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BRIEF REPORT

Ankle pain in rheumatoid arthritis: comparison of clinical and sonographic findings

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Abstract

To describe the prevalence and distribution of clinical and ultrasound (US) pathological findings at ankle level and to compare them, in patients with rheumatoid arthritis (RA). This is a descriptive, cross-sectional study assessing patients diagnosed with RA according to the 2010 ACR criteria, who were recruited consecutively and independently of disease status or treatment and of the presence of pain at ankle level. Clinical and US findings were acquired by two independent rheumatologists. US assessments were performed according to the EULAR and OMERACT indications. A total of 224 ankles of 112 RA patients were examined. One hundred (89.3%) patients were women and 12 (10.7%) were men, with a mean age of 51 years. RA mean disease duration was 72 months. Ankle spontaneous pain was found in 56.2% of the patients. In 65.2% of the patients, US found at least one pathologic sign indicative of joint and/or tendon pathology. Using grayscale US, joint involvement was more frequently found than tendon pathology (37.5% vs 22.3%). Conversely, no substantial difference was found between the prevalence of power Doppler signal at joint and tendon level. There was a significant correlation between clinical findings and US findings indicative of tibiotalar joint synovitis and peroneal tenosynovitis. In the present study, pain and US pathologic findings at ankle level were described and compared in a cohort of RA patients. Spontaneous pain was found in more than half of the patients and US found joint involvement more prevalent than tendon pathology.

Keywords Ankle pain · Rheumatoid arthritis · Synovitis · Ultrasound

Introduction

Ankle and foot involvement can affect up to 90% of patients with rheumatoid arthritis (RA) during the course of the disease [1, 2]. In RA, painful ankle can be related to joint and/or tendon inflammation which can lead to permanent anatomic damage with consequent patient walking disability [3, 4]. Different anatomic structures can be the target of RA at ankle level including synovial tissue, tendons, bursae, ligaments, hyaline cartilage, and bony cortex [5]. Moreover, apart from inflammation, other factors may be responsible for ankle pain, including overuse, repetitive strain, minor injuries, and edema. Thus, an accurate diagnosis is essential for an adequate treatment.

In the last decade, ultrasound (US) has demonstrated to be a sensitive imaging technique that can reveal subclinical inflammatory changes at both joint and tendon levels in patients with RA [6–12].

The aims of this study were to describe the prevalence and distribution of clinical and US pathological findings at ankle level and to compare them, in patients with RA.

Material and methods

Study design

This is a descriptive, cross-sectional study assessing patients diagnosed with RA according to the 2010 ACR criteria [13],

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who were recruited consecutively and independently of disease status or treatment and of the presence of pain at ankle level. Age, gender, disease duration, history, and presence of ankle pain were recorded.

An experienced rheumatologist recorded the presence of spontaneous pain and carried out a physical examination of both the ankles to elicit tenderness. On the same day, another rheumatologist experienced in musculoskeletal US and blind to the clinical findings performed a bilateral US examination of the ankles.

Clinical assessment

Clinical assessment was performed to detect the presence or absence of spontaneous pain and tenderness at four different aspects of the ankle (anterior, lateral, medial, and posterior). Ankle movements were assessed with the knee flexed. The ankle joint was palpated in slight plantar flexion for the anterior aspect; eversion and inversion movements of the ankle were assessed holding patient's calcaneus, and afterwards, abduction and adduction were done by causing the dorsiflexion movement of the ankle. Synovitis of the tibiotalar joint (TTJ) and the talonavicular joint (TNJ) was evaluated by palpation stabilizing the calcaneus with one hand while rotating the forefoot with the other, inward at 30° and outward at 20° [1, 14].

US equipment

We used either a MyLab 70XVG® or a portable MyLab 25® US system (Esaote SpA; Genoa, Italy) both equipped with the same transducer, a 6–18-MHz linear probe. The values assigned to the power Doppler (PD) setting parameters were the following: pulse repetition frequency is 750 Hz, 9.1 MHz frequency for tendon assessment, and 7.7 MHz for joint assessment (Fig. 1).

US images acquisition

Bilateral ankle US examinations were performed using the scanning technique proposed by the latest EULAR standardized procedures for ultrasound imaging in rheumatology [15]. The patients were asked to lie on the bed with the knee flexed at 45° to scan the anterior, medial, and lateral sides of the ankle. On the anterior aspect, the following anatomic structures were scanned: tibialis anterior tendon, extensor digitorum longus tendon, extensor hallucis longus tendon, TTJ, and TNJ. In the medial and lateral aspects, the following tendons were examined: tibialis posterior tendon (TPT), flexor hallucis longus tendon, flexor digitorum longus tendon, and peroneus longus and brevis tendons (PLBT).

Finally, patients were asked to obtain a prone position with the feet hanging freely over the edge of the bed to scan

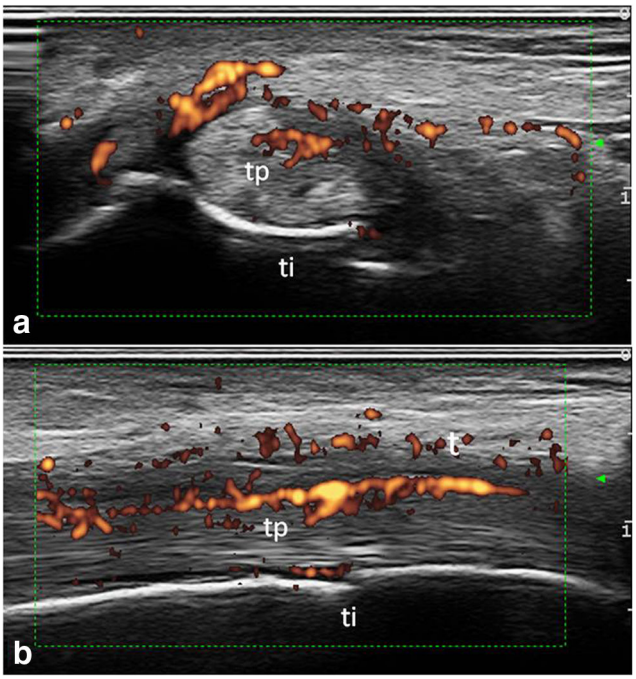

Fig. 1 Representative power Doppler ultrasound images showing an active tenosynovitis of the tibialis posterior tendon (tp). Images were acquired in transverse (**a**) and longitudinal (**b**) scans. ti = tibia

Achilles tendon and retrocalcaneal bursae on the posterior aspect. All US findings were documented on at least two perpendicular planes. PD examinations were performed according to the indications provided by Torp-Pedersen S et al. [16].

US images interpretation

The OMERACT Special Interest Group on US preliminary definitions for both joint and tendon pathology (synovial effusion, synovial hypertrophy, bone erosions, and tenosynovitis) affecting patients with RA was adopted [17]. Moreover, the presence of a partial or complete tendon rupture was recorded. Tendon damage was defined as a discontinuity of the tendon fibrillar pattern partial or complete, confirmed in two perpendicular scans [18–20]. The presence of intra-articular and intra- or peri-tendinous PD signal was recorded.

Informed consent

Informed consent was obtained from all participants.

Statistical analysis

Qualitative variables were described by frequencies and percentages; for quantitative variables, central tendency and dispersion measurements were used. The association between independent and dependent variables was determined by odds ratio (OR). For associations, statistic Fisher's exact test was

calculated by 0.05 levels. The software employed was SSPSv 21.0 (SPSS Inc., IL, USA).

Results

A total of 112 patients (224 ankles) were evaluated; 100 (89.3%) patients were women and 12 (10.7%) were men, with a mean age of 51 years (ranging from 22 to 85 years). RA mean disease duration was 72 months (ranging from 2 to 456 months).

Clinical findings

Prevalence and distribution of clinical findings are reported in Table 1. Ankle spontaneous pain was found in 63 (56.2%) out of 112 patients: in 11 (9.8%) patients only in the right ankle, in 15 (13.4%) patients only in the left ankle, and in 37 (33%) patients the ankle spontaneous pain was found in both the ankles; and no pain in 49 (43.8%) patients. Mean duration of ankle pain was 13.44 months (ranging from 0 to 240 months). Both the medial and lateral aspects of the ankle were the most frequently involved aspects.

Other ankle or foot clinical findings were acquired during the physical examination including edema (19.6%), hallux valgus (4.9%), muscle hypotrophy (1.8%), venous insufficiency (1.8%), surgical deformities due to fracture and malleolar prosthesis (1.3%), and plantar fasciitis (0.9%).

US findings

In 73 (65.2%) out of 112 patients, US found at least one pathologic sign indicative of joint and/or tendon pathology. Table 2 reports the prevalence of the US findings at ankle level. Using greyscale US, joint involvement was more frequently found than tendon pathology (37.5% and 22.3%, respectively). Conversely, the prevalence of power Doppler signal at joint and tendon levels was respectively 7.6% and 8%. No subject without pain had power Doppler signal.

Table 2 Prevalence of US findings at ankle level. Data are presented as the number and percentage of the 224 scanned ankles

US findings	TPT	PLBT	TTJ	TNJ
Synovitis, *n* (%)	–	–	50 (22.3)	34 (15.2)
Tenosynovitis, *n* (%)	24 (11.6)	26 (10.7)	–	–
Power Doppler signal, *n* (%)	11 (4.9)	7 (3.1)	10 (4.5)	7 (3.1)

TPT, tibialis posterior tendon; *PLBT*, peroneus longus and brevis tendons; *TTJ*, tibiotalar joint; *TNJ*, talonavicular joint

Clinical versus US findings

There was a significant correlation between clinical findings (i.e., spontaneous pain referred by the patient and tenderness elicited during physical examination at the lateral side of the ankle) and US findings indicative of TTJ synovitis and peroneal tenosynovitis ($p < 0.0001$); there was no significant correlation between pain and tenderness; no other associations were found.

Table 3 shows the distribution of US findings indicative of TPT and PLBT tenosynovitis and TTJ and TNJ synovitis according to the number of months of ankle pain duration. Longer ankle pain duration was not associated with a higher prevalence of US pathological findings neither at tendon nor at joint level.

Discussion

This is one of the largest cohort studies performed with the aim to compare clinical and US findings at ankle level in patients with RA; more than one hundred patients with or without ankle pain were consecutively enrolled. Ankle spontaneous pain was found in more than half of the RA patients, and abnormal US findings indicative of inflammatory pathology at ankle joint and/or tendon level were detected in 65% of the cases.

Ankle is a complex anatomic site and different pathologic conditions and mechanisms may concur to its final functional impairment. Thus, the US identification of the inflamed joint and/or tendon provides useful information especially in those cases in which a local steroid injection is considered a

Table 1 Prevalence of clinical findings and their distribution in the four aspects of the 224 examined ankles

	Ankle aspects				
	Anterior	Medial	Lateral	Posterior	More than one aspect
Clinical characteristics					
Spontaneous pain present at the time of the visit, *n* (%)	41 (18.3)	48 (21.4)	68 (30.4)	23 (10.3)	51 (22.8)
Tenderness, *n* (%)	18 (8)	36 (16.1)	65 (29)	7 (3.1)	35 (15.6)

Table 3 Tenosynovitis or synovitis detected by US and time with pain in months

Anatomic structure with tenosynovitis or synovitis detected by US	Ankle pain duration in months					
	0	6	12	24	More than 24	*p* value
TPT	3	2	5	4	3	0.02
PLBT	1	3	6	5	2	0.00
TTJ	9	5	5	4	5	0.29
TNJ	9	4	5	4	2	0.57

$n = 112$

TPT, tibialis posterior tendon; *PLBT*, peroneus longus and brevis tendons; *TTJ*, tibiotalar joint; *TNJ*, talonavicular joint

treatment option. In our cohort, the most frequently clinically involved ankle aspects were the medial and lateral ones, and US showed that tendon involvement (i.e., tenosynovitis of TPT and PLBT) represented the most prevalent pathology in those ankle aspects. Comparing the duration of the ankle pain with the US pathologic findings, we found that ankle pain lasting at least 1 year can be equally related to both joint and tendon diseases; when pain lasted less than 1 year, joint involvement was found more prevalent than the tendon one.

In the last 10 years, ankle involvement in RA has been investigated using US by a number of studies [9, 21–29]. In all the studies, US was found a sensitive imaging tool allowing for exact identification of the affected anatomic structures; moreover, not only joints but also tendons were found frequently involved and positively associated with ankle clinical involvement.

In the study by Suzuki et al. [21], 100 ankles in 74 RA patients were scanned, and the analysis of the US data showed that tenosynovitis is a frequent pathologic finding especially in the early stage of the disease (less than 6 months of disease duration). Elsaman et al. obtained similar results in a cross-sectional study conducted in a cohort of 63 patients with active RA [22]. Tibialis posterior and peroneal tendons were the most frequently reported affected [23–25], and tibialis posterior tenosynovitis seems to be the more specific for RA [26]. Furthermore, Janta I et al. found a positive significant correlation between TPT damage assessed by US and radiographic structural damage [27]. In RA patients, the US prevalence of ankle joint involvement seems to have a tendency to increase with the increment of disease duration [26, 28].

The importance of assessing the ankle with US in patients with RA can be also estimated by the results of studies not primarily aimed at investigating ankle joint. In fact, in the study conducted by Naredo et al. in RA patients in clinical remission, ankle was included in the core set of the joints to scan to obtain a highly sensitive detection of residual synovitis [30].

While several studies have been carried out in RA patients, further researches are needed to investigate the prevalence of US abnormalities at ankle level in healthy subjects. In fact, some morpho-structural changes may not be due to RA.

We believe that the data obtained in the present study provide additional insights into this topic and will contribute to develop the best scanning protocol for RA patients, aiming to obtain the maximal relevant information on ankle joint and tendon pathology in the shortest possible time.

Limitations

This study has several limitations. First, it was performed at a single center. Second, despite the results acquired with the same transducer, a 6–18-MHz linear probe, two US systems were used; this could have affected mainly the Doppler findings [31]. Moreover, the disease activity score 28 was not systematically recorded in all the patients (many of the consecutively recruited patients presented without laboratory tests results), because the objective of the study was to investigate ankle pain and compare clinical and US findings at ankle level. Finally, no other imaging techniques (i.e., magnetic resonance imaging) were used to substantiate the US findings as made by Wakefield R et al. [9].

Conclusions

We found that US allows for a sensitive detection and exact identification of joint and/or tendon inflammatory involvement at ankle level in patients with RA, explaining the reason for ankle pain when present, and revealing subclinical disease in asymptomatic ankle.

Compliance with ethical standards

Conflict of interest All the authors declare no conflict of interest for this manuscript.

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