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BRIEF REPORT

A case series to describe the clinical characteristics of foot ulceration in patients with rheumatoid arthritis

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Abstract The aim of this study was to describe the clinical characteristics of foot ulceration in patients with rheumatoid arthritis (RA). Adults with RA and current foot ulceration but without diabetes were recruited. Clinical examination included assessment of RA disease activity, foot deformity, peripheral vascular disease, neuropathy and plantar pressures. Location, wound characteristics and time to healing were recorded for each ulcer. Participants completed the Health Assessment Questionnaire and Leeds Foot Impact Scale. Thirty-two cases with 52 current ulcers were recruited. Thirteen patients (41%) experienced more than one current ulcer: 5 (16%) had bilateral ulceration, 15 (47%) had previous ulceration at a current ulcer site. The majority (n=33) of open ulcers were located over the dorsal aspect of the interphalangeal joints (n=12), plantar aspect of the metatarsophalangeal joints (MTPJs) (n=12) and medial aspect of first MTPJs (n=9). In ulcerated limbs (n=37), ankle brachial pressure index (ABPI) was <0.8 in 2 (5%); protective sensation was reduced in 25 (68%) and peak plantar pressures were >6 kg/cm^2 in 6 (16%). Mean ulcer size was 4.84 by 3.29 mm. Most ulcers (n=42, 81%) were superficial; five (9.6%) were infected. Time to healing was available for 41 ulcers: mean duration was 28 weeks. Three ulcers remained open. In conclusion, foot ulceration in RA is recurrent and multiple ulcers are common. Whilst ulcers are small and shallow, time to achieve healing is slow, posing infection risk. Reduced protective sensation is common in affected patients. The prevalence of arterial disease is low but may be under estimated due to high intolerance of ABPI.

Keywords Case series · Foot ulceration · Healing · Rheumatoid arthritis · Wound

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Introduction

Foot problems commonly occur in patients with rheumatoid arthritis (RA) despite good disease control [1]. Overall prevalence of foot ulceration in patients with RA is estimated at 10–13%, with a point prevalence of 3–5% [2, 3]. A third of affected patients experience multiple sites of ulceration and there is a high rate (47%) of recurrence [2]. Data from the UK provide some insight into the presentation patterns of foot ulceration in RA and the impact on health-related quality of life [2, 4–6], but the clinical characteristics of wounds in affected patients are poorly defined. This is in contrast to diabetic foot ulceration, which has been extensively studied.

This research was undertaken in the context of a larger multi-centre case–control study to establish the predictors of foot ulceration in patients with RA. In this brief report, the aim was to describe in depth the wound characteristics of a cohort of patients at one participating centre including longitudinal data reflecting time to achieve wound healing. This contributes to our understanding of the nature of foot ulceration in RA and the burden to patients and the health service.

Methods

Recruitment of patients

Local ethical and research governance approvals were received and written informed consent obtained from all participants. All adult patients with a consultant diagnosis of RA presenting to a rheumatology foot health clinic with current foot ulceration between April 2009 and June 2010 were invited to participate in the study. Foot ulceration was defined as a full thickness skin defect occurring in isolation on or below the midline of the malleoli and requiring >14 days to heal. Patients were excluded if they had a concomitant diagnosis of diabetes, as this in itself is a known risk factor for foot ulceration, or heel ulceration associated with immobility. All patients were assessed by a specialist rheumatology podiatrist following training to standardise data collection techniques.

Clinical measures

Demographic data, current medication and previous foot surgery were recorded for each participant. In order to quantify current RA disease activity, a 36 swollen and tender joint count was undertaken including disease activity in the foot. A 100-mm visual analogue scale score (0 indicating no pain, 100 indicating pain as bad as it could be) was recorded for pain in each foot prior to any intervention (e.g. debridement and wound cleansing). Participants completed the Health Assessment Questionnaire (HAQ) disability index [7] as a measure of function (0=no disability, 3=completely disabled) and the Leeds Foot Impact Scale (LFIS), a self-completed foot health outcome tool for RA [8]. The LFIS has 51 items in two domains to assess impairment and footwear ($LFIS_{IF}$) (21 items; minimum score 0, maximum score 21) and activity and participation ($LFIS_{AP}$) (30 items; minimum score 0, maximum score 30). Whilst high scores on the LFIS reflect severe impact of disease on the foot, minimally important clinical difference scores have not yet been established for the LFIS. Measurement of forefoot deformity was assessed using the forefoot aspect of Platto's Structural Index [9] (0= no forefoot deformity, 1=established forefoot deformity) and the Manchester Scale for the grading of hallux valgus [10] (0=no deformity, 4=severe deformity). A 10-g monofilament was used to detect sensory loss; six sites were tested twice on the plantar aspect of each foot: the hallux and all metatarsophalangeal (MTP) joints. Reduced protective sensation was identified if the patient was sensitive to less than 11 of 12 applications for each limb [11]. Ankle brachial pressure index (ABPI) was measured on each limb using a hand-held Doppler ultrasound to assess for lower limb arterial disease; a reading of less than 0.8 was considered indicative of arterial disease, whilst greater than 1.3 suggests calcification of the walls of the arteries and incompressible vessels reflecting peripheral vascular disease (PVD) [12]. Plantar pressures were measured using the PressureStat™ foot print mat (Bailey Instruments, Manchester, UK); pressure less than 6 kg/cm^2 (588 kPa) is considered normal and equal to/or more than 6 kg/cm^2 is indicative of high plantar pressure, based on the manufacturer's guidelines [13].

Foot ulceration

All current foot ulceration sites and wound characteristics were recorded for each patient at a single time point. Foot health records were reviewed to identify if current sites had previously been ulcerated; where this information was unavailable patients were asked to report previous episodes. As there are no validated tools to record foot ulceration in this patient group, we adapted the TIME wound assessment tool [14] which facilitates structure assessment of wound bed tissue, the presence of infection/inflammation, moisture imbalance/exudate level and a description of the wound margins/surrounding skin. The length and width (in millimeter) of ulcers were measured; depth was categorised as superficial; deep tissue involving joint capsule, ligament, tendon/muscle; or bone exposed. The wound bed was described as epithelial, granular, sloughy or necrotic. Ulcer exudate was reported by volume and viscosity (low, medium and high). Local and spreading infection was recorded; wound swabs were undertaken when clinically indicated. The presence of vasculitis was reported based on the clinical assessment of wound margins, detection of purpuric rash and nail fold infarcts [15–17]. Time to achieve healing was documented for each current ulcer over a follow-up period of 12 months after the final patient was recruited.

Statistical analysis

Data were entered onto the Statistical Package for the Social Sciences (SPSS version 17). Simple descriptive statistics are reported for all demographic and clinical measures. The mean (range) scores were reported for interval level data, and median (range and interquartile range (IQR)) for categorical or ordinal data. Statistical comparisons were made using chi-square for categorical data, and Mann–Whitney U for ordinal data.

Results

Patient characteristics

Thirty-nine patients were approached to take part in the study. Thirty-two patients (25 females; 7 males) with 52 current

ulcers were recruited. Two patients declined to participate and the ulcers of five potential cases had healed on the day of data collection. Participants' mean age (range) was 72 years (45–85) and mean RA disease duration 22 years (1–48). Thirteen patients (41%) had more than one current ulcer (range, 1–5; mean, 1.6; n=33 ulcers); 6 patients (19%) had bilateral ulceration (n=17 ulcers) and 15 patients (47%) had previous ulceration at a current ulcer site (n=19 ulcers).

Twenty-five (78%) patients were on a disease modifying anti-rheumatic drug (DMARD), 14 (44%) were taking a steroid and 4 (13%) were taking a biologic therapy. Of those patients nine (28%) were taking a combination of DMARDs and steroids, two (6%) were taking a DMARD and biologic therapy, one patient was taking a steroid and biologic therapy and another was taking all three in combination. The mean swollen joint count was 5.5 (0–33) and tender joint count was 9.2 (0–34). The median (range; IQR) HAQ score was 1.88 indicating moderate disability (0.1–3.0; IQR 1.3, 2.4). The median $LFIS_{IF}$ score was 13.5/21 (range 4–19; IQR 10.0, 16.8) and the median $LFIS_{AP}$ score was 25.5/30 (range 5–30; IQR 20.5, 28.0).

Limb level characteristics

The mean Platto forefoot index score in ulcerated limbs was 0.8 (95% C.I. 0.7, 0.8) compared with 0.8 (95% C.I. 0.7, 0.8) in non-ulcerated limbs. The majority (n=23, 62%) of ulcerated limbs had a severe hallux valgus as graded by the Manchester scale; the findings were similar (n=20, 54%) in non-ulcerated limbs.

Participants experienced ulceration affecting 37 limbs, one patient had previously undergone an above the left knee amputation which was unrelated to foot ulceration. Foot surgery had been performed on 11 (30%) ulcerated limbs and 5 (14% chi-squared=2.0; ns) non-ulcerated limbs. Of those operated upon seven (64%), procedures were undertaken at the current site of ulceration. However, all post-surgical wound sites had fully healed prior to the patient presenting with a foot ulcer. The ABPI was less than 0.8, indicating arterial disease in two (5%) ulcerated limbs and in two (5.5%) non-ulcerated limbs. The ABPI was equal to or more than 1.3, suggesting calcification of the arteries and incompressible vessels reflecting PVD in 22 (60%) ulcerated limbs and in 19 (51.5%) non-ulcerated limbs. In six ulcerated limbs and seven non-ulcerated limbs, the patients were unable to tolerate ABPI measurement. Protective sensation was reduced in 25 (68%) ulcerated limbs and 23 (62%) non-ulcerated limbs (chi-squared, 0.01; ns). Peak plantar pressures were high (>6 kg/cm^2/588kPa) in six (18%) ulcerated limbs and three (9%) non-ulcerated limbs (chi-squared, 0.45; ns). The median foot pain was 48.5 (range 0–99; IQR 22.8, 80.3) in ulcerated limbs compared with 30.5 (range 0–98; IQR 11.8, 72.0) in non-ulcerated limbs (Mann Whitney U=1.57, ns).

Wound characteristics

The location of current ulcers and wound characteristics are shown in Table 1. No evidence of vasculitis was detected in the ulcers/limbs on clinical examination. The clinician reported time taken to healing for current ulcers was available for 41 ulcers; the mean duration was 28 weeks (range, 2–71 weeks). Three ulcers remain open at the time of

Table 1 Location of foot ulcers (n=52) and wound characteristics in 32 patients with RA

Ulcer location	
Apex of toes	3
Medial to nail plate	1
Dorsal aspect of interphalangeal joints	12
Interdigital aspect of interphalangeal joints	7
Dorsal aspect of metatarsophalangeal joints	2
Plantar aspect of metatarsophalangeal joints	12
Medial aspect of first metatarsophalangeal joint	9
Lateral aspect of fifth metatarsophalangeal joint	1
Lateral aspect of base fifth metatarsal (styloid process)	1
Below medial malleolus	2
Plantar aspect of base first metatarsal	1
Posterior aspect of calcaneus	1
Ulcer size (mm)	
Mean length (range)	4.84 (0.3–13)
Mean width (range)	3.29 (0.2–11)
Ulcer depth	
Superficial	42 (81%)
Deep	5 (10%)
Bone	4 (8%)
Missing	1 (1%)
Wound infection	
Colonised	46 (89%)
Local	5 (10%)
Spreading	0
Missing	1 (1%)
Wound bed	
Granular	43 (83%)
Sloughy	7 (14%)
Necrotic	1 (2%)
Missing	1 (1%)
Wound exudate	
None	14 (27%)
Low viscosity, low volume	29 (56%)
Low viscosity, medium volume	1 (2%)
Low viscosity, high volume	1 (2%)
Medium viscosity, low volume	5 (10%)
Medium viscosity, medium volume	1 (2%)
Missing	1 (1%)

analysis; the mean follow-up was 108 weeks (range, 79–132). One ulcer resulted in surgery and has subsequently healed. One patient died with open ulceration (n=2). Three ulcers are healed based upon self report but validated time to achieve healing was not available. One patient was lost to follow-up (n=2). The mean healing time for ulcers over the medial aspect of the first MTP joints was 14 weeks, the plantar aspect of MTP joints was 29 weeks, the dorsal aspect of the interphalangeal (IP) joints was 34 weeks and the interdigital aspect of IP joints was 12 weeks.

Discussion

This is the first study to describe the wound characteristics of foot ulceration in a cohort of patients with RA, including time to achieve healing. In keeping with other studies [2, 4, 5], foot ulcers occurred most frequently on the plantar aspect of the MTP joints and the dorsal aspect of hammer toes where time to achieve healing was longest. Whilst most ulcers were small and superficial, patients often experienced multiple ulcers, recurrent episodes and slow time to healing which poses infection risk. Despite the point prevalence of infection being low in this cohort, colonisation was present in 89% of ulcers. Almost half (47%) of the patients were taking either steroids or biologic therapies which are known to be associated with increased risk of skin and soft tissue infection in patients with RA [18]. Open wounds in turn pose a relative contraindication to biologic treatment and may require the patient's medication to be suspended, which, in turn may increase the time to heal [19] or predispose the patient to subsequent ulceration. Patients with foot ulceration had evidence of active disease and significant forefoot deformity, although there was no statistically significant difference between ulcerated limbs and non-ulcerated limbs. A pilot study indicated that active disease was a significant predictor of foot ulceration in patients with RA but forefoot deformity was not, although the reliability of these preliminary findings were limited by the small sample size [5]. Increased foot pain was associated with ulceration, although no statistically significant difference was found between ulcerated and non-ulcerated limbs. However, these results are supported by the findings of qualitative research that indicated wound pain to be a major feature of ulceration leading to a cascade of consequences [6]. The impairment and function domain score (mean, 13.5) of the LFIS is comparable to scores (range, 11–15) in other studies of patients with RA and foot pain and pathology [20–24]. However, the activity and participation domain score (mean, 25.5) and HAQ score (mean, 1.88) appear to be higher than those reported in the other studies ($LFIS_{AP}$ range, 13–22; HAQ range, 0.75–1.04).

Surprisingly, vasculitis was not suspected in any of the ulcer cases based upon clinical examination of the wound and limb. However, this is consistent with the findings of a recent study in which ulcer biopsy revealed vasculitis was not seen in patients with ulceration only on the feet [19]. A limitation of this study is the lack of biopsy data to detect subclinical vasculitis but this could not be justified in the absence of clinical signs. The prevalence of arterial disease was low but may be under estimated due to high intolerance of ABPI in this group; lower limb oedema was present in half of these patients and vessel calcification frequently lead to discomfort on inflation of the pressure cuff. Alternatives for assessing lower limb arterial disease include qualitative Doppler waveform analysis; however, this loses sensitivity in the presence of less than 50% stenosis [25]. In addition photoplethysmography toe pulse measurement has been shown to be comparable to ABPI measurements [26], but equipment is expensive and not used in the standard clinical practice. Reduced protective sensation was recorded in a high proportion of ulcerated limbs (68%) but this was not significantly different from non-ulcerated limbs; the prevalence of reduced protective sensation in patients with RA without ulceration is estimated to be as high as 59% [11]. Peak plantar pressures were not elevated in the majority of ulcerated limbs; however, only 13 (25%) ulcers were located on the plantar aspect of the foot. Peak plantar pressures were high (>6 kg/cm^2/588 kPa) in only two (15%) ulcerated limbs where the wound was located on the plantar aspect of the foot. Analysis is underway of the multi-centre case–control study to establish which factors most accurately predict risk of ulceration.

This study has described the wound characteristics of foot ulceration in RA including time to achieve healing. Whilst foot ulcers in RA may be small and superficial, they take a considerable length of time to heal posing an infection risk and threat to health-related quality of life. Further research is required to establish the predictors of foot ulceration in people with RA and strategies need to be developed in order to reduce the incidence, time to healing and recurrence of foot ulceration in this patient group.

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