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Surgical Treatment Results of Spinal Tuberculosis with Combined Anterior and Posterior Approach

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The purpose of the current study is the presentation of the result of combined anterior and posterior approach and stabilization of unstable and destructive tuberculous infection of spinal column. The clinical and prospective study was performed on 15 cases of spinal tuberculosis. Six patients (40%) had involvement at the thoracic level (Distal to T₅), two (13.3%) at the thoracolumbar and seven (46.7%) at the lumbar level. Of 14 patients with back pain, was relived after operation in 12 cases (85.7%). Kyphosis deformity was corrected in 9 patients (64.28%). A patient with paraplegia obtained complete function following operation. Six of eight patients with paraparesis obtained complete motor function. In 7 patients that obtained complete motor function after operation, the average duration of neurologic symptoms was 6 weeks before operation (ranging from 4 to 8 weeks). This time in patients with partial relief or non relief of motor function was 13.5 weeks (ranging from 11 to 16 weeks). Present findings show that in spinal tuberculosis that needs surgical intervention, combined anterior and posterior approach (with or without instrumentation) has reliable results.

Key words: Tuberculosis, spine, approach, motor

INTRODUCTION

Tuberculosis (TB) of the spine (Pott's disease) is both the most common and most dangerous form of TB infection accounting 50 to 60% of osseous tuberculosis (Pike *et al.*, 2005). Although uncommon, spinal TB still occurs even in patients from developed countries, such as the US and Europe (Dass *et al.*, 2002). The diagnosis of spinal tuberculosis (ST) is difficult and it commonly presents at an advanced stage (Dusmet *et al.*, 1999; Cormican *et al.*, 2006). Delay in establishing diagnosis and management cause spinal cord compression and spinal deformity (Turgut, 2001).

Clinically, there is usually a history of back pain with local tenderness and limitation of movement. Other symptoms, such as low-grade fever, night sweats and weight loss, can be present. Symptoms are commonly present for several months prior to diagnosis. Vertebral collapse from TB may be misinterpreted as compression fractures especially in elderly women. Clinicians should consider Pott's disease in the differential diagnosis of patients with back pain and destructive vertebral lesions (Dass *et al.*, 2002). Initially, plain radiographs of the spine are normal. MRI and radionuclide bone imaging are the studies that first show pathologic changes. MRI can examine the whole spine, which is important because spinal tuberculosis can be multifocal. If MRI cannot be performed, spiral CT is the best option (Dusmet *et al.*, 1999).

Prior to initiating therapy, it is important to obtain adequate samples for culture and sensitivity studies. Spondylitis can be caused by aerobic or anaerobic bacteria, fungi, or mycobacteria. Successful treatment depends on precise identification of the infecting agent. CT-guided fine needle biopsy can yield adequate samples in 25 to 89% of cases (Dusmet *et al.*, 1999; Bewes, 2001). The treatment of spinal tuberculosis is medical and surgical. The results of this combined approach are excellent (Khoo *et al.*, 2003). With cervical and lumbar lesions, anterior decompression and spinal fusion can be advisable. Surgery is reserved for cases with massive bone loss or kyphosis and is essential in cases with neurologic symptoms, vertebral instability, an abscess or septic complications, or failure of medical treatment (Dusmet *et al.*, 1999; Watts and Lifeso, 1996; Kushkhabiev, 2006; Ghadouane *et al.*, 1996; Jutte and VanLoenhout, 2006).

However, opinion varies regarding the operative indication for Pott's spine (Chen *et al.*, 2002; Garcia-Lechuz *et al.*, 2002). A large group of surgeons perform debridement and decompression in all cases, irrespective of neurological involvement. Others perform operative

decompression only in those patients who do not respond to chemotherapy. Depending on the site of involvement and type of disease the surgical approach is decided in individual cases (Kumar, 2005). Prognosis depends on many factors; the magnitude of cord compression, duration of neural complication, age and general condition of patient (Kumar, 2005).

There are different surgical methods and some surgeons use posterior approach and posterior instrumentation. We conducted the current study to evaluate the results of surgical treatment in 15 cases of spinal tuberculosis underwent combined anterior and posterior approach with or without instrumentation.

MATERIALS AND METHODS

The clinical trial was performed on 15 patients with spinal tuberculosis (Pott's disease). Eighteen patients with Pott's disease present to Orthopedics Service of Tabriz Shohada hospital since 1999 to 2004, of which 15 cases underwent surgery. The indications of surgery were as following: 1) suspicion of infection and need for open biopsy, 2) radiographically confirmed paraspinal abscess, 3) prevention from severe kyphosis, 4) neurologic symptoms and 5) impending vertebral collapse.

After admission, demographic data were collected and general and neurologic examination were performed in combination with laboratory tests and imaging including conventional radiography, CT scan and (if necessary) MRI.

Kyphotic deformity was measured in lateral radiography as the angle between upper endplate of the contact vertebra superior to affected vertebra and lower endplate of the contact vertebra inferior to affected vertebra (Fig. 1).

We consulted with Infectious Disease Ward and East Azerbaijan TB Center before operation about medical therapy and its continuation. Appropriate surgical approach and fixation device were selected by surgeon. Then, the patients underwent surgery by anterior and then posterior approaches. We performed anterior approach followed by posterior approach 2 weeks later.

The anterior approach was including anterior debridement, decompression, grafting and (if necessary) anterior instrumentation. In this procedure, intrapleural and retroperitoneal approaches were performed for thoracic and lumbar regions respectively, with patient in right lateral decubitus position. In posterior approach, posterior fusion, grafting and posterior instrumentation were performed over patient in prone position. We used instruments including Rezaian fixator, Cotrel-Dubousset (CD) Instrumentation System. Strut graft substrate was

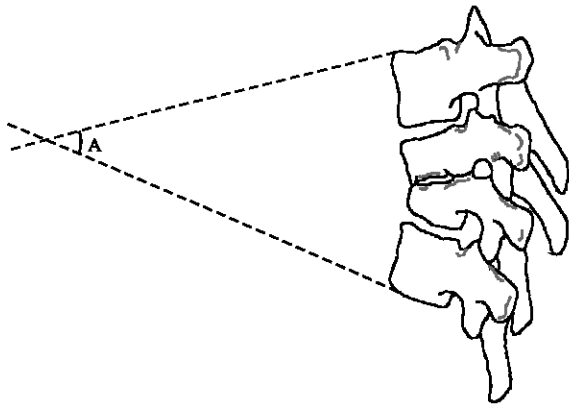


Fig. 1: Diagram of the lateral view of the spine. The angle of deformity (A) is the angle formed by a line that joins the upper endplate of the vertebra that is one level cephalad to the lesion and a line that joins the lower endplate of the vertebra that is one level caudad to the lesion. (Redrawn from Rajasekaran, S. and K. Shanmugasundaram: J. Bone Joint Surg. 69A: 503, 1987)

removed from iliac crest, fibula, or ribs. Intra-operative biopsy was performed in all patients and sent for pathologic examination and culture, which confirmed tuberculous infection. After operation, the patients were moved to ICU and then to ward.

All patients received complete anti-tuberculosis chemotherapy in supervision with East Azerbaijan TB Center. For safety from optimal limitation of spinal movements by patients, they asked to wear Body Jacket for 3 months. The patients followed up regularly after discharge and the information were collected and recorded in forms including patient characteristics, symptoms, general and neurologic examination, laboratory tests, radiological findings, the method of immobility after operation and complications. Plain antero-posterior and lateral radiographs were obtained postoperatively and every 3 months for one year and if fusion was not seen in the first 3 months, radiography was repeated monthly until the fusion was seen.

The fusion was confirmed by the absence of localized pain and tenderness over arthrodesis site, maintenance of corrected deformity, absence of mobility in lateral flexion and hyperextension radiographs and the evidences of fusion in radiographies and (if necessary) by CT scanning. The ESR was monitored for the presence of an active disease process.

Neurologic examination was performed in each visit and the patients were classified according the Frankel *et al.*, classification system (Kristly and Gibson,

2003; Zhang and Li, 2004): Class A (complete spinal injury), Class B (incomplete injury with preserved sensation only), Class C (incomplete injury with nonuseful motor function), Class D (incomplete injury with useful motor function) and Class E (complete recovery).

Finally, the collected data were analyzed with SPSS-11 statistical software and p-values less than 0.05 were considered statistically significant.

RESULTS

There were 12 females and 3 males. The average age of the patients was 37.46 years (4-61 years). The average duration of follow up was 2 years and 4 months (8 months to 4 years).

Back pain, the most common symptom, was present in 14 patients. Other symptoms and signs were anorexia in 11 cases (73.3%), motor function impairment in 9 patients (60%) (paraparesis in 8 cases and paraplegia in 1 case), night sweats in 9 patients (60%), fever in 5 patients (33.3%), history of active pulmonary tuberculosis in 5 patients (33.3%) weight loss and sphincteric impairment in 1 patient (6.6%). Muscular force in patients with paraparesis was 3/5 to 4/5 with 4 cases having reduced DTR (deep tendon reflexes) and 3 cases having extensor plantar reflex.

Six patients (40%) had involvement at the thoracic level (Distal to T₅), two (13.3%) at the thoracolumbar and seven (46.7%) at the lumbar level. None of our series had cervical or lumbosacral or more distal affection. Of 14 patients with back pain, was relived after operation in 12 cases (85.7%).

Kyphosis deformity was corrected in 9 patients (64.28%). A patient with paraplegia obtained complete function following operation. Six of eight patients with paraparesis obtained complete motor function (<0.05). Of four patients with Class C injury before operation (Frankel *et al.*, classification system), 1 case improved to Class D following operation and 3 improved to Class E following operation. Of four patients with Class D injury before operation, 3 cases obtained complete motor function after operation.

In 7 patients that obtained complete motor function after operation, the average duration of neurologic symptoms was 6 weeks before operation (ranging from 4 to 8 weeks). This time in patients with partial relief or non relief of motor function was 13.5 weeks (ranging from 11 to 16 weeks). The average time of restoration of neurological symptoms was 9.4 weeks (11.8 weeks in cases with Class B or C injury and 8 weeks in patients with Class D injury).

ESR was raised in all patients. Eleven patients had para-vertebral and 2 cases had peri-vertebral abscess. The abscesses were detected by imaging and confirmed during operation.

The bone for autogenous bone graft (Strut graft) was removed from iliac crest (in 6 cases), fibula (in one case), fibula and iliac crest (in one case), rib (in one case) and rib and iliac crest (in one case). The average bleeding time in anterior and posterior approaches was 1000cc and 1500cc, respectively.

Post-operation pneumonia and UTI (urinary tract infection) were seen in 1 and 3 patients, respectively who all treated with antibiotic therapy. Atelectasis was seen in 3 patients that were treated with Chest Tube until recovery. Ileus was found in one patient and treated with NG Tube. Wound drainage was seen in one case, with the culture of which was negative and resolved during 3 months.

DISCUSSION

Spinal tuberculosis typically has an insidious onset and slow progression, although acute onset has been reported in the literature (Ramani *et al.*, 2005). Patients usually seek attention weeks to months after onset of the original symptoms due to the low intensity of the initial symptoms. The mean duration between onset of symptoms and clinical presentation in our series was 6 weeks (4-8 weeks) in 7 patients that obtained complete motor function after operation and 13.5 weeks (11-16 weeks) in patients with partial relief or non relief of motor function. Mean averages of lesser durations have been reported in the literature (Colmenero, 1997). The surgery results and regaining the normal motor function were related significantly with duration between onset of symptoms and seeking the mediation. Therefore, we concluded that earlier diagnosis and consequently appropriate treatment intervention prevent from progression of neurologic symptoms. Also, in patients with duration of neurologic symptoms lasting more than 8 weeks, the recovery of neurologic symptoms were delayed 2 folds as another group with duration of neurologic symptoms lasting less than 8 weeks (19 weeks vs. 9 weeks). This result is compatible with findings of other studies (Canale, 2003; Yilmaz *et al.*, 1999).

No patient in our series was seropositive for Human Immunodeficiency Virus (HIV) infection. The incidence of tuberculosis is higher in immunocompromised patients (Bhojraj and Nene, 2002) and there are reports in the literature describing surgical outcomes of spinal tuberculosis in HIV infected patients (Ramani *et al.*, 2005; Govender *et al.*, 2001).

Bhojraj and Nene (2002) suggest that the diagnosis was usually made on clinical and radiological grounds and in countries with tuberculosis endemic (such as India) histopathologic confirmation is not necessary and conservative treatment with antituberculous drugs is a practical alternative to open biopsy. They feel that tuberculous spondylodiscitis, especially in the lumbar spine, can usually be satisfactorily managed conservatively and that there are few indications for surgical treatment.

The ability of MRI to detect tuberculosis of the spine earlier than other techniques could reduce bone destruction and deformity and diminish the need for surgical intervention. Despite the specificity of the patterns revealed by MRI, biopsy is recommended during the stage of osteitis to confirm the diagnosis (Desai, 1994) because the toxicity of antituberculous drugs and duration of this medication requires the confirmation of diagnosis by biopsy culture. In present study all 13 abscesses diagnosed with close clinical examination and imaging, were confirmed during operation. The most common tuberculosis spondylitis in our series was lower thoracic and thoracolumbar regions which is compatible with other studies (Watts and Lifeso, 1996; Ramani *et al.*, 2005).

Unlike historical times, effective medical and surgical management of tuberculous spondylitis is now possible. Proper selection of drug therapy and operative modalities, however, is needed to optimize functional outcomes for each individual case of Pott's disease (Khoo *et al.*, 2003). Surgery allows to assert the diagnosis, to treat a compression, to evacuate pus, to treat or at less to avoid worsening of a deformation and to reduce treatment duration (Ghadouane *et al.*, 1996).

Yilmaz *et al.* (1999) believe that anterior instrumentation is more effective than posterior instrumentation for reducing the deformity and stabilizing the vertebral column in patients who have kyphosis related to tuberculosis of the spine. Anterior instrumentation for spinal tuberculosis could stabilize the spine, correct kyphosis and fuse the grafted bone (Shi *et al.*, 2003). There are a few cases reported about the use of only posterior instrumentation for cervical tuberculosis but it is associated with increased morbidity and requires a double approach (Mukhtar *et al.*, 2003; Sundararaj *et al.*, 2003; Fuster *et al.*, 2001). It is also fraught with increased operating time, prolonged anesthesia and greater blood loss. Since the vertebral body lies anterior and is commonly affected in tuberculosis, decompression and stabilization has to be done by approaching the spine anteriorly (Jain, 2002). Late onset neurological compression can be best avoided by preventing deformity. The use of anterior

instrumentation in thoracolumbar spine tuberculosis has been shown to be associated with a high fusion rate, low complication rate and increased correction rate in kyphosis (Ramani *et al.*, 2005; Dai *et al.*, 2005). Deformity and neurological impairment are major residual problems of spinal tuberculosis after eradication of the infection. Anterior spinal instrumentation is needed to support the collapsed anterior weight-bearing column of the cervical spine. It has been confirmed clinically by studies showing that even in the presence of metallic foreign bodies, the disease responds well to antituberculous chemotherapy (Ramani *et al.*, 2005).

Farage *et al.* (2002) reported a case of a surgical treatment with anterior instrumentation in tuberculous spondylitis (Pott's disease), in a 71 years old woman that was in treatment for pulmonary tuberculosis, with lumbar pain, progressive disability to walk, kyphotic deformity and vesical dysfunction. Anterior instrumentation of spine permitted a good arthrodesis and an immediately stabilization of the spine, without any complication of the infection. The patient was seen a year after the surgery and is free of infection, without motor deficit, pain or reminiscent kyphosis.

Christodoulou *et al.* (2006) concluded that radical debridement followed by anterior stabilization with a titanium cage and bone grafting is a reasonable alternative for tuberculous spondylitis requiring surgical treatment. It enables accurate and lasting deformity correction and provides adequate stability to allow early mobilization. The presence of a titanium cage in an area of mycobacterial infection did not preclude infection control or lead to recurrence.

We found advantages with anterior instrumentation in comparison to posterior stabilization in patients with spondylodiscitis. Advantages of ventral stabilization cause early mobilization postoperatively without any increase in complication rates (Linhardt *et al.*, 2004). Jin *et al.* (2004) reported 23 cases of active thoracolumbar spinal tuberculosis treated by one-stage anterior interbody autografting and instrumentation. They suggest that one-stage anterior interbody autografting and instrumentation in the surgical management of the exudative stage of spinal tuberculosis show more advantages in selected patients, but supplementary posterior fusion should be considered to prevent postoperative kyphosis when this procedure is performed in children.

Anterior debridement, strut grafting and instrumentation have an increasing popularity in the treatment of tuberculosis of spine. Anterior instrumentation is a safe and effective method in the treatment of tuberculosis spondylitis (Benli *et al.*, 2004).

Anterior instrumentation with anterior autologous strut grafting following anterior radical debridement can be a good treatment option with low complication rate, high correction rate in acute local kyphosis and high fusion rate (Benli *et al.*, 2000).

Fukuta *et al.* (2003) performed a retrospective analysis of the clinical outcomes of patients with pyogenic or tuberculous spondylitis who were treated with two-stage surgery (first stage: placement of posterior instrumentation; second stage: anterior debridement and bone grafting). They concluded that this two-stage surgical treatment for pyogenic or tuberculous spondylitis provided satisfactory results and can also be used in patients who are in poor general condition. Chen *et al.* (2002) recommend a two-stage surgical technique combined with antituberculous chemotherapy to treat patients with severe vertebral body destruction attributable to tuberculosis because of its high success rate and a low complication rate.

According to the study of Yilmaz *et al.* (1999) the goal of surgical intervention in our study was prevention from progression of kyphosis deformity and appearance of neurologic impairments. Anterior wedging and as a result progression of kyphosis was more prevalent in thoracic region and less prevalent in lumbar region. This is because of the presence of normal kyphotic curve in thoracic region which aggravate the pressure over the anterior part of vertebrae and cause the progression of kyphosis.

Conversely, this is less probable in lumbar region because of the presence of lordosis curve. In our study, the greatest correction of kyphosis was in combined anterior and posterior operation but because the low number of patients operated with one-stage posterior operation the appropriate was impossible.

The most recovery of neurological symptoms in our series was seen in patients that underwent anterior decompression and debridement by anterior approach. According to the Frankel classification, the average neurological correction created for each patient was 1.8 degree and 0.7 degree for anterior and posterior approaches, respectively. This is because the fact that TB affects the anterior parts of vertebrae more commonly and as a result, by anterior approach we can drainage the abscess, remove the avascular tissues and decompress the spinal cord with less danger (Yilmaz *et al.*, 1999).

In our series, 93% of cases had lumbar or back pain before operation of which 85% relieved post-operatively. Because the anterior column is the most commonly infected area in vertebrae, the lesion of vertebral body is not decompressed with posterior approach only.

Therefore the preferred method of decompression is anterior approach and adding posterior fusion with instrumentation improves stability and reduces postoperation kyphosis.

CONCLUSIONS

Spinal tuberculosis often involves the anterior and medial aspects of vertebral column. In cases with great vertebral destruction and compression of spinal duct by granular tissue (with or without abscess), we recommend ANTERIOR APPROACH (including abscess drainage, debridement of infected osseous and disc, decompression of spinal column and segmental fusion with Strut graft), followed by POSTERIOR APPROACH (including posterior instrumentation and fusion) for correction of kyphosis deformity and prevention from subsequent collapse and reliable 360 degree fusion.

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