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Prevalence of foot problems in people with inflammatory arthritis in Singapore

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Abstract

Background: Foot problems are highly prevalent in people with inflammatory arthritis reported from studies in the UK, Europe and New Zealand, but there is limited evidence from Southeast Asia. The study aim was to evaluate the prevalence of foot problems in people with inflammatory arthritis in Singapore.

Methods: People with inflammatory arthritis were recruited from the rheumatology outpatient clinic of a tertiary hospital in Singapore. Disease and clinical characteristics included age, sex, disease duration, current blood tests and medications. The Leeds Foot Impact Scale was used to evaluate foot impairment/disability and the Modified Health Assessment Questionnaire was used to assess global function.

Results: We recruited 101 people with inflammatory arthritis, of which 50 % were female. The majority of participants were Chinese (70 %). The mean (SD) age was 52 (15) years, and the mean (SD) disease duration was 9.3 (0.3) years. The most commonly reported inflammatory arthritic conditions were rheumatoid arthritis (46), gout (31) and spondyloarthritis (15 %). The mean (SD) of the total Leeds Foot Impact Scale was 17 (13) indicating moderate to severe levels of foot impairment and activity limitation. Over 80 of participants reported foot pain during the course of their condition, and 48 % reported current foot pain. Despite the high prevalence of foot pain, only 21 participants (21 %) had been referred to a podiatrist.

Conclusion: This is the first study to investigate the prevalence of foot problems in people with inflammatory arthritis from Singapore. The majority of the participants reported foot problems, but had not been referred to a podiatry service.

Keywords: Inflammatory arthritis, Podiatry, Foot pain, Foot impairment

Abbreviations: IA, Inflammatory arthritis; RA, Rheumatoid arthritis; Spa, Spondyloarthritis; PA, Psoriatic arthritis; Undifferentiated IA, Undifferentiated inflammatory arthritis; ESR, Erythrocyte sedimentation rate; CRP, C-reactive protein; DAS28-ESR, Disease activity Score in 28-joints using the ESR; MHAQ, Modified Health Assessment Questionnaire; LFIS, Leeds Foot Impact Scale; $LFIS_{TOTAL}$, Leeds foot impact score total; $LFIS_{IF}$, Leeds foot impact score foot impairment/footwear restriction; $LFIS_{AP}$, sLeeds foot impact score activity limitation/participation restriction; FPI, Foot posture index; SI, Structural index; SD, Standard deviations; DMARD, Disease modifying anti-rheumatic drug; NSAID, Non-steroidal anti-inflammatory drugs; VAS, Visual analogue scale; MDT, Multidisciplinary team

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Background

Foot problems associated with inflammatory arthritis (IA) are common, particularly in Rheumatoid arthritis (RA) [1, 2]. Other IA conditions such as gout, spondyloarthritis (Spa) and psoriatic arthritis (PA) also affect the foot [3–5]. However, our knowledge of the epidemiology of foot involvement is based on studies among Caucasians derived primarily from Western countries [2, 6–8] with data currently dominated by studies focusing predominantly on people with RA [9]. While the magnitude of foot impairments and related disability in IA is comparable to that reported in RA [5, 10], relatively few studies to date have focused on IA foot and ankle characteristics from a Southeast Asian population.

RA affects approximately 0.4 % to 0.8 % of the adult population worldwide [11]. It is less prevalent in mainland China and in Hong Kong, with a reported prevalence of 0.37 and 0.35 %, respectively [12–14]. In Singapore, RA is the most common form of IA, affecting about 1 % of the population, equivalent to an estimated 45,000 people [15].

Previous studies of Chinese people have been largely population-based prevalence surveys [13, 16]. These studies suggest that RA in Asians behaves differently from that in Caucasians, such as a relatively greater involvement of the wrist joint and a milder disease course [13, 17, 18]. However, IA-related foot problems can be inadequately understood or overlooked during rheumatology consultations [19]. The aim of this study was to identify the prevalence of foot problems in people with IA attending a rheumatology outpatient clinic in Singapore.

Method

Participants

Participants were recruited from a rheumatology outpatient clinic in Singapore between January 2015 and November 2015. Each inflammatory arthritic condition was based upon medical records and referred by the rheumatologists to the podiatric service. Participants were eligible if they were over 21 years old, rheumatologist-diagnosed inflammatory joint disease and with or without current foot pain. Those with cognitive impairment precluding ability to answer health-related questions accurately were excluded. A convenience sample of 100 participants was predetermined based on a previous study [7]. Each participant attending the clinic was asked to consent to a foot health assessment and to complete a questionnaire. All assessments were conducted by an experienced podiatrist. Ethics approval was obtained from the National Healthcare Group Domain Specific Review Board Singapore. All participants provided written informed consent prior to data collection.

Podiatry services in Singapore are provided at the 6 public hospitals and by a small private sector. Singapore has approximately 80 podiatrists currently working, with most of them employed by the public hospitals. A team of 8 podiatrists works in the hospital in this study. Patients mainly access podiatry services by referral from a doctor. Most referrals come from within the hospital, with a small number coming from private family doctors and patient self-referral. A referral by internal doctor affords a government subsidy for the patient, which reduces their treatment charges by 50 %. Direct referral by a private family doctor and self-referral incurs full non-subsidized charges. At the rheumatology outpatient clinic where the study was conducted there are 13 rheumatologists and 25–30 clinics per week of mixed IA caseloads. During the period of the study there was no formally integrated multidisciplinary service operating; referral to podiatry was dependent on referrals from individual doctors, their decision to do so based on their knowledge of allied health care services or the willingness of the patient to be referred.

Clinical characteristics

Clinical characteristics included the type of IA, disease duration, current medications, erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP). For those participants with a previous foot x-ray the presence of radiographic foot erosions was recorded by reviewing the radiology reports for presence of erosions as documented within the clinical records. Global pain was measured using a 100 mm Visual analogue scale (VAS). The Disease Activity Score in 28-joints using the ESR (DAS28-ESR) was calculated for those people with RA and a same-day ESR result [20]. Responses to the Modified Health Assessment Questionnaire (MHAQ) - a physical function status questionnaire used in the evaluation of a variety of rheumatic diseases - were also recorded [21]. The MHAQ asks participants to answer 8 questions, 1 in each of the 8 functional areas [21]. The MHAQ assesses the degree of difficulty experienced with undertaking specific tasks over the preceding week. MHAQ scores are converted to a range between 0 and 3; with 0 to 1 indicating mild/moderate functional impairment, 1.1 to 2 is moderate/severe, and 2.1 to 3 indicating severe/very severe impairment [22].

Foot and ankle characteristics

Foot and ankle characteristics included the Leeds Foot Impact Scale (LFIS) - a disease specific scale for measuring the impact of foot disease. The LFIS is a self-completed questionnaire comprising 51 items in total, divided into two subscales: impairments/shoes ($LFIS_{IF}$) and activities/participation ($LFIS_{AP}$) [23]. Turner and Woodburn [24] reported a $LFIS_{IF}$ score of >7 and

$LFIS_{AP}$ score of >10 as representing a high to severe level of foot impairment and disability.

The Foot posture index (FPI) was used to assess foot type [25]. The Structural index (SI) evaluated forefoot and rearfoot deformities [26]. SI forefoot scores of ≥10 and rearfoot scores of ≥4 indicate the presence of severe foot deformity [24]. The Manchester scale evaluated the severity of hallux valgus [27]. Participants Previous and current foot pain was recorded Experience of current and previous foot pain and previously seen a podiatrist were recorded as dichotomous responses. Foot lesions that foot ulceration were noted. All demographic and disease activity data were presented as means and standard deviations (SD), and foot assessments as numbers and percentages.

Results

The demographic and clinical characteristics of all participants are shown in Table 1. Additional file 1 demonstrates the demographic and clinical characteristics of each inflammatory arthritic condition that included RA ($n = 46$, 46), gout ($n = 31$, 31), Spa ($n = 15$, 15), PA ($n = 4$, 4) and undifferentiated IA ($n = 5$, 5 %). We recruited 101 participants, the majority of participants being Chinese women with a mean (SD) age of 52 (15) years. The majority of participants with RA were women ($n = 37$, 80) and men with gout (n =25, 81 %). The most commonly reported IA conditions were RA ($n = 46$, 46), gout ($n =$ 31, 31) and spondyloarthritis ($n = 15$, 15 %). The mean (SD) disease duration across all IA conditions was 9.3 (0.3) years. The mean (SD) for BMI of 30.7 (5.0) Kg/m^2 in gout was high compared to the other IA conditions. The MHAQ found mild overall functional impairment with a mean (SD) score of 0.25 (0.36). Blood markers (CRP and ESR) indicated high levels of inflammation in the 41 participants with RA.

The foot and ankle characteristics are summarized in Table 2 with Additional file 1 demonstrating each specific IA condition. Over 80 % of participants ($n = 81$) reported having experienced foot pain during the course of their disease, with over 95 % of participants with gout reporting previous foot pain. Nearly 50 % of participants ($n = 48$) reported current foot pain, of which 45 (45 %) reported daily foot pain. Participants with RA reported current foot pain (n =28, 61 %), whereas only 7 (23 %) participants with gout reported current foot pain. Only 21 % participants had been referred to a podiatrist.

The total mean (SD) of the LFIS was 17 (13). The mean (SD) for the $LFIS_{IF}$ was 7 (7) and the $LFIS_{AP}$ 10 (9) indicating moderate to severe levels of foot impairment and activity limitation. Participants with RA recorded higher levels of foot impairment and disability. The mean (SD) SI forefoot score of 4.9 (4.2) and the SI rearfoot score of 3.5 (3.3) demonstrated moderate levels of foot deformity. All participants with PA ($n = 4$, 100 %) were found to have high levels of rearfoot deformity. The FPI demonstrated a mean (SD) score of 4 (6).

Table 1 Demographic and clinical characteristics

Age, years	52.0 (14.5)
Women, n (%)	51 (50 %)
Ethnicity, n (%)	
Chinese	70 (69 %)
Malay	11 (11 %)
Indian	15 (15 %)
Caucasian	0 (0 %)
Other	5 (5 %)
Body Mass Index, Kg/m^2	27.2 (5.4)
Smokers, n (%)	14 (14 %)
Disease duration, years	9.3 (0.3)
Disease type, n (%)	
• Rheumatoid arthritis	46 (46 %)
• Gout	31 (31 %)
• Spondyloarthritis	15 (15 %)
• Psoriatic arthritis	4 (4 %)
• Undifferentiated inflammatory arthritis	5 (5 %)
Medications, n (%)	
• Methotrexate	42 (60 %)
• Combination DMARD therapy (≥2 DMARDs)	52 (74 %)
• Biologics	4 (6 %)
• Prednisone	40 (40 %)
Other medications, n (%)	
NSAID, n (%)	49 (49 %)
Diabetes Mellitus, n (%)	12 (12 %)
Patient global VAS (VAS 0–100), mm	26 (26)
Tender (28) joint count	1.8 (2.8)
Swollen (28) joint count	1.3 (2.1)
DAS28-ESR score	3.54 (1.1)
ESR, mm/h	31.6 (21.2)
CRP, mg/L	27.4 (32.2)
mHAQ score	0.25 (0.36)

Data presented as mean (SD) unless specified
DMARD Disease modifying anti-rheumatic drug, *NSAID* Non steroidal anti-inflamamtory drugs, *VAS* Visual analogue scale, *ESR* Erythrocyte sedimentation rate, *CRP* C-reactive protein, *DAS-28* disease activity score in 28 joints

Discussion

The study demonstrates that foot problems are highly prevalent in people with IA attending the rheumatology outpatient clinic in Singapore. This study is the first to report prevalence of IA-related foot problems in a Southeast Asian population. Compared to the proportions of the main ethnic groups in Singapore this study demonstrates a representative sample [28]. The demographic and

Table 2 Foot and ankle characteristics

Foot erosion on radiograph, n (%)	19 (40 %)[a]
Previous foot surgery, n (%)	9 (9 %)
Presence of current foot pain, n (%)	48 (48 %)
Previous foot pain, n (%)	81 (81 %)
Current foot ulceration, n (%)	1 (1 %)
Structural Index	
Forefoot score	4.9 (4.2)
Rearfoot score	3.5 (3.3)
Total Structural Index	8.4 (6.2)
Foot Posture Index foot-type	4 (6)
Callus Patterns:	
Forefoot, n (%)	12 (12 %)
Rearfoot, n (%)	0 (0 %)
Toes, n (%)	6 (6 %)
Severity of bunion, n (%)	
Stage 1	48 (48 %)
Stage 2	25 (25 %)
Stage 3	18 (18 %)
Stage 4	10 (10 %)
Has seen a podiatrist before, n (%)	21 (21 %)
FIS_{TOTAL} score	17 (13)
FIS_{IF} subscale score	7 (5)
FIS_{AP} subscale score	10 (9)

Data presented as mean (SD) unless specified
FIS_{TOTAL} Foot Impact Score total, *FIS_{IF}* Foot Impact Score foot impairment/footwear restriction, *FIS_{AP}* Foot Impact Score activity limitation/participation restriction
[a]48 participants underwent foot X-rays

clinical characteristics of this IA cohort were consistent with other epidemiological studies from the UK and New Zealand [1, 3, 29–31]. In the current study 81 % of participants reported having had foot pain. Previous studies evaluating foot involvement in RA report involvement in 56–100 % of people [2, 6, 7, 32–34].

Current foot pain was reported by 48 % of patients with IA, noting a high prevalence in people with RA. Pain is the commonest problem facing patients with IA both generally and specifically related to their feet [31]. We found the data to be lower than has been previously reported in people with RA [6] and gout [35]. The differences may be due to previous studies being conducted in Western countries compared to Asian countries with regard to social, cultural and ethnic compositions [36]. However, there is limited information specifically to the foot in people with gout and RA in Asian populations.

We found the DAS28 demonstrated moderate levels of disease activity and the raised ESR and CRP suggests increased levels of inflammation. However, the DAS28 does not provide a measure of foot involvement, thus patients may be at risk of ongoing joint damage if treatment decisions are made solely on the basis of the DAS [37]. Given that patients can report severe symptoms in their feet, and these general health tools omit the feet, it is vital that foot health assessment tools are used in combination with the general disease assessment tools.

There is evidence that early intervention for existing or potential foot problems can improve long-term outcomes [38, 39]. Previous studies suggest that for people with IA, the involvement of the feet, even to a mild degree, is a significant marker for future impaired mobility, functional incapacity and negative psychosocial impact [7, 40]. Following diagnosis of IA a referral to a podiatrist for baseline assessment, tailored foot health education, self-care advice and necessary intervention, is recommended [40, 41]. However, with over one third of participants with moderate to severe foot impairment and moderate levels of foot-specific pain and deformity, very few patients had actually been referred for podiatry assessment. Greater emphasis on raising awareness of foot problems and podiatry care for people with IA is required in Singapore. Guidelines strongly advocate referral to a podiatrist for essential foot health management [40, 41]. Integration of podiatry services within the rheumatology multidisciplinary team (MDT) could resolve unmet need of people with current or potential IA-related foot problems. Emerging evidence suggests that tight pharmacological control, in conjunction with MDT care, including podiatry, can be effective in the management of people with IA [38, 42]. Further work is required to improve access to podiatry for people with IA in Singapore. Future developments should include the integration of specialist podiatrists into the MDT with emphasis on improving the quality and timeliness of patient care.

We found that only 21 % of participants had been referred to podiatry services. The strongest barriers preventing uptake of podiatry services appear to be: financial constraints (even with a subsidy out-of-pocket payment at the point of care can vary considerably for each service and for each patient, and therefore the cost to the patient plays a major role in healthcare decisions), lack of patient and /or doctor awareness and understanding of the role of podiatry, and low priority given to allied-health interventions by patients. Similar barriers have previously been reported in Australia [3, 43].

Limitations of this study may potentially be a lack of external validity as people were recruited from one tertiary hospital in Singapore and therefore, a true prevalence of foot problems is unknown. The sample of people attending the outpatient clinic may have resulted in selection bias. The study may also suffer from recall bias as some of the questions referred to events that occurred when the people were first diagnosed, past appointments and interventions and self-reporting of

disease duration. We recruited from a mixed rheumatology caseload and grouped different IA conditions together for analysis, whereas previous studies have focused on a single condition such as RA [6, 7] or gout [35]. Although our findings are a true representation of the current service in Singapore, using a heterogeneous cohort potentially limits study comparison, analysis of specific differences and generalizability of findings.

The Leeds Foot Impact Scale was developed specifically to assess the rheumatoid foot, and has demonstrable measurement properties, such as reliability, construct validity, responsiveness, and wide applicability for the evaluation of the impact of disease on the feet [44]. However, anecdotal evidence from the current study identified that participants found it difficult to complete. Although there were no non-responses to the use of Leeds Foot Impact Scale, we observed that a minority of people were unable to comprehend the wording of the questions, especially if English was not their first language. Multiple generic and disease-specific foot scales are available in the English language [44]. Others such as the Foot Function Index, a generic foot scale, has undergone successful cross-cultural validation in several languages including Dutch, German and Taiwan Chinese [45–47]. The Leeds Foot Impact Scale is disease-specific, has been translated to Dutch, German and Hungarian [48]. Singapore's majority population is Chinese and many older Singaporeans are not sufficiently proficient in the English language to enable questionnaire data to be collected without the aid of a translator. Additional work is required to validate a translated foot-specific patient reported outcome measure in simplified Chinese to facilitate further research into IA-related foot pain in Asian communities. Validated outcome tools that are cross-culturally invariant will also provide opportunity for wider international collaboration and comparison between populations.

Conclusion

In conclusion, this is the first study to identify foot problems and uptake of podiatry services in people with IA in Singapore. The uptake of the podiatry service was poor and there is a need for foot-specific patient reported outcome measure in simplified Chinese to facilitate further research into IA-related foot pain, impairment and disability in Asian communities. The study highlights an unmet need for podiatry involvement and lack of compliance with international guidelines.

Additional file

Additional file 1: Table S1. Demographic and clinical characteristics for each inflammatory condition. Data presented as mean (SD) unless specified. **Table S2.** Foot and ankle characteristics for each inflammatory condition. Data presented as mean (SD) unless specified. (DOCX 28 kb)

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Availability of data and materials
Additional file 1.

Authors' contributions
KR and KC conceived and designed the study. AS, PC and ML recruited participants. KC collected and inputted the data. KR conducted the statistical analysis. KR and KC compiled the data and drafted the manuscript with input from AS, PC and ML. All authors have read and approved the final manuscript.

Competing interests
The authors declare that they have no competing interests.

Consent for publication
Not applicable.

Ethics approval and consent to participate
Ethics approval was obtained from the National Healthcare Group Domain Specific Review Board Singapore. All participants provided written informed consent prior to data collection. DSRB 2014/00996.

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