

One-Stage Posterior Instrumentation And Fusion For The Treatment Of Tuberculous Spondylodiscitis Of Dorsal And Lumbar Spine

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Abstract: Spinal tuberculosis is a common disease in orthopedic clinical practice, accounting for one third to one half of bone and joint infections. Over the last 4 decades a lot has changed in the diagnosis, medical treatment and surgical procedures to treat this disorder. The aim of this study was to report the efficacy and safety of single-stage posterior debridement, interbody fusion with autogenous bone grafting and posterior instrumentation for the treatment of active dorsal and lumbar spinal tuberculosis. Our study was carried out in Sohag University Hospital during the period from January 2009 to September 2011. In our study we reported fifteen patients (8 males and 7 females) with age ranged from 20 to 65 years with dorsal and lumbar spinal tuberculosis. All patients underwent physical examination, routine laboratory tests, plain radiographs, MRI, and a biopsy of the infection site for culture on Lowenstein Jensen medium and for histopathological examination. Eleven patients (73.3%) had involvement at the thoracic level and 4 patients (26.7%) had involvement at the lumbar level. Vertebral collapse, destruction, cold abscess, and canal compromise were assessed in MR images. All patients underwent single-stage posterior debridement, autogenous bone graft and pedicle screw fixation. The final diagnosis of tuberculosis was confirmed by histopathological examination of bone biopsy which demonstrated caseating granulomas and by tissue culture on Lowenstein Jensen medium yielded growth of tuberculous bacilli stained by Zeihl-Neelsen staining. Clinical and radiographic results were analyzed. The mean follow-up time following surgery was 20.5 months (range, 9–32 months). Bony fusion was achieved at six- to nine months in all patients (average 7.5 months). Neurologic recovery averaged 1.5 grades on the Frankel scale. No recurrence of tuberculosis or instrumentation failure occurred. Postoperative complications; (superficial wound infections) were encountered in 2 cases which responded to parenteral antibiotics and daily dressing. All patients made full recovery on anti-tuberculous treatment and posterior surgical procedure. It can therefore be concluded that; single-stage posterior instrumentation and fusion can provide radical debridement and it is an effective method to achieve spinal stability in patients with Pott's disease with the advantage of minimal invasive surgery.

[Abdel Rahman Hafez and Mona Fattouh. **One-Stage Posterior Instrumentation And Fusion For The Treatment Of Tuberculous Spondylodiscitis Of Dorsal And Lumbar Spine.** *J Am Sci* 2012;8(9):85-90]. (ISSN: 1545-1003). <http://www.jofamericanscience.org>. 13

Keywords: Posterior instrumentation, Tuberculosis, dorsal and lumbar spine.

1. Introduction

Tuberculosis (TB) involves both pulmonary and extrapulmonary sites. The vertebral column is the most common site of osseous involvement, comprising in most series about 50% of cases of skeletal TB (*Moore and Rafii, 2001*). Since its full description in 1977 by Percivall Pott; TB of the spine also referred to as Pott's disease or tuberculous spondylitis, has been a therapeutic challenge to the physician, orthopedic surgeon and neurosurgeons (*Bailey et al., 2002*). The goals of surgery in Pott's spine are adequate decompression and debridement, maintenance and reinforcement of stability and correction and prevention of deformity (*Garg et al., 2012*). Approach for surgical treatment of thoracic and lumbar tuberculosis is always controversial. The selection of anterior versus posterior approach for surgical treatment of thoracic or lumbar tuberculosis is still a matter of debate. The anterior approach has been preferred throughout the spine

because the pathology of tuberculosis mainly affects the vertebral bodies and disc spaces, and the anterior approach allows direct access to the infected focus and is convenient for debriding infection and reconstructing the defect (*Jain et al., 2008*). However, in the thoracic and lumbar region, anterior instrumentation to provide bone stability may be tenuous because the concomitant osteoporosis associated with infection renders the vertebrae structurally weak and may prevent adequate fixation (*Hee et al., 2002*). Posterior or posterolateral (*Jain et al., 2004*) approaches alone have also been described. It provides excellent exposure for circumferential spinal cord decompression and also allows posterior instrumentation to be extended for multiple levels above and below the level of pathology (*Garg et al., 2012*). In this study we summarized our experience with surgical treatment of selected cases with tuberculous spondylodiscitis of the dorsal and

lumbar spine by single-stage debridement and posterior stabilization.

2. Patients and Methods

Our study was carried out in Sohag University Hospital during the period from January 2009 to September 2011. Fifteen patients (8 males (53.3 %) and 7 (46.7 %) females) with age range from 20 to 65 years (mean age 42.5 years); with thoracic (11 patients, 73.3%) and lumbar tuberculosis (4 patients, 26.7%) were treated by posterior debridement, autogenous bone grafting and posterior fixation. Cases reviewed in this study had active spinal tuberculosis from the 8th thoracic to the 5th lumbar vertebrae and none of them had draining sinuses. The diagnosis of TB was based on clinical presentation (as the patients presented to our hospital with severe back pain, localized tenderness, neurological deficits, and symptoms of tuberculosis as weight loss, and low grade fever), erythrocyte sedimentation rate (ESR), C-reactive protein levels, and findings on plain radiography, and magnetic resonance imaging. A biopsy was taken from the infection site for histopathological analysis and culture of the excised tissue on Lowenstein Jensen medium and staining of the specimen by Zeihl-Neelsen staining for detection of Acid fast bacilli. Histopathological and bacteriological examinations performed postoperatively confirmed the diagnosis in all cases.

- Laboratory findings of the patients were; an elevated erythrocyte sedimentation rate (ESR) and a positive C-reactive protein (CRP) (++) test.
- All 15 patients were evaluated by anteroposterior and lateral radiography for vertebral collapse or angular deformity and by magnetic resonance imaging (MRI) for detection of granulation tissue and its spreading, degrees of tuberculous pathology in the spinal canal and canal compromise. Radiographic findings of tuberculous spondylitis included intraosseous and paraspinal abscess formation with disc destruction, subligamentous spreading of infection, vertebral body destruction and collapse, and extension in the spinal epidural space. Two contiguous vertebrae were involved in all patients together with the intervening disc (*Figure 1*).
- All patients underwent routine chest radiographs and sputum examination for the tubercle bacilli to determine if there was primary pulmonary tuberculosis.
- No patient was found to have pulmonary tuberculosis. Two weeks preoperatively, all patients were administered conventional antituberculous therapy with isoniazid (5-10 mg/kg/day, with no more than 300 mg/day), rifampicin (5-10 mg/kg b.wt./day, with no more than 300 mg/day), and ethambutol (15 mg/kg

b.wt./day, with no more than 500 mg/day) and nutritional support therapy. And this therapy was continued for 6–9 months postoperative. At the end of the medical treatment laboratory tests (ESR and CRP) and radiological examination were done to the patients to evaluate the disease activity.

- Using Frankel scoring (*Frankel et al., 1969*) the cases were divided as follows: Frankel B, loss of motor power with only intact sensation (2 cases); Frankel C, motor power present but not useful (3 cases); Frankel D, motor power present and useful (5 cases), and 5 patients had intact neurological function (Frankel E). None of the cases in this study were assessed as Frankel A (complete spinal cord injury) (*Table 2*).
- Histological examination of the biopsy samples showed granulomas and caseating necrosis compatible with TB lesion; (caseous necrosis, epithelioid lymphocytes, langhan's giant cells).
- Acid fast bacilli were detected in the specimens by Zeihl-Neelsen staining and *Mycobacterium tuberculosis* was grown from the tissue cultured on Lowenstein Jensen medium and incubated at 37° C for 4-6 weeks.
- All patients were followed up for a minimum of 9 months. All patients were assessed clinically and examined by AP and lateral radiographs of the spine performed immediately following surgery, at 6 weeks and at 6 months, then every 6 months up to the final follow up and studied for the progress of healing.
- On each assessment, data related to drug regimen and its side effects if any, improvement of back pain and tenderness were recorded.
- Erythrocyte sedimentation rate and C-reactive protein (CRP) test were checked at the same intervals to assess disease activity.
- Postoperative Neurological assessment was performed at each follow-up visit and compared with the preoperative state using Frankel scoring. (*Table 2*).

Operative technique

Patients were operated under general or spinal anesthesia in the prone position through a posterior midline approach. The lamina, facet joints, transverse processes, and costotransverse articulations were exposed. Exposing the vertebral laminae of involved segments, the posterior pedicle screws were installed. In cases of lumbar region, we preferred fusing as short a segment as possible. In the lower thoracic region, we preferred fusing at least two vertebrae above and below the lesion. Bilateral costotransversectomy at thoracic levels drained prevertebral abscesses and exposed diseased vertebral bodies. Partial or total laminectomy,

according to the extent of spinal canal stenosis, was performed before debridement of the affected intervertebral discs and vertebrae. If necessary, a facetectomy or pediclectomy was also performed. To obtain a broader view, 1 spinal nerve on the focal side may be sacrificed in the thoracic levels. The necrotic material within the body and disc was removed using curettes, and paraspinal abscess was drained. Corpectomy and discectomy were performed. Following completion of the corpectomy and debridement, the stability was achieved by installing permanent rods with compression maneuvers under vision. Posterior interbody grafts were applied after ensuring no compression of the spinal cord. For all patients, autogenous bone was selected for posterior fusion at the instrumentation segments. Only the levels fused anteriorly were grafted posteriorly using autogenous rib or iliac crest after decortication of the spinous processes, laminae and transverse processes. Biopsy specimens were sent for histopathological and microbiological study. Immediately post surgery, routine lateral and anteroposterior radiographs were obtained to assess the extent of decompression and placement of graft and instrumentation. The patients were followed for at least for 9 months. Patients without neurological deficits were allowed to walk in a molded thoracolumbar orthosis 1 week postoperatively. The brace was worn for 3–6 months.

Table (1): Descriptive data of patients included in the study.

Factor	Number	Percent %
Age incidence (years)		
20 - < 35	2	13.3
35 - < 50	6	40
50 - < 65	7	46.7
Sex incidence		
Male	8	53.3
Female	7	46.7
Level affected		
Thoracic	11	73.3
D 8–9	3	20
D 9–10	5	33.3
D 10–11	3	20
Lumbar	4	26.7
L 2–3	1	6.7
L 3–4	1	6.7
L 4–5	2	13.3
Occupation		
Workers	9	60
House wives	5	33.3
Students	1	6.7
Total	15	100

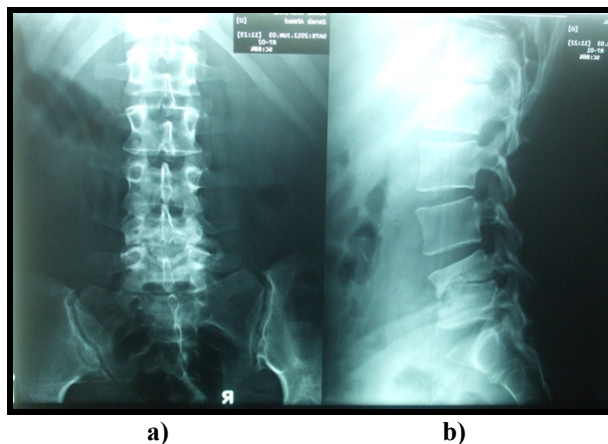


Figure 1: Anteroposterior (a) and lateral (b) X-ray of spine of 25 years-old woman complaining of low back pain of several months duration without neurological affection; showing TB spondylodiscitis of L4-5 with destruction of L4 and L5 vertebral bodies and intervening disc by the tuberculous lesion.

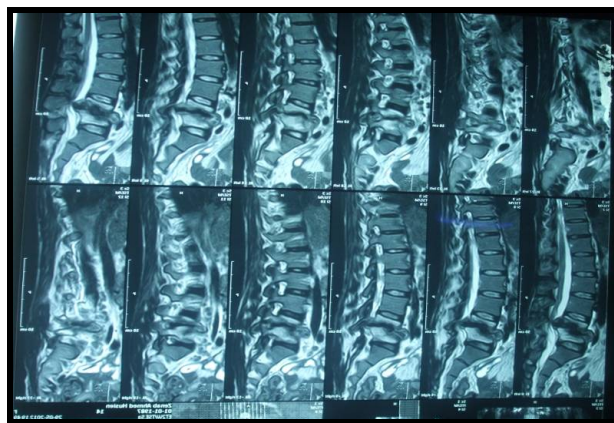


Figure 2: Preoperative sagittal MRI showing destroyed L4 and L5 vertebrae and intervening disc and presence of paraspinal abscess.

Table (2). Neurological state before and after surgery.

Frankle Classification	
A (Complete paraplegia)	
B (Preserved sensation)	
C (Useless motor)	
D (Useful motor)	
E (Normal)	
Total	

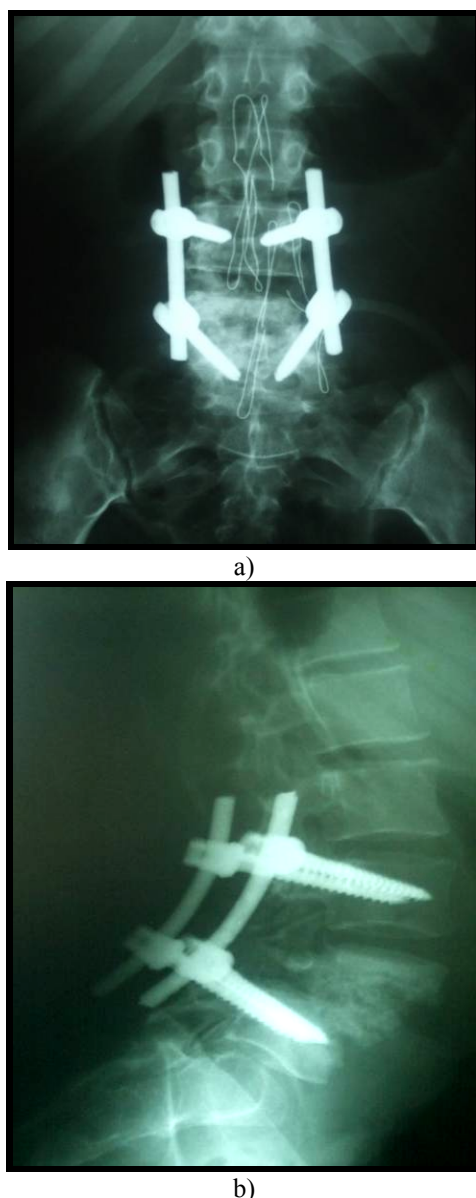


Figure 3: Postoperative anteroposterior (a) and lateral (b) radiographs showing transpedicular screws with bone graft with restoration of lumbar lordosis.

Postoperative management

The drain was removed after 72 hours. Patients were permitted to ambulate after remaining supine for 7 to 15 days postoperatively. Stitches were removed 2 weeks postoperative; and then patients were mobilized with an appropriate thoracolumbar support. The braces were used for an average of 4.5 months (range, 3-6 months) postoperatively. All patients were treated with the antituberculous chemotherapy regimen for 6 to 9 months. Liver function and ESR were monitored carefully at regular intervals. Follow-up examinations were performed at 6 weeks and at 6 months and 1 year.

Subsequent follow-ups occurred at 6-month intervals. All cases were followed up for an average of 20.5 months (range, 9–32 months).

Complications

Two cases had superficial wound infection which responded well to parenteral antibiotics and daily dressing. None of the patients had an iatrogenic neurological injury or loosening of the hardware. None of the implants needed to be removed.

3. Results

Patients ages ranged from 20-65 years (mean: 42.5 years). The presenting symptoms mostly were low-back pain and difficulty in walking. The mean duration of prodromal symptoms before admission was 13 months. Ten patients had neurological deficits at the time of presentation. Microbiological and histological studies of the excised tissues confirmed the diagnosis of tuberculous spondylodiscitis in all cases. Severe back pain was immediately reduced following surgery and the activities of daily living showed a marked improvement. Wounds healed without chronic infection or sinus formation. The average follow up was 20.5 months (range 9–32 m). All the patients achieved full clinical and radiological cure of infection. All cases presented with neurological deficit showed complete neurological recovery within the first 6 months following surgery and the other patients remained neurologically free. Clinical improvement was markedly evident in all cases after surgery with gradual improvement of back pain. There were no signs of reactivation. There was no recurrence of the disease in any patient at the final follow-up. All patients achieved bone fusion. Spinal fusion occurred at a mean of 7.5 months after surgery.

4. Discussion

Pott's disease is the most common granulomatous bacterial infection of the spine and the most common bone TB with 50-60% of cases (*Karaeminogullari et al., 2005*). The spinal column is an easy target for the tuberculous bacilli due to features of Batson plexuses and spinal circulation (*Gokce et al., 2012*). Biopsy is the only certain method which can be used to confirm the diagnosis (*WHO, 2010*). Any pathological material obtained from joint, bone, or lymph nodes, should be submitted for histological and microbiological examination for tuberculosis. However even on histology the changes may be non-specific; in some studies the results of biopsy reveal chronic, non-specific inflammation in 50% of cases (*Shah et al., 2011*). Microbiological confirmation is required for the final diagnosis of vertebral TB and fine-needle aspirate, imaging-guided percutaneous biopsy, or open biopsy may be essential (*De Backer et al., 2005*). Excellent

results with treatment of TB spine can be achieved if early diagnosis is made. Increasing back pain should suggest plain radiography of the spine, and perhaps followed by MRI. In the present study 15 patients presented with persistent back pain in Sohag University Hospital during the period from January 2009 to September 2011. The mean duration of prodromal symptoms before admission was 13 months. Delay in diagnosis and surgery can cause degenerative pathologies, deformities and complete paraplegia, especially in cases with incomplete neurological deficit (*McLain and Isada, 2004*). These types of patients should be immediately immobilized, admitted to hospital, and early surgical treatment should be performed. Surgical treatment is by far the superior treatment. In the present study, our patients underwent one-stage posterior decompression, interbody grafts, and transpedicular instrumentation and fusion. Average patient age was 42.5 years (range, 20-65 years). By surgery; abscess drainage and debridement done enhance drug treatment, reduction of the total time of healing of the local lesion and probably improves the quality of healing, especially in cases with extensive destruction and sequestration (*Agrawal et al., 2010*), biopsy specimens could be taken efficiently for histopathological and microbiological diagnosis (*McLain and Isada, 2004*); local instability and disc degeneration are treated by fusion, which prevents pain and the development of deformity (*Al Sebai et al., 2001*); decompression is provided in cases with neurological problems; if there is any deformity, it can be corrected (*Kim et al., 2004*). Surgical treatment leads to rapid recovery and early mobilization. Excisional therapy has been practiced by many workers for all cases of tuberculosis of spine, with excellent results when combined with antituberculous drugs. The incidence of healing has been 80–96%. Various surgical methods have been used to treat spinal tuberculosis, but few data have been reported on the use of 1-stage posterior decompression, interbody grafts, and transpedicular instrumentation and fusion in the treatment of thoracic and lumbar spinal tuberculosis. Because the inflammation is usually located in the anterior aspect, anterior debridement and strut grafts were recommended by some surgeons. However, this procedure may result in progression of kyphosis as a consequence of failure of the bone graft (*Zhang et al., 2010*). Because of the complications of this method, additional posterior instrumentation, which is applied to reduce kyphotic deformities and to prevent correction loss and graft failure, has been applied by some surgeons. (*Talu et al., 2006*). However, this combined procedure has a longer operation time, longer healing duration, and higher surgical trauma (*Yilmaz et al., 1999*). In the present study, our 15 patients underwent one-stage posterior decompression, interbody grafts,

and transpedicular instrumentation and fusion followed by antituberculous chemotherapy. Average follow-up was 20.5 months (range, 9-23 months). All patients achieved bone fusion at a mean of 7.5 months after surgery. Our results agreed with that of *Moon et al. (2011)* who have reported one stage surgery in their series with posterior instrumentation followed by chemotherapy for treatment of patients with spinal tuberculosis to prevent development of the deformity. In our series graft failure did not occur. None of the patients had an iatrogenic neurological injury or loosening of the hardware. None of the implants needed to be removed. There was no recurrence of the disease in any patient at the final follow-up. We preferred the posterior approach because of minimally invasive surgery; a mere posterior approach for debridement, fusion, and instrumentation often limits the extent of surgical intervention to a minimum (*Zhang et al., 2010*). This approach reduces total operative time and morbidity and allows early mobilization, which reduces the complication risk of long-term bed rest and decreases hospitalization cost. Also, a posterior approach offers good access to the spinal canal for efficient decompression of the neural elements, especially in cases of epidural suppuration, and renders good clinical results (*Güzey et al., 2005*). It can therefore be concluded that; posterior surgical removal of the inflammatory lesion, replacement by autograft, posterior fusion and fixation with an appropriate device seem to be the best method for the treatment of tuberculosis of the spine which gives good results. This can sufficiently cover our goals of management of spinal TB to eradicate the infection, to prevent or treat neurological deficits, to correct spinal deformities, to achieve normal sagittal contours of the spinal column, and to achieve unrestricted mobilization and normalization of patients' daily activities as soon as possible.

Summary and Conclusion

Our results show that single-stage posterior decompression, interbody grafts, and transpedicular instrumentation and fusion is an efficient surgical management for the treatment of tuberculous spondylodiscitis of dorsal and lumbar spine offers a rigid and reliable fixation of the spine with a minimum surgical intervention and encourages neurological recovery, early bony healing and allows early and faster rehabilitation when performed together with antituberculous chemotherapy.

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7/22/2012