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Surgical Treatment of Spinal Brucellosis

Pavlos Katonis, MD; Michael Tzermiadianos, MD*; Achilleas Gikas, MD†; Panayiotis Papagelopoulos, MD‡; and Alexander Hadjipavlou, MD**

We retrospectively reviewed 10 patients with spinal brucellosis of the thoracic and lumbar spine who were treated successfully with a combination of surgery and antibiotics. All patients had back pain; six patients had radiculopathy and one patient had paraparesis. Patients with spondylodiscitis without epidural abscesses (n = 3) had transpedicle discectomy and drainage. Epidural abscesses in the lumbar area caused by spondylodiscitis (n = 3), spondylitis (n = 2), and discitis with infected disc herniation (n = 1), were drained using a posterior approach combined with posterolateral fusion in two patients with spondylodiscitis and discectomy in the patient with a herniated disc. One patient presented with a pathologic fracture and neural compression and was treated with anterior corpectomy and reconstruction. Antibiotic treatment was given for 3 to 9 months. Mean followup was 3 years. Back pain improved soon after surgery. Recovery from radiculopathy and paraparesis was complete. One patient had recurrence of infection 9 months after initial treatment. Clinical manifestation of spinal brucellosis can include spondylitis, spondylodiscitis, discitis, epidural abscess, paraspinal abscess, and vertebral collapse. Transpedicle drainage allows tissue diagnosis and facilitates treatment. Because brucellosis usually responds to antibiotics, surgery is considered as the last resort in treating spinal brucellosis, but severe neurologic deficit and incapacitating back pain often necessitate surgical intervention.

Level of Evidence: Therapeutic study, level IV (case series). Please see the Guidelines for Authors for a complete description of levels of evidence.

From the *Orthopaedic Department and the †Department of Internal Medicine University Hospital of Crete, Heraklion; and the ‡Orthopaedic Department, University of Athens, Athens, Greece.
Each author certifies that he has no commercial associations that might pose a conflict of interest in connection with the submitted paper.
Each author certifies that his institution has approved the human protocol for this investigation and that all investigations were conducted in conformity with ethical principles of research.
Correspondence to: Alexander G. Hadjipavlou, MD, Professor of Orthopaedic surgery, University Hospital of Heraklion, P.O. BOX 1352, P.C. 711 10 Heraklion, Crete, Greece. E-mail: ahadjipa@med.uoc.gr.
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INTRODUCTION

Brucellosis is a systemic disease transmitted through contaminated unpasteurized milk, soft white cheese, or direct contact with infected animals.[14] Spinal involvement is a well-known complication of Brucella infection and is not an uncommon cause of spondylodiscitis (2–5%) in Mediterranean countries.[23] The infection has a predilection in the lower lumbar spine and can involve the entire vertebral body. It usually spreads as a secondary process to the contiguous disc and the adjacent vertebra. Furthermore, it can be complicated with epidural or paraspinal granulomatous abscesses. Preservation of the vertebral architecture despite the presence of diffuse spondylodiscitis is a hallmark of brucellosis that distinguishes it from other granulomatous diseases such as tuberculosis.[24]

Administration of antibiotics is the mainstay of treatment of Brucella spondylodiscitis and surgery usually is indicated for an epidural abscess causing neurologic symptoms.[25] However, many patients respond only partially or temporarily with antibiotic therapy; some authors report 40% of patients require several courses of treatment.[25] Large paravertebral abscesses usually are associated with an inadequate response to antibiotics.[2] The role of surgery in patients who do not have neurologic symptoms remains controversial. The successful treatment of pyogenic spondylodiscitis by means of transpedicle drainage,[12] suggests the potential role of this technique in the treatment of spinal brucellosis. The rationale for this approach is to obtain adequate tissue sample for bacteriologic and histologic diagnosis and to promote healing by stimulating granulation tissue from the subchondral vertebral body region to invade and heal the avascular disc space.[12] In patients who are neurologically compromised, effective decompression of neural tissue by either anterior or posterior approach is the treatment of choice.

We asked whether early surgical intervention by means of minimally invasive surgery (uncomplicated cases), or open surgery (with neural compression) would result in pain relief and restoration of neural deficits.

MATERIALS AND METHODS

We retrospectively reviewed 10 patients (six men, four women) who had been treated for spinal brucellosis from January 2000 to January 2003. All patients presented with severe back pain ranging from 8 to 10 on the visual analogue scale (VAS). The character of the back pain was inflammatory (constant pain and night pain not relieved with rest) in eight patients, and mechanical (pain provoked by motion) in two patients (Table 1). The duration of symptoms ranged from 4 to 10 weeks for patients with inflammatory pain, and 14 to 22 weeks for patients with mechanical pain. Six patients were febrile and presented constitutional symptoms (sweats, myalgia, and weakness) at the time of admission. Past history attributable to brucellosis was positive only in two patients. One of the two patients with mechanical pain previously had received antibiotic treatment (doxycycline and rifampicin) for 3 months without clinical improvement. Antibiotics were discontinued 3 weeks before surgery.

The diagnosis of brucellosis was made by isolating Brucella species from blood or tissue specimens or by serologic tests (standard tube agglutination test for antibody titers $\geq$ 1:160, Coombs' test $\geq$1:320 and Rose Bengal). Cultures were incubated for 30 days. Spinal involvement was confirmed by magnetic resonance imaging (MRI). The infection was localized in the lumbar spine in eight patients and in the lower thoracic spine in one patient. One patient had multifocal involvement of lumbar and thoracic spine. The most commonly involved segment was L2-L3. Two patients had spondylitis, seven had spondylodiscitis, and the infection presented as isolated discitis in one patient (Fig 1). Epidural abscess complicated all patients with spondylitis, three patients with spondylodiscitis, and the patient with disc herniated discitis (Fig 1B). Pathologic fracture of T12 occurred in one patient (Fig 2). The patient with the pathologic fracture initially was diagnosed (by imaging resources only) as metastatic carcinoma and the patient had received radiotherapy.

Patients with epidural abscess exhibited severe radiculopathy with leg pain (mean VAS 9) and reduction of muscle strength in the tibialis anterior and extensors (Grades 3 to 4 in the 5-scale grade). The patient with the pathologic fracture had severe paraparesis (ASIA Grade C)[1], caused by intracanal bone extrusion and kyphotic deformity compromising the spinal cord (Fig 2). The patient with the infected disc herniation had acute onset of severe back pain and sciatica 4 days before surgery.

The patients with spondylodiscitis without epidural abscess (n = 3) had percutaneous transpedicle drainage of purulent material (Fig 3). Patients with epidural abscess (n = 6), had laminectomy and drainage and the patient with the infected disc herniation also had discectomy. Laminectomy was combined with posterior stabilization with laminar claws in the two patients who had severe mechanical low back pain. The patient with the pathologic fracture of T12 had anterior corpectomy followed by reconstruction with titanium cage filled with autologous bone graft and anterior plate fixation (Fig 4).

Antibiotic treatment consisted of a combination of doxycycline and rifampicin for 3 months in the first four patients and for at least 6 months (range, 6–12 months) in the rest of the patients. The discontinuation of antibiotic coincided with the drop of antibody titers to 1:160 or less. Doxycycline was administered orally 100 mg twice daily, and rifampicin was administered as a single dose of 600 or 900 mg daily (initially intravenous followed by oral administration after an average of 2 weeks). A second-generation cephalosporin was given for the first 24 to 48 hours after the surgical procedure. A thoracolumbosacral orthosis (TLSO) was applied for 3 months to relieve pain, provide stability, and promote healing.

The mean followup time was 32 months (range, 12–68 months). Clinical, radiographic, and laboratory assessment (Rose Bengal, erythrocyte sedimentation rate [ESR] and C-reactive protein [CRP]) was done at 1, 3, 6, 9, and 12 months postoperatively and every 6 months thereafter. The severity of clinical sequelae was classified according to the patient's functional status at the latest followup visit as suggested by Solera et al[23]: normal (no pain or neurologic deficits); mild sequelae (no neurologic deficits and pain with exercise that do not interfere with work); moderate sequelae (pain interfered with work or mild

TABLE 1. Patient Characteristics

Age (years)	Gender	Level	Local Symptoms	MRI Findings	Surgical Treatment
56	M	L4–L5	Back pain	Spondylodiscitis	PTD
67	F	L2–L3	Back pain	Spondylodiscitis	PTD
59	M	L3–L4	Back pain	Spondylodiscitis	PTD
35	M	L2–L3 T11–T12	Mechanical back pain and radiculopathy	Spondylodiscitis epidural abscess	PTD, laminectomy, L2–L4 fusion
62	F	L2–L3	Mechanical back pain and radiculopathy	Spondylodiscitis epidural abscess	PTD, laminectomy, L2–L4 fusion
42	M	L5–S1	Back pain and radiculopathy	Spondylodiscitis epidural abscess	Laminectomy
63	M	L3	Back pain and radiculopathy	Spondylitis epidural abscess	Laminectomy
68	F	L3	Back pain and radiculopathy	Spondylitis epidural abscess	Laminectomy
38	M	L5–S1	Back pain and radiculopathy	Infected disc herniation and purulent epidural abscess	Discectomy and drainage
72	F	T12	Back pain and paraparesis	Spondylodiscitis pathologic fracture	T12 anterior corpectomy

MRI = Magnetic resonance imaging; M = Male; F = Female; PTD = Percutaneous transpedicle discectomy

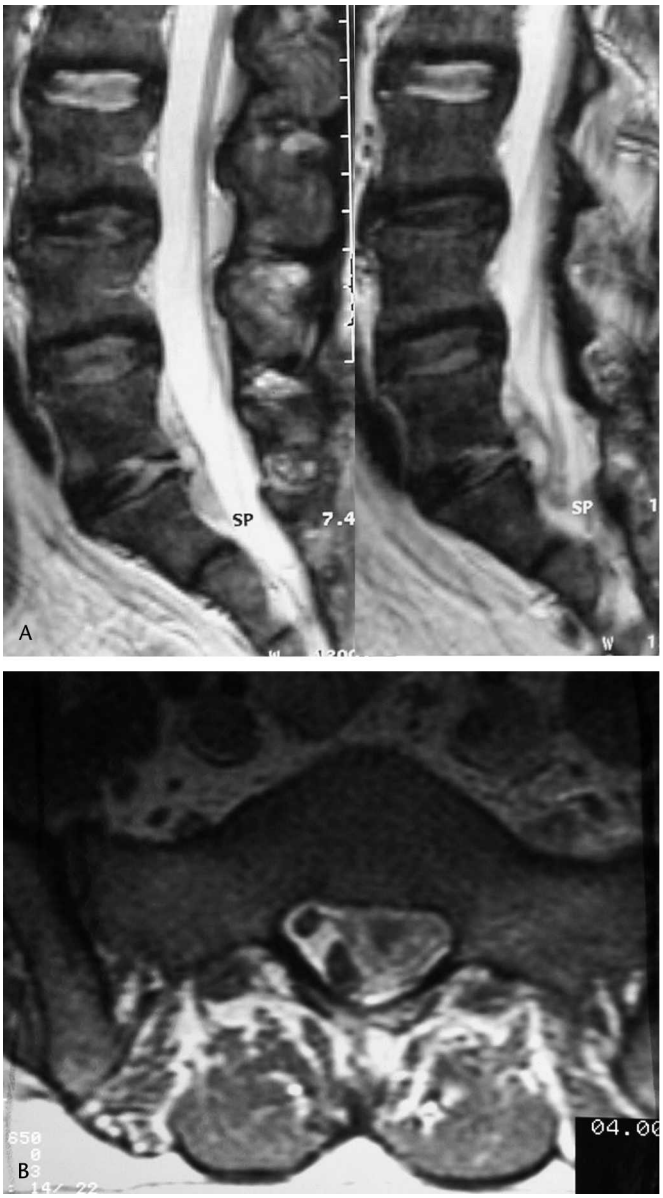

Fig 1A–B. (A) A T2-weighted sagittal MRI shows an infected disc herniation. (B) A T1-weighted axial MRI shows an epidural abscess.

motor or sensory deficits); and severe sequelae (permanent and excruciating pain or motor deficits).

RESULTS

Serologic testing was positive in all patients; while blood cultures grew brucella in only three patients. Adequate specimens were obtained in all patients who had either transpedicle discectomy or open surgery. Histologic and bacteriologic studies of specimens obtained at surgery confirmed the diagnosis in all patients.

Fig 2. A T2-weighted sagittal MRI of the patient with pathologic fracture of T12 shows acute kyphosis compromising the spinal cord. An area of high intensity signal is evident within the spinal cord at the site of compression.

Back pain improved from 8 to 10 on the VAS preoperatively to 1 to 3 on the VAS 1 month after surgery. Patients reported a dramatic reduction of back pain within hours after transpedicle drainage; pain progressively decreased during the first month after open procedures. Recovery from radicular pain and decreased muscle strength or paraparesis was complete. The patient with the ASIA C paraparesis was able to walk (ASIA D), and regained her previous activities. Clinical sequelae at the latest followup visit were classified as normal in seven patients and mild in three. No patient had moderate or severe sequelae.

One patient who had multilevel (lumbar and thoracic) spinal involvement and was treated with transpedicle discectomy at L2-L3 and posterior instrumentation at L2-L4 and antibiotics for 3 months for severe mechanical back pain developed again back pain 9 months after the initial

Fig 3. A hard-copy reproduction from an image intensifier shows a discectomy forceps placed through a working sleeve during percutaneous transpedicle discectomy.

surgery. Magnetic resonance imaging showed recurrence at T11-T12 spinal level (Fig 5A) with paraspinal abscesses formation (Fig 5B). He had percutaneous transpedicle drainage of purulent material from T12 vertebral body followed by percutaneous drainage of paraspinal abscesses (Fig 6A). Antibiotic lavage was done for 48 hours through drains inserted into the pedicle holes (Fig 6B). Systematic antibiotic administration was continued for 6 months.

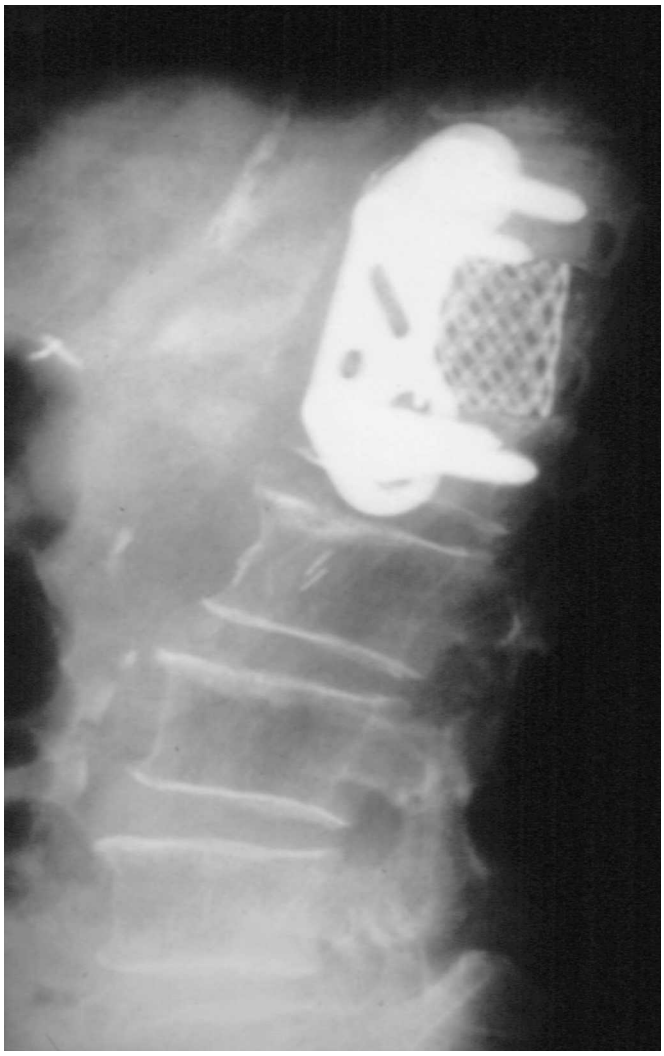

Fig 4. Lateral postoperative radiographs shows corpectomy of T12 and reconstruction with titanium cage and anterior plate in the patient shown in Figure 2.

DISCUSSION

The musculoskeletal system is among the most frequent target of brucellosis,[5] and the spine is the area most frequently affected.[4,17] The incidence of brucella spondylodiscitis has been reported to range from 6% to 30%.[2,5,9,17] Because, during the period of this study 50 other cases of systematic brucellosis were treated in our hospital, it can be assumed that the incidence of spinal involvement was 20%. However, seven of these patients reported symptoms of back pain without sciatica and weren't subjected to imaging investigation of the spine. We can only speculate that these patients might have been affected with spinal brucellosis and responded well to antibiotic treatment. These results muddle the true incidence of clinical involvement, possibly raising the figure to 34%.

Limitations of this study are its retrospective design and the relatively small number of patients treated in an individual rather than systematic way. The patients had great variations in the severity of infection and clinical manifestations and therefore were subjected to different surgical procedures. We had no control patients treated nonoperatively. However, because this is a relatively rare disease that most commonly is treated nonoperatively, the results of surgical intervention might merit attention.

Lumbar involvement was found in 90% of patients in this series, a finding that is in agreement with other studies indicating that brucellosis affects predominantly the lumbar spine.[5,9,19] Multifocal thoracic and lumbar involvements were found in one patient, which also has been reported by other researchers.[25] Localized spinal pain is

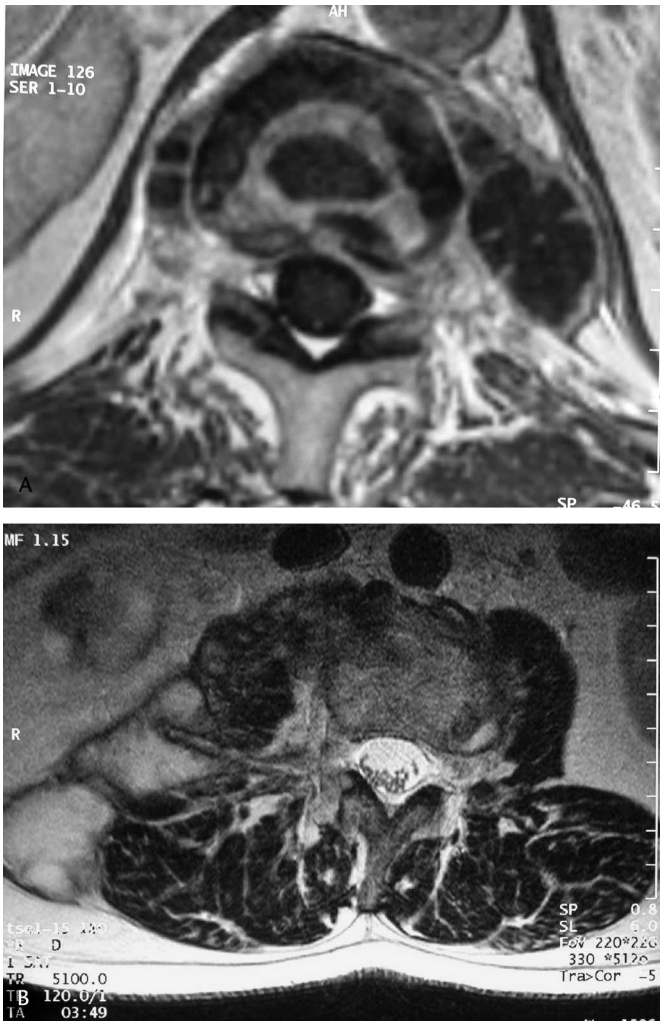

Fig 5A–B. (A) A T1-weighted MRI shows spondylodiscitis of T12 with paraspinal abscess. (B) A T2-weighted image shows the extent of the paraspinal abscesses.

the earliest sign of spinal involvement[2,16,18]; usually it precedes neurologic symptoms by a few weeks.[15] Severe back pain was dominant in all patients in this series. The incidence of neurologic findings secondary to radiculopathy or cord compression varies greatly among studies, ranging from 19%[3] to 40%[28] to 74%.[18] In this series, the incidence of spinal brucellosis complicated by neurologic deficit was 70%. We encountered two rare cases of spinal involvement. In one patient, the infection manifested with acute radicular symptoms caused by infected disc herniation and purulent epidural abscess. Paraparesis from vertebral collapse causing cord compression with kyphotic deformity was seen in another patient.

High antibody titers or rising antibody titers to Brucella antigens usually indicate brucellosis.[26] Because patients with positive blood cultures but negative serology have been reported on,[20,21] isolation of the organism from blood or tissue cultures is the only indisputable proof of the disease. Some authors have reported a low frequency of positive blood cultures.[17,28] However, others cite incidence as high as 74%.[25,27] The organism is fastidious. Unless the disease is suspected and appropriate media are used, culture results usually are negative.[17] Positive blood cultures were found in three patients in this series. It is evident that tissue biopsy is essential for proper diagnosis and treatment. Percutaneous transpedicle approach for biopsy yields excellent diagnostic results.[12]

Surgical treatment should be considered as the last resort in spinal brucellosis because of the usual good response to antibiotic treatment. Surgery for the treatment of spinal brucellosis, according to published reports,[2,3,17,25,28] has been done in between 3% and 29% of patients. Soft tissue epidural masses without severe neurologic compromise may resolve with antibiotics[2,25,28]; therefore, surgery usually is reserved for patients with neurologic deficits.[2,3,6,9,17,28] However, many patients respond only partially or temporarily and may require several courses of treatment.[25] Large paravertebral abscesses usually are associated with lack of response to antibiotics.[2] Minimally invasive surgical techniques may allow better control of the infection by draining abscesses. Successful percutaneous aspiration and drainage of epidural[7] or paravertebral abscesses[10] has been reported. Percutaneous transpedicle discectomy and drainage is cost effective, promoting relief of pain and healing (stimulation of granulation tissue to invade the avascular disc space from the subchondral region.[12]

Severe neurologic deficit caused by bone deformities and purulent epidural abscesses are absolute indications for surgery because of possible irreversible neural damage. Although there are reports that almost ½ of the abscesses are asymptomatic and resolve with antibiotics,[2,28] we encountered neurologic symptoms in all of our patients. Solera et al[25] reported that patients with treatment failure, defined as persistence of symptoms after 6 weeks of appropriate treatment, tend to have large epidural masses on the imaging studies. Surgical drainage of the abscesses or discectomy and drainage of the infected disc herniation resolved neurologic symptoms in all patients in this series and led to uneventful recovery. Drainage of the abscess in the lumbar region successfully was done using a posterior approach and laminectomy.

The infection may present as isolated discitis, spondylitis, or spondylodiscitis. To the best of our knowledge, pathologic fractures have not been reported to occur in spinal brucellosis because the vertebral architecture tends to be conserved even in cases of severe infection. The patient who sustained the pathologic fracture was a 73-year-old woman and osteoporosis might have been a pos-

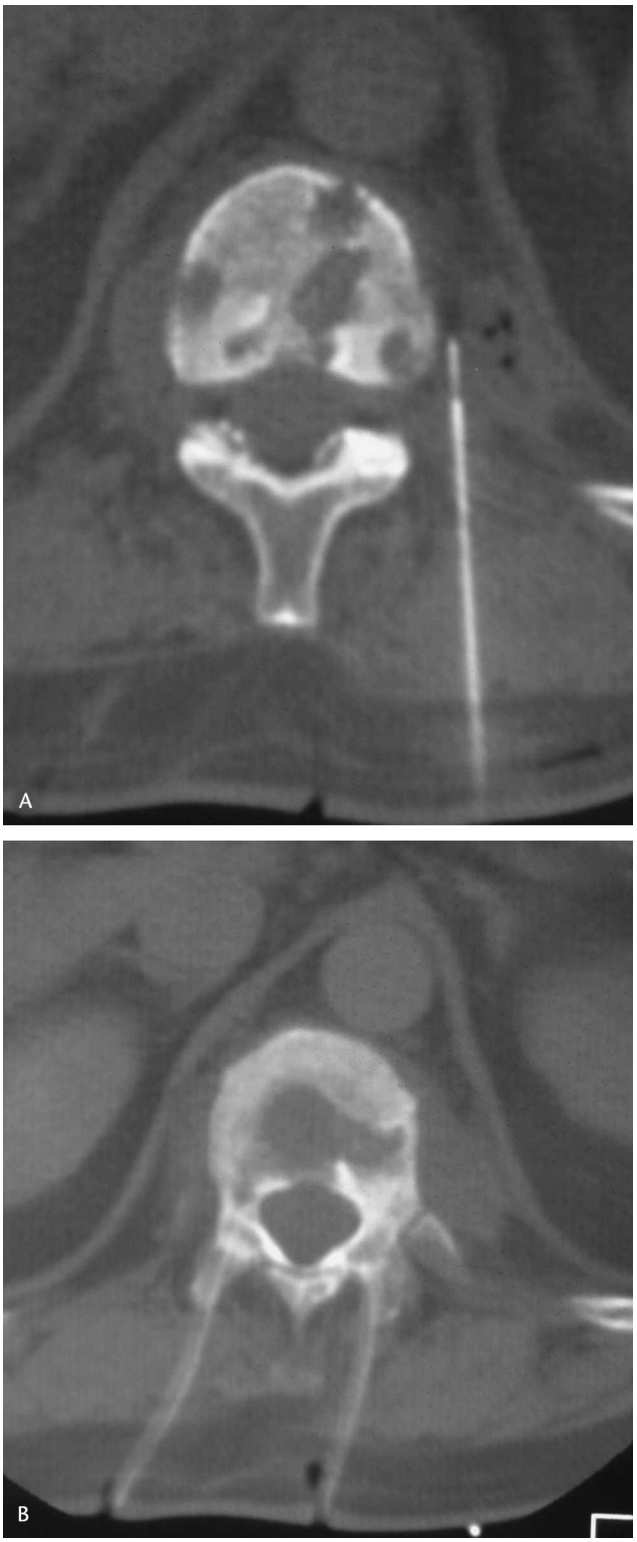

Fig 6A–B. (A) Percutaneous computed tomography (CT)-guided drainage of paraspinal abscess is shown. (B) Bilateral percutaneous transpedicle drainage tubes placed after transpedicle discectomy for suction–irrigation with antibiotics is shown.

sible contributing factor. Kyphotic deformity with cord compression necessitated anterior decompression with corpectomy of T12, reconstruction with Titanium cage filled with autograft, and stabilization with an anterior plate. Implantation of metallic hardware in the presence of spinal infection has not been a contraindication in our experience.[11,13]

The prognosis of brucellar spondylitis is good. Mortality or severe sequelae are infrequent. Mortality has been reported in patients with cervical involvement, epidural abscess with cord compression and tetraplegia[3,8] or extension of the inflammatory process to the abdominal aorta.[22] Relapse rate ranges between 4%[3] to 14%,[25] and can be as high as 55% when antibiotic treatment is administered for only 6 weeks.[17] In this series, antibiotic treatment was given for 3 months in the first four patients. One of these patient experienced relapse of the infection. For that reason, we advocate prolonged administration of antibiotics for at least 6 months.

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