Low prevalence of retinopathy, but high prevalence of nephropathy among Maori with newly diagnosed diabetes: Te Wai o Rona: Diabetes Prevention Strategy

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Abstract

Aims/Hypothesis: To describe the prevalence of retinopathy and microalbuminuria at diagnosis of diabetes in a predominantly Maori study population.

Methods: Biomedical assessment including photographic retinal examination was undertaken among 157 (68.9% of eligible) members of Maori families (3.3% non Maori) diagnosed with diabetes during a community screening programme (n=5,240) as part of a diabetes prevention strategy.

Results: Mean HbA1c of those with newly diagnosed diabetes was 7.8±1.5% with 34.4% having an HbA1c ≥8.0%. Retinopathy was present in 3 (1.7%) subjects, cataracts in 3.2%, microalbuminuria in 29.6% and albuminuria in 7.7%. After adjusting for covariates, only smoking was a risk factor for microalbuminuria/proteinuria (current and former smokers: increased 3.81(1.32-11.0) and 3.67(1.30-10.4) fold respectively).

Conclusions: The prevalence of retinopathy at diagnosis was lower than in previous studies, yet that of microalbuminuria/proteinuria remained high. The retinopathy data suggest that case detection for diabetes in the community may be improving, but that other strategies among those at risk of diabetes, including those promoting smoking cessation, will be needed to reduce the risk of renal disease among Maori with diabetes.

Type 2 diabetes can remain undiagnosed for many years. In the UKPDS, 50% of patients already had complications at diagnosis (1). However, the prevalence of different complications at diagnosis of Type 2 diabetes varies by population with retinopathy ranging from 6.7-30.2% (2) and chronic kidney disease present in up to 33%(3).

Maori are an ethnic group experiencing a high prevalence of diabetes and its complications (4), including retinopathy (5) and nephropathy (6). As part of a district-wide diabetes prevention programme (4,7), Te Wai o Rona: Diabetes Prevention Strategy invited Maori for assessment of diabetes risk, including an oral glucose tolerance test (OGTT). Participants with newly diagnosed diabetes were assessed for microvascular complications, allowing comparison of the prevalence of retinopathy and nephropathy at diagnosis.

Research Design and Methods

Those invited were aged ≥28 years on 30th September 2005, without known diabetes and resident within the boundaries of the Waikato District Health Board (DHB), and the tribal area of Ngati TuWharetoa in the neighbouring Lakes DHB. Members of households with at least one Maori resident, Maori with past gestational diabetes mellitus or aged ≥23 years with 2 parents with known diabetes, were also considered eligible unless unfit to sign a consent form or terminally ill. The trial is Australasian Controlled Trials Registry registered (ACTRN012605000622606), approved by the local ethics committees with all participants giving signed consent.

Recruitment (5/2004-3/2006) occurred through health, community and media channels. Transport was provided. Participants undertook an OGTT with HbA1c (upper limit 6.4%), lipids and creatinine, anthropometric measurements, questionnaires and sitting blood pressure. All anthropometric and blood pressure measurements were standardized, taken in duplicate, and repeated if beyond a specified tolerance level.

Participants with new diabetes (8) were referred to primary care. Attendance and implementation of care were reviewed by telephone and through local diabetes databases. Mydriatic retinal photographs (*Waikato* (9): Nikon D100 camera;Topcon 50 EX; 2 MT-10 35 mm camera backs; one TL-207 digital relay lens; Nikon D1 synchronisation cable and set of Topcon IMAGEnet Lite Software; *Lakes*: Nikon D200 Topcon NW6S (Tokyo, Japan)) were taken by specialist medical photographers and categorised by local ophthalmologists. No significant retinopathy was defined as <5 micro-aneurysms.

The criteria for microalbuminuria (albumin:creatinine ratio (ACR) 2.5-29.9 mg/mmol creatinine (men), 3.5-29.9 (women)) and albuminuria (ACR ≥30), using a single laboratory random urine, followed local Guidelines (10). Estimated glomerular filtration rate (eGFR) used the Cockcroft and Gault formula. ATPIII criteria (11) defined the metabolic syndrome.

Statistical analyses included Chi squared test and analysis of variance, or logistic regression (using both direct and forward conditional approach). All comparisons were two sided and $p<0.05$ taken as significant.

Results

Of the 5,240 non pregnant, Maori family members recruited, (approximately 20%/10% of the female/male Maori populations respectively(12)), 240 were identified with newly diagnosed diabetes. On follow up, 12 were thought by their general practitioners not to have diabetes. Of the remaining 228, 32 (14.0%) had moved, were non-contactable or refused, 4 had died and 12 did not attend appointments. Urine was collected from 142 (62.3%), of whom 119 also had their eyes reviewed and 38 had their eyes reviewed but no urine sample. The 48 (21.1%) with neither eye nor urine results were younger (48±13 vs 54±11 years, p=0.003), had lower blood pressure (139±19/91±11 vs 150±25/96±14 p=0.007/.020) were more likely to be unemployed (20.8% vs 4.4%, p<0.001), but were otherwise similar. Table 1 shows the characteristics of the 180 with eye and/or urine assessments: only 3 (1.7%) had retinopathy (non-vision threatening). Microalbuminuria was present in 29.6% subjects and albuminuria in 7.7%.

Those with microalbuminuria/proteinuria had higher blood pressure and were more likely to smoke, but after adjusting for covariates, only the latter was a significant risk factor (current and former smokers: increased 3.81(1.32-11.0) and 3.67(1.30-10.4) fold respectively).

Conclusions

In the mid 1990's, Maori with known Type 2 diabetes had a comparable risk of any retinopathy as New Zealand Europeans. However, when present, retinopathy was more advanced (5), with a greater need for laser therapy (13). Recently, local data suggested a reduction in the rate of non-vision threatening retinopathy (9). Our current study shows that among Maori with newly diagnosed diabetes, retinopathy is uncommon, and less common than in newly diagnosed subjects with diabetes in earlier studies in other populations (2). Whether this low rate is due to increased screening/earlier detection of diabetes, or a change in risk factors is unclear. Our numbers (and we expected more with retinopathy) were too few for further analyses. One possible bias was that recruitment was for a diabetes prevention trial. However, the demographic and anthropometric characteristics reflected those in previous surveys (12, 14), and many participants entered to support family members or to contribute to what was seen as a Maori programme aimed at controlling a problem (ie diabetes) in their communities. The retinal screening method, mydriatic retinal screening, although not as sensitive as stereoscopic fundoscopy has previously been shown to have a sensitivity of over 80% for both any, and more severe, retinopathy (15). Furthermore, the method used in the Waikato has recently been carefully evaluated (9). While the follow up response rate was reasonable (68.9% for the retinal review and 62.2% for urine tests), the mobility of the population and non attendance for urine and/or eye review did reduce the response. These still remain reasonable in this population (14).

Maori with diabetes are known to have more microalbuminuria/nephropathy than New Zealand Europeans (4,9). We now show that this excess at diagnosis is associated with smoking, (and possibly raised blood pressure) but no other identified risk factors. We have previously shown smoking to be a risk factor for nephropathy among Maori (6) and that nephropathy is associated with familial renal, rather than diabetes/pre-diabetes, related mechanisms (16). The lack of association between microalbuminuria and glycaemia or metabolic syndrome, along with the discordance in prevalence with retinopathy, supports the suggestion of a diabetes independent, renal susceptibility to nephropathy among Maori.

The high proportion of this cohort with new diabetes who had the metabolic syndrome and its various components (particularly increased waist circumference and raised blood pressure) was not surprising (14, 17). The purpose of Te Wai o Rona: Diabetes Prevention Strategy was to deal with these risk factors for cardiovascular disease and diabetes through lifestyle change. Maori with diabetes have particularly high mortality rates from diabetes associated heart disease and nephropathy (18) and our data confirm that the process for these have commenced prior to diagnosis. Clearly there is an urgent need for primary care to enhance current approaches to screening and management of metabolic syndrome components.

There are several implications from these data that may be of importance in other ethnic groups at high risk of diabetes and diabetic nephropathy. Firstly, the low prevalence of retinopathy at diagnosis, may mean that few Maori have their diabetes long enough to

develop this complication and that diabetes case detection may be improving. This is supported by recent screening data from Auckland (19). Secondly, that Maori excess predisposition to diabetic nephropathy may be significantly predicated on factors present prior to diabetes developing, including smoking. Although some of these factors may remain unknown, interventions that protect against both nephropathy and cardiovascular disease (such as smoking cessation, ACE inhibition and blood pressure control) may be justified in the pre-diabetic phase or even earlier.

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Table 1. Clinical Characteristics of Participants

Characteristics (n)	Cohort (180)	Retinopathy(3)	Microalbuminuria/ proteinuria(53)
Average Age (years)	54±11	58±10	54±12
Non-Maori	3.3%	0%	0%
Gender (%Male)	44.4%	0%	49.1%
Body mass index (kg/m^2)	37.5±7.3	31.2±9.3	37.3±8.7
Waist >102 cm(men) or >88cm (women)	90.0%	66.7%	84.6%
Current/ex smoker	30.6%/27.8%	66.7%/0%	35.8%/35.8%*
No alcohol now	43.9%	66.7%	45.3%
No qualifications	47.2%	66.7%	43.4%
Working full/part time	40.0%/10.6%	0%/0%	37.7%/11.3%
Community services card	52.8%	100%	56.6%
Blood pressure (mm Hg)	150±25/96±14	160±32/96±15	157±25*/101±15**
On Antihypertensive	31.1%	33.3%	30.2%
Elevated blood pressure (treated hypertension or systolic ≥ 130 mm Hg and/or diastolic ≥85 mm Hg	89.4%	66.7%	92.5%
Pulse (bpm)	73±12	81±7	75±14
Total Cholesterol(mM)	5.6±1.3	6.7±0.8	5.7±1.4
HDL<1.04 mmol/l (men) or <1.29 mmol/l(women)	46.7%	0%	54.0%
Triglycerides ≥1.7 mM	52.8%	66.7%	60.8%
Fasting Glucose ≥6.1mM	88.9%	100%	91.8%
Metabolic Syndrome (ATP3)	89.4%	66.7%	88.7%
HbA1C (%)	7.8±1.5	9.2±0.8	8.0±1.7
HbA1c 8.0+%	34.4%	100%	34.6%
Cataract	3.2% (/157)		4.7%
Other pathology (glaucoma)	0.6% (/157)		2.3%
Retinopathy:	1.9% (/157)		4.7%
No significant retinopathy-photos possible	98.1% (/152)		95.1%
-Non vision threatening ret	1.9% (/152)		4.9%
-Vision threatening ret	0% (/152)		0%
Microalbuminuria	29.6% (/142)	[1]50.0%	79.2%
Albuminuria	7.7% (/142)	50.0%	20.8%
Estimated GFR (eGFR)<60	5.6%	0%	5.7%
eGFR 60-89.9 ml/min/1.73m^2	23.9%	100%	32.1%
eGFR 90-119.9	36.7%	0%	26.4%
eGFR 120.0 ml/min/1.73m^2	32.2%	0%	35.8%

** $p \leq 0.01$ * $p < 0.05$ vs microalbuminuria/proteinuria 1 one missing urine