Clinical Imaging 38 (2014) 719–723

Contents lists available at ScienceDirect

Clinical Imaging

journal homepage: http://www.clinicalimaging.org

# Magnetic resonance imaging findings of musculoskeletal brucellosis

Zulkif Bozgeyik [a,*], Serpil Aglamis [b], Pinar Gundogan Bozdag [c], Affan Denk [d]

[a] Department of Radiology, Faculty of Medicine, Firat University, 23119, Elazig, Turkey
[b] Department of Radiology, Van Government Hospital, 65300, Van, Turkey
[c] Department of Radiology, Elazig Government Hospital, 23200, Elazig, Turkey
[d] Department of Infection Disease, Faculty of Medicine, Firat University, 23119, Elazig, Turkey

ARTICLE INFO

*Article history:*
Received 13 December 2013
Received in revised form 18 March 2014
Accepted 14 April 2014

*Keywords:*
Brucellosis
Spondylodiscitis
Sacroiliitis
Peripheral arthritis
Magnetic resonance imaging

ABSTRACT

**Objective:** The aim of this retrospective study was to determine the magnetic resonance imaging (MRI) findings of patients with musculoskeletal brucellosis.
**Materials and methods:** Sixty-eight among 304 patients with musculoskeletal brucellosis, aged 12–82 years (average, 50.2 years), were included in the study. Patients were diagnosed based on clinical findings, *Brucella* agglutination tests, and MRI findings. MRI was performed to all of the patients with sacroiliitis, spondylitis-spondylodiscitis, and peripheral arthritis.
**Results:** *Brucella* serum agglutination test was >1/160 in all cases and blood cultures were positive in twelve cases. The most commonly affected site was the spine (57.3%), wherein lumbar vertebrae were found to be most commonly affected. The second most common affected site was sacroiliac joint (26.4%), whereas peripheral joints were affected in 11 cases (16.1%).
**Conclusion:** Brucellosis may affect various sites in musculoskeletal system. The spine was the most frequently affected site in our study. Sacroiliac joints and the other peripheral joints were less commonly involved sites. Brucellosis should be included in the differential diagnosis of a patient with arthralgia or symptoms of musculoskeletal system disorders especially in endemic areas.



## 1. Introduction

Human brucellosis, a chronic granulomatous zoonosis caused by facultative intracellular bacteria of the genus *Brucella*, involves many organs and tissues, [1]. The disease usually affects young and middle age adults. It is an endemic disease in the Mediterranean region including Turkey, Indian and Arabian Peninsula, parts of the Central and South America and Mexico [2]. The disease is transmitted to humans either by direct contact with the infected animals or by consumption of unpasteurized milk obtained from the infected animals or dairy products produced from such milk [3]. The disease mainly affects organs rich in reticuloendothelial cells, particularly the musculoskeletal system, which is the most frequent target site [4,5]. The most common symptoms of brucellosis include fever, arthralgia, fatigue, sweating, inapetence, weight loss, chill, and myalgia. Incubation time of the disease is usually 1–5 weeks that may extend up to three months [6]. Diagnosis of musculoskeletal brucellosis may be difficult due to nonspecific clinical symptoms. Analysis of imaging of musculoskeletal brucellosis may be helpful in the diagnosis of the disease and in prevention of delayed manifestation of brucellosis with abscess which requires invasive treatment methods. The aim of this study was to present magnetic resonance imaging (MRI) findings of the musculoskeletal brucellosis.

* Corresponding author. Department of Radiology, Faculty of Medicine, Firat University, 23119, Elazig, Turkey. Tel.: +90 424 233 35 55x1396; fax: +90 424 237 67 73.
*E-mail address:* bozgeyik4@hotmail.com (Z. Bozgeyik).

http://dx.doi.org/10.1016/j.clinimag.2014.04.007
0899-7071/

## 2. Patients and methods

A retrospective analysis of 304 patients with brucellosis, presented to our hospital in last six years, was carried out. Sixty-eight patients with brucellosis involving musculoskeletal system were identified. Diagnosis of brucellosis was made by culturing the sera/body fluids employing standard BACTEC method [7] or testing the sera for *Brucella* agglutinins using the standard agglutination test. All positive agglutination tests were assumed to be secondary to brucellosis. Titers of 1:160 or more were considered as a significant parameter for diagnosis of brucellosis [8]. MRI was performed in all patients having pain and positive serological tests of brucellosis. Musculoskeletal system manifestations of brucellosis were diagnosed by appropriate laboratory findings and physical examination in conjunction with MRI findings.

MRI was performed with 1.5-T MRI scanner (General Electric signa excite highspeed scanner, Milwaukee, USA) using appropriate coils. T1-weighted, T2-weighted, fat saturated T1- and T2-weighted images and STIR (short Tau Inversion Recovery) images were obtained on axial, coronal, and sagittal planes. T1-weighted contrast enhanced images were also obtained after administration of gadopentetat dimeglumin (Gd-DTPA).

Vertebral bodies, endplates, intervertebral discs, paravertebral soft tissue, and epidural spaces were assessed for the diagnosis of spondylitis and spondylodiscitis. Presence of paraspinal involvement, diffuse or focal involvement, epidural extension, cord compression and multifocal involvement were evaluated in patients with spinal

brucellosis. Typical MRI findings for osteomyelitis or discitis were decreased signal intensity in the vertebral bodies on T1-weighted image, increased signal intensity in the vertebral body on T2-weighted images, increased signal intensity in intervertebral discs on T2-weighted images, loss of endplate definition on T1-weighted images [9], increased enhancement of endplate, intervebral disc and paravertebral soft tissue after gadolinium injection [10].

Bone marrow edema and intraarticular synovial fluids are important clues for early diagnosis of brucellar sacroiliitis. Sclerosis and ankylosis were observed in late phase of the disease. Unilateral or bilateral involvement, bone marrow edema, joint expansion or narrowing, joint fluid, joint derangement (irregularity of the joint surfaces), joint sclerosis, periarticular involvement, and contrast enhancement were assessed in sacroiliitis.

Diagnosis of peripheral joint involvement was based on the visualization of increased synovial fluid and bone marrow edema on MRI. Evaluation of peripheral joint involvement included presence of bone marrow edema, joint derangement, enhancement of synovium and periarticular soft tissues after intravenous injection of gadolinium.


**Fig. 1.** Brucellar spondylodiscitis. a. Sagittal STIR image shows hyperintense lesions contiguous spinal involvement. b. Sagittal T1-weighted image shows hypointense signal in the vertebral bodies and endplates. c. Contrast enhanced T1-weighted sagittal image shows formation of spondylitis and involvement of intervertebral disc space between T10-S1 vertebral levels. d. Contrast enhanced T1-weighted axial image shows enhancement in affected vertebra and paravertebral soft tissue.

## 3. Results

Twenty-seven (39.7%) male and 41 (60.2%) female patients with musculoskeletal brucellosis (mean age 50.2 years, range 12–82 years) were included in the study. *Brucella* serum agglutination test was >1/160 in all patients; and blood cultures were positive in 12 patients. The sensitivity of serum agglutination test and blood culture in the diagnosis of brucellosis in our patients were 100% and 17.6%, respectively. As well, bacteria from abscess formation were identified in three patients.

The most commonly affected site was the spine (57.3%). Multilevel involvement was seen in eight patients (11.7%). Noncontiguous and contiguous multisegment involvements were seen in five (7.3%) and three patients (4.4%), respectively (Fig. 1). Lumbar vertebrae and disc spaces were most common affected sites of the spine (74.5%). Thoracic (17.6%) and cervical (7.8%) spine involvements were seen in nine and four patients, respectively. The most prominent involvement was L5-S1 in the lumbar spine (31.3%). Focal spinal involvement was seen in three patients (7.7%). Twenty-three patients (59%) had paravertebral soft tissue involvement and seven patients (17.9%) had abscess formation (Fig. 2). We also detected epidural extension in 22 patients (56.4%) and cord compression in four patients (10.2%) (Table 1).

The second most common affected site was the sacroiliac joint (26.4%). Bilateral involvement of sacroiliac joints was detected in 11 patients, whereas unilateral joint involvement was seen in seven patients (Fig. 3). Bone marrow edema was seen in eleven patients. Sacroiliac joints were categorized as normal (not widened or narrowed) in ten patients (55.5%), widened in two patients (11.1%), and narrowed in six patients (33.3%). Intraarticular fluid was detected in six patients. Bone sclerosis and joint derangement were seen in 12 (66.7%) and 13 (72.2%) patients, respectively. Contrast enhancement of the joints was detected in 11 patients (61.1%); whereas, periarticular soft tissue involvement was seen in three patients (16.7%) (Table 2).

Peripheral joints were affected in 11 patients (16.1%). Knee (27.3%) and ankle (27.3%) joints were most frequently affected sites. The other involved joints were sternocostal (18.2%) (Fig. 4), hip (9.1%), shoulder (9.1%) and elbow (9.1%). Increased fluid was observed in affected joints in all patients. Bursitis was seen in four patients (36.3%) and tendinitis was seen in five patients (45.5%). Contrast enhancement of the joint capsule and periarticular soft tissue was detected in six patients (54.5%) (Table 3).

## 4. Discussion

Brucellosis is one of the commonest anthropozoonotic infections with a pandemic distribution [11] and stays as an uncontrolled problem in regions of high endemicity. Although it has been manifested more commonly in developing countries, but the world is clearly becoming a “smaller” place due to increased travel rates; therefore understanding of these infectious processes from abroad is important. Brucellosis is an infectious process which may mimic other atypical infectious processes. Differential diagnosis of infectious musculoskeletal involvement should be considered along with patient history, findings of clinical and serological tests, and imaging outcomes.

Human infection can occur through consumption of raw meat and unpasteurized dairy products that contain *Brucella*. Infection can also occur via inhalation of airborne animal manure and through skin abrasions [12]. *Brucella* affects all age groups, and our study showed a wide range of age distribution from 12–82 years similar to other studies [3,13,14]. A presumptive diagnosis can be made by demonstrating high or rising titers of specific antibodies in the serum. Mantecon et al. reported the sensitivity of standard agglutination test in brucellosis as 84.6% [8]. Isolation of the organism from the blood