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Foot pain, impairment and disability in patients with acute gout flares; a prospective observational study

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ABSTRACT

Objectives: The aim of this study was to evaluate the impact of acute gout on foot pain, impairment and disability.

Methods: This prospective observational study recruited 20 patients with acute gout flares. Patients were recruited from emergency departments, hospital wards and rheumatology outpatient clinics throughout Auckland, New Zealand. Patients were recruited at the time of the flare (baseline visit) and then reassessed at a follow-up visit once the acute flare had resolved 6-8 weeks after the initial assessment. Joint counts, C-reactive protein and serum urate were recorded at both visits. General and foot-specific outcome measures were also recorded at each visit including pain visual analogue scale, Health Assessment Questionnaire (HAQ)-II, Lower Limb Tasks Questionnaire, and the Leeds Foot Impact Scale.

Results: The foot was affected by acute gout in 14 (70%) patients. Objective measures of joint inflammation including swollen and tender joint counts and C-reactive protein significantly improved at the follow-up visit, compared with the baseline visit. At baseline, high levels of foot pain, impairment and disability were reported. All patient-reported outcome measures of general and foot-specific musculoskeletal function improved at the follow-up visit compared with the baseline visit. However, pain, impairment and disability scores did not entirely normalise after resolution of the acute gout flare.

Conclusions: Patients with acute gout flares experience severe foot pain, impairment and disability. These data provide further support for improved management of gout to prevent the consequences of poorly controlled disease.

Key words: gout, pain, foot, disability, joint, outcome measures

Significance and Innovations

KEY MESSAGES

- Patients with acute gout flares experience severe foot pain, impairment and disability.
- There is a high predilection of gout to the foot.
- The disease burden of gout on the foot is substantial.

INTRODUCTION

Gout is the most common inflammatory arthritis affecting men [1]. Gout typically presents as acute self-limiting attacks of severe joint inflammation. The prevalence of gout in the U.S. has risen over the last twenty years and now affects 8.3 million (3.9%) American adults [2]. In New Zealand, rates of gout have also increased [3], with most recent prevalence estimates of 3.2% European adults, 6.1% Maori adults and 7.6% Pacific adults [4].

The foot is frequently affected by acute gout flares, most often at the first metatarsophalangeal joint (1st MTPJ), midfoot and ankle joint [5-8]. In a cross-sectional survey of 354 patients with gout, 76% had involvement of the 1st MTPJ [5]. Roddy [8] reported that acute gout affected the 1st MTPJ in 66% of patients, the midfoot in 20% patients, and the ankle in 15% patients.

Although research has shown that gout is associated with reduced health related quality of life, musculoskeletal disability and work disability [9-12], the specific impact of gout flares on musculoskeletal function and disability has not been explored in detail. Moreover, although it is well recognized that gout frequently affects the feet, the consequences of acute gout on the foot have not been described. At present, no existing guidelines address specific management of foot disease in gout. The aim of this study was to understand the impact of acute gout flares on foot pain, impairment, and disability.

PATIENTS AND METHODS

This was a longitudinal observational study designed to assess the impact of acute gout on the foot. Patients were recruited from emergency departments, hospital wards and rheumatology

outpatient clinics throughout Auckland, New Zealand. Patients were recruited at the time of the flare (baseline visit) and then reassessed at a follow-up visit once the acute flare had resolved 6-8 weeks after the initial assessment. The Northern X Regional Ethics Committee approved the study and all patients provided written informed consent.

Patients were included if they had an acute gout attack within the previous 48 hours. The diagnosis of acute gout was made according to the American College of Rheumatology criteria for the classification of acute arthritis for primary gout [13]. Patients were assessed on two separate occasions by a single examiner (MF). At the baseline visit, the following clinical information was recorded: age, sex, ethnicity, medical history and medications. Clinical information specific to the patient's gout and their current flare was recorded. Weight, height and subcutaneous tophus count was also recorded. At each visit, the following measures were measured: tender joint count, swollen joint count, C-reactive protein, serum urate, patient global assessment (100mm visual analogue scale), pain (100mm visual analogue scale), Health Assessment Questionnaire (HAQ-II) [14,15], and a detailed assessment of foot structure, function and disability, using measures outlined below.

Foot pain was evaluated using a pain visual analogue scale (VAS) Pain intensity was scored along a 100mm horizontal line with the left-most boundary representing 'no pain' and the right-most boundary representing 'extreme pain'. Higher scores indicate greater pain.

Forefoot and rearfoot deformities were quantified using the Structural Index Score [16], which considers hallux valgus, MTPJ subluxation, 5th MTPJ exostosis, and claw/hammer toe

deformities for the forefoot (range 0-12) and calcaneus valgus/varus angle, ankle range of motion and pes planus/cavus deformities for the rearfoot (range 0- 7). Foot type was assessed using the Foot Posture Index which is a validated method for quantifying standing foot posture, such as flat or high-arched feet [17]. The normal adult population mean Foot Posture Index score is +4, and scores above +4 suggest a pronated (flat-foot) type.

Foot impairment and disability were measured using the Leeds Foot Impact Scale (LFIS) [18]. This is a self completed questionnaire that was developed to evaluate foot health status in patients with rheumatoid arthritis. The LFIS comprises of 51 questions divided into two sub-categories: impairment/footwear ($LFIS_{IF}$) and activity limitation/participation restriction ($LFIS_{AP}$). These two components relate closely to the domains outlined by the World Health Organisation's (WHO) International classification of functioning, disability and health (ICF) [19]. The LFIS also measures the psychological effect(s) of the disease on the individual. Each question is answered as being 'true' or 'false', with a true response scored as one point and a false response as zero. Scores are then totalled to provide an overall score for each subsection, with a maximum overall score of 51. Higher scores are indicative of greater levels of disability. Turner [20] reported that a $LFIS_{IF}$ score of >7 points is indicative of moderate-to-high levels of foot impairment and a $LFIS_{AP}$ score of >10 points is indicative of moderate-to-high levels of foot disability.

The Lower Limb Tasks Questionnaire was used to measure function in the lower extremity [21]. This questionnaire captures the patient's account of their functional status within the previous 48 hours and is divided into two domains; activities of daily living and recreational activities.

All data were analysed using SPSS V18.0 for Windows. Scores between the baseline and follow-up visits were analysed using dependent t-tests for paired samples. Categorical data were analysed using Chi-squared tests. All tests were two tailed and $p<0.05$ was considered significant.

RESULTS

Twenty patients were recruited into the study and completed the baseline visit (Figure 1). Follow-up data were available for 18 (90%) patients. The mean (SD) time between visits was 74 (42) days. One patient withdrew at follow-up due to non-gout related illness and another patient could not be contacted for follow-up.

Clinical characteristics at baseline are shown in Table 1. Patients were predominantly middle aged Maori and Pacific men, with high rates of obesity and co-morbidities such as hypertension and cardiovascular disease. These patients reported high frequency of gout flares (approximately one/month). Allopurinol use was low in the group overall. Most patients reported that their first flare had affected the foot, most often the 1st MTPJ.

The clinical features of the gout flares at the baseline and follow-up visits are shown in Table 2. The foot, in particular the 1st MTPJ and the ankle joint, was affected 14 (70%) patients at the baseline visit. Polyarticular flares were common. High scores for pain and disability were observed at the baseline visit. There was a significant improvement in clinical measures of acute gout between the baseline and follow-up visits in patient global assessment, HAQ-II, swollen

joint count, tender joint count and C-reactive protein. Serum urate did not significantly change between the two visits. All patients were receiving treatment for management of acute gout at the baseline visit, most often non-steroidal anti-inflammatory drugs (NSAIDs). NSAID use was significantly less frequent at the follow-up visit.

The foot specific measures at the baseline and follow-up visits are shown in Table 3. Foot pain, as measured by the foot pain VAS, was high at the time of the gout flare and reduced by 73% at follow-up. Foot Posture Index scores did not differ between baseline and follow-up visits. At both visits, the Foot Posture Index scores indicated a pronated (flatfoot) foot type. The Structural Index for the forefoot and rearfoot also did not differ between the two visits. Both the forefoot and rearfoot structural indices demonstrated moderate structural problems.

There were significant differences between baseline and follow-up visits in both components of the Leeds Foot Impact Scale (impairment and activity/participation) (Table 3). High levels of impairment (scores > 7 points on the $LSIS_{IF}$) were found with all 20 patients (100%) at baseline and 10 (54%) patients at follow up visit (baseline vs. follow-up visit, $p<0.001$). High levels of disability (> 10 points on the $LSIS_{AP}$) were also found with all 20 patients (100%) at baseline and 7 patients (35%) reporting severe disability at the follow-up visit (baseline vs. follow-up visit, $p<0.001$).

Baseline data for both domains of the Lower Limb Tasks Questionnaire indicated severe restrictions of daily living and recreational activities (Table 3). These values improved at the follow-up visit but did not entirely normalise.

DISCUSSION

This study has shown that acute gout flares are associated with severe foot pain, impairment and disability. Measures of foot pain, impairment and disability improved following treatment of the acute gout attack, but did not entirely normalise. Most patients in our study reported that their initial gout attack affected the foot, and over two-thirds had a documented flare affecting the foot at the baseline visit. These findings emphasize the predilection of gout to the foot and provide support to prevent recurrent flares and the consequences of gout flares on musculoskeletal function.

Clinical measures of gout flares such as swollen and tender joint counts, patient global assessment, HAQ-II and C-reactive protein were all high at the time of the baseline visit, with significant improvements following resolution of the flare. In contrast, there was no change in the serum urate between the two timepoints. Previous studies have reported that serum urate frequently drops at the time of an acute gout flare, and rises in the convalescent period [22-24]. It is possible that the trend to greater use of allopurinol at the follow-up visit has masked this effect in our study.

The severity of foot pain at the time of the gout flare was consistent with reports of generalised pain from clinical trials of acute gout [25,26]. We observed that at the follow-up visit, pain did not entirely resolve, suggesting that foot-related pain may be a constant feature in patients with recurrent gout flares. This depiction of pain has been reported in a quantitative study where patients with severe gout described living with constant pain [27]. We also found patients with

an acute flare experienced high levels of general and foot-related impairment and disability as measured by the Leeds Foot Impact Scale. Moreover, at the follow-up visit, more than half the patients still reported foot impairments and one third reported on going disability. The current study was of a prospective observational design, and patients were recruited at the time of the acute gout flare. Therefore, assessment of prior foot function, impairment and disability could not be undertaken. However, in a previous case-control study [28], we assessed subjective and objective measures of foot function in patients with a history of gout and in control subjects with no history of gout or other forms of arthritis. The gout cases were specifically excluded if they had an acute gout flare. The key findings of that study were that patients with a history of gout had higher levels of general and foot-specific disability, pain and impairment, compared with control participants. Collectively, our findings suggest that the disease burden of gout on the foot is substantial and has a negative impact on the well-being of the patient.

In contrast with the Leeds Foot Impact Scale, which contains questions concerning pain and impairment and quality of life, the Lower Limb Task Questionnaire provides data solely related to difficulty in ADL activities and in recreational activities. In these domains, lower limb function was appreciably reduced during an acute flare. Of particular note is that recreational activities were severely limited at the time of flare, and at the follow up visit, these activities remained restricted. These data indicate important limitation in the ability of the individual to participate in exercise, which in turn may have an adverse impact on prevention of obesity and management of cardiovascular risk. These data are consistent with previous qualitative work, indicating that patients give up recreational activities such as sport because of gout [27]. Difficulty in daily living activities improved to more satisfactory levels at follow up, however,

they remain well below normative values (38/40) for a much older cohort (69 yrs) without pathology [29]. The activities daily living score from the follow-up visit were similar to a study on knee OA [29]. Together, these data demonstrate that recurrent acute flares reduce the patient's lower limb function severely.

The primary limitation of this study was its small sample size. Despite the small sample size, clear differences in foot parameters were observed across the baseline and follow-up visits. Another limitation was that recruitment was primarily from secondary care facilities/providers, and it is possible that acute gout flares treated within the primary care environment may have produced different levels of severity and impact. The majority of patients in this study were of Maori and Pacific ancestry, with low rates of allopurinol use. This finding is consistent with our previous studies of poorly controlled gout in New Zealand [30,31]. The long disease duration and severity of chronic gout in the patients may explain the residual function limitation observed in the baseline visits. Analysis of the impact of gout flares from other units and in primary care will be of great interest.

This work raises a number of further research questions. We observed that the majority of patients with a pronated foot type (flatfoot). It is possible that abnormal biomechanical loading due to excessive pronation may contribute to the clinical manifestations of gout in the feet. Future prospective studies investigating the relationship between foot type and severity/persistence of disease will be of interest. Currently there are no specific tools/indices that have been developed or validated in individuals with gout affecting the foot. Future work could be directed towards developing a gout foot-specific tool for clinical practice and for use as

an outcome measure in clinical trials of gout. In addition to patient reported outcome measures, such a tool could include the presence of digital deformities, tophi and range of motion at the 1st MTPJ, subtalar and ankle joints. This may further lead to the development of a more tailored scoring system for foot impairment and disability in both acute and chronic gout in accordance with the WHO ICF model for disability [19]. Furthermore**,** despite the frequent involvement of the foot in gout, no studies to date have examined the role of footwear in this condition. The relationship between foot pain, deformity and footwear warrants further investigation, as this may provide useful insights into non-pharmacological approaches to gout management.

In summary, the foot is frequently affected by acute gout flares. Patients with acute gout flares experience severe foot pain, impairment and disability. These data provide further support for improved management of gout to prevent the consequences of poorly controlled disease.

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Table 1: Baseline clinical data (n=20)

Male sex, n (%)	17 (85%)
Age (years), mean (SD)	54 (16)
Ethnicity:	
NZ European, n (%)	7 (35%)
NZ Maori, n (%)	6 (30%)
Pacific Island, n (%)	7 (35%)
Co-morbidities:	
Hypertension, n (%)	13 (65%)
Cardiovascular disease, n (%)	10 (50%)
Diabetes mellitus, n (%)	2 (10%)
Duration of gout (years), mean (SD)	13.2 (11.4)
Diuretic use, n (%)	5 (25%)
Aspirate proven disease, n (%)	12 (60%)
Site of first flare:	
1st MTPJ, n (%)	12 (60%)
Midfoot, n (%)	1 (5%)
Ankle, n (%)	6 (30%)
Knee, n (%)	0 (0%)
Elbow, n (%)	0 (0%)
Hands, n (%)	1 (5%)
Body mass index (kg/m^2), mean (SD)	35 (11)
Any tophi, n (%)	9 (45%)
Total number of subcutaneous tophi, mean (SD)	1.9 (2.8)
Number of subcutaneous tophi affecting feet, mean (SD)	0.3 (0.6)
Number of flares in previous three months, mean (SD)	3.4 (2.7)

Table 2: Clinical features of gout flares

Variable	Baseline visit (n=20)	Follow-up visit (n=18)	P
Site of flare:		NA	NA
1st MTPJ, n (%)	6 (30%)		
Midfoot, n (%)	1 (5%)		
Ankle, n (%)	10 (50%)		
Knee, n (%)	3 (15%)		
Elbow, n (%)	2 (10%)		
Hands, n (%)	3 (15%)		
Polyarticular flare, n (%)	9 (45%)	NA	NA
Tender joint count, mean (SD)	8 (9)	1 (1)	0.01
Swollen joint count, mean (SD)	3 (3)	0 (1)	<0.001
Patient global assessment score, mean (SD)	65 (23)	32 (23)	<0.001
HAQ-II, mean (SD)	1.9 (0.6)	0.9 (0.6)	<0.001
C-reactive protein (mg/L), mean (SD)	54.8 (61.6)	3.2 (1.4)	0.03
Serum urate (mmol/L), mean (SD)	0.50 (0.15)	0.42 (0.12)	0.65
Allopurinol use, n (%)	8 (40%)	11 (61%)	0.06
Colchicine use, n (%)	13 (65%)	9 (50%)	0.13
Prednisone use, n (%)	10 (50%)	5 (28%)	0.11
NSAID use, n (%)	16 (80%)	5 (28%)	<0.001

Table 3: Foot-specific measures of pain, impairment and disability

	Baseline	Follow-up	P
Variable	**Mean (SD)**	**Mean (SD)**	
Foot pain visual analogue scale	60 (28)	16 (16)	<0.001
Structural Index (forefoot)	5 (5)	5 (5)	1.00
Structural Index (rearfoot)	6 (3)	5 (3)	0.25
Foot Posture Index	5 (3)	6 (3)	0.13
Leeds Foot Impact Scale (impairment)	16 (4)	9 (5)	<0.001
Leeds Foot Impact Scale (activity/participation)	25 (5)	18 (8)	0.002
Lower Limb Task Questionnaire (activity)	16 (7)	28 (7)	<0.001
Lower Limb Task Questionnaire (recreational)	4 (3)	12 (8)	<0.001

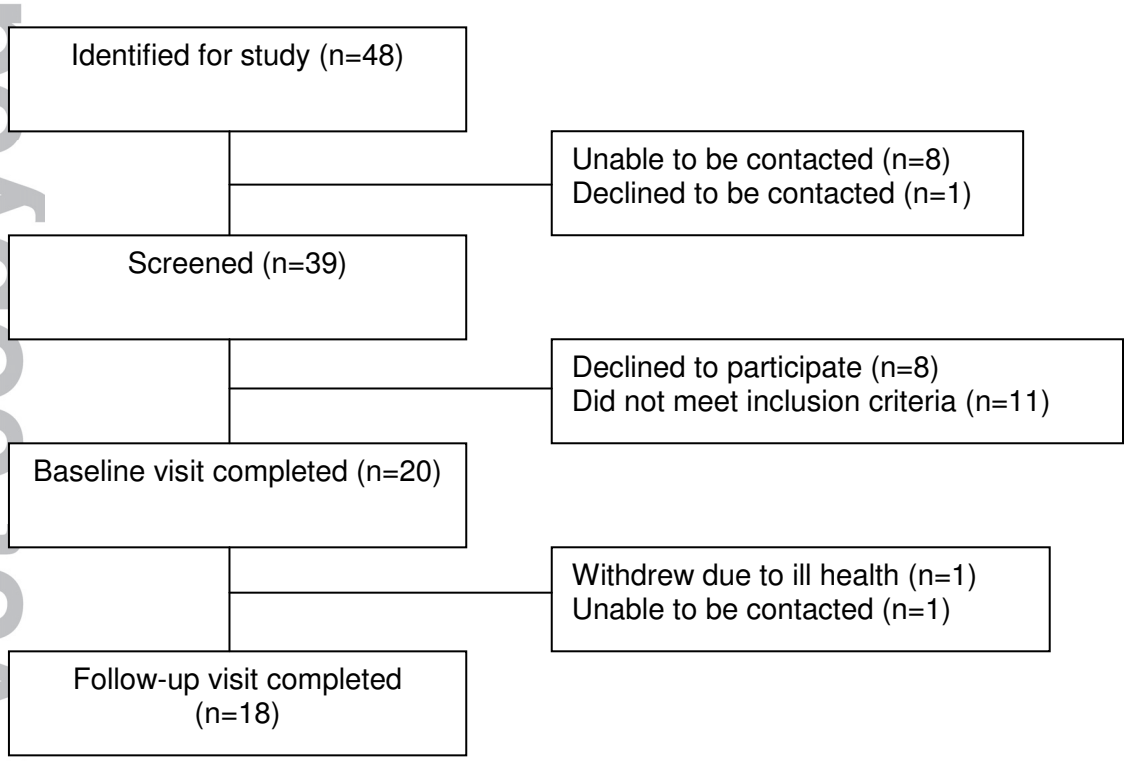

Figure 1: Flow of study patients