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MR IMAGING FEATURES OF FOOT INVOLVEMENT IN PATIENTS WITH BEHCET'S DISEASE

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SUMMARY

Objective: *To determine alterations of the soft tissues, tendons, cartilage, joint spaces, and bones of the foot using magnetic resonance (MR) imaging in patients with Behcet's disease (BD).*

Materials and methods: *Clinical and MR examination of the foot was performed in 25 consecutive patients (50 ft) with BD. As a control group, 15 healthy volunteers (30 ft) were also studied. Joint effusion/synovitis, retrocalcaneal bursitis, Achilles tendinopathy, soft-tissue edema, para-articular enthesophytes, bone marrow edema, sinus tarsi syndrome, heel fat pad edema, enthesopathy at the Achilles attachment and at the plantar fascia attachment, tenosynovitis, subchondral cysts, bone erosions, joint space narrowing, subchondral signal changes, osteolysis, luxation, and sub-luxation were examined.*

Results: *Clinical signs and symptoms (pain and swelling) of foot involvement were present in 20% (5/25) of the patients while frequency of involvement was 52% (13/25) by MR imaging. The most common MR imaging findings were joint effusion/synovitis (28%), tenosynovitis (24%), retrocalcaneal bursitis (24%),enthesopathy in the plantar fascia attachment (20%), Achilles tendinopathy (16%), sinus tarsi syndrome (16%), heel fat pad edema (16%), and soft-tissue edema (12%). The most commonly involved anatomical region was the hindfoot (36%) followed by midfoot (24%), ankle (16%) and forefoot (4%).*

Conclusion: *In conclusion, in this MR imaging study, we found a high prevalence of foot involvement in BD. We believe that foot involvement, being extremely important in the differential diagnosis of rheumatic diseases tend to be overlooked. Therefore, careful examination of the foot is required in the evaluation of BD, even if the patient has no complaints.*

INTRODUCTİON

Behcet's disease (BD), of which etiology is unknown, has a classical triad of recurrent oral and genital ulcers, eye lesions, and skin lesions. Arthropathy, neurological and gastrointestinal involvement, cardiopulmonary lesions, and family history are other manifestations (1).

Conventional radiography, even using particular projections, may only reveal the presence of indirect signs of both chondral and ligamentous lesions. The introduction of new diagnostic techniques as magnetic resonance (MR) imaging has been of great help in the study of the foot and ankle which have complex three-dimensional anatomy. MR imaging allows the assessment of the inflammatory disease and its progression with greater sensitivity than clinical examination and radiography. MR imaging detects inflammatory changes such as synovitis, tenosynovitis, and enthesopathy and also bone erosions and osteophytes because of its excellent soft tissue contrast (2). The potentiality of MR imaging in the detection and diagnosis of foot involvement in rheumatologic disorders is well known (3-5). To the best of our knowledge, foot involvement assessed by MR imaging in patients with BD has not been reported. For this reason, we planned to determine the features of foot involvement using MR imaging in patients with BD.

MATERİALS AND METHODS

This study was a prospective trial with a standardized protocol, which was approved by our institutional review board. Patient group consisted of, twenty-five consecutive BD patients (12 female, 13 male; aged 23–57 years; mean 34±17.6) who fulfilled the International Study Group (ISG) criteria (1). All the patients negative for serum rheumatoid factor and HLA-B27. The mean duration of the disease in the study population was 3–24 years with a mean of 7±5.6 years. As a control group; 15 (7 female, 8 male; aged 21–59 years; mean 37.9±.16.9) asymptomatic volunteers who did not report any history of joint disease and had no signs of arthritis on clinical examination were also studied. None of the patients and controls in study group had a history of any traumatic episode. BD patients and controls were screened by 1.5 T MR system (Philips Medical Systems, Gyroscan Intera, Best, The Netherland) using a head coil. MR imaging protocol included T1-weighted spin-echo (SE), T2-weighted fast-field echo (FFE), and fat-suppressed short tau inversion recovery (STIR) sequences of the foot and ankle in sagittal, axial, and coronal planes on two sides. MR imaging and clinical examination were performed on the same day. MR images were read without knowledge of clinical data by two radiologists, who reached a consensus. MR imaging abnormalities are presented in Table 1. The incidence of MR imaging abnormalities in the forefoot, midfoot, hindfoot, and ankle were recorded. The metatarsaphalangeal joints, proximal and distal interphalangeal joints and phalanges were identified as forefoot. The midtarsal joints, 1st through 5th metatarsals, tarsal bones, plantar interosseous muscles, and plantar ligament were defined as midfoot. Talocalcaneal joint, calcaneus, talus, sinus tarsi, Achilles tendon, and plantar fascia were defined as hindfoot.

Articular and bone abnormalities including subchondral signal changes, para-articular enthesophytes, bone marrow edema, bone erosion, subchondral cysts, joint space narrowing, osteolysis, luxation, sub-luxation, tenosynovitis, enthesopathy, heel fat pad edema, plantar fasciitis, sinus tarsi syndrome (STS), retrocalcaneal bursitis, and soft-tissue edema were diagnosed using the criteria reported in previous articles (2-5).

Achilles tendon has uniformly low signal intensity on all MR imaging pulse sequences with a flattened or slightly concave anterior border. Peritendonitis, acute, and chronic Achilles tendinopathy, all of these changes were accepted as Achilles tendinopathy (2-5).

RESULTS

Disease characteristics of all of 25 BD patients are demonstrated in Table 2. In the control cases MR imaging abnormalities suspicious for BD were not found. On the other hand, clinical signs and symptoms (pain and swelling) due to foot involvement were present in 5 of 25 (20%) BD patients while frequency of involvement was 13 (52%) with MR imaging assessment. In the 13 patients with MR imaging abnormalities, asymmetric-bilaterally feet involvement and symmetric- bilaterally feet involvement were determined in 5 (38%) and 8 (62%) BD patients, respectively. The remaining twelve BD patients had no MR imaging abnormalities. Foot MR imaging findings of the BD patients are summarized in Table 1. Various MR imaging abnormalities were found within the same feet. Additionally, different anatomical regions of the foot were involved in the same BD patient. Enthesopathy in the Achilles attachment, subchondral signal changes, osteolysis, luxation, sub-luxation and joint space narrowing were not detected. The most common MR imaging findings were joint effusion/synovitis (28%), tenosynovitis (24%), retrocalcaneal bursitis (24%), enthesopathy in the plantar fascia attachment (20%), Achilles tendinopathy (16%), STS (16%), and heel fat pad edema (16%) (Figs 1-7). The most commonly involved anatomical region was the hindfoot (36%) followed by midfoot (24%), ankle (16%) and forefoot (4%).

Joint effusion/synovitis is described as an increase in the fluid signal from the joints on STIR and T2-weighted FFE images (2,5). Of 25 patients, 7 (28%) had joint effusion/ synovitis on STIR and T2-weighted FFE images. Of these seven patients, five consented for a contrast enhanced MR study and all of these patients demonstrated enhancement in the synovium, which was defined as synovitis. Also, of 25 patients, 4 (16%) had STS on precontrast MR imaging . Of these four patients, three consented for a contrast enhanced MR study. A total of eight patients had contrast enhanced MR imaging study on sagittal, axial, and coronal planes on two sides.

DISCUSSION

BD is a systemic small and large vessel vasculitis where articular and extraarticular findings (tenosynovitis and enthesitis) may also be seen (1). The global distribution of reported disease suggests a geographic pattern coincident with the ancient 'silk route' characterized by greatest prevalence in Turkey, Iran and Japan. The disease occurs most commonly in the second or third decades (6), which was also true for our series. While previously the disease was suggested to be more frequent in males, recently the women are found to have a similar incidence (6). Female to male ratio was 12/13 in our series.

Foot and ankle involvement is very frequent in patients with inflammatory joint disease and may cause disability (2-4). MR imaging is used as a method for the diagnosis, follow up, and prognosis of inflammatory joint disease. MR imaging helps depict the complex anatomy of the foot, providing detailed information on the pathological states which are useful for a therapeutic approach (2-4, 7). Therefore, we performed MR imaging to evaluate possible foot abnormalities in patients with BD.

The incidence of arthritis in Behcet's disease ranges from 50 to 70% in different studies. Arthritis has been reported as an initial manifestation in 6-9% of BD patients (8). Arthritis in BD is generally described as an intermittent, self-limiting, non-erosive, non-destructive, and non-deforming subacute arthritis. Rarely, erosive arthritis may be seen (9, 10). Joint involvement is usually monoarticular or symmetrically oligo-articular (11). In our study, majority of patients showed bilaterally- symmetric changes (62%).The joint disease manifestations in BD are described as synovitis, tenosynovitis, joint effusion, bone surface erosions, enthesitis and Achilles tendinopathy (8, 11, 12). Radiologic findings have been reported as being none to mild or moderate. Most of the reported radiologic findings consisted of those depicted on conventional radiographs. The most commonly involved joints in BD are knees, ankles, wrists, and elbows (13). Other joint involvement is rarely encountered (12). To the best of our knowledge, this is the first MR imaging study investigating foot involvement in patients with BD. In our study, 52% of 25 patients had MR imaging abnormalities. We believe that the high frequency of foot involvement seen in our patients may be due to multiplanar capability, excellent soft-tissue resolution, and earlier detection of some of the abnormalities by MR imaging.

The synovium is primarily affected in inflammatory arthritis. BD is a disease that affects synovium diffusely; sites of involvement include synovial joints, tendon sheaths and bursae (14). In our foot MR imaging study, the most common finding was the joint effusion/synovitis with 28% frequency. Previous miniarthroscopy studies compared with histopathological findings have documented that

synovitis, as determined by contrast-enhanced T1-weighted MR imaging, represents true synovial inflammation (15), which was also true in our patients with BD (Figs.1,4,5).

Tenosynovitis is commonly associated with inflammatory arthritis, and its detection helps in early discovery of the disease. Inflammatory tenosynovitis is often associated with rheumatoid or seronegative arthritis and gout. MR imaging is the best equipped modality for demonstrating small amounts of fluid around the tendon. Tenosynovitis can be readily enhanced and detected with fat-saturated, contrast-enhanced, T1-weighted images (16, 17). MR imaging permits superior visualization of the tendons along their orthogonal planes. Sagittal and coronal images of the tendons show the site and extent of tendons better than axial ones (17). Similar findings were found in our study (Figs. 1-3). Progressive inflammatory changes can lead to formation of fibrous or scar tissue around the tendon, as is noted with stenosing tenosynovitis (17). In our study, one of six patients with tenosynovitis had stenosing tenosynovitis (Fig. 2). To the best of our knowledge, stenosing tenosynovitis has not previously been reported in patients with BD.

Retrocalcaneal bursitis can be seen in arthropathies such as rheumatoid arthritis, ankylosing spondylitis, psoriasis, and Reiter's syndrome (18). In our study, retrocalcaneal bursitis was found in 6 (24%) patients with BD (Fig. 3).

Achilles tendinopathy including acute, chronic, and peritendonitis is seen in systemic inflammatory diseases, such as rheumatoid arthritis. Peritendonitis is analogous to synovitis in sheathed tendons. It is seen as increased signal intensity, characterized with slightly ill defined external margins, on STIR images and as low-intensity strands on T1-weighted sagittal spin-echo images (2, 17, 19), similarly in our study (Fig. 4). In our study, among four (16%) patients with Achilles tendinopathy, one was peritendonitis, one was chronic and the rest were found to be acute.

MR imaging is sensitive in diagnosing STS. Most of the cases of STS are posttraumatic and may also result from inflammatory disorders, like rheumatoid arthritis, ankylosing spondylitis, and gouty arthritis (20). In this study, STS was detected in 4 (16%) patients with BD (Fig. 5). To the best of our knowledge, STS has not previously been reported in patients with BD.

Entheseal involvement is a commonly seen clinical histopathologic and imaging feature of Spondyloarthropathies (SpAs) and may be the initial site of joint inflammation (2, 5, 7). Inflammation may occur at any entheseal insertion but most commonly in the enthesis sites of the foot (2). In our study, enthesopathy in the plantar fascia attachment was found in 5 (20%) patients with BD (Fig. 6).

SpAs include psoriatic arthritis, reactive arthritis, and ankylosing spondylitis (AS). SpAs typically involve distal joints of hands and feet (2, 5). There is no consensus about including BD into seronegative SpA group of diseases (21). Sacroiliac joint (SIJ) is reported to be involved in a minor portion of patients with BD. In addition, there are studies reporting cases with BD coexistant with AS and Achilles tendinopathy and another long-standing case of BD with extensive erosive arthropathy radiologically mimicking psoriatic arthritis (9, 10). Some authors reported that BD is not a part of SpA complex (22). However, it still remains unclear why there have been many patients with coexisting BD and AS. The common MR imaging findings seen in the foot in SpAs are Achilles tendinopathy, retrocalcaneal bursitis, joint effusion/synovitis, soft-tissue edema, and para-articular enthesophytes. The most commonly involved anatomical region in patients with AS and psoriasis has been shown to be the hindfoot (3, 4). Similar findings were found in our patients with BD (Table 1).

Ultrasonographic changes in hand flexor tendons of BD patients who had no clinical complaints have been related to ongoing subclinical inflammation (23). Recent data suggest that pro-inflammatory cytokines contribute to inflammatory cascade of BD and indicated a relationship between chemokines and subclinical inflammation (24). In our study, among 13 (52%) patients with MR imaging abnormality, five had clinical findings, while, the rest had not. MR imaging abnormalities detected in our BD patients who had no arthritic signs or symptoms may be considered to be a result of a similar process.

The limitations of this study are the absence of radiographic images, the lack of histopathological correlation and small number of contrast-enhanced imaging. In conclusion, we found a high prevalence of foot involvement in BD. According to us, the physician should consider the possibility of foot involvement in BD even if the patient has no complaints. Additional studies using IV contrast and including larger number of patients are needed to assess its role in the diagnosis of inflammatory diseases. We suggest that foot MR findings might be useful to detect disease activity and prognosis in BD.

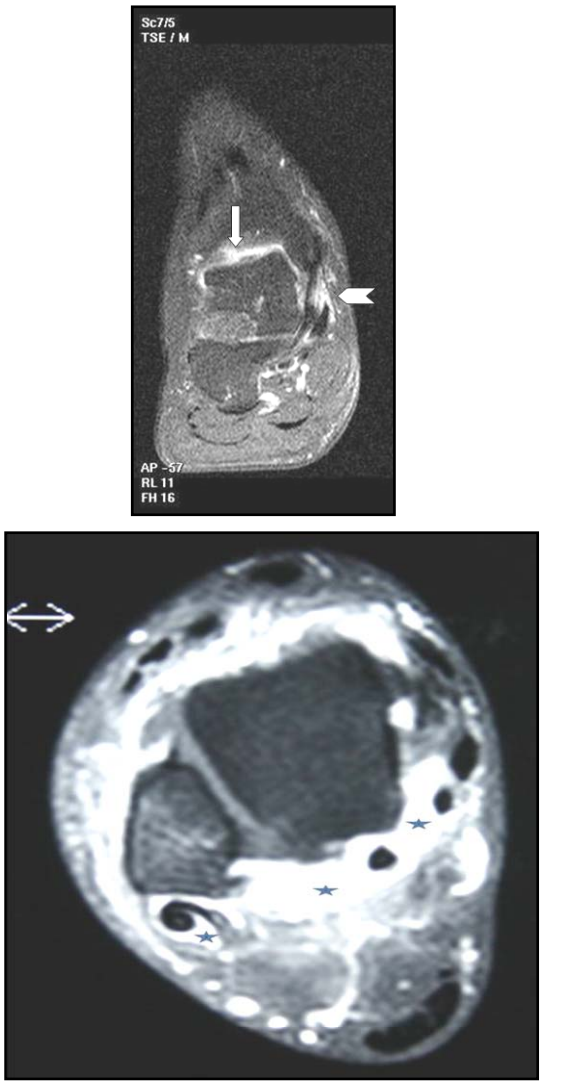

Figure 1: Synovitis (arrow) and tenosynovitis (arrowhead) are demonstrated on coronal (a) and tenosynovitis (star) is shown on axial (b) contrast-enhanced with fat suppressed MR images in different BD patients.

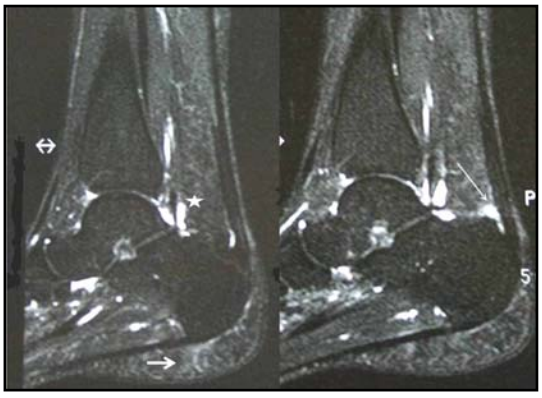

Figure 2: Stenosing tenosynovitis (arrow)) is demonstrated on T2-weighted FFE sagittal MR image.

Figure 3: Retrocalcaneal bursitis (long arrow), tenosynovitis (star), and heel fat pad edema (short arrow) are demonstrated on continued STIR sagittal MR images in the same foot.

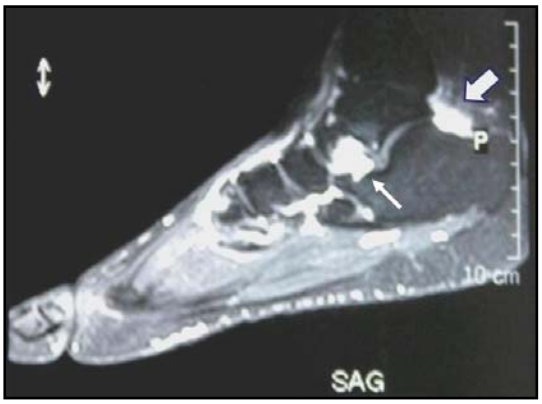

Figure 4: Achilles peritendonitis (short arrow) and joint effusion/synovitis (long arrow) are shown on STIR sagittal MR image.

Figure 5: Sinus tarsi syndrome (thin arrow) and synovitis (thick arrow) are shown on contrast-enhanced with fat suppressed T1-weighted sagittal MR image.

Figure 6: Enthesopathy in the plantar fascia attachment (arrow) is shown on sagittal T1-weighted (a) and STIR (b) MR images.

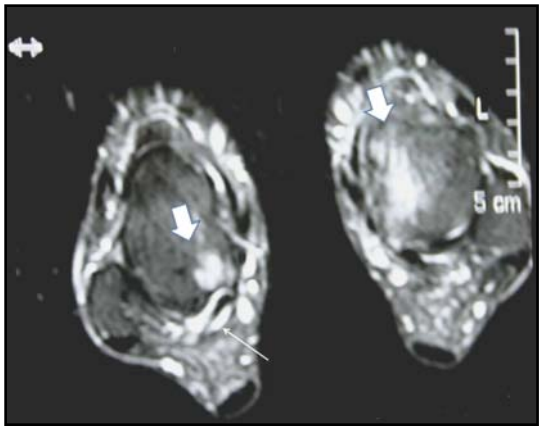

Figure 7: Bone marrow edema (thick arrows) and tenosynovitis (thin arrow) are demonstrated on STIR axial MR images on two sides.

Table 1: MR imaging abnormalities of foot in 25 patients with Behcet's disease are presented.

MR imaging abnormalities	Forefoot	Midfoot	Hindfoot	Ankle	A total number of patients with mentioned abnormalities
Joint effusion/synovitis	1	2	5	2	7(28%)
Tenosynovitis		3	6		6(24%)
Retrocalcaneal bursitis			6		6(24%)
Enthesopathy in the plantar fascia attachment			5		5(20%)
Achilles tendinopathy			4		4(16%)
Sinus tarsi syndrome			4		4(16%)
Heel fat pad edema			4		4(16%)
Soft-tissue edema		3	3	2	3(12%)
Para-articular enthesophyte		2	2		2(8%)
Bone marrow edema			2		2 (8%)
Bone erosion			2		2(8%)
Subchondral cysts			2		2(8%)
A total number of patients with involvement of the anatomical region	1(4%)	6(24%)	9(36%)	4(16%)	-

Table 2: Clinical features of 25 patients with Behcet's disease.

	N(%)
Oral aphthous lesions	25(100%)
Genital aphthous lesions	21(84%)
Positive Pathergy test	18 (72%)
Skin lesions	14(56%)
Other articular involvement	12(48%)
Uveitis	3(12%)
Major vasculitic complication	-

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