used at lectures, meetings, conferences. . .

At the same time "Toolkit" was issued. Having read it, we realized its practical usefulness. We realized that all our problems and solutions are there. It was like a students' book for us. Also, we realized there are no expected and unexpected problems.

We found some volunteers, some money and a lot of energy and we started with actions.

**WSC-1634****Stroke Support Organization****Making the most of our collective knowledge to improve stroke prevention, survival and recovery: Developing a stroke association "knowledge ecosystem"**

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*Message summary:* Knowledge and information is at the heart of what we do, with the Research & Information Directorate aspiring to be the knowledge hub of our organization. We aim to provide people affected by stroke with high quality information that is driven by and responsive to their needs, and at the same time ensure our people have access to the information, data and knowledge they need to do their job effectively.

*What research, collection of facts or evaluation was done to inform the poster?*

An internal Stroke Association information audit from 2011 and a review of the structure and activities of the Research & Information Directorate in 2012.

*What were the results of the research, investigation or evaluation?* The information audit demonstrated a huge appetite for more internal information and new knowledge management (KM) processes to bring about improvement in sharing and collaborating. The review of the Research &

Information Directorate identified a number of required changes, including the creation of a new Knowledge & Information (K&I) team to take forward key aspects of directorate business and start embedding knowledge management within the organization.

*Discussion of findings in terms of implications for stroke support organizations:* The poster will demonstrate on-going innovations that the Stroke Association are developing to help achieve its KM goals in support of stroke survivors and the wider organization, and how they will contribute to a collective organizational “knowledge ecosystem”.

This will include work on our core health information (accredited by the Information Standard, a UK certification program to quality assure health information) and consolidated stroke statistics; the proposed Create Once, Publish Everywhere (COPE) approach to health information creation and its place in a wider organizational content strategy; the development of KM tools and techniques to investigate stroke-related topics with internal expert groups; the introduction of a corporate “Knowledge Centre” to present topic-related intelligence from within and beyond the charity; and the proposed use of this and other existing technologies to allow internal experts to discover, discuss and develop our organizational stroke knowledge, and to then reuse our core assets in areas such as internal training, publications and campaigning activity like Action on Stroke Month (see infographic for use of our statistics by the Metro).

These innovations will be framed by our proposed KM schema: the Data > Knowledge > Information “pipeline,” supporter by the model behaviors of Seek > Sense > Share.

Stroke Association (UK) – after Harold Jarcho’s Seek > Sense > Share framework

### WSC-1635

#### Stroke Support Organization

#### Living a life after stroke with peer support

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Peer support is an integral part of stroke recovery for stroke survivors and carers of all ages. With the right infrastructure and resources, peer support can be incredibly impactful on an individual’s self-management and well-being poststroke.

Recent national Stroke Association surveys (including the Needs Survey and Feeling Overwhelmed – the emotional impact of stroke) both highlight the often unmet need of emotional and psychological support during their recovery.

Providing an environment for peer support is one way stroke support organizations can try to meet this need. The importance of mutual peer support and encouragement to support individual’s recovery and well-being is integral. Where better to get this than from an inclusive environment of peers who empathize and encourage those who feel very isolated or alone poststroke.

We can share expertise of how to set up a voluntary led group/network including creating role descriptions for volunteer recruitment, setting up a committee, creating governing documents, face to face and online training modules, as well as how to set up financial systems and processes to ensure sustainability. Physical resources and templates can also be made available.

This voluntary led social peer support can enable stroke support organizations to develop a sustainable local footprint and expand their reach in supporting more stroke survivors and carers.

### WSC-1630

#### Stroke Support Organization

#### History of Slovenian stroke support organization

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Slovenian Stroke Support Organisation (SSO) has been established in 1996 and registered as a charity with 20 members in 1997. It derived from the idea of few stroke survivors at the time they were ending their stroke rehabilitation program. They were asking themselves »What will happen now? This idea was assisted by retired stroke physicians.

Aims of SSO have been based on Helsingborg Declaration. Funding for daily operations has been obtained mainly from national lottery (80%). From initial three stroke clubs there is now 19 clubs covering all main Slovenian regions and 2500 members. Main activities of SSO are carried out via stroke clubs on monthly basis by following means: education (workshops, lectures), creative workshops, ongoing physiotherapy, socialization, sports activities, and self-help groups. SSO additionally organizes transport for stroke survivors to relevant events, 14-day rehabilitation program in Spa’s, organizes »stroke awareness« events, national gathering of Slovenian stroke survivors, is responsible for media contacts and publishing relevant information material. SSO is one of founding members’ of Stroke Alliance of Europe, launched in 2004.

### WSC-0174

#### Stroke Support Organization

#### Fight stroke – A grass roots campaign to give stroke a voice in Australia

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<sup>1</sup>National Stroke Foundation, Melbourne, Australia

The ‘fight stroke campaign’ was developed to improve the profile of stroke and to encourage Australians to speak out to improve the outcomes for stroke survivors.

A project team was convened to develop the campaign using a Theory of Change methodology.

The campaign aimed to increase: 1. government funding for stroke 2. recognition of stroke as a significant health issue by government and the general public 3. the engagement of individuals and organizations in stroke advocacy

To achieve this we made stroke a problem and then provided solutions. We had to make stroke matter to all Australians so they’d complain to government directly and via the media and, we had to teach them to do this in an effective and organized manner.

The team then set about developing a: 1. campaign to raise the awareness of stroke 2. case for support – updated data on the burden of stroke in Australia 3. Call to Action document outlining what would make a difference to the lives of stroke survivors 4. National Action Plan for Stroke – providing a costed solution on how government could fund stroke

A series of activities were planned to obtain media coverage and provide opportunities for advocacy. At the end of year 2, the NSF has more than 11,000 fight stroke supporters, \$2 million allocated by the federal government for a FAST campaign and stroke became a top 10 health issue for Australians. In addition, stroke was allocated funds in a pre-election promise for the first time since stroke was made a national health priority in 1996.

**WSC-1621****Stroke Support Organization  
A university and Stroke Support Organization (SSO)  
collaborative project to train speech and language  
therapy students**S Levy<sup>1</sup>, C Edelstein<sup>2</sup>, S Boxnboim<sup>1</sup>, B Kaplan<sup>1</sup>, N Weinberger<sup>1</sup><sup>1</sup>*Weekly Stroke Survivors' Club, Neeman Association of Stroke Survivors, Haifa, Israel*<sup>2</sup>*Speech and Language Therapy, Lowenstein Rehabilitation Centre, Raanana, Israel*

Description presented of unique collaborative project between academia and SSO for preparing speech and language therapy students prior to their clinical experience. Major aim to develop holistic knowledge on stroke survivors living in the community. Such initiative proved beneficial for professional development of students, who gained experiential learning, while providing extra resources to SSO members and its club activities. Students in dyads or triads fulfilled specific assignments aimed at developing familiarity with coping of a stroke survivor and his family. In addition they prepared an original activity for all participants attending weekly club activity.

Before-after questionnaires were presented consecutively to two cohorts of 24 and 23 second year students. After completion of project, marked changes appeared in their choice of future professional specialization. Although work with children and autism remained most popular choice, 50% increase found in numbers considering future work with stroke survivors.

Positive feedback on program included: opportunity to start developing their professional personality in nonthreatening environment; broadening of information concerning survivor, family and overall effects of stroke; optimism concerning outcomes of rehabilitation and recovery from stroke; change in emotional attitude towards stroke; satisfaction in depth and type of knowledge gained.

Following this experience, students able to express mature advice to colleagues commencing the project, such as: embarrassment passes quickly; be prepared for strong emotional effects; learn important possibilities of outsider's role; invaluable knowledge gained about poststroke coping.

Viewing its success, recommend to apply variations of project in training of other allied health professionals treating stroke survivors.

**WSC-1628****Stroke Support Organization  
Nursing leadership in the development,  
implementation and scaling up of evidence based  
approaches to community stroke care**R Melifonwu<sup>1</sup>, B Ogungbo<sup>1</sup>, O Osi-Ogbu<sup>1</sup><sup>1</sup>*Head Quarters, Stroke Action Nigeria, Abuja, Nigeria*

*Introduction:* Discussions about enhancing nursing capacity to contribute to prevention, treatment and management of NCDs is given much attention. Within stroke care, evidence abound on nursing contributions in the use of evidence based interventions to address key risk factors like tobacco use, physical inactivity, harmful use of alcohol, unhealthy diets, and, educational interventions to promote self-care. There is little evidence on nursing contributions at the policy, advocacy, and service development levels in stroke care.

These studies were conducted within statutory agencies. The role of non-statutory agencies in promoting advocacy, education, research and influencing policy is documented. These NGO's offer stroke support enabling survivors and carers to cope with 'Life After Stroke'.

*Aims:* Development of stroke support organizations

*Method:* A 1999 UK Department of Health's funded action research to 'develop the role of the nurse consultant in evidence based stroke care' resulted in the establishment of Stroke Action UK offering advocacy,

awareness, prevention, social support, vocational rehabilitation. This was modeled as Stroke Action Nigeria in 2012.

*Result:* Strategic advocacy led to a signed MOU with the Federal Ministry of Health. As a result, a national: Power to Stop Strokes campaign, Stroke Assembly conference, Stroke Helplines, Stroke Support and Community Outreach Strategy are in place.

*Conclusions:* This highlights nursing contribution to policy, advocacy and service development. Nursing leadership is imperative for expanding global capacity to address the high incidence, mortality and morbidity associated with strokes. The WHO, Governments and Professional institutions should do well to promote and sustain this.

**WSC-1302****Stroke Support Organization  
Are you aware of cerebrovascular disease and stroke?**S Selcuk Stroke Group<sup>1</sup>, T Turkey Brain Action Group<sup>2</sup>, Turkey Stroke Support Organization (TSSO)<sup>3</sup><sup>1</sup>*Faculty of Medicine, Selcuk University Faculty of Medicine, Konya, Turkey*<sup>2</sup>*Neurology, Turkish Neurological Society, Ankara, Turkey*<sup>3</sup>*Neurology, Turkish Cerebrovascular Disease Society, Eskisehir, Turkey*

The meeting was performed to increase awareness of public on cerebrovascular diseases. The targeted population were patients associations, patients and citizens. The panelists and speakers were medical students. The meeting was supported by Turkish Neurological Society and was planned as an activity of Turkish Brain Action Group which performs various activities for the "Turkey Brain Year" as parallel to "the European Brain Year" in collaboration with Turkey Stroke Support Group. A stroke victim told her own experiences and difficulties in her life. During the meeting following subjects were told by the medical students and experiences and views were shared in the final section. Main subjects were; What is cerebrovascular disease? What is stroke? What is prevalence of cerebrovascular disease and stroke? Do you know the risk factors of these diseases? How do you recognize stroke symptoms? Is the treatment possible for stroke disease? Do you aware that the fastest admission is the most important factor for the most effective treatment of stroke? Is the prevention of stroke possible? Is there any hope to improve of neurological disabilities after stroke? Questions were replied by two professors who are interested in stroke.

This activity was evaluated as an effective and useful to increase awareness and knowledge of cerebrovascular disease and stroke for the citizens and also medical students (as the future of health care).

**WSC-1383****Stroke Support Organization  
The development of an information, advice and  
support service for families affected by pediatric  
stroke**A Panton<sup>1</sup>, A Gordon<sup>2</sup><sup>1</sup>*Child Stroke Support Service, Stroke Association, London, United Kingdom*<sup>2</sup>*Neurosciences Department, Evelina London Children's Hospital, London, United Kingdom*

*Introduction:* The UK Stroke Association is working together with Evelina London Children's Hospital to help families affected by pediatric stroke. Stroke is estimated to affect up to 1500 children a year in the UK. The longer term needs of families are diverse and at present there is no systematic method in the UK for offering families follow-up.

*Aims:* Funding was obtained for a 3-year project to pilot a Child Stroke Support Service delivering a holistic model of information, advice and

support to families. The Child Stroke Coordinator works with families to identify their information provision and follow up needs, and acts a single point of contact to co-ordinate communication and care. The Child Stroke Service is a non-clinical service that spans health, education, social care and voluntary sector contexts in response to a families needs.

**Methods:** The Child Stroke Service has an open referral system, at any stage following diagnosis. The Service offers contact via email, phone or face to face visits, and can offer support in meetings in educational or medical settings. The Service has been recording nature, location and frequency of support provided. The Service has been open to referrals since August 2013.

**Results:** The Child Stroke Service has provided a pilot model for Information, Advice and Support for families affected by pediatric stroke. Initial service data has identified need for both condition-specific support and more general case coordination and advocacy.

**Conclusions:** The Child Stroke Service has developed a centralized webpage for families: <http://www.stroke.org.uk/about/childhood-stroke>

### WSC-1088

#### TIA and Minor Stroke

#### Findings of transesophageal echocardiography in patients with transient ischemic attack

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**Introduction:** Transient ischemic attack (TIA) has been recognized as a waning signal for stroke. International guidelines vary substantially on how to manage patients with TIA. Data about the findings of cardiac evaluation by transesophageal echocardiography (TEE) in TIA patients are lacking.

**Aims:** The aims of the present study were to investigate the findings of TEE in patients with TIA in according to the new definition (transient neurological symptoms without evidence of infarction in the brain imaging).

**Methods:** During a 3-year period (2011–2013), 861 patients (mean age, 70 ± 13 years; women, 49.7%) with TIA were included in a prospective monocenter-study and evaluated.

**Results:** TEE was performed in 233 (27.1%) of 861 consecutive patients suffering from TIA. TIA patients who were evaluated by TEE were younger (67 vs. 71 years;  $p < 0.001$ ) than those who were not evaluated by TEE. They had higher rate of sensory loss as a TIA symptom (41.5% vs. 31.2%;  $p = 0.005$ ) and lower rate of previous stroke (16.5% vs. 25.4%;  $p = 0.006$ ) than those who did not.

Patent foramen ovale was detected in 59 (25.7%), atrial septal aneurysm in 13 (5.7%), severe atherosclerotic plaques in the aortic arch in 25 (11.7%) patients. One patient had a fibroelastoma detected by TEE.

In 5.2% (12 of 233) of patients underwent a TEE, the indication for anticoagulation therapy was based on the TEE results and one patient received a heart surgery.

**Conclusion:** TEE in TIA patients yields additionally detections of cardiac sources for embolism resulting in an indication for anticoagulation.

### WSC-1602

#### TIA and Minor Stroke

#### Should magnetic resonance imaging (MRI) be the imaging modality of choice in TIA and what impact does it have on diagnosis and management

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The national clinical guidelines for stroke states that if a patient has had a suspected TIA (following assessment by a specialist) and requires brain

imaging then diffusion-weighted magnetic resonance imaging (MRI) is considered most desirable except where contraindicated, in which case computed tomography (CT) should be used. This is especially the case in patients who have a suspected TIA and are at a high risk of stroke (ABCD2 score of 4 or above or with crescendo TIA).

MRI in some trusts however is not an accessible service to all patients, and the number of MRI scans are limited. We looked at patients who attended the TIA clinic at a hospital in Essex over a 6 month period to assess how many underwent and MRI scan, and whether the MRI made any change to diagnosis or management. Of the 286 patients seen in the TIA clinic, 211 underwent a CT scan (73%) and only 36 patients had an MRI scan (13%). Twelve of the 36 MRI scans (33%) showed changes not apparent on the CT. In six MRI scans (17%) there was evidence of an ischemic event not evidenced on CT scan. This changed the diagnosis and management in 2 cases. The greater sensitivity of MRI in detecting ischemic lesions is certainly evidenced in this study and it is clear that MRI should be readily available to all patients.

### WSC-1353

#### TIA and Minor Stroke

#### Usefulness of pulse wave velocity test to diagnose subtypes of acute ischemic stroke

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**Introduction:** Pulse wave velocity (PWV) test or Flow Mediated Dilatation (FMD) test may be used as indicators of arteriosclerosis. The purpose of our retrospective study was to investigate whether clinical subtypes of acute ischemic stroke are related to PWV or FMD values.

**Aims:** To investigate whether clinical subtypes of acute ischemic stroke are related to PWV or FMD values.

**Methods:** Included in our study were patients 1) who were hospitalized due to acute ischemic stroke between May 2012 and Mar 2014, 2) who underwent FMD and PWV tests. Evaluated were patients' features, clinical subtypes of acute ischemic stroke and PWV or FMD values.

**Results:** During the study period, 140 patients (pts.) matched to our criteria. There were 60 pts with large vessel disease (LVD), 36 pts with small vessel disease (SVD) and 44 pts. with cardiogenic embolism (CE). Their mean age was 71.8 ± 11.26 years (ns; ANOVA) and female was 56 pts (ns; chi-square test). FMD value was 4.04 ± 2.45% (ns; ANOVA), however PWV value was 2403.84 ± 721.36 cm/s ( $p < 0.05$ ; ANOVA). In LVD, SVD and CE subtype groups, PWV value was 2398 ± 731, 2320 ± 675 and 2067 ± 518 cm/s. There were significant difference ( $p = 0.0117 < 0.0167$ ) between LVD and CE subtype groups.

**Conclusion:** Patients with LVD had higher PWV value than those with CE, however there were no differences of FMD value among three subtype groups.

### WSC-1426

#### TIA and Minor Stroke

#### CT angiography (CTA) based triage of TIA patients is safe and reduces hospital admissions

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**Introduction:** Providing timely access to specialized care for patients with high-risk TIA is critical to their outcome. Previously in our institution

these patients received a stroke consult in the ED and admission to hospital. Recently we showed that patients without symptom relevant abnormalities on CT/CTA were at low risk of recurrent stroke.

**Aim:** To safely use CT/CTA to triage TIA patients either to be seen in the ED or urgently as an out-patient.

**Methods:** The TIA Rapid Access Clinic (TIARA) started in July 2013 and uses CT/CTA to triage patients. Patients with high risk TIA (motor or speech symptoms  $\geq$ 5 minutes within 48 hours) underwent CT/CTA head/neck in the ED. If no symptomatic extracranial or intracranial stenosis  $\geq$ 50% or occlusion the patient was discharged and referred to the TIARA clinic. Patients with clinically relevant CT/CTA abnormality were seen by stroke team in the ED and admitted to hospital.

**Results:** 1727 new consults were seen in the stroke prevention clinic since July 2013. 99 (6%) of these patients were TIARA referrals. Median time for assessment was 1 day for TIARA. 2/99 (2%) of TIARA patients and 24/1628 (1.5%) of other clinic patients suffered a recurrent stroke before being seen in clinic.

**Conclusions:** We have safely reduced the number of hospital admissions for TIA by implementing a rapid access clinic in conjunction with urgent CTA based vascular imaging in the emergency department. The rate of early recurrent stroke prior to first stroke team assessment is very low with this CT/CTA based triaging approach.

## WSC-1022

### TIA and Minor Stroke

#### Analysis of modern strategy of evaluation of transient ischemic attack in a stroke center of Budapest

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**Introduction:** the definition and strategy of evaluation of transient ischemic attack (TIA) changed remarkably in the last years. Instead of the duration, the presence of ischemic brain lesion is important. The risk of stroke is high during the first month after TIA. In case of ischemic lesion proved by cranial MRI, the risk of stroke is 15–18 times higher. The ABCD<sup>(2)</sup> score is available to estimate the stroke risk. The literature is divided in the safety of ambulant evaluation of TIA.

**Patients and method:** 176 of 1992 patients admitted to our department had TIA in 2013. All these patients had cranial CT, Doppler sonography, laboratory tests, EEG, ECG. We accounted the ABCD<sup>(2)</sup> score and based on this the patients were divided into 3 (low, moderate, high risk) groups. We analyzed the time of admission (working/on-call duty hours). We compared the hospital and ambulant financing by Hungarian National Health Insurance Fund.

**Results:** 134 of 176 patients had hypertension, 35 diabetes, 30 hypertension and diabetes. 22.7% of TIA patients were <60 years old, 60% of them had low, 40% moderate risk for stroke. At the age of  $\geq$ 60, 74,3% of patients had moderate, 24,3% high risk. Based on the recommendations, 53.4% of patients were eligible for outpatient evaluation. 65% of patients eligible for ambulant service, arrived during on-call duty hours. The financing of outpatient evaluation is 40% of hospital managements.

**Conclusion:** 10–15% of our patients with TIA is eligible for ambulant evaluation. The financing system does not accept the outpatient management.

## WSC-0740

### TIA and Minor Stroke

#### Risk factors frequency of the transient ischemic attack (TIA)

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**Introduction:** Transient ischemic attack (TIA) is a transient neurologic deficit of cerebrovascular origin without infarction. A transient ischemic attack (TIA) is like a stroke, producing similar symptoms, but usually lasting only a few minutes and causing no permanent damage.

**Aim:** Early identification and treatment of patients with transitory ischemic attack.

**Method:** This research encompassed 156 patients (male and female) with Dg. TIA, whose average age was 65, being treated in our hospital from January until August 2013. During the research we followed risk factors such as: HTA, D. mellitus. HLP, A:A., atherosclerosis, previous cerebrovascular disease, obesity, smoking, alcoholism. All the patients underwent CT scanning and/or MRI of the brain, carotid ultrasonography, EKG, cholesterol level. The registered values of HTA, glycemia, heart arrhythmia during the pronounced typical symptoms and signs depend on the affected vessel and surrounding brain tissue.

**Results:** 63,3% of all the treated patients had hypertension (above 180/100 mmHg), 20% had hyperglycemia (above 10 mmol/l) and 16,7% had arrhythmia absoluta. Patients with involvement of the carotid territory 60%; patients with involvement of the vertebrobasilar territory 20%; out of which 9% had recurrent transitory ischemic attack, and 6% stroke. Right after the diagnosis was determined, the antiplatelet or anticoagulant therapy was given.

**Conclusion:** Early identification and treatment of patients with transitory ischemic attack is very important for the stroke prevention. Good control of blood pressure, diabetes mellitus and hyperlipidemia reduces the risk of recurrent TIA and stroke.

## WSC-1245

### TIA and Minor Stroke

#### Cerebral amyloid angiopathy case presenting with transient ischemic attack-like symptoms

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Sporadic cerebral amyloid angiopathy (CAA) is a common disease of cerebral small vessels characterized by progressive deposition of age-related amyloid- $\beta$  in cortical walls and leptomeningeal small cerebral arteries. "Amyloid spells" referred to as repetitive, stereotypic and often lasting several minutes, Transient focal neurological episodes (TFNEs) can be observed. Transient focal neurological deficits may be termed as amyloid seizures and may occur as clinical presentation of cerebral amyloid angiopathy.

86-year-old woman was admitted with complaints of numbness and weakness in left arm and leg and slurred speech. Patient had myocardial infarction 3 months ago and use acetylsalicylic acid 100 mg, and 10 days ago and 4 days ago the patient had complaints of numbness, weakness and dysarthria in left arm and leg, which lasted 30 minutes and then resolved spontaneously. The patient had a history of hypertension, but no smoking and alcohol. There was no feature in physical examination and neurological examination was normal. Complete blood count, biochemistry, lipid profile, C-reactive protein and erythrocyte sedimentation rate were in normal range and ECG was in normal sinus rhythm. According to cranial CT scan taken in the emergency department, there was no lesion detected. Doppler USG of carotid and vertebral artery were also normal. In clinical follow-up because of recurrent left hand numbness and weakness the

patient was heparinized. During follow-up, intermittent numbness in patient's left arm recurred also when using clopidogrel 75 mg/day, acetylsalicylic acid 100 mg/day and a 24-hour infusion of 15,000 units intravenous heparin. On cranial MRI; FLAIR AS level intensity image enhancement of right central sulcus, obliteration in the central sulcus and slight contrast enhancement in contrast images has been detected. Nonaneurysmal focal subarachnoid hemorrhage area was viewed in the central sulcus. Moreover in SWI sequence in the same area, lesion has been detected. According to current imaging and clinical findings patient was diagnosed as transient focal neurological deficit related to amyloid angiopathy. Heparin and clopidogrel treatment was discontinued. Paroxysmal disorder at very slight degree has been detected in right frontal region in EEG and levetiracetam 1000 mg/day was administered to the patient. After the revision of treatment no clinical recurrence was observed during follow-up.

Focal neurologic deficits in the form of paresthesias, which are recurrent and stereotypical and emitting and ending in a few minutes, superficial cortical siderosis, lobar intracerebral hemorrhage, cognitive impairment in the elderly are among the clinical presentations of CAA. Focal symptomatic intracerebral hemorrhage or subarachnoid hemorrhage occurs more frequently compared to ischemia. Therefore, demonstration of intraparenchymal or subarachnoid hemorrhage in small areas with flow-sensitive MRI is extremely important in the diagnosis of CAA. At this point, it was requested to approach suspicious to the diagnosis of patients with transient focal neurological symptoms and also emphasize to the importance of SWI sequence containing cranial imaging at the diagnosis.

### WSC-1203

#### TIA and Minor Stroke

#### Increased serum lipoprotein(a) as a potential predictor for small artery occlusive stroke

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**Introduction:** Despite compelling evidence of lipoprotein(a) [Lp(a)] as an independent risk factor for ischemic stroke, its underlying mechanism remains unclear. Previous a few studies have shown that increased Lp(a) levels were correlated with burden of cerebral atherosclerosis and large artery atherosclerotic (LAA) stroke. But a role of Lp(a) as a predictor for small artery occlusive (SAO) stroke remains still undetermined.

**Aims:** This study investigated the association between SAO stroke and increased serum Lp(a) levels in Korean patients with ischemic stroke.

**Methods:** We analyzed data prospectively collected over 24 months period on consecutive patients with first-ever ischemic stroke and stroke-free controls. Ischemic stroke patients had been classified into etiologic subtypes with the Stop Stroke Study Trial of Org 10172 in Acute Stroke Treatment (SSS-TOAST) classification. Serum Lp(a) levels were measured in 100 SAO stroke cases and 100 stroke-free controls. Vascular risk factors including Lp(a) and lipid profiles among hospitalized cases of first-episode SAO stroke were compared with stroke-free control.

**Results:** In the univariate analysis, Lp(a) as Lp(a) levels  $\geq 30$  mg was associated with an increase risk of SAO stroke. In multivariate analysis, there was an increased risk of SAO stroke associated with increased Lp(a) levels.

**Conclusions:** Our results indicate that Lp(a) levels were significantly increased in SAO stroke cases compared to stroke-free controls.

### WSC-1021

#### TIA and Minor Stroke

#### Cerebral small vessel disease as a predictor of future vascular events in patients with transient ischemic attack

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**Introduction:** Clinical decisions remain uncertain when patients only present a subjective symptom suspicious for transient ischemic attack (TIA) without relevant atherosclerosis or cardioembolic sources. Since neuro-imaging technologies have become more developed, we are now able to define small vessel TIAs more precisely.

**Aims:** In this study, we attempted to identify neuro-imaging predictors of vascular events after TIAs.

**Methods:** Study subjects were extracted from our prospective stroke registry from Sep 2003 to Feb 2011. We evaluated clinical characteristics and brain magnetic resonance image findings (silent brain infarcts, leukoaraiosis severity, cerebral microbleeds and acute ischemic lesion on diffusion-weighted imaging). Subsequent stroke, TIA, or acute coronary syndrome after index TIA was recorded as a clinical outcome. TIA subjects with clear causative atherosclerotic lesions were selected for further statistical comparison.

**Results:** We determined that 70 patients had small vessel TIAs (group 1) and 59 patients were classified as large vessel TIAs (group 2) because they had TIA symptom with relevant large vessel atherosclerosis. Among group 1, five patients had stroke or TIA and three patients had acute coronary syndrome. Only leukoaraiosis severity showed a statistically significant hazard ratio to predict stroke or TIA recurrences in group 1 (hazard ratio: 9.419, 95% confidence interval: 1.059–84.845,  $p = 0.044$ ). This significance maintained after adjusting age, gender and other MRI findings. Age and hypertension were the most contributable vascular risk factors of the leukoaraiosis severity in both groups.

**Conclusion:** Our findings suggest that leukoaraiosis severity is a possible risk factor for future in patients with small vessel TIAs.

### WSC-1354

#### TIA and Minor Stroke

#### A 6-month audit analyzing TIA clinics for future optimization

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**Introduction:** An NHS District General Hospital serving a population of 3.2 million runs a 7-day one-stop TIA Clinic; receiving referrals from Accident and Emergency, General Practitioners, paramedics and from within the hospital as well as other hospitals.

**Aims:** This audit was to identify the following:

1. What % of presentations are actually TIAs?
2. What % are High Risk TIAs (defined using the ABCD<sub>2</sub> score)?
3. Are we compliant with National Stroke Guidelines 2012: High Risk TIAs should have a "specialist assessment" within 24 hrs and Low Risk within 7 days?
4. If not, what areas require improvement?

**Methods:** Every referral made to the TIA Clinic between April and Sept 2013 was audited using a proforma completed when the patient attended the TIA Clinic.

**Results:** Two hundred ninety-four patients were seen; 132 (44.9%) were actual TIAs, of which 82 (62.1%) were high risk, and 129 (43.9%) were non-TIA/stroke diagnoses.

50 (61.0%) of high risk TIA patients were seen by the TIA clinic within 24 hrs from the first contact they made with referring specialists. There were delays between patient's first contact, referrals being made/received and patients being seen by the TIA clinic.

**Conclusions:** We now use an electronic referrals system and aim to educate the public and other professionals about TIAs.

A future audit is planned.

#### Reference

- 1 NICE Guidelines TIA: assessment, early management and imaging. Available at <http://pathways.nice.org.uk/pathways/stroke> (Accessed).

### WSC-0726

#### TIA and Minor Stroke Factors affecting motor deterioration in acute deep white matter infarction

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A substantial amount of patients with acute deep white matter infarction suffered from progressive motor deficits. This study aims to determine its predictors.

54 patients with acute deep white matter infarction were prospectively evaluated by daily NIHSS motor score. Motor deterioration was defined as drop in NIHSS motor score of more than or equal to 1 point during the first 7 days. Patients with and without motor deterioration were compared on their clinical and radiological parameters.

Eleven patients (20.4%) had motor deterioration. They had higher mean diastolic blood pressure in the first 24 hours ( $88.1 \pm 17.2$  mmHg; vs.  $79.0 \pm 10.9$  mmHg,  $p = 0.033$ ); elevated hemoglobin level ( $14.6 \pm 1.2$  g/dL vs.  $13.2 \pm 1.6$  g/dL,  $p = 0.007$ ); elevated hematocrit level ( $0.433 \pm 0.035$  vs.  $0.392 \pm 0.043$ ,  $p = 0.005$ ); elevated white cell count ( $7.1$  [ $6.0$ – $7.9$ ]; vs.  $8.5$  [ $7.3$ – $9.2$ ],  $p = 0.025$ ); elevated total protein ( $73$  [ $70$ – $75$ ] vs.  $76$  [ $73$ – $81$ ],  $p = 0.03$ ); elevated total cholesterol ( $5.5 \pm 1.5$  mmol/L; vs.  $4.6 \pm 1.0$  mmol/L,  $p = 0.01$ ); elevated low density lipoprotein (LDL) cholesterol ( $3.6 \pm 1.3$  mmol/L vs.  $2.7 \pm 0.8$  mmol/L,  $p = 0.005$ ) and elevated urine albumin to creatinine ratio ( $5.1$  mg/mmol [ $2.0$ – $8.4$ ]; vs.  $1.45$  mg/mmol [ $0.7$ – $2.6$ ],  $p = 0.019$ ). After logistic regression analysis, LDL cholesterol higher than  $3.2$  mmol/L (relative risk 11.85; 95% CI 1.95–72.09;  $p = 0.007$ ; Table 1) and urine albumin to creatinine ratio higher than  $3.5$  (relative risk 8.02; 95% CI 1.32–48.8;  $p = 0.024$ ) were independent predictive factors for progressive motor deterioration.

Progressive motor deterioration in acute deep white matter infarction was independently associated with elevated LDL cholesterol and urine albumin to creatinine ratio.

**Table 1.** Multivariate Logistic Regression Analysis (Forward stepwise)

	Relative Risk (95% Confidence Interval)	$p$
LDL Cholesterol > 3.2 mmol/L	11.85 (1.95–72.09)	0.007
Urine albumin to creatinine ratio >3.5	8.02 (1.32–48.8)	0.024

Parameters excluded: age, NIHSS, mean diastolic blood pressure, haemoglobin level, haematocrit level, white cell count, total protein, total cholesterol >5.2 mmol/L.

### WSC-1483

#### TIA and Minor Stroke Case of incidental white matter flair hyper intensities on MRI scan – What next to do?

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**Introduction:** The increasing use of brain MRI in various clinical settings frequently results in the discovery of white matter lesions (WML) which appear as hyperintensities on FLAIR images of nonspecific clinical significance. While WML are considered to be uncommon in a younger healthy population screened for comorbid diseases, they are increased 10-fold in subjects over 55 years of age.

**Aims:** To present a case where the radiological finding of an isolated focal WML described as “nonspecific” encompassed clinical significance.

**Methods:** We describe the case of a 50-year old male with a history of arterial hypertension, who presented with nonprogressive left-sided hypesthesia of >24 hours duration. The neurological examination revealed isolated reduced pinprick sensation on the left upper and lower limb. A CT Head scan was requested with normal findings.

**Results:** As the symptoms persisted, he underwent further investigations with MRI Head which showed an isolated focal area of FLAIR hyperintensity in the right frontal subcortical white matter without any areas of restriction in the DWI images. In this case, as the anatomical location of the lesion correlated with the clinical presentation and because of the vascular risk factors the patient was treated with secondary stroke prevention.

**Conclusions:** The finding of WML can very often be incidental and result in unnecessary investigations and frustration for the patients. Physicians worry because of the range of associated differential diagnosis. Most of these underlying conditions can be identified with the help of a good history and some basic tests, which will prevent extensive investigations.

### WSC-1204

#### TIA and Minor Stroke Efficacy of prior antiplatelet treatment in patients with noncardioembolic ischemic stroke or transient ischemic attack

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**Background and purpose:** Patients with a history of cardiovascular diseases are at high risk state for ischemic stroke. However, poor adherence to antiplatelet treatment (APT) was sometimes observed. We aimed to evaluate the efficacy of prior APT for an early neurological deterioration and a short-term outcome in patients with noncardioembolic ischemic stroke and transient ischemic attack (TIA).

**Methods:** Among the consecutive 7077 stroke or TIA patients who were admitted to the 7 stroke centers within 7 days after the onset, 2703 noncardioembolic stroke or TIA patients who were admitted within 24 hours with prior modified Rankin scale (mRS) of 0 or 1 and without atrial fibrillation were included into the present study. We observed a neurological deterioration (NIH Stroke scale score worsening of 1-point or more) during 21 hospital days and short-term outcome at 21 days after admission.

**Result:** Among the 2703 patients, prior APT was done in 627 (23.2%) patients. Prestroke APT was associated with hypertension, dyslipidemia, diabetes mellitus, and chronic kidney disease. The initial NIH Stroke Scale score (2 vs 3) was lower, an acute neurological deterioration was less

frequent (8.5% vs 15.4%), and a good outcome (mRS of 0 or 1) at 21 days after admission was more frequent (59.5% vs 43.0%) in patients with than without APT. On the multivariate analysis, APT was positively associated with the short-term good outcome (OR 0.68, 95% CI 0.28–0.83).

**Conclusions:** In patients with noncardioembolic stroke or TIA patients with prior cardiovascular diseases, prior antiplatelet use was associated with a good acute clinical course and a consequent short-term good outcome.

### WSC-0331

#### TIA and Minor Stroke

#### Clinical implications of acute ischemic lesions on diffusion-weighted images in transient ischemic attack patients

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**Introduction:** A substantial proportion of transient ischemic attack (TIA) patients have acute lesions on Diffusion-weighted images (DWI). Although the patients with positive DWI are at high risk of stroke after TIA, it is unclear how these positive lesions correlate with clinical characteristics in TIA patients.

**Aims:** We aim to determine the factors associated with the positive DWI.  
**Methods:** We studied 180 consecutive TIA patients (108 males, 69 ± 13 years of age) who were hospitalized in our institution within 24 hours after the symptoms onset. We assessed the clinical characteristics and comorbidities of the patients on admission.

**Results:** DWI finding was positive in 71 patients (39%). Patients with positive DWI had more symptom duration ( $p < 0.05$ ), frequency of large-artery atherosclerosis ( $p < 0.01$ ), higher score of NIHSS on admission ( $p < 0.05$ ), and higher level of C-reactive protein on admission ( $p < 0.05$ ) than patients without. In contrast, patients with positive DWI findings had lower frequency of statin use before the onset ( $p < 0.05$ ) than patients without. On multivariate logistic regression analysis with adjustments for age, sex, and other variables, symptom duration ([OR] 1.07, 95% [CI] 1.02–1.12,  $p < 0.01$ ), large-artery atherosclerosis (OR 3.50, 95% [CI] 1.67–7.59,  $p < 0.01$ ), and statin use before the onset (OR 0.29, 95% [CI] 0.11–0.71,  $p < 0.01$ ) were independently related to positive DWI.

**Conclusions:** Presence of acute lesions on DWI correlates with symptom duration, large-artery atherosclerosis, and absence of statin use before the TIA onset independently.

### WSC-0555

#### TIA and Minor Stroke

#### Clinical predictors of diffusion-weighted MR-imaging (DWI) abnormalities in transient ischemic attack (TIA)

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**Introduction and aim:** Diffusion-weighted MR-imaging (DWI) is very sensitive to acute ischemic lesions in transient ischemic attack (TIA). A DWI abnormality can thus support the clinical diagnosis of TIA. The purpose of this study was to identify clinical predictors of a DWI abnormality.

**Methods:** We studied 724 consecutive patients admitted to our department with a clinical diagnosis of TIA or minor stroke from February 2010

to September 2012. We included patients presenting with acute focal neurological symptoms and who underwent a DWI scan during hospitalization. The association between specific clinical characteristics and presence of a DWI abnormality was examined by odds ratios (ORs) in a univariate analysis and adjusted ORs in a multivariate analysis.

**Results:** Age > 60 years (OR = 1.64, 95% CI = 1.18–2.29), gender (male, OR = 1.86, 95% CI = 1.33–2.61), symptom duration >24 hours (OR = 2.57, 95% CI = 1.78–3.69), ataxia (OR = 4.44, 95% CI = 2.34–8.30), facial palsy (OR = 2.67, 95% CI = 1.76–4.04), dysarthria (OR = 2.48, 95% CI = 1.54–3.98), monoparesis (OR = 2.25, 95% CI = 1.51–3.41), and hemiparesis (OR = 1.65, 95% CI = 1.13–2.43) were significantly associated with a DWI abnormality. On the contrary, visual impairments (OR = 0.38, 95% CI = 0.25–0.64), dizziness (OR = 0.57, 95% CI = 0.38–0.86), sensory symptoms (OR = 0.63, 95% CI = 0.45–0.89), and headache (OR = 0.65, 95% CI = 0.43–0.99) were found to be significantly associated with no DWI lesion. A multiple logistic regression analysis confirmed the results.

**Conclusion:** Our findings confirm existing high-risk markers as predictors of a DWI abnormality in TIA. Clinical symptoms less suggestive of TIA predicted no abnormality. These clinical predictors may help differentiate transient neurological symptoms due to cerebral ischemia from symptoms with noncerebrovascular etiologies.

### WSC-0805

#### TIA and Minor Stroke

#### Utility of primary care based TIA electronic decision support: A cluster randomized controlled trial

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<sup>2</sup>General Practice, Otago University, Dunedin, New Zealand  
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<sup>4</sup>Geriatric Medicine, Otago University, Wellington, New Zealand

**Introduction:** Transient ischemic attack (TIA) is a medical emergency and rapid intervention reduces stroke risk.

**Aims:** To test whether a TIA Electronic Decision Support (EDS) tool in primary care improves guideline adherence, reduces recurrent vascular events and treatment cost, and achieves user satisfaction.

**Methods:** Multicenter, single-blind, parallel-group, cluster randomized (1:1) controlled trial in New Zealand. Eligible patients presented to a participating general practice as their first point of health care contact after experiencing symptoms their doctor interpreted as a TIA or stroke. Intervention group patients received EDS assisted and control patients routine care. Main outcomes: 90-day stroke rate and guideline adherence. Secondary outcomes: vascular events/death, adverse events, treatment cost, user feedback. Ethics approval/consent obtained.

**Results:** Twenty-nine intervention and 27 control practices registered 172 and 119 eligible patients respectively. Intervention group patients experienced more guideline adherent care (76.2% vs. 41.2%; OR 4.57; 95% CI 2.39–8.71;  $p < 0.0001$ ), reduced 90-day stroke rate (1.2% vs. 4.2%; OR 0.27, 95% CI 0.05–1.41;  $p = 0.098$ ), reduced 90-day vascular event/death rate (3.5% vs. 11.9%; OR 0.27; 95% CI 0.09–0.78;  $p = 0.016$ ) and no increase in adverse events. Average patient treatment cost was NZ\$1479 lower (cost ratio 0.65; 95% CI 0.49–0.87;  $p = 0.004$ ) and both general practitioner and specialist feedback was positive with most general practitioners indicating that if available they would consistently use the EDS in TIA management.

**Conclusions:** As compared with routine care the use of a TIA electronic decision support tool in primary care resulted in improved guideline adherence, fewer subsequent vascular events, reduced treatment cost, and excellent end-user satisfaction.

**WSC-0779****TIA and Minor Stroke****Changes in postural stability after a transient ischemic attack (TIA) of patients with diabetic peripheral neuropathy**D Petrova<sup>1</sup>, I Angelov<sup>2</sup>, K Stambolieva<sup>3</sup><sup>1</sup>Department of Neurology, National Multiprofile Transport Hospital "Tzar Boris III," Sofia, Bulgaria<sup>2</sup>Research, INC Research Bulgaria, Sofia, Bulgaria<sup>3</sup>Department of Cognitive Psychophysiology, Institute of Neurobiology Bulgarian Academy of Sciences, Sofia, Bulgaria

**Introduction:** The progression of the Diabetic peripheral neuropathy (DPN) and hypertension at the time of diagnosis is the cause for the metabolic and vascular/hypoxic damage and predisposes to a transient ischemic attack (TIA). The postural stability is greatly impaired after the TIA.

**Aim:** The aim of this study was to evaluate the effect of Alpha-Lipoic Acid (ALA) for improvement of neuropathic deficits and postural stability after the TIA in patients with type 2 DPN.

**Patients and methods:** Thirty DPN patients after the TIA (aged between 55 and 68 years) were randomly divided in two groups: control group (15 patients) and experimental group (15 patients). All patients were treated with medicines for the prevention of ischemic disease, but the experimental group received the ALA in the therapy. The postural stability was evaluated by static posturography 3 days after diagnosis of the TIA and on the 25 day after the therapy.

**Results:** Mean values of subjective score for postural instability, measured by a visual analogue scale, was decreased with 33% in ALA treated patients and 16% in the control group. In both groups the mean values of all posturographic parameters before the treatment were significantly higher than after treatment. Most pronounced decrease of subjective and posturographic parameters was observed for experimental group (with ALA). **Conclusion:** Treatment with medicines for the prevention of ischemic disease together with ALA stabilized the quiet upright stance, which impacts the improvement of the quality of life of patients with type 2 DPN.

**WSC-0964****TIA and Minor Stroke****Cerebrovascular incident and risk factor assessment in patients with transient ischemic attack**R Valante<sup>1</sup>, S Valtina-Brige<sup>1</sup>, A Gudreniece<sup>1</sup>, E Miglane<sup>1</sup>, A Millers<sup>1</sup><sup>1</sup>Neurology, Pauls Stradins Clinical University Hospital, Riga, Latvia

**Introduction:** Transient ischemic attack (TIA) is a major risk factor of stroke. The aim of the study was to estimate prognosis using ABCD<sup>2</sup> score depending on TIA pathogenesis.

**Materials and methods:** The study was performed in P. Stradins CUH, 156 patients, admitted to Neurology department with TIA during 2012–2014 year were included. Patients were interviewed by telephone using specialized questionnaire forms 6 months after the TIA event.

**Results:** 52.6% of patients had moderate risk (4–5 points), and 10.2% had high stroke recurrence risk (6–7 points), others had low risk.

In 42.3% of cases the etiology of TIA was cardioembolic. 77.3% of patients were discharged on anticoagulants and 7.6% on dual antiplatelet therapy. After 6 months 57.5% of patients continued using anticoagulants, and 6.1% continued dual therapy, 6.1% of patients stopped using medications. In the 6 months recurrent cerebrovascular incident occurred to five patients, one patient suffered from severe ischemic stroke.

38.5% of patients had atherothrombotic TIA. After 6 months 91.6% of patients had good medical compliance. 33.3% were diagnosed with critical internal carotid artery stenosis, most of them underwent endarterec-

tomy. Two patients had recurrent TIA in 6 months. One of them refused endarterectomy, second refused using medications.

19.2% of patients were with undetermined etiology. One of them suffered severe lethal ischemic stroke.

**Conclusion:** The majority of patients with TIA had high risk of stroke according to ABCD<sup>2</sup> score. Our study concluded that strict secondary prophylaxis effectively prevents recurrent cerebrovascular incidents. After cardioembolic TIA recurring cerebrovascular incidents were observed more frequently.

**WSC-1408****TIA and Minor Stroke****Changes of hemodynamic parameters in vertebral arteries in functional test positions in patients with vertebrobasilar insufficiency and cervical spondylosis**S Vasic<sup>1</sup>, J Kolar<sup>2</sup>, N Sremcevic<sup>3</sup>, D Radak<sup>4</sup><sup>1</sup>Rehabilitation and Ultrasonography, Specialized Rehabilitation Hospital, Banja Koviljaca, Serbia<sup>2</sup>Neuroangiology, Institute for Cardiovascular Disease "Dedinje," Belgrade, Serbia<sup>3</sup>Rehabilitation and Management, Specialized Rehabilitation Hospital, Banja Koviljaca, Serbia<sup>4</sup>Vascular surgery, Faculty of Medicine University of Belgrade, Belgrade, Serbia

**Introduction:** Cervical spondylosis (CS) is related to occurrence of clinical symptoms of vertebrobasilar insufficiency (VBI), particularly in older population.

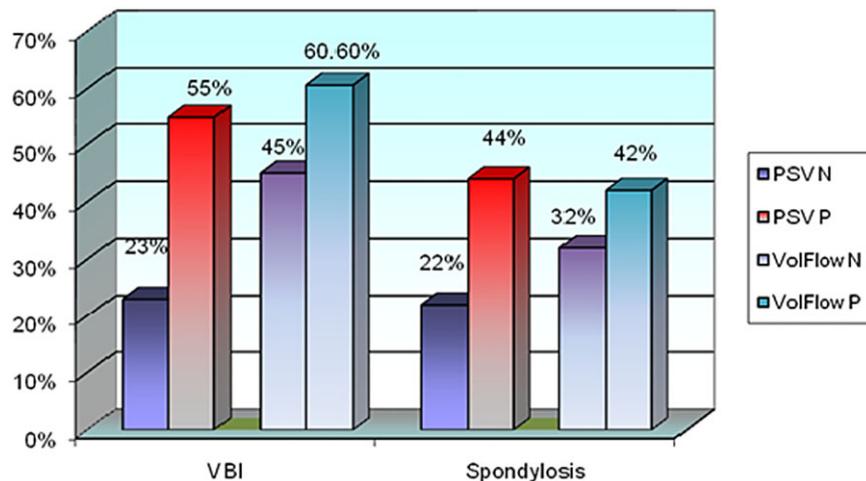
**Aims:** To evaluate hemodynamic changes in extracranial segments of vertebral arteries (VA) in functional tests by Color Duplex Ultrasonography (CDUS) in patients with VBI and CS.

**Methods:** A prospective study was carried out on study group (100 individuals) with CS and VBI and control group (50 individuals) with CS only. Morphological and hemodynamic parameters in V1–V3 segments were determined by bilateral ultrasonographic evaluation of the extracranial part of VA in diagnostic position and functional tests for VBI.

**Results:** As per statistical processing, groups were homogeneous by gender, age and risk factors for atherosclerosis. Fig. 1 presents changes in Peak Systolic Velocity ratio (PSV) and Volume Flow (VF).

**Diagnostic position:** hemodynamically significant changes of PSV and reduction in VF from V1–V3 segments were registered by comparing all three VA segments in both groups. There was no significant difference between groups.

**Functional tests:** double increase of VA number with PSV change in both groups and significant reduction of VF in study group were registered, most often during contralateral head rotation.



**Fig. 1** Comparison of PSV and VF changes in neutral (N) and functional test (P) in study and control groups.

**Conclusions:** Significant changes of PSV and VF in both groups in diagnostic position and more intensive changes in functional tests report in favor of spondylosis as a cause of VBI.

#### WSC-0430

##### TIA and Minor Stroke

##### A prospective evaluation of efficacy of a nurse-led TIA clinic in Hong Kong

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**Introduction:** Patients with transient ischemic attacks (TIAs) are at risk of developing ischemic stroke and early management is of paramount importance. An alternative to the conventional physician-led assessment is nurse-led TIA clinic which can provide rapid access to evaluation and diagnostic investigations of TIA.

**Aims:** To evaluate the efficacy of nurse-led TIA clinic in cardiovascular risk factors control and prevention of ischemic stroke

**Methods:** A prospective study was conducted in a nurse-led TIA clinic in the United Christian Hospital between January and July 2013. TIA patients were screened by stroke nurse and protocol-driven investigations and treatment were initiated. The efficacy endpoints were measured by healthcare utilization, biomedical parameters, lifestyle modification and patients' satisfaction score at 3 months.

**Results:** A total of 213 patients were screened by stroke nurse and 85 patients were diagnosed to be TIA by stroke physician. At 3 months (n = 33), 3 patients hospitalized for nonvascular events, 1 patient for recurrent TIA and none for nonstroke vascular events. The mortality was 0%. For biomedical parameters, significant reduction in mean total cholesterol (p = 0.001), mean LDL (p < 0.001), mean SBP (p = 0.011) and mean DBP (p = 0.002). Three (38%) out of 8 active smokers ceased smoking. The mean patients' satisfaction score was 9.1 out of 10

**Conclusion:** Nurse-led TIA clinic is efficient in providing early access to initial evaluation and diagnostic workup. Combined with physician's treatment, TIA patients can achieve significant improvement in cardiovascular risk factors control and low incidence rate of ischemic stroke at 3 months. Our TIA patients are satisfied with this modality of assessment pathway and this can serve as a model of care for future TIA services.

#### WSC-0428

##### TIA and Minor Stroke

##### The surveillance of anticoagulation therapy for stroke patients with atrial fibrillation (AF) in transient ischemic attack (TIA) clinic in a regional hospital in Hong Kong

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**Introduction:** Atrial fibrillation (AF) is a major risk factor for ischemic stroke<sup>(1)</sup> and oral anticoagulation (OAC) is highly effective in preventing ischemic strokes in patients with AF.<sup>(2)</sup> Stroke Nurses are authorized to initiate the OAC therapy to the targeted patients

**Aims:** To evaluate the treatment rate of OAC and the clinical outcomes for stroke patients with AF at 3 months

**Methodology:** A prospective study of anticoagulation therapy of TIA or suspected TIA patients with AF/PAF was conducted in United Christian Hospital. The outcome measures included the treatment rate of OAC and the clinical outcomes at 3 months.

**Results:** From January to December 2013, 399 patients were assessed. 54 (14%) patients were diagnosed with AF/PAF. The overall treatment rate of OAC increased from 12 (22%) patients to 37 (68%) patients. 23 patients were managed in TIA clinic and 20 (87%) patients received OAC.

At 3 months clinical outcomes (n = 50), the overall recurrent stroke rate and recurrent stroke rate in TIA clinic (n = 20) was 12% and 5% respectively. The mortality rate was 6%, 2 patients died of large vessels diseases and 1 patient died of pulmonary fibrosis but 0% mortality rate in TIA clinic

**Conclusion:** Stroke Nurse initiated OAC is one of the effective measures to increase the treatment rate of OAC. The patients tend to select NOACs instead of warfarin because NOACs address several limitations of warfarin in day-to-day clinical practice. Further study should be considered to increase the treatment rate OAC for acute ischemic stroke patients with AF.

## WSC-0804

## Uncommon Stroke Disorders

## A case of acute cerebral infarction in young adult associated with the polycythemia vera

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**Introduction:** Several primary hematologic disorders have been associated with ischemic stroke. The main cause of stroke in the hematologic disorders are coagulopathy or thrombosis.

**Aims:** We report one patient of acute cerebral infarction associated with polycythemia vera.

**Methods:** A 44-year-old man admitted to our hospital complaining of left extremities weakness. His symptoms occurred suddenly 2 days ago. He had been well before admission and his past medical history was unremarkable. He had no history of any medical or neurological illness. Vital sign was stable at admission. On the neurological examination on admission, he was alert and well oriented. In motor examination, left hemiparesis was Medical Research Council(MRC) grade 3. He had no sensory abnormality and no ataxia. Diffusion weighted imaging showed hyperintense signal on right MCA territory. Brain CT angiography showed no evidence of definitive intra and extra cranial aneurysm or stenosis. laboratory studies revealed normal serum electrolytes, renal function except elevated hemoglobin, decreased erythropoietin. US abdomen revealed splenomegaly, mild fatty liver. PBS revealed moderate polycythemia. Phlebotomy, BM biopsy was performed. then he was diagnosed as polycythemia vera. he took hydroxyurea 500 mg bid.

**Results:** Base upon clinical manifestation and radiologic findings, we diagnosed right middle cerebral artery infarction. laboratory studies, bone marrow biopsy revealed polycythemia vera.

**Conclusions:** The case presented herein is characterized by an association between acute cerebral infarction and hematologic disorder. we should be curious of other causes except cerebral atherosclerosis when young adult patient without other risk factors was diagnosed as ischemic infarction.

## WSC-1512

## Uncommon Stroke Disorders

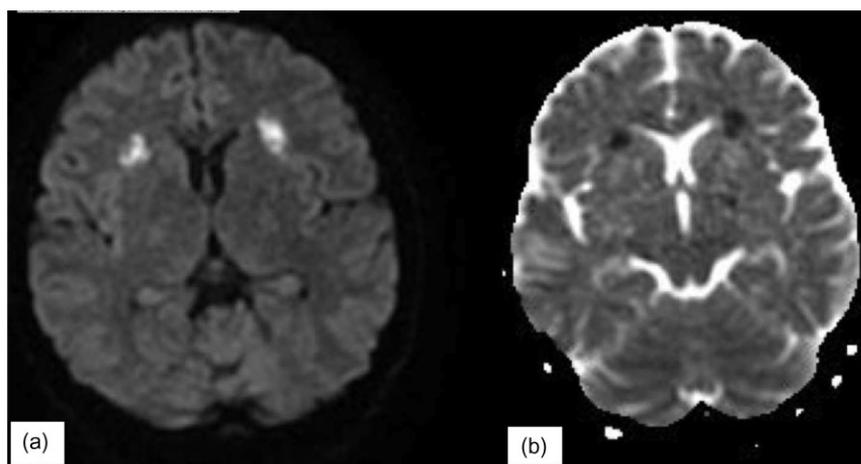
## A cerebrovascular disease case associated with organophosphate intoxication

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**Introduction:** Organophosphates are widely used chemical structures and may lead to severe intoxications. Organophosphates are one of the irreversible acetylcholinesterase (ACE) inhibitors and cause accumulation of acetylcholine on cholinergic receptors. Intoxication results with the extreme muscarinic, nicotinic and central nervous system (CNS) effects of excessive acetylcholine. Increased acetylcholine concentration on CNS may cause headache, confusion, seizures, depression in respiratory center and even coma. There are evidences that there is CNS perfusion changes in organophosphate intoxications.

**Case:** 34-year-old female patient consulted to our emergency department with the complaints such as tarnished gazes, somnolence, perception disorders, dysmnnesia. It was learned that the patient applied insecticide sprays; containing 2,2 – dichlorovinyl dimethyl phosphate, imidacloprid 2.15%; at home for 1 week depending on her obsessive-compulsive disorder. In her neurological examination; restricted cooperation, partially impaired location-time-person orientation, bilateral Babinski (+) was diagnosed. In Diffusion Magnetic Resonance Imaging (MRI) taken in the Emergency Service; diffusion restriction was diagnosed on bilateral caudate nucleus and its response was seen on ADC (Fig. 1a, b).

**Result:** We aimed to present our patient, who gave a positive response to antiplatelet – anticoagulant treatment and supportive treatment, as a case of cerebrovascular disease which is thought to develop secondary to organophosphate intoxication.



## WSC-0932

### Uncommon Stroke Disorders Mirror pseudo-aneurysms of distal lenticulostriate arteries: A rare case report

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**Introduction:** Mirror pseudo-aneurysms of distal lenticulostriate arteries (LSA) are extremely rare, no published case report or study mentioned it yet. We report an extremely rare case of mirror pseudo-aneurysms in distal LSA manifests as both cerebral ischemia and intracerebral hemorrhage (ICH).

**Case illustration:** A 35-year-old male without any vascular risk factors presented with transient left hemiparesis. Brain MRI revealed a lacunar infarct in right basal ganglia region. He was treated with oral anticoagulation. Three months later he developed transient right hemiparesis. Brain CT Scan revealed a small ICH in left basal ganglia region. The oral anticoagulants were stopped. Brain MRA was normal. Cerebral DSA revealed bilateral mirror image pseudo-aneurysms in distal LSA. Blood biochemistry and collagen vascular work up were normal.

**Discussion:** In view of recurrent strokes in young person, the patient was suggested to do extensive vascular examination. Brain MRA was normal, however, cerebral DSA revealed mirror pseudo-aneurysms in distal LSA. Very small size of LSA aneurysm can be missed in noninvasive neuroimaging modalities. Collagen vascular work up was done to find the underlying etiology of multiple aneurysms, but the result was normal. No interventional was done because these lesions are pseudo-aneurysms with fragile nature and very small size of the parent arteries.

**Conclusion:** Extensive vascular examination is needed to reveal the structural abnormality of vascular disorders especially if the patient does not carry conventional risk factors for ICH or cerebral ischemia; hence selection of an appropriate treatment method can be determined.

## WSC-0946

### Uncommon Stroke Disorders Clinical characteristics and antithrombotic treatment of vertebral artery dissection

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<sup>1</sup>Neurology, Tokyo Saiseikai Central Hospital, Tokyo, Japan

**Introduction and aims:** To investigate the clinical characteristics and optimal treatment of vertebral artery (VA) dissection.

**Method:** We examined 23 VA dissection cases of Japanese patients (19 men, 4 women; mean age, 46.0 years) who were admitted in our stroke center from January 2006 to January 2014. They fulfilled the diagnostic imaging criteria for cerebral artery dissection.

**Results:** There were 22 dissection sites in the intracranial VA and 1 in the extracranial VA. Only 1 patient had head trauma and the others had no

clear trigger events. Thirteen cerebral infarctions (CI) and 5 subarachnoid hemorrhage (SAH) were presented. Five patients complained of only headache. Among 18 patients who developed CI or only headache, anti-thrombotic agents were not used in 10 because of aneurysmal formation. ADL at discharge was mRS 0–2 in all 10 patients. In the remaining 8 patients, heparin was used in 4, aspirin was used in 1, and no antithrombotic agents were used in 3. Among 4 patients for whom heparin was used, ADL at discharge was mRS 0–2 in 2 and mRS 3–6 in 2. Among 5 patients who developed SAH, ADL at discharge was mRS 0–2 in 2 and mRS 3–6 in 3.

**Conclusions:** VA dissection occurred more frequently in the intracranial VA. Patients who developed CI showed good recovery even if antithrombotic agents were not used. Heparin did not improve the prognosis of VA dissection.

## WSC-0747

### Uncommon Stroke Disorders Convexal subarachnoid hemorrhage: Presentation of two cases

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Nontraumatic, nonaneurysmal, convexal subarachnoid hemorrhage (SAH) is a rare condition which has different clinical and radiological features in comparison with aneurysmal SAH and has numerous different causes. These patients present less commonly with thunderclap headache and nuchal rigidity and more commonly present with seizures and focal neurological deficits. Cerebral amyloid angiopathy (CAA) is the most common cause in elderly patients and reversible cerebral vasoconstriction syndromes (RCVS) in young patients. Prognosis is very good in young patients with RCVS but can be poor in elderly patients with CAA. We report two cases with convexal SAH. First patient was a 54-year-old woman who presented with acute headache and transient numbness on lips and tongue. She had a history of hypertension, migraine, hypothyroidism and bipolar disorder. Examination revealed nuchal rigidity and meningeal irritation signs. Sulcal hemorrhages were detected in MRI and CT, DSA was normal. SAH resolved without sequela. Although the angiography was normal, a diagnosis of RCVS was considered since early angiography may not show vasoconstriction in RCVS. Second patient was a 21-year-old female patient who suffered from acute abdominal pain, headache and transient dysarthria. She had a history of systemic lupus erythematosus and ischemic stroke and was on warfarin treatment. Neurologic examination was normal. Sulcal hemorrhages were detected in MRI, MR angiography and venography were normal. Acute phase reactants were elevated and the abdominal pain was considered as serositis and improved after methylprednisolone treatment. SAH resolved without sequela and was considered to be a part of SLE disease activity.

## WSC-0309

### Uncommon Stroke Disorders An unusual cause of stroke: Mad honey poisoning

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Food poisoning due to grayanotoxin containing toxic honey (mad honey) presenting with dizziness, hypotension, bradycardia, atrial-ventricular block, respiratory depression and impaired consciousness with a good prognosis has been commonly seen in the Black Sea coast of Turkey. The toxic effects usually last within 24 hours. Different clinical entities, mostly coronary syndromes were reported. We present a case of a 47-year-old male admitted with dizziness and left hemiparesis with an unremarkable

history except of intentionally eating a few spoon of honey. While bradycardia and hypotension were improving after intravenous saline solution and atropine, the hemiparesis persisted. Cranial magnetic resonance imaging (MRI) revealed multiple ischemic lesions. All the investigations related to stroke were within normal limits. We presented this case to imply a probable relationship between mad honey and ischemic stroke.

### WSC-0327

#### Uncommon Stroke Disorders

#### Cerebral amyloid angiopathy related inflammation: Is SWI the clue for diagnosis?

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**Background:** Cerebral amyloid angiopathy-related inflammation (CAA-ri) is characterized by various neurological symptoms such as gradually developing confusion, progressive cognitive decline, seizure or headaches; T2 hyperintensities on magnetic resonance imaging (MRI); and neuropathological evidence of cerebral amyloid angiopathy (CAA) and associated vascular or perivascular inflammation. Despite histological confirmation is necessary for accurate diagnosis, in case of typical clinical features and neuroimaging, the diagnosis can be established without biopsy.

**Case summary:** We present the case of a 57-year-old man with a history of hypertension who presented to the emergency department 3-week history of progressive headache and a gradually developing altered mental status. On examination, he was found to have left sided weakness and decreased psychomotility. Routine clinical work-up (lab investigations, CT, cerebrospinal fluid analysis) didn't show obvious diagnosis, so we performed an MRI. It's raised the suspicion of CAA-ri which diagnosis is verified by neuroradiological evaluation. High-dose steroid treatment was initiated, the patient rapidly responded to treatment, his focal neurological signs resolved. Control MRI after 1.5 months showed a multiple hemorrhagic lesions in the field of previous inflammation which posteriorly supported the previous supposed work-diagnosis.

**Conclusions:** Despite the characteristic pathological features of cerebral amyloid angiopathy, the typical clinical presentation, good response to steroids and accurate neuroradiological criteria make biopsy unnecessary to diagnose CAA-ri.

### WSC-1223

#### Uncommon Stroke Disorders

#### Clinical and neuroimaging features of epileptic seizures in ischemic stroke

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The aim of the study was to establish the clinical and neuroimaging features of poststroke seizures.

265 patients with ischemic stroke leading to different types of epilepsy versus 203 patients suffered from ischemic stroke with no epileptic seizures (control group) were integrally examined.

With focal seizures predominating (92,5%), simple partial seizures (68,5%) developed more frequently as early seizures (within the first 7 days) (ES), whereas complex partial (56.7%), secondary generalized (59.3%) and polymorphic focal seizures (52.4%) dominated in patients with late seizures (LS). Generalized seizures developed at the onset of stroke (45%).

MRI analysis data showed the prevalence of cortical ischemic foci in patients with epileptic seizures (81,6%) as compared to the control group patients (38,7%,  $\chi^2 = 89,2$ ,  $p < 0,001$ ). The median apparent diffusion coefficient of the lesion locus in the patients with seizures was 0,00058 mm<sup>2</sup>/sec, while this parameter in the control group was 0,00048 mm<sup>2</sup>/sec ( $p = 0,029$ ). ES occurred more frequently in patients with acute ischemia in the superior temporal, angular and postcentral gyri, as well as in the posterior portions of the inferior parietal lobule (AUC = 0,87,  $p = 0,0000023$ ), LS were observed during ischemia in the temporal lobe pole, superior temporal, precentral, inferior frontal gyri, motor and sensory cortex, inferior parietal lobule, insula (AUC = 0,77,  $p = 0,000228$ ).

Thus, in patients with early and late poststroke epileptic seizures the predominance of focal seizures, the cortical localization of ischemic foci, the peculiarities of ischemic foci topography were revealed.

### WSC-1375

#### Uncommon Stroke Disorders

#### Posterior circulation stroke: Clinical characteristics, risk factors, outcome and predictors of outcome in Northwestern Nigeria

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**Introduction:** Posterior circulation stroke differ from anterior circulation strokes in the area of etiology, clinical features as well as associated morbidity and mortality.

**Aims:** The study aimed to evaluate etiology, clinical characteristics, outcome and determinant of outcome in a cohort of patients with posterior circulation stroke in Northwestern Nigeria.

**Methods:** We prospectively analyzed 57 patients with posterior circulation stroke in a tertiary care center in Kano, Northwestern Nigeria. Patients were analyzed for demographic data, risk factors, clinical characteristics, stroke subtypes and mortality.

**Results:** Posterior circulation stroke accounted for 57 (9.6%) of 595 of all strokes seen in the study period. They comprised 44 males (mean age 47.8 ± 17.7) and 13 females (mean age 46.3 ± 13.7). Overall, their age ranged between 24 and 90 (mean age 47.4 ± 16.7). However, 52.7% of the patients were less than 45 years of age. The most common site affected was the cerebellum 33 (57.9%). Hypertension was found to be the most common risk factor 49 (86%). Headache and vertigo were the most common symptoms accounting for 83.6% and 86.3% respectively. Thirty-eight (66.7%) had an ischemic stroke type, and overall twenty one (36.8%) died. Independent determinants of death in the study after logistic regression using 95% confidence interval were admitting hyperglycemia (OR = 47.49) and hemorrhagic stroke (OR = 197.15).

**Conclusions:** Our study showed the occurrence of posterior circulation stroke in relatively younger age group. Headache and vertigo were the most common symptoms. Independent predictors of death in the study were admitting hyperglycemia and hemorrhagic stroke.

### WSC-0868

#### Uncommon Stroke Disorders

#### Clinical and radiologic characteristics in PRES/RCVS at pregnant and postpartum period

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**Introduction and aims:** PRES (posterior reversible encephalopathy syndrome) and RCVS (reversible cerebral vasoconstriction syndrome) are often recognized in pregnancy and puerperal period. Vasogenic edema is thought to be the main pathologic feature in PRES and in contrast, cere-

bral vasoconstriction in RCVS. To clarify characteristics of PRES and RCVS in pregnancy, the puerperal period.

**Subject and methods:** We examined 24 pregnancy/puerperal related women with neuroradiologic evaluation by cranial MRI/MRA, cerebral angiography and SPECT. Twenty four patients included 3 pregnancy-induced hypertension, 15 eclampsia and 6 post partum angiopathy.

**Results:** Convulsions was the predominating symptoms (75%), following headache (67%), visual disturbances (29%) and thunderclap headache was recognized only in 2 patients (8%). Radiologically, PRES and RCVS were merged in 16 cases. In addition to PRES and RCVS, cerebral hemorrhage (1), subcortical subarachnoid hemorrhage (1), subdural hematomas (1), cerebral infarction (5) and reversible splenial lesion (1) was shown in acute phase. In 6 of 16 PRES/RCV mergers, vasoconstriction was recognized after brain edema has disappeared and it persisted for from several days to several months. As for the clinical outcome 3 months later was almost good: mRS 0 (22), 3 (1) and 6 (1). However, the image findings 3 months later showed an irreversible change in 21% including old cerebral hemorrhage (1) and infarction (5).

**Conclusions:** Convulsions and headache was the main symptoms of PRES/RCVS but it rarely develops for the thunder headache. Clinical outcome is generally good however, "irreversible" radiologic findings such as bleeding or infarction is often recognized.

## WSC-0909

### Uncommon Stroke Disorders

#### A case of reversible cerebral vasoconstriction syndrome during hemodialysis diagnosed by carotid duplex sonography and transcranial Doppler

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**Introduction:** Reversible cerebral vasoconstriction syndrome (RCVS) is characterized by sudden, severe headache, focal neurologic deficit, and multifocal vasoconstriction of cerebral arteries lasting several weeks to months. Noninvasive investigations such as magnetic resonance angiography (MRA) and transcranial Doppler (TCD) have been largely used for the diagnosis and follow-up of vasoconstriction. Herein, we report a case of RCVS during hemodialysis firstly diagnosed by TCD and carotid duplex ultrasonography (CDU).

**Case report:** A 61-year-old man with end-stage renal disease consulted to neurologic department due to severe headache, vomiting, and confusion during hemodialysis. Focal neurologic deficit was not observed. Ambulatory blood pressure monitoring showed elevated average systolic pressure up to 184 mmHg daytime and 192 mmHg nighttime. CDU during hemodialysis revealed increased pulsatility index and change of waveform to high resistance pattern on carotid and vertebral arteries to compare with baseline. On MRI and MRA, there was no parenchymal abnormality, but multifocal stenoses on intracranial arteries. TCD also showed increased blood flow velocities on multiple intracranial arteries. Intensive blood pressure lowering therapy was done. His symptoms were gradually improved and the follow up TCD 2 weeks later, mean flow velocity of intracranial arteries were decreased in overall.

**Conclusion:** The present case was RCVS presenting severe headache with mental change during hemodialysis, and which was diagnosed by hemodynamic change during dialysis detected by CDU. Measuring cerebral flow using TCD and CDU is noninvasive and easily performed bed-side. And it will be more helpful for the patients on hemodialysis, who complains neurologic symptoms during dialysis.

## WSC-0588

### Uncommon Stroke Disorders

#### Acute stroke associated with combined protein C and S deficiency during pregnancy

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**Introduction:** Stroke related to pregnancy is rare with limited understanding. Patients with protein C and S deficiency are at increased risk for venous thrombosis or arterial infarction especially during pregnancy.

**Case:** A 28-year-old woman with 22-week pregnancy presented with sudden headache and visual disturbance. Neurologic examination revealed findings consistent with left hemianopia and left hemi-body paresthesia. MRI showed acute right posterior cerebral artery territorial infarction. Cardiologic work up revealed no embolic source of stroke. Laboratory data revealed both protein C and protein S deficiency. Coagulation profiles returned to normal 6 months after the delivery.

**Conclusions:** Although either protein C or S can cause acute arterial stroke in young individual, acute stroke associated combined protein C and S deficiency in pregnancy is extremely rare.

## WSC-1429

### Uncommon Stroke Disorders

#### An unusual cause of stroke in a previously fit young man

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**Case:** A previously fit 21-year-old male with a history of mild asthma, presented to The Royal Sussex County Hospital, Brighton one evening. He complained of left sided weakness, dysarthria and poor coordination when trying to use his left hand. He was assessed by telemedicine and clinically had signs of a posterior circulation territory stroke. A CT head confirmed a dense right posterior cerebral artery. Prior to commencing thrombolysis the SpR in ED noted some peri oral telangiectasia. On further questioning the patient reported that his father had hereditary hemorrhagic telangiectasia (HHT) and had died in his 50s. Although the patient did not have a formal diagnosis, he suspected he had HHT because he suffered with frequent nose bleeds. The patient was thrombolysed, made a good recovery and was discharged home after 10 days. During his admission we noted several episodes where his oxygen saturations dropped, once in a physiotherapy session, the others at rest. On each occasion respiratory examination was unremarkable. In view of his diagnosis of HHT (he fitted the diagnostic criteria when assessed on admission) a CT thorax with contrast was requested. This confirmed a large arterio venous malformation (AVM) in the left upper lobe and a number of smaller AVMs. A transthoracic bubble echo revealed no structural heart disease but demonstrated right to left flow. The patient was referred to a specialist center for further treatment.

**Conclusions:** In young patients with HHT it is important to consider pulmonary AVMs as a cause of cerebral emboli.

**WSC-0408****Uncommon Stroke Disorders****Aortic atherosclerosis evaluation of resected specimen using three-dimensional ultrasonography**

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**Introduction:** Aortic atherosclerosis plaques of  $\geq 4$  mm detected by two-dimensional (2D) transesophageal echocardiography (TEE) can be potential source of cerebral embolism. However, evaluation of the plaque composition by TEE is rather simple compared with histological classification.

**Aims:** To examine the three-dimensional (3D) TEE on autopsied aorta and to compare the plaque histology and the graphic appearance from 3D ultrasonography among same specimens, we applied the American Heart Association (AHA) histologic classification of atherosclerosis.

**Methods:** Four autopsied human aortae (71–86 years, 3 men) were fixed in 10% formalin perfusion of 100 mmH<sub>2</sub>O pressure. After 3D ultrasonography was performed on 4 aortae, histological samples were taken from aortic plaques. One pathologist evaluated plaque histology with no information concerning the results of 3D ultrasonography.

**Results:** The result of 3D ultrasonography corresponded to the AHA atherosclerotic histologic classification type II, IV, V and VI of aortic plaques of each case. The aortic intraluminal surface was almost smooth on the type II, mildly irregular on the type IV, and moderately irregular with two-dimensionally defined marked calcified lesions on the type V. Multiple ulcerated plaques and protruding lesions were observed on the type VI. Highly similar findings in extent and severity of aortic atherosclerosis were obtained with 3D ultrasonography to those with macroscopic pathological findings. Pathologically proven morphological changes such as concavity and convexity of an ulcerated plaque or a protruding lesion were detected with 3D ultrasonography.

**Conclusions:** We categorized 3D ultrasonographic appearance according to AHA histological classification of atherosclerosis.

**WSC-1629****Uncommon Stroke Disorders****A rare cause of young stroke: Cerebral venous thrombosis**

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**Case report:** A 22-year-old female case had had intensive headache and difficulty in using her left hand after C-section performed at term under spinal anesthesia. At that moment, her blood pressure was also high. After approximately 1 hour, she developed contractions in the right arm and unconsciousness. It was learned from her antecedent that she had received no medication or had no disease during pregnancy. Her personal and family histories were unremarkable. Detecting monoparesis in the left arm and extensor plantar skin reflex on neurological examination, scanning was requested. Cranial MRI demonstrated a lesion in the temporoparietal localization, which was consistent with venous infarction (Fig. 1). MR venography revealed decreased flow in the left sagittal sinus (Fig. 2). The patient, who was diagnosed with cerebral venous thrombosis, was hepa-

rinized. Her cardiac examination, extracranial Doppler ultrasonography, transthoracic and transcardiac ECHO examinations were unremarkable. Blood analyses included complete blood count, total biochemistry, serum lipids, PT, aPTT, thyroid function tests, fibrinogen, D-dimer, protein C, protein S, antithrombin III, homocysteine, activated protein C resistance, FVL mutation, prothrombin 20210A mutation and MTHFR. Results of the patients were unremarkable except for detecting heterozygote carriage for MTHFR-C677T gene mutation. Clinical picture was associated with pregnancy and presence of MTHFR mutation. Anticoagulant and anti-epileptic therapies were recommended for 1 year. In this paper, it was highlighted that probability of cerebral venous thrombosis should be considered in the presence of focal neurological deficit and seizures in the cases with acute- or subacute-onset headache.

**WSC-0639****Uncommon Stroke Disorders****Brain stem involvement in a patient with Fahr's syndrome**

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**Case:** A 63-year-old female patient was admitted to the emergency room during the postictal period having experienced generalized seizures in 4-hour intervals. During the neurological examination, the patient was in the altered state of consciousness associated with postictal periods so cooperation was problematic. An examination performed 2 hours later showed that the bilateral pupils were defective due to cataract surgery. Moreover, bilateral hand tremor, bradykinesia, associated loss in movement, and anteflexion posture were observed. Brain computed tomography showed calcification in the bilateral basal ganglia, thalamus, periventricular white matter, cerebellar dentate nucleus, and pons. Laboratory results were as follows: serum total calcium level, 5.1 mg/dL (N: 8.8–10.2); phosphorus, 4.9 mg/dL (N: 2.5–4.5); parathormone, 0.1 pg/ml (N: 15–68); and vitamin D within the normal range. Thyroid ultrasound was normal. The patient was diagnosed with Fahr's syndrome secondary to hypoparathyroidism. The patient's mini-mental exam score was 24/30. The neuropsychological test that followed the mental test determined verbal and nonverbal memory impairment, accompanying significant findings observed in the frontal axis, as well as visuospatial dysfunction. Memory impairment was observed in the recording, learning, and information retrieval processes. The patient received regular follow-up care through outpatient services.

**Conclusions:** In patients with Fahr's syndrome, calcifications in nonclassical residential areas, such as in the midline of the brain stem, were reported for the first time in 2011. The current case is presented to draw attention to this rare localization and to contribute to the literature.

**WSC-0471****Uncommon Stroke Disorders****Characteristics of wake-up stroke through the timing – An experience from an Arab cohort**

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**Introduction:** Wake-up Stroke (WUS) doesn't have distinctive clinical characteristics. Physiological changes in circadian rhythm (cerebral autoregulation, vascular tone, blood pressure, coagulation profile) are thought to predispose to WUS.

**Aim:** Our objective is to identify the characteristics WUS among Arab.

**Methods:** Retrospectively assessed consecutive patients admitted (within 5 days of symptoms) to Acute Stroke Unit of King Fahad Medical City (November 2010 to Aug 2012). Patient's demographics, risk factor, stroke volume (ABC/2 method), location, etiology (TOAST criteria), and functional status (NIHSS, BI, GOS score) were assessed. WUS was grouped, into Group A (0:00–06:00), B (06:01–12:00), C (12:01–23:59) based on the 'wake up' time. Statistical analysis was done using SAS version 9.2.

**Results:** Of the 236 patients fulfilling inclusion criteria-219 were ischemic stroke. From them 65 (29.7%) were WUS having more male (78% vs 62%), AF (13% vs 7%; p-0.11), cardioembolic (21% vs 16%; p-0.41), and insular stroke (23% vs 11%; p-0.039). WUS Group A (n = 28) had more obese (26% vs 10%, 20%); AF (17% vs 9%, 3.8%; p-0.715); left sided, subcortical, brainstem stroke; higher BI, GOS. Group B (n = 10) had older age (65.6 vs 60.63 y; p-0.9572), smallest volume (15 vs 26, 45 cumm) of stroke. Group C WUS (n = 27) had bilateral, right sided, cortical, insular stroke (27% vs 26%, 17%; p-0.5457); large artery atherosclerosis (15% vs 12%, 6%; p-0.7262) with symptomatic stroke (20% vs 16%, 7%; p-0.7499), cardioembolic stroke (12% vs 7%, 9%, p-0.3573), largest stroke volume (46 vs 26, 14 cumm), higher admission (p-0.1285) and discharge (p-0.248) NIHSS.

**Conclusions:** The clinical characteristics of our Arab WUS were not significantly different from non-WUS. However, this study revealed a significantly higher rate of involvement of insular cortex in WUS, the rationale behind this occurrence is yet to be unraveled.

### WSC-1095

#### Uncommon Stroke Disorders

#### The efficacy of mirabegron, a beta3-adrenergic agonist, in patients with overactive bladder with chronic cerebral infarction

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**Introduction:** Mirabegron is a  $\beta_3$  adrenergic agonist for treatment of overactive bladder having a new mechanism of action. The overactive bladder often occurs in combination with chronic cerebral infarction.

**Aims:** We have evaluated the effects of mirabegron on overactive bladder with chronic cerebral infarction.

**Methods:** Serial 371 subjects in outpatient department of neurology were undergone a screening test of overactive bladder symptom score (OABSS) and IPSS (International Prostate Symptom Score) -QOL index.

**Results:** Forty-one subjects were enrolled in this study. Eight weeks after treatment, total OABSS score (from  $7.1 \pm 2.7$  to  $5.1 \pm 3.1$ ) and IPSS-QOL index (from  $4.4 \pm 1.3$  to  $3.1 \pm 1.6$ ) were significantly improved. There were no characteristic side effects, including side effects observed in the treatment with anticholinergic drugs.

**Conclusions:** This study indicates that mirabegron is an effective treatment for overactive bladder with chronic cerebral infarction.

### WSC-1410

#### Uncommon Stroke Disorders

#### Seizures during the first 24 hours of acute stroke

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**Introduction:** Seizures in the first 24 hours of stroke have been of variable incidence with figures quoted between 3% and 6% in most series. They are associated with significant morbidity and mortality.

**Aims:** To find the incidence of seizure in the first 24 hours in our patients and to see if there is an association between stroke subtypes and its etiology.

**Methods:** All stroke patients who were fully investigated and admitted in Al-Zaytouna Specialist Hospital (Khartoum) between February 2009 and

March 2014 were retrospectively studied. Patients with history of epilepsy and provoked seizures were excluded.

**Results:** 180 patients. 109 (60.5%) males and 71 (39.5%) females. 109 (60.5%) with ischemic stroke, 71 (39.5%) with hemorrhagic stroke. 40 (22.8%) had seizures within 24 hours, 28 (70%) suffered cerebral infarct and 12 (30%) with hemorrhagic stroke. Cerebral Venous Sinus Thrombosis (C. V. S. T.) in 17 patients, 13 of whom had seizures. 8 patients with seizure had cardioembolic etiology. In 12 patients with hemorrhagic stroke 6 patients had vascular anomalies.

**Conclusion:** Our study unlike previous studies demonstrated that cerebral infarct had a higher incidence than hemorrhagic stroke. This is due to the fact that C. V. S. T. and cardiac embolization constitute a significant portion of our case series. We recommend that patients with small cortical infarcts and in the absence of cardioembolic cause deserve to be investigated for C. V. S. T.

### WSC-0398

#### Uncommon Stroke Disorders

#### Endovascular management of traumatic pseudoaneurysm of the pericallosal artery –Case report

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**Introduction:** Traumatic intracranial pseudoaneurysms are rare complication of closed head injuries.

**Aims:** To evaluate the efficacy of the coiling with stent in the treatment of traumatic pseudoaneurysms, we report a case of traumatic pseudoaneurysm of the pericallosal artery managed endovascularly with stent.

**Methods:** A thirteen-year girl was admitted to the emergency department suffering from traffic accident. She was in a stuporous state (Glasgow Coma Scale Score 7: E2V1M4). Initial cranial CT scans demonstrated a small amount of subdural hematoma (SDH) on the right convexity and anterior falx SDH. Her mentality was recovered to alert state. On 7th day, she suffered seizure and her mentality decreased to a stuporous state. Brain CT scans showed a new appearance of acute SDH on the right convexity and falx SDH with severe brain swelling. Emergent craniectomy and hematoma removal was performed. Then we performed an angiography to exclude pseudoaneurysm. We found a pseudoaneurysm at the pericallosal artery which was managed endovascularly using coils and stent.

**Results:** She recovered her consciousness with mild left hemiparesis. Cranioplasty was performed and follow-up angiography showed the obliteration of pseudoaneurysm and the patency of the pericallosal artery.

**Conclusions:** Treatment with coiling with stent provides a variable approach for patients with traumatic pseudoaneurysm of the pericallosal artery, maintaining patency of the artery and thus leading to good clinical results. An expanded clinical experience and a larger sample are needed.

### WSC-1148

#### Uncommon Stroke Disorders

#### Unilateral transient hearing loss accompanied with abducens nerve palsy caused by the neurovascular conflict

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**Introduction:** The term neurovascular conflict (NVC) has been introduced to describe the anatomic situation where a nerve makes contact

with a blood vessel, at the exit zone of the brain's trunk. The most common clinical expressions are trigeminal neuralgia, hemifacial spasm, spasmodic torticollis, glosopharyngeal neuralgia, disabling positional vertigo, neurogenic hypertension, and tinnitus. We present here an unusual case in which superior vertebral artery creates a NVC with the left rostral part of brainstem and left abducens nerve, generating a clinical picture characterized by a transitory unilateral hearing loss, tinnitus and abducens nerve palsy.

*Case:* A 62-year-old male patient came to the hospital describing following problems: 30 days beforehand he had the hearing loss and tinnitus on the left side. 7 days before the examination, hearing problems and tinnitus became minor, while double vision occurred. The examination demonstrated isolated lateral rectus muscle palsy on the left side, while hearing was correct. BAEPs showed a V wave amplitude decrease with increase in stimulation intensity, which revealed discrete dysfunction in the left part of the rostral brainstem. MRI endocranium with MRA showed NVC of superior cerebellar artery, which pressed the abducens nerve. The patient was not motivated for the microvascular decompression, and after 6 months the symptoms diminished with double vision appearing only occasionally.

*Conclusion:* Diagnosis of the unilateral abducens nerve palsy mostly leads to the assumptions of diabetic neuropathy, tumor, aneurism, fracture, stroke, or infection while the NVC, which is associated with the same symptoms, is rarely taken into account.

*Key words:* neurovascular conflict, superior cerebellar artery, abducens nerve palsy.

### WSC-1171

#### Uncommon Stroke Disorders

##### Music agnosia: Easily missed in a fast turnaround service

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A 35-year-old previously well man with no vascular risk factors was admitted with a sudden onset of minor left sided weakness, headache and slurred speech. CT Brain scan was normal but MRI showed right middle cerebral artery infarction. He was discharged with early supported discharge support after 2 days. Outpatient investigations revealed no evidence of vasculitis or paroxysmal atrial fibrillation. Transoesophageal echocardiography (TOE) showed a small patent foramen ovale thought to be likely culprit for his 'cryptogenic' stroke. He was given oral clopidogrel 75 mg daily.

Follow up revealed a complete resolution of his motor deficits but he complained of inability to appreciate music which was an important part of his life. Music seemed strange and unpleasant with notes sounding out of key. He had given up playing the guitar. Bird song or other repetitive sounds would trigger off music in his head, so called 'ear worms'. These symptoms contributed to his low mood. With time his appreciation of music is improving. Loss of music appreciation can significantly contribute to poststroke depression.

#### Discussion

In a fast turnaround service it is often easy to dismiss certain symptoms as innocuous, wherein they have the potential to be significantly distressing to the patient. The above case of music agnosia illustrates this. Further similar cases maybe required to establish the potential of functional MRI as a diagnostic tool to predict the possibility, and appropriately counsel the patient prophylactically.

### WSC-0773

#### Uncommon Stroke Disorders

##### Down syndrome and moyamoya disease: An autoimmune link?

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*Introduction:* Moyamoya disease is a rare cause of stroke. Patients with Down syndrome have an increased predisposition to moyamoya and our case suggests that there may be an autoimmune link between the two.

*Case:* A 5-year-old boy with Down syndrome was found on routine thyroid function testing to have hyperthyroidism and was commenced on carbimazole. A week later, he presented with left sided limb and facial weakness. Brain imaging demonstrated evidence of a chronic infarction and several acute infarctions bilaterally affecting various vascular territories. MR angiography revealed stenosis of multiple vessels including bilateral internal carotid arteries in the presence of collaterals representing moyamoya disease. Further investigations showed a raised anticardiolipin IgG. He was commenced on aspirin and recovered within days. He is receiving neurosurgical input for revascularization.

*Discussion:* An association between Down syndrome and moyamoya is well described in literature. The exact cause of this is yet to be identified. One theory hypothesizes that a protein encoded on Chromosome 21 may be related to the development of moyamoya. A second theory postulates an autoimmune association. Down syndrome is associated with autoimmune disorders such as Graves' disease. Previous literature also describes an association between moyamoya disease and disorders with autoimmune mechanisms. Given the presentation of stroke in the setting of Graves' disease and anticardiolipin IgG antibodies in our patient, this latter theory seems plausible.

*Conclusion:* Patients with Down syndrome have an increased risk of moyamoya disease and an autoimmune mediated process may explain the link between these conditions.

### WSC-1613

#### Uncommon Stroke Disorders

##### Risk of recurrent cervical artery dissection during pregnancy

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*Background:* Hormonal and mechanical factors might increase the risk for cervical artery dissection (CAD) during pregnancy and puerperium. There is considerable uncertainty how to counsel women with a previous CAD regarding the risk of recurrence during pregnancy and puerperium. *Aims:* This study investigates whether there is an increased risk of recurrent CAD during pregnancy and puerperium.

*Methods:* 97 women aged 16–45 yrs who had experienced CAD in the previous decade were identified in 4 centers. All women were contacted

and the clinical course after primary CAD was assessed using a predefined protocol.

**Results:** 53 women were included in the analysis (55%). 11 women declined to participate, 33 did not respond. Nonparticipating women did not differ from participants regarding key baseline characteristics. Average follow-up time was 72 months after the primary CAD. Nine women (17%) suffered recurrent CAD after a median of 14 days (range, 2 days to 117 months). In 11 women (20%), 13 pregnancies occurred after a median of 48 months (range 14 to 86 months; n = 6 vaginal delivery, n = 7 caesarean section). Two pregnant women had suffered recurrent CAD  $\geq$ 18 months prior to the pregnancy. None of the 5 women with connective tissue disease became pregnant. During pregnancy and puerperium, no recurrent CAD or other neurological complication occurred in any woman (including preeclampsia).

**Conclusions:** Within the limits of a relevant nonresponse rate, this study could not find evidence for an increased risk of recurrent CAD or other complications during pregnancies starting at least 12 months after CAD.

### WSC-0338

#### Uncommon Stroke Disorders

##### A rare cause of stroke: Chronic severe iron-deficiency anemia (a case series)

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**Introduction:** iron-deficiency anemia (IDA) has been reported as a rare cause of stroke in children and adults. Although the pathophysiology is not completely understood, there are at least two possible mechanisms: the thrombocytosis reactive to IDA and the anemic hypoxia induced by IDA.

**Aims:** to draw attention on a rare but perfectly treatable cause of stroke.

**Methods:** a case-series of four young women (age between 35 and 42 years) with acute ischemic stroke or transient ischemic attack (TIA) and chronic IDA due to uterine fibroids and repeated menorrhagia.

**Results:** All the patients had severe IDA (hemoglobin between 6 and 7,3 g/dL) and reactive thrombocytosis. All of them had brain computed-tomography on admission and brain magnetic resonance imaging in the next 48 hours. All other known causes of stroke were ruled out by careful neurovascular, hematologic and cardiologic exams. Malignancy was also excluded. All the patients received aspirin, blood transfusion and oxygen when needed with good clinical outcome and without major disability after 90 days (modified Rankin scale 0–1).

**Conclusions:** severe IDA with thrombocytosis may be a risk factor for ischemic stroke and the primary prevention (early identification and treatment of IDA) must remain a priority. Future works are needed regarding the pathophysiology, risk stratification and treatment options in stroke related to IDA.

### WSC-0681

#### Uncommon Stroke Disorders

##### May-Thurner syndrome as a hidden etiology of cryptogenic stroke – Analysis of the group of the patients

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May-Thurner syndrome or ilioacaval compression is a syndrome characterized by the compression of the left iliac vein with the right iliac artery against the spine. The pathogenesis is unclear, it is proposed that mechanic compression leads to disruption of the endothelium with increased deposition of the lipids and plaque formation. In certain cases deep vein thrombosis develops which increases the risk of pulmonary

artery embolization as well as ischemic stroke in young patients with PFO (patent foramen ovale) as a result of paradox embolization. More women than men are affected, usually at the age between 20 and 40. The diagnosis is based on MRI venography with 100% sensitivity and 96% specificity in the pelvic region. The embolic etiology of the stroke is in 40–60% of patients under 50 years with May-Thurner syndrome associated with PFO. We analyzed group of the 52 patients with PFO associated with ischemic stroke for the presence of May-Thurner syndrome. Among them 47% were positive, 17% were negative, the average age was 45 years.

In conclusion, May-Thurner syndrome is a rare cause of ischemic stroke associated with patent foramen ovale and should be considered in young patients under 50 years.

**Key words:** May-Thurner syndrome, stroke, MR venography, patent foramen ovale.

### WSC-0451

#### Uncommon Stroke Disorders

##### A study of acute symptomatic seizure in acute stroke

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**Introduction:** Acute symptomatic seizure is a rare complication of acute ischemic stroke. However, the underlying mechanism of this symptom is not yet clear. The purpose of our study is to identify predictors for acute symptomatic seizure.

**Methods:** In this retrospective study, we analyzed patients who were taken to our hospital by ambulance for seizure as a first symptom of acute ischemic stroke. We identified patients who showed epileptic seizure when an ambulance arrived, and who were diagnosed with acute ischemic stroke after MRI examination at our hospital. Neurological findings, etiology of stroke, MRI findings, type of seizure and EEG findings were investigated for each patient.

**Results:** Of 1,224 stroke patients, eleven (0.9%) exhibited acute symptomatic seizure. Symptoms of seizure were clonic seizure (72.7%), tonic seizure (18.1%) and aphasia (0.09%). MRI showed infarction in various areas; infarctions in the parietal lobe, temporal lobe, parieto-occipital lobe, fronto-parietal lobe, fronto-temporal lobe, insula, thalamus, and corpus callosum were found in one patient each, and infarctions in the occipital lobes were found in two patients. Six patients showed EEG abnormalities, which were mostly generalized slow waves, with some patients showing sharp waves and PLEDS. Status epilepticus was not observed because intravenous administration of diazepam or phenytoin easily suppressed these seizures.

**Conclusions:** Acute symptomatic seizure is quite rare as a first symptom of acute ischemic stroke. The area of infarction includes both the frontal lobes and other forebrain regions. Seizure is easily controlled by routine treatment.

### WSC-1184

#### Uncommon Stroke Disorders

##### Adhesive arachnoiditis and spinal myelopathy secondary to subarachnoid hemorrhage in a patient with severe dengue

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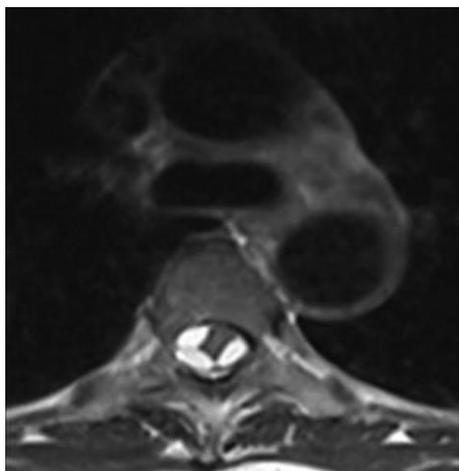
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**Introduction:** The adhesive arachnoiditis and myelopathy are rare complications of subarachnoid hemorrhage, underdiagnosed and with poor prognosis. The diagnosis is based on clinical suspicious and brain imaging.

**Clinical case:** 64-year-old woman, without vascular risk factors, with a history of subarachnoid hemorrhage (SAH) Hunt Hess 3 Fisher IV with

severe dengue. Six months later, she comes to her medical appointment due to gait instability. At physical examination D8 sensory level, bladder disturbance, lower limb ataxia and paraparesis with progressive deterioration. Lumbar puncture was performed without success. NMR thoracolumbar with intradural cysts in D3 – D7, with deformation and compression of the spinal cord, myelopathic changes in D7 – D11 and marked diffuse thickening of the cauda equina. The treatment performed was decompressive laminectomy (D2-D8) with spinal arachnoid cyst excision and lysis of adhesions. Patient discharged without significant changes in her assessment.

**Conclusion:** In patients with progressive gait disturbance and spinal cord syndrome with a history of SAH, especially with heavy bleeding, with posterior location, spinal adhesive arachnoiditis should be considered as a cause and treatment must be individualized for each patient.



**WSC-1240**  
**Uncommon Stroke Disorders**  
**Neurovascular reactivity in patients with obstructive sleep apnoea**

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**Introduction:** Endothelial dysfunction has been shown in patients with obstructive sleep apnoea syndrome (OSAS). However, neurovascular dysfunction is not known which is related to endothelial function as well.

**Aims:** We investigated neurovascular reactivity using visual stimulation in patients with OSAS by means of transcranial Doppler (TCD).

**Methods:** Data were collected 49 patients who have moderate to severe OSAS (an apnoea hypopnea index of >15/hour), and compared with those of 15 healthy subjects matched for age and vascular risk factors. Reactivity is defined as relative changes between blood flow velocities measured during stimulus and rest.

**Results:** Since there is no significant side difference, the Doppler data of the left and right sides were pooled both in patients and controls. Thus, 98 vessels (posterior cerebral artery) in patients and 30 vessels in controls were analyzed. OSAS patients showed similar reactivity to visual stimulation with respect to controls (27.7% vs. 29.1;  $p < 0.05$ ).

**Conclusion:** These data demonstrate normal neurovascular reactivity in OSAS patients. OSA has been implicated in the pathogenesis stroke, which are associated with impaired endothelial responses. In contrast to lower cerebrovascular reactivity, neurovascular reactivity as shown by TCD is normal.

**WSC-0851**  
**Uncommon Stroke Disorders**  
**Restless leg syndrome and periodic limb movements induced by acute pontine infarction in a patient with iron deficiency anemia**

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**Introduction:** Restless legs syndrome (RLS) is characterized by unpleasant sensation in the legs that is relieved by movement. Periodic limb movements (PLM) is a sleep disorder with recurrent episodes of repetitive, stereotyped limb movements predominantly occurring in the legs. Bilateral PLM/RLS have been rarely reported in patients with stroke. We experienced a woman with bilateral PLM/RLS after right pontine infarction.

**Case report:** A 46-year-old left-handed woman was admitted because of sudden onset of dysesthesia in her left extremity. Diffusion-weighted imaging revealed an acute infarction in the right dorsolateral pons. Two days later, she had uncomfortable and unpleasant sensation in the both legs that are relieved by movement at night. Her involuntary movement of her both legs appeared at night and daytime. Laboratory investigations showed that serum hemoglobin level was 9.5 g/dl, hematocrit was 29.0%, iron was 19.7 ug/L, ferritin was 6.2 ng/ml and total iron binding capacity was 389 ug/dL. Dopamine agonist and oral iron medication were done for the PLM/RLS and IDA. At 3 months after discharge, abnormal movements and sensations disappeared.

**Conclusions:** PLM/RLS is the result of disinhibition of either the descending inhibitory pathways to the brainstem generator or the ascending sensorimotor cortex. IDA might play an important role through the disruption of nigrostriatal dopaminergic pathways. Acute pontine infarction might be a trigger factor for the development of bilateral PLM/RLS with IDA.

**WSC-1018**  
**Uncommon Stroke Disorders**  
**An uncommon case of early neurological deterioration after stroke thrombolysis**

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**Introduction:** Early neurological deterioration is relatively a common event that can occur within first 3 days following an acute Ischemic stroke. We describe a case of an uncommon complication of stroke thrombolysis.

*Case report:* 88-year-old man presented with symptoms of right arm weakness, paresthesia and dysarthria. His initial NIHSS score was 8. He was thrombolysed with Alteplase at 171 minutes from the onset of symptoms. His 1 hour NIHSS improved to 1.

Five hours post thrombolysis his clinical condition deteriorated with reduction in GCS and he had two grand mal seizures. After this event there was a marked deterioration clinically and his NIHSS at 24 hours increased to 19.

He had an MRI scan done that showed multiple foci of restricted diffusion mostly in the territory of left middle cerebral artery (MCA). This was highly suggestive of multiple infarcts of an embolic nature.

CT angiogram showed 50% stenosis of the proximal right ICA and left proximal ICA distal to the bifurcation. A MR venogram did not suggest any venous lesions.

*Conclusion:* It is assumed that thrombolysis accelerated the breakup of an unstable plaque from the left carotid artery leading on to a shower of emboli in the MCA artery territory. There was no other source of thrombus detected in the heart (he was in sinus rhythm and normal echo) or in any other vasculature in the imaging. This can be an uncommon complication of stroke thrombolysis and need to be considered in future studies.

### WSC-0186

#### Vascular Cognitive Impairment/Vascular Dementia Aerobic exercises enhance cognitive functions and brain derived neurotrophic factor in ischemic stroke patients

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*Introduction:* Stroke is a leading cause of functional impairments. High percentage of these patients will experience some degree of cognitive affection, ranging from mild cognitive impairment to dementia

*Aims:* Demonstrate the role of aerobic exercises enhancing cognitive functions and its effect on Brain Derived Neurotrophic factor (BDNF) in postischemic stroke patients in the territory of anterior circulation

*Methods:* We included thirty Egyptian ischemic stroke patients in the territory of anterior circulation. They were divided into 2 groups; group 1 (G1) were subjected to physiotherapy program without aerobic exercises and group 2 (G2) were subjected to the same previous program followed by aerobic exercises. Both groups were subjected to pre and post-treatment Addenbrookes's Cognitive Examination- Revised (ACER) and serum level of BDNF

*Results:* Our results showed a significant improvement in ACER score in G2 compared to G1 post-treatment ( $p = 0.017$ ). BDNF serum level significantly increased in G2 post-treatment compared to pretreatment ( $p = 0.001$ ) and compared to G1 group ( $p = 0.0458$ ). ACER improvement was positively correlated to increase in serum level of BDNF ( $r = 0.53$ ,  $p = 0.044$ ).

*Conclusion:* Aerobic exercises improve cognitive functions of ischemic stroke patients. This improvement is related to the increase in serum level of BDNF.

### WSC-1605

#### Vascular Cognitive Impairment/Vascular Dementia Profile and determinants associated with vascular cognitive impairment in African stroke survivors: The CogFAST – Nigeria study

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*Objective:* Sub-Saharan Africa faces a potential epidemic of noncommunicable diseases including stroke and dementia but little is known about the burden of stroke-related cognitive dysfunction. We assessed baseline profile of and factors associated with vascular cognitive impairment (VCI) in stroke survivors participating in the Cognitive Function After STroke (CogFAST) Nigeria Study.

*Methods:* We recruited 217 subjects ( $\geq 45$  years old) comprising 143 stroke survivors and 74 demographically matched stroke-free healthy controls. We obtained demographic, clinical and lifestyle information and assessed cognitive status of the subjects at baseline 3 months after stroke. Standard neuropsychological tests included the Vascular Neuropsychological Battery which assessed executive function/mental speed, memory, language, and visuospatial/visuoconstructive functioning. Cognitive impairment and dementia were defined based on the AHA/ASA VCI guidelines and the DSM IV Criteria.

*Results:* Among the stroke survivors – mean age ( $60.4 \pm 9.5$  years) 43.4% female, mean number of years of education ( $9.4 \pm 5.6$  years), modified Rankin score (median = 2), 57 (39.9%) had cognitive impairment no dementia (CIND) while 12 (8.4%) were demented at baseline. Multivariate analysis revealed older age [OR = 1.05 (1.00 – 1.09)], low education [OR = 5.09 (2.17 – 11.95)], prestroke cognitive decline [OR = 4.51 (1.20 – 16.88)] and medial temporal lobe atrophy [OR = 2.25 (1.16 – 4.35)] were independently associated with cognitive dysfunction whereas pre-stroke daily intake of fish [ $p = 0.022$ , OR = 0.39 (0.15 – 0.89)] was inversely associated.

*Conclusions:* These results suggest high frequency of early VCI in older Nigerian stroke survivors. Apart from ageing – associated neurodegeneration and cognitive decline, educational level and prestroke diet particularly fish consumption were identified as modifiable factors. This emphasizes the vital role of education and healthy nutrition in building reserves to ameliorate cognitive dysfunction after stroke.

### WSC-0351

#### Vascular Cognitive Impairment/Vascular Dementia Cognitive state following stroke: The predominant role of the preexisting white matter changes in the TABASCO study

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*Introduction:* Stroke is a major cause of cognitive impairment and dementia in adults. Previous research has failed to define the role of the ischemic lesion, beyond other risk factors known in elderly.

*Aims:* This study used structural equation modeling to determine the respective impact of newly detected ischemic lesions and preexisting white matter changes on poststroke cognitive state.

*Methods:* TABASCO (Tel-Aviv Brain Acute Stroke Cohort), a prospective study including first-ever mild-moderate ischemic stroke patients.

Patients underwent magnetic resonance imaging scans within 7 days from symptoms onset and were cognitively assessed 1 year after using a computerized neuropsychological battery. Normal appearing white matter tissue integrity and volume of ischemic lesions and preexisting white matter were measured, together with demographic parameters. Their contribution to cognitive state was assessed using structural equation modeling path analysis. Two models were hypothesized, differing only by the role of the ischemic lesion volume.

**Results:** The study included 142 mild to moderate stroke patients. Structural equation modeling analysis confirmed the predominant role of white matter lesions volume (standardized path coefficient  $\beta = -0.214$ ) and normal appearing white matter integrity ( $\beta = -0.185$ ) on the global cognitive score, while ischemic lesion volume showed no such contribution ( $\beta = 0.033$ ). In addition, the model excluding the ischemic lesion presented superior fit (comparative fit index 0.958 versus 0.202).

**Conclusions:** Mild to moderate stroke patients with preexisting white matter changes are more vulnerable to cognitive decline regardless of their new ischemic lesions. Treatment of these patients should focus on cognitive rehabilitation and neuro-protective therapies alongside standard care.

### WSC-1039

#### Vascular Cognitive Impairment/Vascular Dementia Cognitive impairment at 90 days predicts mid-term mortality in first-ever ischemic stroke survivors

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**Introduction:** Functional assessment in stroke survivors is mostly limited to motor abilities, with cognitive assessment largely omitted.

**Aims:** We sought to analyze the frequency of cognitive impairment in ischemic stroke survivors and its prognostic relationship at 12 months after the initial event.

**Methods:** We assessed first-ever ischemic stroke survivors 90 days after the event by the mini-mental state examination (MMSE). Patients with a stroke recurrence during the follow-up were not included. The distribution of MMSE scoring was analyzed according to functional categories as determined by the modified Rankin scale (mRS). We also studied the impact of MMSE scores on 12-month mortality.

**Results:** A total of 435 stroke survivors (50.1% women, median age 68 years, interquartile range: 55–76 years) received cognitive assessment by MMSE [mean: 23.2 points, standard deviation (SD): 6.3 points]. The mean MMSE score was progressively lower in patients with mRS 0–1 (25.8, SD: 4.4 points), mRS 2–3 (22.0, SD: 6.6 points) and mRS 4–5 (18.4, SD: 6.8 points) ( $p < 0.001$ ). Moreover, the frequency of cases with MMSE  $< 24$  was significantly higher as motor disability increased, but remarkably, patients with a very good functional status (mRS 0–1) also had a high frequency of suboptimal performance ( $< 24$  points) on the MMSE (mRS 0–1: 23.9%, mRS 2–3: 46.6%, mRS 4–5: 72.5%,  $p < 0.001$ ). A similar situation was observed with MMSE  $< 18$  points (mRS 0–1: 6.3%, mRS 2–3: 22.4%, mRS 4–5: 42.0%,  $p < 0.001$ ). MMSE  $< 24$  points was significantly associated with 12-month mortality (6.0% vs 1.7%, in patients with MMSE  $< 24$  or higher, respectively; HR: 3.79, 95% CI: 1.16–12.37).

**Conclusion:** Despite the limitations of MMSE as screening tool of the mental function in patients with cerebrovascular injury, it is clear that cognitive impairment occurs after a first-ever ischemic stroke, even in subjects without significant motor disability. A poor cognitive performance at 90 days is a risk factor for mid-term death.

### WSC-0985

#### Vascular Cognitive Impairment/Vascular Dementia Predictors of vascular cognitive impairment poststroke in a Bahraini cohort: A case-control proposed comparison

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**Introduction:** Poststroke dementia and cognitive impairment are associated with poor long-term outcomes, including survival and disability after stroke. The contribution of genetic factors such as the presence of ApoE  $\epsilon 4$  allele and its association with cognitive impairment poststroke remains inconclusive particularly in Middle-Eastern regions.

**Aims:** The aim of the study is to examine the correlates and potential predictors of cognitive impairment including biomarkers in stroke patients and compare these functions to healthy older adults in Bahrain.

**Methods:** A prospective stroke sample of  $n = 200$  patients (case group) and  $n = 100$  healthy ageing individuals (control group) will be recruited from the largest Medical Complex in Bahrain. A neuropsychological battery of cognitive assessments (global, executive and meta-cognition) will be conducted on all participants and categorized into four sub-groups (nonvascular cognitive impairment, vascular cognitive impairment with no dementia, vascular dementia and mixed dementia) using the DSM-IV dementia criteria, Hachinski Ischemic Score (HIS) and the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE). Biomarkers will include ApoE, sRAGE, NEP, BACE1, biochemistry and hematology measurements.

**Results:** The primary study outcome is to determine early risk factors for cognitive impairment after stroke in a Bahraini cohort. The study has received full ethical approval from the Bahrain Ministry of Health and from the affiliated university.

**Conclusions:** With increasing stroke incidence rates in Bahrain, this research study will provide useful biological and epidemiological data for future development and planning of health policies and guidelines for stroke care within the Gulf region.

### WSC-0678

#### Vascular Cognitive Impairment/Vascular Dementia Validation of the Brazilian–Portuguese version of the modified Telephone Interview for Cognitive Status (TICS-M) among stroke patients from the EMMA study

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**Introduction:** Cognitive impairments and dementia are common neuropsychological changes in poststroke patients.

**Aims:** To examine the psychometric properties of the Brazilian version of Modified Telephone Interview for Cognitive Status (TICS-M) for assessing cognitive dysfunction in poststroke patients.

**Methods:** The original version of TICS-M was translated and cross-culturally adapted into Brazilian-Portuguese. Two researchers applied the TICS-M to 61 subjects in three time points: (1) personal interview around 6 months after stroke, (2) telephone interview 1 week after the first evaluation, and (3) telephone interview 2 weeks after first evaluation. All

patients were followed in the Stroke Mortality and Morbidity Study (The EMMA study) and they had confirmed diagnosis of cerebrovascular accident. The reliability of the TICS-M was calculated by test-retest Pearson correlation, intraclass correlation (ICC), and Cronbach's alpha coefficient of internal consistency. The criterion validity of the instrument was assessed by signal detection analysis (Receiver Operating Characteristics curve) by adopting Mini Mental State Examination (MMSE) as the gold standard. The structural validity of TICS-M was assessed through Principal Components Analysis.

**Results:** Test-retest reliability and ICC ranged from 0.87–0.97 across the evaluations. The Cronbach's alpha was 0.96. Factor analysis extracted three meaningful domains: working memory, recall memory, and orientation. The best cut-off point to screen dementia was 14/15 (91.5% sensitivity, 71.4% specificity). The area under the curve was 0.89.

**Conclusions:** The Brazilian version of TICS-M suggests being reliable, stable, and homogeneous instrument to screen dementia in poststroke patients. Good sensitivity and ability to detect salient cognitive domains favors its usefulness in stroke.

### WSC-0522

#### Vascular Cognitive Impairment/Vascular Dementia The cognitive impairment in poststroke patients

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**Introduction:** The poststroke cognitive impairment is one of most wide spread cognitive disorders in Armenia, but remains underestimated till recent time.

**Aims:** The aim of this study was to investigate the risk factors for cognitive impairment in patients after ischemic stroke.

**Methods:** 168 patients (aged 58–86, 95 males and 73 females) after the first ischemic stroke were examined. Clinical and neuropsychological investigation was carried out within 1 and 3 months after the stroke with the use of NIHSS, Barthel index (BI), Mini MENTAL Status Examination (MMSE), FAB, Semantic Verbal Fluency test (SVF), CES-D. The control group consisted of 53 people without stroke.

**Results:** The degree of neurological deficit did not depend on age. MMSE decline was found in 108 patients, FAB in 128 patients at the first visit. Data differences in patients and control group were confirmed in MMSE ( $26.22 \pm 3.22$  and  $27.79 \pm 1.55$ ,  $p = 0.0000$ ), SVF ( $15.78 \pm 6.15$  and  $20.19 \pm 6.35$ ,  $p = 0.0001$ ). Significant differences between the average CES-D in patients group and controls were not detected. At the first visit age was associated with the tests: MMSE ( $R = -0.21$ ,  $p = 0.0084$ ), FAB ( $R = -0.25$ ,  $p = 0.0016$ ), SVE ( $R = -0.28$ ,  $p = 0.0006$ ), CES-D ( $R = 0.20$ ,  $p = 0.0143$ ), BI ( $R = -0.21$ ,  $p = 0.0082$ ). Reduction of cognitive impairment was established at the second visit: MMSE ( $28.02 \pm 2.22$ ,  $p = 0.0000$ ), FAB ( $15.59 \pm 2.19$ ,  $p = 0.0000$ ), SVF ( $18.02 \pm 6.35$ ,  $p = 0.0084$ ) increased. The average CES-D was lower than at the first visit ( $11.17 \pm 8.41$  and  $8.47 \pm 8.01$ ,  $p = 0.0122$ ). Correlations between age and FAB ( $R = -0.24$ ,  $p = 0.0154$ ), SVF ( $R = -0.25$ ,  $p = 0.0185$ ), CES-D ( $R = 0.24$ ,  $p = 0.0163$ ) preserved.

**Conclusion:** Cognitive impairment in poststroke patients are mainly associated with frontal dysfunction. The patients age has a negative effect on the cognitive status, degree of depression and social activity.

### WSC-0346

#### Vascular Cognitive Impairment/Vascular Dementia Cilostazol, an antiplatelet drug, for prevention of cognitive decline in patients with mild dementia receiving donepezil

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**Introduction and aims:** Combinatorial therapy directed at both vascular and degenerative aspects of dementia may offer a promising strategy for treatment of dementia, which has a multifactorial basis in the elderly. We investigated whether cilostazol, an antiplatelet drug, may delay cognitive decline in the elderly receiving donepezil.

**Methods:** Medical records were retrospectively surveyed to identify patients who had received donepezil for more than 1 year and undergone MMSE at least at two time points. Those with an initial MMSE score of less than 27 points were subjected to analysis ( $n = 156$ ), with a cut-point of 21/22 applied to assign them to mild ( $n = 70$ ) and moderate/severe ( $n = 86$ ) dementia. The change of MMSE score per year was compared between patients who had received donepezil and those given donepezil/cilostazol. This study, including the procedure for enrolment, has been approved by our Institutional Review Board.

**Results:** In patients with mild dementia who had received donepezil/cilostazol ( $n = 34$ ;  $77.2 \pm 6.8$  years old), the annual change in MMSE score was  $-0.5 \pm 1.6$  during  $28.6 \pm 11.7$  months, with those receiving donepezil only ( $n = 36$ ;  $78.4 \pm 6.5$  years old) scoring less ( $-2.2 \pm 4.1$ ) during  $30.4 \pm 12.8$  months with a statistical intergroup difference ( $p = 0.022$ ). Multivariate analysis showed that absence of cilostazol treatment was the only significant predictor of MMSE decline. A positive effect of cilostazol was found in three MMSE subscores, orientation for time or place and delayed recall. However, in patients with moderate/severe dementia, there were no intergroup differences in decrease of MMSE scores.

**Conclusions:** These results suggest potential for cilostazol in the suppression of cognitive decline in patients receiving donepezil with mild dementia but not in those with moderate/severe dementia.

### WSC-0589

#### Vascular Cognitive Impairment/Vascular Dementia Which domain of comprehensive neuropsychologic test can predict decline in subcortical ischemic vascular disease?

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**Introduction and aims:** Serial screening tests can show decline patterns of cognitive function in the elderly. The Mini-Mental state examination (MMSE) is the most widely used for screening and is used for determining cognitive changes. Little is known which cognitive domain in comprehensive neuropsychologic test is associated with cognitive decline at the subsequent MMSE screening.

**Methods:** Total 79 patients of cognitive impairment with subcortical ischemic vascular disease from the memory clinic at Hallym University Medical Center, Kangnam Sacred Heart Hospital were enrolled. Comprehensive neuropsychiatric (NP) test including the MMSE was conducted at baseline and follow up MMSE test was performed at 1 year. Cognitive decline was defined as a -3-points or greater loss on the MMSE in 1 year. **Results:** Total 43 patients had received comprehensive NP test and follow up MMSE test. Twenty (44.4%) patients presented cognitive decline over 1 year. Multivariate analysis showed only the frontal-executive functional domain (OR 0.265, 95% CI 0.089–0.791,  $p = 0.017$ ) of comprehensive NP test were correlated with cognitive decline.

**Conclusions:** Our findings suggested that cognitive decline in SIVD mainly depends on frontal functions unlike AD in which memory domains predominate. Future studies should be performed to predict decline of cognitive function in patients with various types of cognitive impairment.

### WSC-0195

#### Vascular Cognitive Impairment/Vascular Dementia Transcranial Doppler ultrasonography: A method of evaluating cognitively impaired and noncognitively impaired elderly

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**Introduction:** Aging and dementia are associated with changes in cerebrovascular structure and function which contribute to associated cognitive decline. Transcranial Doppler Ultrasonography (TCD) is a noninvasive, inexpensive and portable technique with high temporal resolution that can successfully assess the intracranial hemodynamics of the aging brain. **Objective:** The purpose of this study was to investigate and compare the cerebral hemodynamic status (blood flow velocity and pulsatility index) of cognitively impaired and noncognitively impaired elderly using Transcranial Doppler.

**Methods:** This is a cross sectional study conducted in Jose R. Reyes Memorial Medical Center (JRRMMC) from January to August 2013. Forty patients were selected using convenience sampling and were screened using the Montreal Cognitive Assessment-Philippines (MoCA-P). Scores more than or equal to 21 were grouped under noncognitively impaired elderly while scores lower than 21 were under cognitively impaired elderly. Transcranial ultrasound basal examination were performed using a 2-MHz power motion probe (M-mode) to study the middle cerebral artery (MCA), the anterior circulation artery (ACA) and posterior cerebral artery (PCA).

**Results:** Our findings showed that patients with cognitive impairment have lower mean flow velocity ( $p$  value = 0.0001) and higher pulsatility index ( $p$  value = 0.0001) when compared to noncognitively impaired elderly.

**Conclusion:** Our findings are congruent with previous observations that abnormalities in cerebral hemodynamic status are present in cognitively impaired elderly and may be related to microvessel damage secondary to vascular risk factors.

### WSC-0697

#### Vascular Cognitive Impairment/Vascular Dementia Clinical factors influencing the rate of progression of poststroke dementia

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**Introduction and aims:** The results of clinical studies about the severity of poststroke dementia patients are limited in Korea. We reviewed medical records to inspect the clinical factors related to the progression of dementia severity and to estimate the outcome of poststroke dementia patients.

**Methods:** The patients who visited the hospital by first time between March 2013 and December 2014, among the patients with poststroke dementia visited to hospital, formed the analysis cohorts. Retrospective review of medical records was performed.

**Results:** A total of 2965 patients were included during that period. The average duration of illness is  $24.61 \pm 28.18$  months. By the severity of illness, mild cases were 1032 patients (34.81%), moderate cases 1278 (43.10%), severe cases 655 (22.09%), and mean score of MMSE was  $14.82 \pm 6.24$ . Among the clinical factors related to the progression of dementia severity, female patients showed longer duration of illness by 2.89 times compared with average, by the results of univariate analysis of 120 severe dementia patients clinical data.

**Conclusions:** Among the clinical factors related to severity of poststroke dementia, severity of dementia is higher in patients with overweight, existence of inmate and past history of aphasia symptom. The progression speed of poststroke dementia is suggested to be slow in female, regarding longer duration of illness in severe poststroke dementia patients than male.

### WSC-0982

#### Vascular Cognitive Impairment/Vascular Dementia The pattern of cognitive impairment in stroke survivors with carotid stenosis

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**Introduction:** Carotid artery stenosis is a common cause of ischemic stroke. However, it may have other sequelae such as development of vascular cognitive impairment.

**Aims:** To assess cognitive function in patients with carotid artery stenosis. **Methods:** Patients >50 years old with >50% carotid artery stenosis detected on Doppler ultrasonography but who had not had carotid endarterectomy and had no documented cognitive impairment were included. A modified version of the "Hachinski 30-minute battery" was used

(Hopkins verbal Learning test, Animal Naming; Controlled Word Association Test; Digit-symbol coding task from the WAIS (III); Centre for Epidemiologic studies-depression Scale; Trails part A and B; cube copy, clock drawing and orientation subsections of the MoCA). We calculated z scores for the appropriate individual assessments and an average z score for each patient as a measure of global cognitive function. Z scores allow comparison to age matched normative data and performance was described as ranging from 'very superior' to 'profound impairment'.

**Results:** Thirty-three participants were included: 20 males; mean age 70.4 years (range 52–87). The majority of participants scored within the

average or low average range (Table 1) with 24% scoring as borderline. Performance appeared worst in TRAIL making test (Table 2). There were no significant differences between side of the carotid stenosis and whether the stenosis was symptomatic or asymptomatic.

**Conclusion:** In comparison to normative data borderline cognitive impairment is common in patients with carotid artery stenosis especially within attention/switching tasks. An analysis of how this relates to structural abnormalities in the brain is planned.

**Table 1** Overall average z score clinical description n (%)

	Clinical description n (%)										
	Very superior	Superior	High Average	Average	Low Average	Borderline	Impaired	Mild	Moderate	Severe	Profound
Total Average Cognitive Z Score	0	0	2 (6.1%)	12 (36.4%)	11 (33.3%)	8 (24.2%)	0	0	0	0	0

**Table 2** z Score clinical description n (%) for individual assessments

Assessment	Clinical description n (%)											
	Very superior	Superior	High Average	Average	Low Average	Borderline	Impaired	Mild	Moderate	Severe	Profound	
HVLT Average z score	0	1 (3%)	1 (3%)	11 (33%)	9 (27%)	8 (24%)	1 (3%)	0	1 (3%)	0	0	
Animal Naming	0	1 (3%)	3 (9%)	16 (49%)	9 (27%)	4 (12%)	0	0	0	0	0	
COWAT	2 (6%)	1 (3%)	2 (6%)	10 (30%)	7 (21%)	8 (24%)	0	0	0	0	3 (9%)	
TRAILS Average z score	0	0	7 (21%)	9 (27%)	7 (21%)	10 (30%)	0	0	0	0	0	
Trails A	0	1 (3%)	2 (6%)	12 (36%)	5 (15%)	13 (39%)	0	0	0	0	0	
Trails B	0	0	9 (27%)	8 (24%)	5 (15%)	11 (33%)	0	0	0	0	0	
	Low Depression				Mild Depression				Major Depression			
CES-D	20 (60%)				7 (21%)				6 (18%)			

## WSC-1387

### Vascular Cognitive Impairment/Vascular Dementia Discriminating mild cognitive impairment from normal cognition and dementia combining delayed story recall and instrumental activities of daily living

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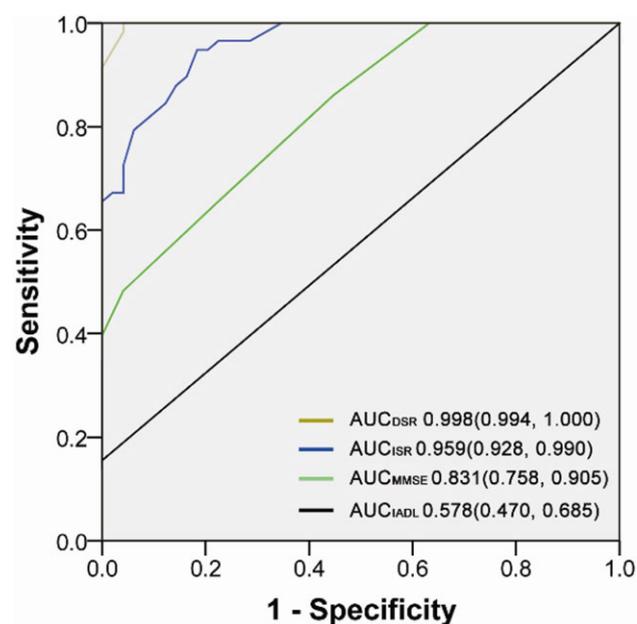
**Introduction:** Mild cognitive impairment (MCI) has been conceptualized as an intermediate state between physiological age-associated cognitive decline and mild dementia.

**Aims:** To assess the validity of combining delayed story recall and instrumental activities of daily living for discriminating MCI against normal cognition and dementia.

**Methods:** Study was carried out at memory clinic in Beijing. Participants recruited were divided into three groups, normal cognition (NC), MCI and dementia. The story recall (immediate and delayed), mini-mental state examination (MMSE), activities of daily living (ADL) were tested in all participants. Receiver operating characteristic (ROC) curve analysis was used to assess the diagnostic utility of above neuropsychological tools.

**Results:** 158 participants were involved. The delayed story recall test (DSR) was the best tool for identifying MCI from NC (Figure below). When the optimal cut-off value of DSR was 15 ( $\leq 15$  indicates MCI), sensitivity and specificity were 100% and 95.9%, respectively. When discriminating patients with MCI against dementia, IADL got a similar diagnostic accuracy to MMSE, and the optimal cut-off value for dementia diagnosis was 10 ( $\geq 10$  indicates dementia). Combining tests of DSR and IADL, the correct classification rate was 91.8% for all participants, 86.2% for MCI group, and 92.2% for dementia group.

**Conclusions:** The preliminary findings indicate that combining DSR and IADL may help to recognize early dementia in community.



## WSC-1013

### Vascular Cognitive Impairment/Vascular Dementia Deciphering the cerebral microinfarct using rodent models and multimodal MRI

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**Introduction:** Cerebral microinfarcts are common in the aged brain and are twice as frequent in humans affected by vascular dementia (VaD). Recent studies have demonstrated the feasibility of detecting microinfarcts in the human brain with 7T MRI (van Veluw *et al.*), which suggests that neuroimaging of microinfarcts may serve as biomarkers for VaD in the aging population.

**Aim:** To understand the age of microinfarcts that are detectable by MRI.

**Methods:** We generated microinfarcts in the cortex of mice by photothrombotic occlusion of single bottleneck penetrating vessels (Shih *et al.*). The spatiotemporal evolution of individual microinfarcts was tracked over 2-weeks using T1-weighted, T2-weighted, fluid-attenuated inversion recovery (FLAIR), T2\*-weighted, diffusion-weighted and diffusional kurtosis imaging (DKI).

**Results:** We found that the time window to visualize microinfarcts using MRI was relatively short when using conventional structural imaging sequences, lasting 3–5 days after occlusion. DKI, which is sensitive to abnormalities in tissue microstructure during stroke (Hui *et al.*), prolonged microinfarct visibility by a few additional days. *In vivo* optical imaging and *post mortem* histology revealed that loss of microinfarct visibility occurred at the peak of tissue inflammation, as evidenced by microgliosis.

**Conclusion:** Microinfarcts observed with multimodal MRI result from recent occlusive events indicative of ongoing small vessel disease. Invisible microinfarcts are not necessarily benign and may contribute to tissue injury through local inflammation. Adopting new imaging sequences that prolong or enhance microinfarct visibility may be useful in the assessment of human microinfarct burden.

## References

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## WSC-1157

### Vascular Cognitive Impairment/Vascular Dementia Failure of aphasia therapy due to possible social-emotional agnosia

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In this study, the possible cerebral causes underlying an erratic communication problem of a 62-year-old male patient who consulted to our center for aphasia therapy have been assessed in various aspects.

Having a cardiac operation 9 months ago, the patient began to have communication problems just after the operation and he was guided to our center with prediagnosis of global aphasia. There was no any motor abnormality on neurological examination of the patient on admission. However, the computerized brain tomography showed widespread cerebral infarcts in temporal lobes bilaterally. Although he seems like global aphasia because of absence of spontaneous speech, auditory understand-

ing, repetitions and naming, Wernicke-like aphasia profile has been stood out because of irrelevant speech that complicated with unsteady paraphasias. The patient did not show any improvement despite 12 sessions of speech therapy. He was unable to nonverbally perceive others' emotions in social situations, limiting normal social interactions. The patient also showed functional blindness to nonverbal social-emotional cues in voice, gesture, and facial expression. He has no visual agnosia. We suggested that failure of aphasia therapy in this patient seems likely due to a social-emotional agnostic state. Symptoms of this kind of agnosia can vary depending on the area of the brain affected.

### WSC-0415

#### Vascular Cognitive Impairment/Vascular Dementia Glial activation and white matter change in baboon brain with chronic cerebral hypoperfusion

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**Background:** Cerebral hypoperfusion is an important risk factor for dementia and ischemic white matter changes are closely associated with cognitive impairment in the aged. To explore the pathophysiology of human white matter disease, a nonhuman primate model in the baboon has been awaited. The purpose of this study was to evaluate the glial activation and demyelination in the white matter of the baboon model with chronic cerebral hypoperfusion.

**Methods:** Eighteen adult baboons (Papio Anubis; 15–20 kg) were subjected to permanent occlusion of both the internal carotid arteries and left vertebral artery (three-vessel occlusion; 3VO) for 1, 3, 7, 14, and 28 days (n = 3 each plus 3 sham animals). Brains were perfusion fixed and processed for immunohistochemical analysis for evaluation of activated astrocytes (GFAP), microglia (CD68). True color analysis was carried out to measure percentage of staining (for GFAP and CD68) per area using image processing software. Luxol fast blue staining was used for the grading of demyelination in the white matter.

**Results:** Microglial and astroglial cells were activated 3 days after 3VO. Glial cell activation was more prominent in deep white matter than in corpus callosum and periventricular white matter. Luxol fast blue staining demonstrated that demyelinating change in the white matter developed after 14 days after 3VO, predominantly in the deep white matter.

**Conclusions:** These results indicated that chronic cerebral hypoperfusion induced glial activation and white matter change in baboon brain. We suggested that baboons are useful animals to investigate the dynamics of vascular cognitive impairment pathology.

### WSC-0395

#### Venous Diseases Additive benefit of hematological work-up in etiological evaluation of cerebral venous thrombosis

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**Introduction:** Cerebral venous and dural sinus thrombosis (CVST) is a rare under-diagnosed condition with a wide spectrum of clinical presentations accounting for about 0.5% of stroke patients.

**Methods:** The study group consisted of 31 CVST patients who were prospectively followed up unit from January 2009 to January 2014, in our stroke within a university hospital in Istanbul, Turkey. All patients were

analyzed in detail including protein S/C/antithrombotic-III deficiency, Factor V Leiden/prothrombin/MTHFR mutations and antiphospholipid antibodies.

**Results:** Among 31 patients, 18 were women (58.1%). The mean age of the study group was 46.4 ± 14.4 years (between 18 and 76 years). Mean age of onset of CVST was 40.8 ± 13.4 years. In 83.8% of cases, symptoms started with either acute or subacute onset. Headache was the most common reported presenting symptom (77.4%), followed by focal neurological deficit (25.8%) and visual problems (19.4%). Two most common localizations of thrombosis were transverse (32.3%) and superior sagittal sinuses (12.9%). The most common etiological risk factors were oral contraceptive use (19.4%), followed by local infections (12.9%) and hematological disorders (12.9%). All patients were treated with antiaggregant medication in which 67.7% were prescribed with anticoagulants in the first 6 months. 80.6% of patients had favorable outcome, 13.0% still have complaints of headache and/or visual problems, and only 6.5% remained with minor neurological deficits.

**Discussion:** Recent developments in evaluation of hematological disorders revealed that thrombophilia is an important risk factor in the development of CVST following oral contraceptive use, and is observed as common as local infections causing CVST.

### WSC-1261

#### Venous Diseases The cerebral venous sinus thrombosis in infant with right mesial temporal lobe tumor – Clinical case

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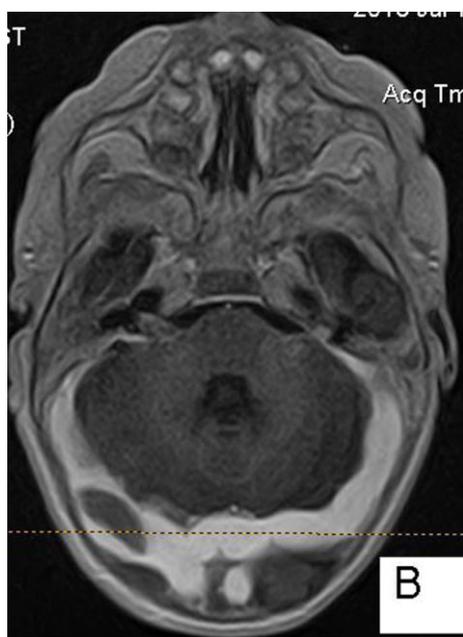
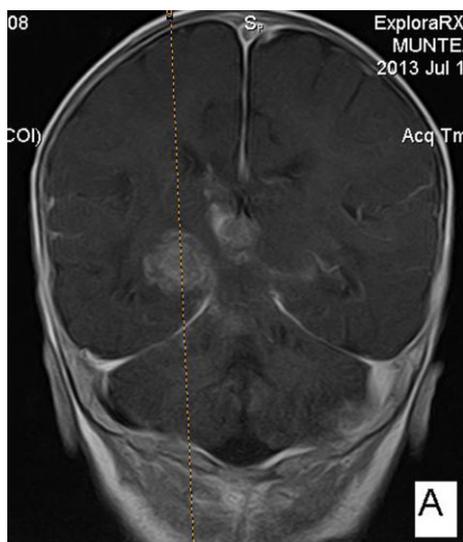
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The cerebral venous sinus thrombosis in infants is frequently a misdiagnosed condition and is due to local or systemic infection, dehydration, cerebral vascular malformations, coagulation disorders or rarely, brain tumors.

The authors present the case of an infant diagnosed with thrombosis of the superior sagittal sinus and right transverse sinus secondary to a brain tumor.

The boy, aged 3 months, was hospitalized in the department of neurology for somnolence and sudden-onset generalized seizures. Neurological examination revealed bilateral ptosis. He received add-on antiepileptic treatment. CT brain scan: active hydrocephaly. The patient was transferred to the department of neurosurgery and an external ventricular drainage was inserted. MRI: right mesial temporal lobe tumor with areas of central necrosis and subarachnoidian spread associated with partial thrombosis of the superior sagittal sinus (Fig. 1a) and right transverse sinus (Fig. 1b). The heparin therapy was instituted and an open-biopsy was performed. Pathological examination revealed primitive neuroectodermal tumor and the prognosis of the patient was reserved.

The intracranial venous thrombosis in children may be associated with brain tumors. The diagnosis requires a high degree of suspicion and the prognosis depends both of the neurosurgical treatment and anticoagulant therapy.

**WSC-1139****Venous Diseases****Clinical characteristics of cerebral venous thrombosis due to Behçet's disease**L Gungor<sup>1</sup>, H Dogru<sup>1</sup>, B Dogan<sup>1</sup><sup>1</sup>Neurology, Ondokuz Mayıs University Faculty of Medicine, Samsun, Turkey

Behçet's disease (BD) is a multisystem chronic inflammatory disease. Behçet's vasculitis involves both arteries and veins. Cerebral venous thrombosis (CVT) occurs in 8% of Behçet patients, and corresponds to 18% of Neuro-Behçet Syndrome. Here, we present eight cases of CVT with BD of our clinic.

Four of the patients (50%) were women. The mean age was 33 years. Six of the patients (75%) had previous diagnosis of Behçet's disease. Two (25%) had new diagnosis during the investigation for recent CVT. Six patients were on colchicine when CVT has developed. Two (25%) had previous history of deep vein thrombosis.

Headache was present in all of the patients at admission. Two had blurred vision, one had diplopia and one had aphasia as initial symptom.

The occluded veins were superior sagittal sinus, transverse sinus and sigmoid sinus. Two patients (25%) had another accompanying venous thrombosis in a different region of the body. Arterial imaging revealed a pulmonary artery aneurism in one (12.5%). Seven patients (87.5%) received intravenous methylprednisolone before anticoagulation. All patients were put on azathioprine. The clinical prognosis was excellent in seven (87.5%), one patient had moderate morbidity related with chronic intracranial hypertension and accompanying systemic complications related with BD.

BD should be considered and investigated in patients with CVD. Arterial aneurysms should be present in BD and should be investigated before anticoagulant therapy. Venous thrombosis may not be limited to cranium. Colchicine is not efficient for preventing CVT in BD. CVT in BD respond to steroid and anticoagulant therapy well.

**WSC-0595****Venous Diseases****Bilateral sixth nerve palsy following sigmoid sinus thrombosis**F K Hoo<sup>1</sup>, W A Wan Sulaiman<sup>1</sup>, S Hasan<sup>1</sup>, H Basri<sup>1</sup>,S Mohd. Sazly Lim<sup>1</sup>, Y L Foo<sup>1</sup>, S M Ching<sup>2</sup>, V Ramachandran<sup>3</sup><sup>1</sup>Department of Medicine, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Serdang, Malaysia<sup>2</sup>Department of Family Medicine, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Serdang, Malaysia<sup>3</sup>Institute of Gerontology, Universiti Putra Malaysia, Serdang, Malaysia

*Introduction:* The most common cause of bilateral sixth nerve palsy was trauma. Moreover, sigmoid sinus is rarely reported as a site of central venous thrombosis. Bilateral sixth nerve palsy as a clinical entity of sigmoid sinus thrombosis (SST) is distinctly uncommon. Hereby, we report a case of bilateral sixth nerve palsy following SST.

*Case description:* A 22-year-old right handed gentleman presented with a 4-day history of headache, vomiting and diplopia. His vital parameters were unremarkable. Pupils were equal. Fundoscopy revealed bilateral swollen optic disc. Cranial nerve examination revealed bilateral sixth nerve palsy. Other neurological or systemic examinations was unremarkable. There was no nuchal rigidity. Thrombophilia screenings were all normal. Magnetic resonance imaging (MRI) revealed right transverse and sigmoid dural venous sinus thrombosis extending to the right internal jugular vein. The patient was initially treated with subcutaneous enoxaparin injection 60 mg given twice daily and then converted to warfarin with a target international normalized ratio of 2:3. He was discharged well, with improvements in symptoms and signs.

*Conclusions:* Bilateral sixth nerve palsy following SST, although rare, is a potentially treatable condition with favorable outcome. A high index of clinical suspicion is necessary whenever clinicians encounter a patient presenting with bilateral sixth nerve palsy.

**WSC-0567****Venous Diseases****Significance of venous drainage of central nervous system in cerebrovascular diseases**Z Kršmanovic<sup>1</sup>, E Dincic<sup>1</sup>, T Lepic<sup>1</sup>, D Veljancic<sup>1</sup>, R Raicevic<sup>1</sup><sup>1</sup>Neurology, Military Medical Academy, Belgrade, Serbia

Owing to the fact that 60–70% of brain blood is represented by venous blood, venous drainage is undeservedly neglected. It is necessary to know well anatomy and physiology of venous system in order to understand impaired venous drainage of CNS. The role of diagnostic imaging tech-

niques (Noninvasive Ultrasound examination, Magnetic Resonance Venography, CT Venography, Selective Venography, Intravascular ultrasound) for examination of venous drainage of CNS will be discussed.

Several studies have shown a relationship between internal jugular vein (IJV) drainage anomalies, characterized by jugular venous reflux (JVR) during Valsalva maneuver and specific neurological diseases.

Emphasize will be on findings in the field of venous drainage in patients with: Transient global amnesia; Idiopathic intracranial hypertension (IIH); Cerebral venous thrombosis; Leukoaraiosis; Stroke; Transient monocular blindness (TMB); Perimesencephalic hemorrhage.

### WSC-1175

#### Venous Diseases

#### Study of common carotid artery, vertebral artery blood flow velocity in the circle of Willis variations

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**Background:** End-diastolic ratio (ED ratio) of the common carotid artery, MV ratio and diameter-ratio of the vertebral artery is indicative of blood vessel stenosis or occlusion of the peripheral artery. However, the effect on these indicators in A1 and P1 hypoplasia is a variation of circle of Willis is unknown.

**Materials and methods:** We studied 117 cases of consecutive to perform brain MRI and carotid echo in our department, were excluded symptomatic cerebral infarction and intra and extracranial vascular stenosis. We examined the ED ratio in A1 and P1 hypoplasia. Further, we examined the vertebral artery mean blood flow velocity and diameter of the vertebral artery in P1 hypoplasia.

**Result:** In the study of ED ratio, there was no significant difference between the normal group, A1 hypoplasia group, and P1 hypoplasia group. The diameter of the CCA, there was no significant difference between the normal group, the P1 hypoplasia group. However, in A1 hypoplasia group, there was a significant difference  $7.27 \pm 0.51$  CCA diameter of the hypoplastic side, and  $8.00 \pm 0.78$  open side ( $P = 0.0049$ ). The vertebral artery diameter, there was a significant difference between the normal group and the P1 hypoplasia group. The criteria for evaluation of vertebral artery Saito *et al.* became the evaluation of stenosis or occlusion in 5 of 9 cases of the P1 hypoplasia.

**Conclusions:** There was no effect on ED ratio is A1 hypoplasia, however, in the P1 hypoplasia, there is a possibility to be evaluated and stenosis or occlusion of vertebral artery, it should be noted.

### WSC-1455

#### Venous Diseases

#### Analysis of blood flow in the common carotid artery and vertebral artery in circle of Willis variation

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**Background:** The end-diastolic ratio (ED ratio) of the common carotid artery (CCA), mean blood flow in the vertebral artery (VA), and diameter of the CCA and VA can indicate peripheral angiostenosis and occlusion. However, the effect of hypoplasia of the A1 and P1 segments in circle of Willis variation on these indicators is unknown.

**Materials and methods:** Carotid artery ultrasonography and head magnetic resonance imaging were performed in our department. A total of 117 consecutive subjects were assessed after excluding those with intra and extra cranial angiostenosis and symptomatic cerebral infarction. The ED ratio of the hypoplastic A1 and P1 segments was analyzed. Furthermore, VA diameter and mean blood flow in the hypoplastic P1 segment were examined.

**Results:** A1 hypoplasia was found in 17 cases (15%), P1 hypoplasia in 9 cases (9%), and a combination of both in 3%. ED ratio analysis did not show any significant differences among the normal group, A1 hypoplasia group, and P1 hypoplasia group. CCA diameter in the A1 hypoplasia group significantly differed from that of the patent side ( $P = 0.049$ ). Mean blood flow in the VA in the normal group significant differed from that in the P1 hypoplasia group ( $P < 0.001$ ), but no difference in VA diameter was noted between the P1 hypoplasia group and normal group. The definition of Saito *et al.*, 5 out of 9 cases of P1 hypoplasia are evaluated with vertebral stenosis or occlusion.

**Conclusion:** A1 hypoplasia does not affect ED ratio, but P1 hypoplasia could cause vertebral artery stenosis and occlusion.

### WSC-1218

#### Venous Diseases

#### Novel factor Xa inhibitor for the treatment of cerebral venous and sinus thrombosis – First experience in seven patients

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**Introduction:** Thrombosis of cerebral veins and sinus (CVT) is a rare stroke etiology. Pharmaceutical treatment is restricted to heparin and oral anticoagulation (OAC) with vitamin K antagonists (VKA).

**Aims:** We assessed the potential benefit of a novel factor Xa inhibitor (FXaI) for CVT.

**Methods:** Between January 2012 and December 2013 we recorded data from our CVT patients. We included all patients with clinical and neuro-radiological follow-up until March 2014 and patients with septic or traumatic CVT as well as patients with endovascular recanalization were excluded. The modified Rankin scale (mRS) was used to assess clinical severity; excellent outcome was defined as mRS 0–1. Recanalization was assessed on follow-MR angiography (MRA). Patients were then divided in two treatment groups according to OAC: VKA and FXaI. Clinical and radiological baseline data, outcome, recanalization status and complications were retrospectively compared between the two groups.

**Results:** Of 30 patients with CVT, 16 were included and seven were treated with FXaI. Overall outcome was excellent in 93.8% and all patients showed at least partial recanalization. No statistical significant differences were found between the groups, except the use of heparin before start of OAC ( $p = 0.03$ ). One patient in the VKA and two patients in the FXaI group suffered from minor bleeding ( $p = 0.55$ ) and no recurrent thrombotic event was observed within the median (range) clinical follow up of eight (5–26) months.

**Conclusions:** A novel FXaI showed a similar clinical benefit as VKA in the treatment of CVT. Further systematic prospective evaluation is warranted.

## WSC-0599

## Venous Diseases

## Clinical features of cerebral venous thrombosis in Japanese patients

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**Introduction and aims:** The clinical symptoms, radiological features and prognosis in Japanese patients with cerebral venous thrombosis (CVT) have not yet been adequately characterized. The purpose of this study was to elucidate the clinical features of CVT patients in Japan.

**Methods:** A total of 6,336 patients who suffered from acute stroke and were enrolled in the Fukuoka Stroke Registry from June 2007 to May 2012 were evaluated. The diagnosis was confirmed by digital subtraction angiography, magnetic resonance venography or contrast-enhanced computed tomography.

**Results:** Thirteen patients (seven females; mean age, 48 years) were diagnosed with CVT. The most frequently occluded venous sinus was the transverse sinus, followed by the superior sagittal sinus. The risk factors for CVT were a prothrombotic condition (31%), systemic disease (15%), pregnancy (9%) and unknown (31%). On admission, nine patients had focal neurological deficits and eight patients had headache. CT/MRI on admission showed intracranial hemorrhage in eleven patients and venous infarct in six patients. All but one patient received anticoagulant therapy, and two of these patients showed enlargement of the intracranial hemorrhage. Six patients showed a poor functional outcome (modified Rankin Scale (mRS) 2–6) at 1 year after discharge. The poor prognosis patients were significantly older and had more severe neurological deficits on admission than the good prognosis (mRS 0–1) patients.

**Conclusions:** The CVT patients in this study tended to be elderly, and had a higher rate of intracranial hemorrhage than those in previous reports. These factors might have led to the poor prognosis in our series.

## WSC-0926

## Venous Diseases

## A case of fatal cerebral venous thrombosis in familial Mediterranean fever

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**Introduction and aims:** Familial Mediterranean fever is a rare genetic autoinflammatory disease with recurrent fever and inflammation. Various neurological manifestations have been reported in the literature, but cerebral venous thrombosis has never been described.

**Methods and results (case description):** A 23-year-old male patient visited our emergency department on August 27, 2013, with the chief complaint of right arm weakness. He had many previous episodes of recurrent fever and arthralgia since childhood, and had been diagnosed as familial Mediterranean fever with MEFV gene identification. One year ago, he experienced portal vein thrombosis, which was improved with anticoagulation. Initial brain CT revealed bilateral multiple intracranial hemorrhages along the superior sagittal sinus, more severe in left. Severe thrombocytopenia was also noticed, probably due to the splenomegaly which was previously diagnosed. Under the impression of superior sagittal sinus thrombosis, MR and catheter venography was performed, which showed complete obliteration of superior sagittal sinus. Intravenous anticoagula-

tion with high dose heparin soon started, but activated partial thromboplastin time was not promptly prolonged, and his status rapidly progressed with brain swelling despite intracranial pressure lowering treatment. Seizure followed and more intracranial hemorrhages developed in follow-up brain CT. He was sentenced to brain death after 3 days, and expired 1 week later.

**Conclusions:** This familial Mediterranean fever patient was characterized with recurrent thrombotic spell, one of which resulted in fatal cerebral venous thrombosis, which we describe first time.

## WSC-0638

## Venous Diseases

## Successful treatment of seven cases of cerebral venous sinus thrombosis with Dabigatran

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**Introduction:** Cortical venous sinus thrombosis is an acute neurological emergency. Venous sinus thrombosis needs to be treated with oral anticoagulants. The only oral anticoagulants tried has been warfarin. We present 7 cases who, for various reasons could not be put on warfarin and hence the new oral anticoagulant Dabigatran was started and venous sinus thrombosis successfully treated. Dabigatran is a factor X direct inhibitor.

**Aim:** To present successful treatment of 7 cases of cerebral venous sinus thrombosis with Dabigatran

**Methods:** Seven cases of cerebral vein thrombosis were treated with Dabigatran instead of Warfarin because of either poor control of INR, inability to check INR on regular basis or staying in very remote place with no lab facility nearby. Informed consent was taken and dabigatran 150 mg twice a day was started for 6 months. Meanwhile all workup for cerebral vein thrombosis was done and results were as follows

**Results:** Of the total 7 cases 6 were male and 1 female. Thrombophilia screen was negative in all. Homocysteine was high and Vitamin B12 was low in all except one. Follow up MRI and MRV showed complete recanalization in all and Dabigatran was stopped after 6 months.

**Conclusion:** Though awaiting FDA approval for treatment of cerebral vein thrombosis with dabigatran we have seen very good results of successful treatment of Cerebral venous sinus thrombosis with it. As there is no need for INR testing and no food or drug interactions the treatment becomes very easy for both the patient and treating doctor.

## WSC-0626

## Venous Diseases

## The vein of Galen thrombosis: An uncommon site of central venous thrombosis

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**Introduction:** Two of the most common sites of central venous thrombosis are superior sagittal sinus and transverse sinus. Thrombosis of deep cerebral venous system (DCVT) is extremely rare, particularly with the involvement of the vein of Galen. Here, we describe a case of brain magnetic resonance imaging (MRI) confirmed (DCVT) of the vein of Galen

**Case report:** A 52-year-old lady with background history of hypertension and uterine fibroid, presented with a 3-day history of headache and confusion. On examination, she was confused, not orientated to time, place and person. She was afebrile and hemodynamically stable. Cranial nerve examination and fundoscopy were unrevealing. Systemic physical examination and neurological examination were normal. Routine blood investigations were unremarkable and thrombophilia screenings were negative. However, brain magnetic resonance imaging (MRI) revealed deep cerebral

venous thrombosis, with hyper-intense areas seen in the head of the caudate nucleus bilaterally, the thalamus and lentiform nucleus. There was also evidence of infarct at the left temporal region. The patient was initially treated with subcutaneous enoxaparin injection 60 mg given twice daily and then converted to dabigatran 150 mg twice daily. Her headache and confusion resolved and she was discharged well.

**Conclusion:** Although DCVT is rare, an early diagnosis remains the cornerstone towards optimal results in terms of morbidity and mortality in this potential lethal condition.

**WSC-1445**

**Venous Diseases**

**Usefulness of susceptibility-weighted imaging to predict the cortical venous reflux due to the dural arterio-venous fistula**

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**Introduction:** Susceptibility-weighted imaging (SWI) is reported as useful sequence in differentiating and characterizing diverse brain pathologies.

**Aims:** We evaluate cortical venous reflux associated with arterio-venous fistula using susceptibility weighted imaging (SWI).

**Methods:** This sequence was used for the 17 patients with dural arterio-venous fistula involved with cortical venous reflux. For all patients, another sequence of MRI and the angiography were performed. We compared about the detection of cortical venous reflux between SWI and the other imaging of MRI.

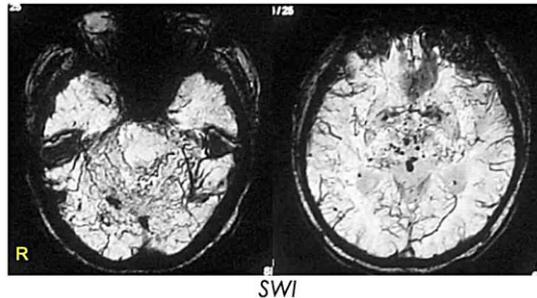
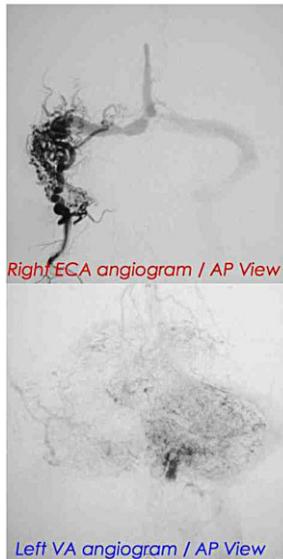
**Results:** SWI gave the information of cortical venous reflux for all cases. SWI showed the extended vein with cortical venous reflux more clearly than T2 imaging. But venous structure nearby skull base representing superior ophthalmic vein and sphenoparietal sinus was detected unclearly on SWI.

There are three cases of manifestation with venous infarction. SWI of this area showed strongly low signal intensity but white matter nearby the dilated veins showed high signal intensity.

The caliber of this venous structure had decreased after intervention. It indicated cortical venous reflux diminished due to occlusion of abnormal shunt.

**Conclusion:** In the evaluation of dural arterio-venous fistula accompanied with cortical venous reflux, SWI is useful sequence.

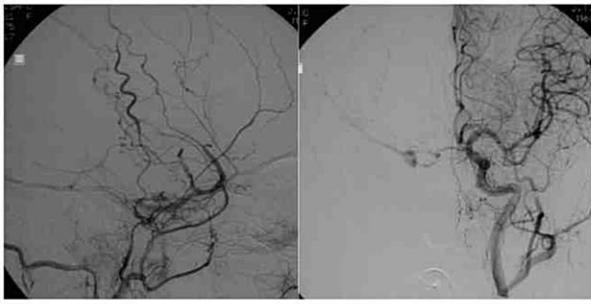
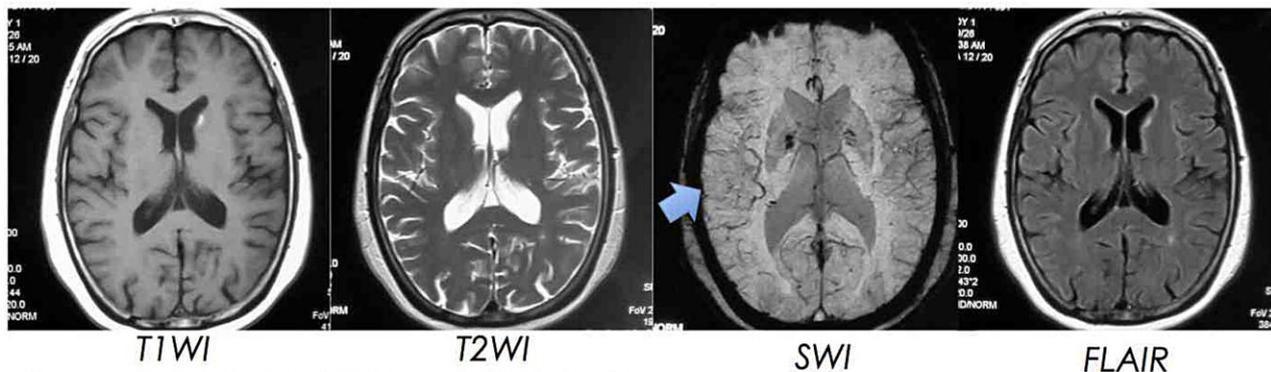
## Transverse-Sigmoid dAVF



SWI demonstrates dilated cortical veins at cerebellar hemisphere.

Small vessels (showing low signals) were recognized at bilateral basal ganglia and cerebellar hemisphere. Cortical veins were dilated and showed with laterality.

# Cavernous Sinus dAVF



Right ECA angiogram Lateral View      Left CCA angiogram AP View

Rt. Deep sylvian vein is well recognized. (blue arrow)

- Laterality of flow void is an important finding.
- T2WI doesn't show right deep sylvian vein.
- Ischemic change in deep white matter is not recognized.

→ In this case, SWI is useful for prediction of cortical reflux.