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Involvement of foot in patients with spondyloarthritis: Prevalence and clinical features

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ABSTRACT

Background: The purpose of this study was to evaluate the foot involvement in a group of patients with spondyloarthritis in regard to symptoms, type and frequency of deformities, location and radiological changes.
Methods: We conducted a cross sectional study including 60 patients with spondyloarthritis over a period of six months. Anamnesis, clinical examination, podoscopic examination, biological tests and X-rays of feet were done for each patient.
Results: Foot involvement was found in 31 patients (52%). It was symptomatic in 35% of cases and inaugural in 42% of cases. The most frequent site was the hindfoot (22 patients/31). Radiological findings were: erosion (17%), reconstruction (33%), erosion and reconstruction (50%). Forefoot involvement was found in 18/31 patients. Forefoot deformities were found in 9 patients. Two patients had sausage toe and feet skin abnormalities were observed in 12 patients. At podoscopic examination, 23 patients had abnormal footprints. Foot involvement was more frequent in peripheral spondyloarthritis ($p = 0.008$). Patients with foot involvement had an advanced age of disease onset ($p = 0.05$), a shorter disease duration ($p = 0.038$) and more comorbidities ($p = 0.039$). Foot involvement was correlated with C Reactive protein ($p = 0.043$).
Conclusion: In our study, foot involvement and foot symptoms were seen frequently in spondyloarthritis and it is associated with late onset of the disease and with higher inflammation in blood tests.

1. Introduction

Spondyloarthritis (SpA) is a heterogeneous group of arthritic diseases sharing clinical and radiologic features. Subsets include ankylosing spondylitis (AS), psoriatic arthritis (PsA), reactive arthritis (ReA), arthritis associated with inflammatory bowel disease (AIBD) and undifferentiated SpA (uSpA). They are associated with the human leukocyte antigen B27 (HLA-B27) and sometimes triggered by infection [1]. Most involve the axial joints in the spine, particularly the sacroiliac joint, but can also involve peripheral joints. Foot involvement is common and is an essential element in the early diagnosis of SpA [2]. The study of the association between SpA and foot involvement is interesting to identify patients early who are at risk of developing foot involvement and thus potentially intervene at an early stage.

The purpose of this study was to determine the rate of occurrence of foot involvement in patients with SpA and to describe clinical and radiological features of foot involvement in these patients.

2. Methods

This cross-sectional study was conducted at our outpatient clinic over a 6-month period from March to September 2014. Patients with SpA meeting Amor's criteria [3] and PsA (Caspar criteria) [4] were enrolled. The study conforms to the 1995 Helsinki declaration, was approved by the Hospital local Ethics Committee and all patients gave their informed consent prior to their inclusion. We evaluated the patients' demographic features and clinical characteristics. Disease activity was assessed by the Bath Ankylosing Spondylitis Activities Disease Index (BASDAI) [5] and the life quality by the Bath Ankylosing Spondylitis Functional Index (BASFI) [6].

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All patients underwent clinical examination of foot and ankle to determine footprint and podiatric abnormalities [7,8]. Bursitis, synovitis, tenosynovitis and talocrural arthritis were assessed clinically. Radiographs (spine, pelvis and feet) were performed for all patients and were examined by 2 experienced rheumatologists. Radiological damage was scored by the Bath Ankylosing Spondylitis Radiologic Index (BASRI) [9] and radiographic damage of foot was scored as follows: complete destruction, erosions, joint space narrowing and bone sclerosis.

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) for Windows, version 11.5. The Chi-squared test of Pearson was used to compare categorical variables between the groups, or the Fisher exact test in case of non-validity. The t Student test was used to compare two averages from independent series. Pearson correlation analysis was used to reveal the relationships between parameters. A p-value lower than 0.05 was regarded as statistically significant.

3. Results

3.1. Descriptive study of patients

Sixty patients were enrolled, mean age was 44 ± 14 years [range: 15–82]. The sex ratio (F:M) was 0.27 (47 males and 13 females). Comorbidities were noted in 48% of cases (n = 29). The mean duration of disease was 10.4 ± 9.3 years [range: 1 month–39 years]. It was AS (n = 33), AIBD (n = 13), PsA (n = 12), ReA (n = 1) and uSpA (n = 1). The SpA was axial (40%), peripheral (5%) or axial and peripheral (55%). Foot involvement was found in 31 patients (52%). It was symptomatic in 21 patients and inaugural in 13 patients. Mean time to onset of foot involvement was 5.31 ± 3.8 years [range: 1 month–15 years].

3.2. Involvement of hindfoot

It was founded in 22 patients (Tables 1 and 2). Fifteen patients had posterior heel pain: bilateral in 14 patients. The mean time to onset of heel pain was 5.83 ± 4 years [range: 1 month–15 years]. The mean of Visual Analog Scale for Pain (VAS pain) was 66.6 ± 12 mm [50–100]. None of the patients had retrocalcaneal bursitis or subtalar arthritis. Radiological abnormalities were found in 18 patients: erosion (n = 3), reconstruction (n = 6), erosion and reconstruction (n = 9). Insertional Achilles tenosynovitis was observed in 2 patients and talocrural arthritis in one patient.

3.3. Involvement of forefoot

Forefoot involvement was found in 18 patients (58%). Metatarsal pain was present in 9 patients. It was bilateral in all patients and inflammatory in 6 patients. Mean time to onset of metatarsal pain was 4.23 ± 3.5 years. The mean VAS pain was 61.1 ± 19 mm. Squeeze test was positive in 7 patients. Metatarsal synovitis was observed in 3 patients and intermetatarsal bursitis was present in one patient. The Table 3 showed radiographic abnormalities of metatarsal joints, proximal interphalangeal joint and distal interphalangeal joint. Deformities of forefoot were found in 9 patients: overlapping toes (n = 8), claw toes (n = 2), hallux valgus (n = 5) and quintus varus (n = 2).

Table 1
Involvement of foot in spondyloarthritis.

	Foot involvement N/T	(%)
Ankylosing spondylitis	13/33	39
Rheumatism of chronic Inflammatory bowel disease	6/13	46
Psoriatic arthritis	11/12	92
Reactive arthritis	0/1	0
Undifferentiated SpA	1/1	100

N: The number of foot involvement.
T: The total of rheumatic diseases.

Table 2
Details of foot involvement.

	Frequency N	%
Foot involvement	31	71
Hindfoot involvement	22	
Heel pain	15	
Tenosynovitis heel	2	
Talocrural arthritis	1	
Retrocalcaneal bursitis	–	
Subtalar arthritis	–	
Forefoot involvement	18	58
Metatarsal pain	9	
Positive squeeze test	7	
Metatarsal synovitis	1	
Deformations	9	
Transverse tarsal joint involvement	1	
Skin involvement	12	39

3.4. Others foot involvement

Involvement of the transverse tarsal joint was observed in a patient who presents a synostosis of the tarsal bones. Problems with footwear were noted in 12 patients. Antalgic gait was noted in 10 patients. Feet skin abnormalities were observed in 12 patients: palmoplantar pustulosis (n = 1), psoriasis (n = 7), nail psoriasis (n = 2), palmoplantar keratoderma (n = 3) and callus (n = 1) with a mean time of onset 6.3 ± 6.7 years [range: 1–20]. At podoscopic examination, 23 patients had abnormal foot prints: cavus foot was observed in 14 patients and a flat foot in 9 patients.

3.5. Impact of foot involvement

Antalgic gait and shoe problems were more frequent in patients with involvement of foot ($p = 0.001$ and 0.027 respectively). A statistically significant relationship was also found between an antalgic gait and involvement of the hindfoot or forefoot ($p = 0.006$ and $p = 0.007$ respectively). There was no relationship between foot involvement and socio-demographic data except the presence of comorbidities ($p = 0.039$) (Table 4). Six patients with foot involvement had skin psoriasis and 9 patients had chronic inflammatory bowel disease. Smoking and body mass index (BMI) had no effect on foot involvement in SpA ($p = 0.229$ and $p = 0.785$ respectively) (Table 4). Obesity, defined by a BMI more than 30 kg/m^2 had no relationship with foot involvement. Involvement of foot was more frequent in patients who had peripheral SpA ($p = 0.008$). The patients with foot involvement had advanced age of disease onset ($p = 0.05$) and shorter disease

Table 3
Frequency of radiological abnormalities of forefoot.

	Metatarsal joint	Proximal interphalangeal joint	Distal interphalangeal joint
Complete destruction	1	–	1
Joint space pinching	2	3	4
Erosion + joint space pinching	1	2	2
Bony proliferation + joint space pinching	1	2	1
Bony proliferation + Erosion	1	–	–

Table 4
Comparisons of socio-demographic data between the two groups.

		SpA with involvement of foot (N = 31)		SpA without involvement of foot (N = 29)		*p*
		n	%	n	%	NS
Gender	Male	24	77	23	79	NS
	Female	7	23	6	21	
Marital status	Married	19	61	18	62	NS
	Single	12	39	11	38	
Housing	Urban	20	64	23	79	NS
	Rural	11	36	6	21	
Profession	Unemployed	12	38	13	46	NS
	Manuel	8	26	10	34	
	Office	8	26	3	10	
	Retired	3	10	3	10	
Smoking		15	48.4	13	44.8	NS
Comorbidities		20	64.5	11	37.9	0.039
BMI	Mean	23.6		23.9		NS
	Range	(16–38)		(17–33)		

SpA: spondyloarthritis, BMI: body mass index, NS: not significant ($p > 0.05$).

Table 5
Comparisons of different index of SpA and biology data between the two groups.

		SpA with foot involvement	SpA without foot involvement	***p***
BASDAI	Mean (Range)	39.19 (0–78)	41.55 (0–82)	NS
BASFI	Mean (Range)	43.9 (0–98)	42.21 (0–89)	NS
TJC	Mean (Range)	3.45 (0–17)	1.21 (0–4)	0.011
SJC	Mean (Range)	1.00 (0–7)	0.10 (0–2)	0.029
NA	Mean (Range)	1.71 (0–5)	1.41 (0–3)	NS
MS	Mean (Range)	0.57 (0–3)	0.79 (0–3)	NS
VAS	Mean (Range)	55.16 (0–100)	49.31 (0–100)	NS
PGA	Mean (Range)	51.45 (0–80)	49.83 (0–100)	NS
ESR	Mean (range)	41.84 (3–115)	33.93 (3–90)	NS
CRP	Mean (range)	28.52 (0.4–119.9)	15.24 (1.5–61.5)	0.043

SpA: spondyloarthritis; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; BASFI: Bath Ankylosing Spondylitis Functional Index; AFI: algofunctional index; TJC: tender joint count; SJC: swollen joint count; NA: nocturnal awakening; MS: morning stiffness; VAS: visual analogue scale; PGA: patient's global assessment; BMI: bone mass index; ESR: erythrocytes sedimentation rate; CRP: C-reactive protein; NS: not significant ($p > 0.05$).

duration ($p = 0.038$). The Table 5 showed that foot involvement was associated with Tender joint count (TJC) ($p = 0.011$) and swollen joint count (SJC) ($p = 0.029$). Presence of sacroiliitis was less frequent in patients with involvement of feet ($p = 0.011$). Presence of coxitis or inflammatory spondylitis was not correlated to the involvement of feet. Biologically, the mean value of CRP was statistically higher in patients with involvement of hindfoot ($p = 0.002$) (Table 5). CRP was correlated with TJC ($p = 0.018$) and SJC ($p = 0.024$). HLA B27 blood test performed in 23 patients was present in 7 patients (30%). A positive correlation was found between HLA B27 and hindfoot involvement ($p = 0.036$).

4. Discussion

4.1. Frequency of foot involvement in SpA

Frequency of involvement of foot in SpA according to the authors ranges from 38 to 100% [10,11]. Foot problems are frequent in normal population (30–83%), increasing with age and are most common among women [12,13]. However, foot problems in SpA usually concern young men [2]. The hindfoot is more frequently involved than forefoot [2]. Heel pain, a major symptom in the SpA, reflects a calcaneal enthesitis and is present in approximately 30–42% of cases [14,15]. Compared to the literature, heel pain was less frequent and later in onset in this study. The severity of heel pain varies: it can be intense at onset and then it increases gradually [2]. Sometimes it becomes chronic and causes antalgic gait [16].

4.2. Diagnosis of foot involvement in SpA

Besides an antalgic gait and problems of footwear were noted in 17% and 20% of our patients. Radiological changes can be seen without the presence of heel pain. Thus, bone scans, MRI and ultrasound Doppler coupled may be necessary to diagnosis these changes [11,17–19]. Involvement of the subtalar joint and the talocrural joint are rare in SpA. Involvement of the forefoot is common in AS (15–20%), in ReA 50% and in PsA (80%). Forefoot lesions often occur early at the onset of disease in 10–30% of cases [20]. Unlike rheumatoid arthritis, metatarsalgia in SpA is rather asymmetrical and usually affects both first rays [21]. Sausage toe is a tripolar involvement with flexor tenosynovitis and sometimes periostitis confirmed by ultrasound and mainly by MRI [22,23]. Its frequency in SpA varies from 5 to 24% [15,24]. It is seen most often in ReA and especially in PsA. Indeed, the prevalence and the incidence of Sausage toe in PsA are 33% and 48% respectively [25] and it is present more in severe forms of the disease [26]. Specific features that are pathognomonic of PsA and thus should be searched for include arthritis mutilans of the toe, Bauer's toe and psoriatic onychopachydermoperiostitis of the great toe. The difficulty is the frequent underhanded evolution that leads to late

diagnosis at the stage of irreducible deformities with an unfavorable functional prognosis. [20]. In our series, the forefoot deformities were more frequent than in other studies (15%) although forefoot involvement was sometimes more frequent [10]. These deformities were mainly bilateral and irreducible with unfavorable functional outcome. Ankylosing tarsitis, osteophytosis of the dorsal surface of the talus, navicular and cuneiform gives spiculated appearance of the foot [2]. Radiological changes in transverse tarsal joints may be present in 19% of cases with a risk of progression to severe ankylosis of all tarsal joints [2,27] as observed in one patient.

Palmoplantar keratoderma or Vidal-Jacquet syndrome [28] can reach the palms and soles. The hyperkeratosis may also affect nails which become yellowish and thickened [2,29,30]. It typically belongs to the symptoms of ReA in about 10% of patients [2]. The prevalence of hyperkeratosis in our series was much less (3 patients with PsA).

4.3. Factors associated with foot involvement in Spa

In this study, inflammatory bowel disease or cutaneous psoriasis in the personal history of patients with SpA was significantly associated with foot involvement. Eulry et al. [15], in contrast to our findings, had not shown a correlation between personal history of psoriasis and/or balanitis and/or bowel disease and the presence of heel pain and/or sausage toes.

Kim et al. [31], in a study including 625 patients with AS, showed that smoking was significantly associated with the presence of peripheral arthritis including those of feet. Smoking appears to influence architecture and clinical appearance of foot. Indeed, Tauveron et al. [21] noted in smoking women's feet hyperkeratosis, subcutaneous dystrophy of the support points of the metatarsal heads. It has been noted that obesity was a risk factor for heel pain in general population.

In our series, obesity was not a risk factors for foot involvement. In our series, obesity was not a risk factor for foot involvement. Involvement of foot is more common in patients who have SpA with peripheral joints involvement, as noted in our study. Moreover, the study of Eulry et al. [15] showed that 91% of patients with the diagnosis of SpA with peripheral arthritis have foot involvement (heel pain and/or sausage toes). Borman et al. [33], in a study including 44 patients with SpA, showed that the BASDAI had no correlation with the presence of radiological or sonographic signs of enthesitis feet. This was demonstrated by our study since the BASDAI was not correlated to the involvement of feet in different locations. The study of Eulry et al. [15] showed that the duration of morning stiffness (MS) was positively correlated with the presence of heel pain and/or sausage toes in patients with SpA. It was not objectified in our series. Our study showed that the number of nocturnal awakening (NA) was not influenced by the presence of a foot involvement. This can be explained by the fact that heel pain in SpA does not result in NA but it occurs when get up, then decreases slowly walking, constituting a real MS [2,17,34]. Our study also showed that the VAS pain and patient's global assessment (PGA) were higher in patients with foot involvement, but the difference was not statistically significant. This can be explained by the fact that heel pain, foot enthesitis, dactylitis and arthritis of feet are the source of the pain of varying intensity, which aggravates the pain of patients with SpA and interferes with the overall assessment of patients.

In our study, sacroiliitis was negatively correlated to the involvement of forefoot. Taccari et al. [35], in a retrospective study of 140 patients with polyarticular PsA showed that peripheral joints were more frequent and severe with highest radiological score ($p < 0.001$) when coexisted axial lesions (bilateral sacroiliac illite, stage 2 or unilateral, stage 3 and above and/or syndesmophytes). These results suggest that the involvement of axial and peripheral joints including foot defines a subgroup of patients with more severe disease. There is a positive correlation between the involvement of foot and biological markers of inflammation [15,36]. Our study also found that HLA B27 was correlated with reaching the hindfoot. HLA B27 blood test helps to attach an isolated involvement of the hindfoot (heel pain essentially) to SpA Group [37].

We have recruited patients from an outpatient rheumatology department in a tertiary general hospital in Tunisia; therefore, the sample was representative to whole region. Nevertheless, some limitations have to be considered. The primary limitation of this study was its cross-sectional study design, which provided only correlation findings. The second limitation is the limited number of patients and the third is the absence of control group.

5. Conclusion

This cross sectional study showed that foot involvement was frequent in SpA, especially in peripheral types and advanced age of onset of the disease. It is associated with comorbidities and blood inflammation. Therefore, foot involvement and its functional results should be evaluated separately regardless of the disease activity of the patient. More studies about the foot involvement at the early and late stages of the disease are needed.

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Conflicts of interest

All authors were fully involved in the study and preparation of the manuscript and the material within has not been and will not be submitted for publication elsewhere.

The authors declare no conflicts of interest.

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