Original Article

Management of spinal brucellosis and outcome of rehabilitation

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Study Design: Review of cases.

Objective: To review cases of brucellosis in order to clarify diagnostic guidelines, treatment regimes and prognosis.

Setting: University Hospital, Turkey.

Methods: Study of 11 patients (9 male, 2 female) with either brucellar spondylitis or epidural brucellar abscess. Diagnosis made on clinical presentation, laboratory findings, radiographic evidence and a minimum brucellar anti body of 1:160, a positive bacteriological culture and/or histological finding of inflammation of granulomatous tissue. All patients were treated with a combination of oral antibiotics. Surgery was performed in 8 patients.

Results: At least 6 months antibiotic therapy using Rifampicin and Doxycycline is recommended. Surgery is indicated in the presence of spinal instability, cord compression or radiculopathy. In our series eight patients required surgery.

Conclusion: The patients complaining of back pain, particularly in endemic areas should be investigated as possible cases of brucellosis.

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Introduction

Brucellosis is an infection caused by bacteria of the genus brucella. Human infection results from occupational contact with an infected animal or by ingestion of infected milk, milk products, or tissues.¹

Brucella spondylitis was first described by Kulowski and Vinke and is among the most serious complications of brucellosis.² Localized brucellosis may occur at almost any anatomical location. Osteomyelitis usually occurs in the vertebrae, with the lumbosacral area as the most frequent site. There is a disc space infection with involvement of both adjacent vertebrae.¹ The spinal form of brucellosis has no specific symptomatology or clinical finding; therefore, a high index of suspicion is necessary for the correct early diagnosis. Of those with spondylitis, between 10 to 43% of the cases have some degree of neurological deficit and a paraspinal abscess develops in 10–20%.³

The earliest features are mild osteoporosis and epiphysitis localised in the antero-superior angle, followed by narrowing of the joint space and involvement of the contiguous vertebral.^{4,5} As the interosseous

infection progresses with increasing vertebral body destruction, a delineating rim of sclerosis develops with subsequent anterior and lateral osteophytosis.⁴ Posterior elements of the spine are rarely involved.^{4,6} Eventually, the spine stabilises with marked sclerosis and bony ankylosis in the majority of the cases.^{4,5}

Our experience with spinal brucellosis has been reviewed in an attempt to clarify issues such as diagnostic guidelines, treatment regimens, and effect of rehabilitation on outcome.

Materials and methods

A total of 11 patients with either brucellar spondylitis or epidural brucellar abscess comprising this study were admitted to the Dicle University Hospital between 1994–1999. They ranged in age from 21 to 62 years.

The diagnosis of brucellar spondylitis was made based on the clinical presentation, laboratory findings, radiographic evidence of a focal destructive vertebral lesion as well as, a minimum brucella antibody titre of 1:160, a positive bacteriological culture and/or histologic finding of inflammation in the granulomatous tissue.

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Magnetic resonance imaging (MRI) scans were obtained by using a Siemens 1.5-Tesla Magnetom scanner before and after intravenous injection of 0.1 mmol/kg gadolinium diethylenetriaminepentaacetic acid (Gd-DTPA) contrast material.

All patients were treated with the combination of Rifampicin 600 mg/day oral and doxycycline 200 mg/day oral. Antibiotics were continued until the brucella agglutination titres returned to 1:80 or less and clinical and radiographic evidence suggested a cure. The antibiotics were given for 6 months. Patients were followed up for one year. In addition, serology and at least one blood cultures were repeated.

All of the patients with spinal brucellosis were admitted to the rehabilitation programme as soon as the diagnosis was confirmed, and antibiotic therapy was started. In the acute phase, initial exercise, movement into flexion or extension, depends on which activity centralises low back pain (i.e., less radicular pain) or does not exacerbate low back pain. Usually, extension exercise was begun with prone lying with a support under the stomach to maintain a neutral position. These exercises continued until tolerated with unsupported prone lying. Repeated extension posturing in standing, for use after sitting or forward bending activities was performed. Once the acute pain subsides, the focus of the rehabilitation program was to improve function. Strengthening exercises on the back and abdominal muscles was started in all patients in this phase.

In the chronic phase, exercise was planned to improve the function of the spinal muscles. This was typically manually resisted exercise of the trunk limited to short arcs performed in rotation, flexion, extension, and side-bending.

Results of the neurological examination of each patient on admission and discharge from the rehabilitation unit were recorded. Based on the International Standards for Neurological and Functional Classification of Spinal Cord Injury, the strengths of 5 paired myotomes for the lower limbs (L2 to S1) were graded according to the following scale: 0, total paralysis; 1, palpable or visible contraction; 2, active movement, full range of motion (ROM) with gravity eliminated; 3, active movement, full ROM against gravity; 4, active movement, full ROM against moderate resistance; 5, (normal) active movement, full ROM against full resistance. The motor score for the lower limbs was obtained by the summation of the grades for the myotomes of both lower extremities and ranged from 0 (complete paralysis) to 5 (normal power bilaterally).

Assessment of the functional outcome was based on the modified Bartel index by Shah.⁷ This was an ordinal scale with total score ranging from 0 (totally dependent) to 100 (completely independent). It consists of ten weighted items: feeding, bathing, grooming, dressing, bladder control, bowel control, toileting, chair/bed transfer, mobility and stair climbing.

The gains in the motor scores for the lower limbs and the modified Barthel scores were computed by

calculating the differences between the scores on admission and at the end of the rehabilitation programme.

Statistical analysis

The motor and modified Barthel scores on admission and discharge were compared by using the Wilcoxon rank-sum test. Statistical significance was assumed as $P < 0.05$.

Results

Demographic characteristics

There were nine men and two women with a mean age of 43.09 ± 14.03 (range 21–62) years.

Clinical characteristics

The clinical data are summarised in Table 1. Localised spinal pain and tenderness to percussion were present for 1 week to 6 months before diagnosis in each patient.

Laboratory characteristics

Erythrocyte sedimentation rate (ESR) was over 20 mm in all 11 patients. The mean value of ESR was 49 mm. The microorganism was cultured from blood samples in only two patients. Agglutination titers were over 1/160 in all patients.

Histopathologic characteristics

The reaction of tissue to brucella is the formation of granulomas. Small granuloma without necrotic foci were observed. Granuloma included epithelioid histiocytes and few Langhans type giant cells, lymphocytes, plasma cells and fibroblasts, which were around fibrinoid type necrosis. Small foci of abscesses were noted in the centre of large granulomas.

Radiological characteristics

MRI examination revealed decreased signal intensity in the discs; vertebral bodies were hypointense in T1- and hyperintense in T2-weighted sections. Indentations and

Table 1 Associated signs and symptoms in 11 patients

Findings	No. of patients
Back pain	11
Sweat	10
Paraparesis	1
Fever	6
Reflex changes	7
Parasthesia	4
Incontinence	1
Drop foot	4

lytic lesions were determined in the inferior and superior end-plates of vertebral bodies. Minimal para- and prevertebral soft tissue components were hyper-intensified. These findings were compatible with the diagnosis of discitis and osteomyelitis. Two patients who had MRI demonstrating an extradural mass mimicking herniated discus intervertebralis were later found to have pyogenic discitis at surgery (Figure 1A,B). Contrast injection revealed increased signal intensity in the discs and vertebral bodies in T1 and T2- weighted sections (Figure 2).

Surgery characteristics

Surgery was performed in eight patients. The three patients were treated medically because they had no neurological deficit (two patients) or they were considered high anaesthetic risks. Decompression laminectomies and discectomies were performed in six patients and microchirurgical decompression and discectomies in two patients.

Level involved characteristics

The location of abscesses were at L2–L3 level in one patient, at L3–L4 level in two patients, at L4–L5 level in six patients, and at L5–S1 level in two patients.

Neurologic characteristics

The mean total ASIA Motor Score on admission was 21.45 ± 22.9 and 29.27 ± 5.88 on discharge, and difference was significant ($P < 0.05$) (Table 2).

Rehabilitation Characteristics

The mean admission/discharge MBI scores were 82.72 ± 16.18 and 97.72 ± 3.43 , respectively, and this difference was significant ($P < 0.05$) (Table 2). Similar improvements were seen in the self-care and mobility categories of the MBI. On admission, two patients were severely dependent (MBI 0–60), six patients moderately dependent (MBI 61–90) and three patients independent (MBI 91–100). Upon discharge, none of the patients were severely dependent, while one patient was moderately dependent and 10 others independent.

Discussion

Brucellosis is a systemic infectious disease

The incidence of the disease in Turkey is 0.59 per 100,000 population per annum while there are 500,000 new cases of Brucellosis reported annually world-wide.¹ In the Middle East as a whole, this figure reaches 86 cases per 100,000 population.^{3,8} Brucellosis is an important health issue that sometimes leads to epidemics in many regions in our country.

The disease was found to involve most commonly the lumbar spine, particularly the L4 and L5 vertebrae

although brucella lesions of the spine can occur at any level.^{4,6,9–11} Spinal lesions multiple levels account for 9% of all cases.¹⁰ In the other studies, between 11 and 80% of patients with brucellosis have bone and joint involvement and, of those, 6 to 54% have spinal column involvement^{12–14} most commonly affecting the lumbar spine.⁵ In our study, the most common level of infection was the lumbar region.

The incubation period of acute brucellosis usually varies between 7 and 21 days, but may be months. The onset is often insidious with a low-grade fever and no localising complaints. Malaise, weakness, fatigue, headache, low back pain, myalgia, sweat, and chills are often prominent. The disease may be asymptomatic with only serologic evidence of infection. The manifestations of symptomatic brucellosis may be divided into acute brucellosis, localized disease, and chronic brucellosis.¹⁵ Soft-tissue abscess, if present, is smaller than that usually seen in tuberculosis and does not involve the psoas.⁵

In brucellosis, back pain is one of the most common symptoms.⁶ It may sometimes manifest as signs similar to lumbar disc lesions. These signs may result from the compression of spinal cord with soft tissue lesions as well as from inflammatory reactions of the discus to the disease at early stages.^{16,17} In our study also, back pain was most commonly encountered. In patients coming with back pain complaints, particularly in endemic areas, or in those under risk, brucellosis should be considered for differential diagnosis and should be definitely investigated.

Routine radiological investigation, including only direct radiograph and CT may not help in the differential diagnosis of the disease, and may mislead one to diagnose another cause of low back pain and/or radiculopathy, such as lumbar disc herniation, which was the case in our patient. MRI, which is a routine investigation in the work-up of patients, where surgery is thought to be indicated, was the crucial step in making the differential diagnosis. MRI revealed an intact vertebral architecture despite evidence of diffuse vertebral osteomyelitis, disc space involvement, minimal associated paraspinal soft-tissue involvement and no gibbus deformity, and supported the diagnosis of brucellar spondylitis. When compared to the other inflammatory conditions, there was no characteristic finding, but it was definitely differentiated from lumbar disc herniation. MRI examination reveal decreased signal intensity in intervertebral disc; the vertebra corpus may be hypointense and T1- and hyperintense in T2-weighted sections. Indentations and lytic lesions may be determined in the inferior and superior end-plates of vertebral bodies, respectively.^{11,16} In our two patients, both clinical findings and MRI findings were suggested to be herniated discus intervertebralis, but histopathologic examination revealed that the subligamentous granulomatous issues were brucellosis. Granulomas in brucellosis were eventually healed with fibrosis and calcification.

Figure 1 (a) Sagittal T1, weighted image shows decreased signal intensity in the L3–4 vertebral bodies and iso-to hyperintense compared to another disc space, an ill defined soft tissue mass within the anterior epidural space at the L3–4 level (arrows) and (b) T2-weighted image shows increased signal intensity intervertebral disc space with abscess

Figure 2 Sagittal T1-weighted image after contrast injection shows increased signal intensity in the inferior and superior end-plates of vertebral bodies at the L4–5 level

Table 2 Mean lower extremity motor power and functional scores on admission and discharge

Motor and functional scores	At admission to rehabilitation	At discharge from rehabilitation	P-value
Mean motor power (ASIA motor score)	21.45 ± 3.45	29.27 ± 5.88	$P < 0.05$
MBI scores	82.72 ± 16.18	97.72 ± 3.43	$P < 0.05$

Treatment of patients should be prolonged since the eradication of organism from bone may be difficult. We believe at least 6-month' therapy treatment would be beneficial and should be continued until serology is negative. We prefer therapy with rifampicin and doxycycline. Because of the high recurrence rate careful long term follow-up is strongly recommended. High recurrence rate is probably due to relapse.^{12,18}

Surgery is indicated in the presence of certain complications. These include evidence of spinal instability, cord compression or radiculopathy. In our series, eight out of eleven patients underwent posterolateral laminectomy and excision of granulation tissue. When the primary abnormality was

formation extending to the spinal canal at L3–4 level (arrows)

anterior, the extradural exposure was done by removal of the pedicle.

In the differential diagnosis, tuberculosis of the spine, pyogenic osteomyelitis due to other bacteria, herniated disc and metastatic lesions have to be considered. The changes in tuberculosis appear relatively early, osteoporosis is more marked and destruction more severe than in brucellosis.¹⁹

In general, published reports on the outcome of rehabilitation have been very limited.²⁰ Isometric exercises must start in the acute phase and early mobilisation must start in the subacute phase because prolonged immobility results in a wide range of deleterious effects such as reduced work capacity and loss of muscle strength. Maximising lower extremity muscular flexibility is important for allowing normal lumbar motion. Because of their attachments to the pelvis, the hip flexors and extensors have a great influence on positioning of lumbar spine.

At the end of the rehabilitation program patients observed less pain and were able to perform their daily work with fewer complications. In the final radiological examinations of every patient, degenerative alterations at the pathologic disc space were found to be less than we had expected.

In a study carried out on patients with 14 pyogenic bacteria and 12 mycobacterium tuberculosis spinal involvement, Yen *et al.* evaluated MBI and determined significant improvements in discharge scores of patients with respect to their admission scores. They also found significant improvements in discharge scores of the same patients in terms of the motor scores for the lower limbs ($P < 0.05$).²⁰ In our study, we determined significant improvements in discharge scores of the patients with respect to their admission to hospital when we evaluated motor scores for lower limbs and MBI ($P < 0.05$).

In conclusion, in patients with backpain particularly in endemic areas, brucellosis should be definitely investigated. In these patients, the value of aggressive surgical and/or antimicrobial therapy in conjunction with a comprehensive rehabilitation program during hospitalisation are emphasised in order to provide optimal management and prevent further disability.

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