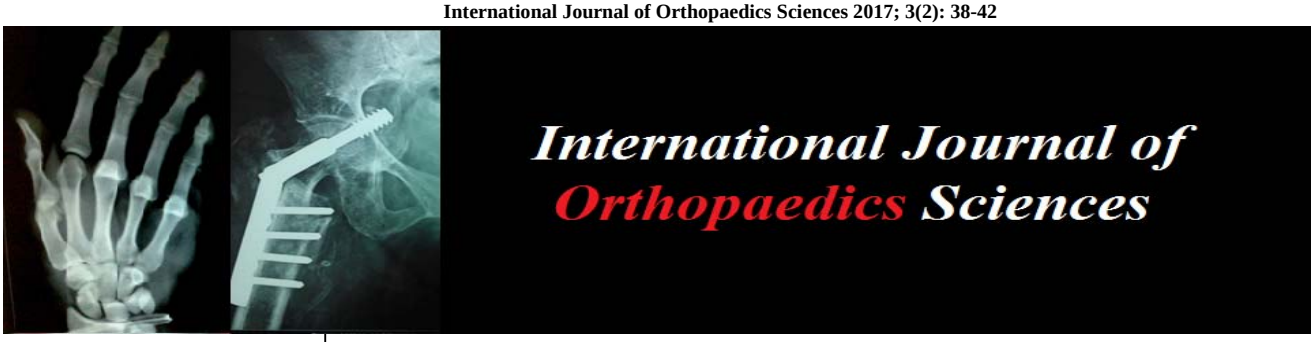

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Posterior only debridement and instrumentation in thoracolumbar spinal tuberculosis

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Abstract
Introduction: Spinal tuberculosis is the most common form of skeletal tuberculosis with the dorsolubar region being the most commonly affected region. The most dreaded complication of spinal tuberculosis is tubercular paraplegia seen in around 40% of the cases. There has been controversy regarding the surgical treatment of the disease and also the approach to be used and the use of implants. In our study we have have operated 41 patients of thoracolumbar tuberculosis by posterior only debridement, implantation by pedicle screw and rods and fusion.
Purpose: The purpose of this study is to assess the functional and neurological outcome of the patients of thoracolumbar tuberculosis treated by a posterior only approach. The inraoperative blood loss, bony fusion, neurological recovery and post operative blood loss was studied in all patients.
Methods: Forty- One patients with thoracolumbar tuberculosis who underwent posterior approach in combination with debridement, interbody autografting and instrumentation were reviewed. The mean age group of the study was 44.0±12.3 years. All cases were followed up for 12–27 months. The groups were compared by parameters like blood loss, improvement in kyphosis, neurological recovery. Bony fusion was assessed by Bridwell criteria. Final functional outcome was assessed by Prolo scale.
Results: The mean duration of hospital stay was 21.0±4.8 days. The average blood loss was 714.6±80.8 ml. The mean preoperative kyphotic angle was 23.8±4.2 degrees which improved to a mean of 8.1±2.7 degrees and at final followup were 12.3±3.9 degrees. Definitive fusion was seen in 90% of the cases. There was no deterioration of neurological symptoms in any of the patient.
Conclusion: The posterior approach combined with debridement and instrumentation can be a better alternative than the classical anterior approach. A better correction of the deformity combined with a decreased blood loss and low morbidity is observed with the posterior approach.

Keywords: Debridement and instrumentation, thoracolumbar spinal tuberculosis, posterior

1. Introduction
More than 30 million people are suffering worldwide from overt tuberculosis and more than 2 million of them have the active, spinal form [1]. Ninety-five percent of tuberculosis patients are in the developing regions of the world. In HIV-negative patients, around 3% to 5% of tuberculosis is skeletal, whereas in HIV-positive patients, about 60% of the cases involve the bone. The discovery of effective antituberculous chemotherapy has largely made uncomplicated spinal tuberculosis a medical disease [2-3]. The challenges faced by the spinal surgeon nowadays in the management of spinal tuberculosis are the problems of progressive deformity and correction of residual severe deformity. The spine is involved in 50% of osteoarticular tuberculosis cases. Spinal tuberculosis is the form most dangerous, as it may cause destruction of the vertebral body, spinal deformity and/or paraplegia and pulmonary insufficiency secondary to the deformity of thoracic cage. Spinal tuberculosis is indolent and slow growing and can be diagnosed both clinically and radiologically in endemic regions [4-5]. The characteristic radiographic findings include rarefaction of the vertebral end plates, loss of disc height, osseous destruction, new-bone formation and soft-tissue abscess. Often, multiple vertebrae are involved and late fusion or collapse of vertebrae is not uncommon. An MR scan will detect a tubercular lesion before it can be seen on a plain radiograph. The changes in the spinal cord may be interpreted as oedema of the cord, myelomalacia, atrophy of the cord and syringomyelia [6-7].

Oedema of the cord is compatible with good neurological recovery following treatment, while myelomalacia, accompanied by a severe neurological deficit may show incomplete recovery [8-10]. Surgery has the advantage of controlling spinal deformity while also limiting or improving the neurological impairment associated with this disease [11]. Surgery can be performed by anterior or posterior single approach, or a combination of both. Various treatment options, including debridement with anterior spinal fusion, anterior spinal fusion with posterior spinal fusion, posterior spinal fusion alone and posterior spinal fusion followed by anterior spinal fusion, have been used for treating spinal tuberculosis [12-14]. In our study, we report the use of posterior only approach for debridement and instrumentation for the treatment of spinal tuberculosis. The aims of our procedure are to remove the infected material and the psoas abscess by surgery, to promote natural wound healing by firm fixation with pedicle screw instrumentation, and to facilitate early ambulation and rehabilitation.

2. Material and Methods

From January 2012 to November 2014 a total of 41 patients were studied. The study was conducted in a prospective analysis with a single surgeon operating on all the cases. All cases were treated with debridement through a posterior approach and posterior stabilization with pedicle screws and rods. All the patients presented with constitutional symptoms of pain, back ache, malaise, weight loss with 80% of the patients presenting with some neurological deficit. Indications of surgery comprised of neurological deficits, spinal deformities, large paravertebral abscess, radicular pain due to compression by granulation tissue or patients not responding to medical therapy. Diagnosis was established by X-rays and MRI if the suspected lesion. Histopathological examination of the biopsy sample and PCR of the pus sample was done in all cases post operatively to confirm the diagnosis. Tuberculosis culture and sensitivity was done in all cases to confirm and diagnose drug resistance. Prior to surgery all patients underwent routine hematological and radiographic evaluation which included haemoglobin, WBC count, ESR, Quantitative CRP, Liver function tests, Renal function tests, Electrolytes and blood grouping. Electrocardiogram and Chest X-ray was done in all patients.

All patients were started on a five drug regimen (Inj. Streptomycin, Tab. Rifampicin, Tab. Isoniazid, Tab. Pyrazinamide, Tab. Ethambutol) prior to surgery. DVT prophylaxis in form of Low molecular weight heparin was given to all paraplegic patients. MRI of whole spine was done in all patients.

All patients were operated under general anesthesia with endotracheal intubation. A posterior midline approach was used in all cases with the incision centering over the involved vertebral level. Pedicle screws were placed under fluoroscopic guidance in vertebral bodies 2 level above and below the lesion. If the upper part of the vertebral body was not destroyed, the affected vertebra was incorporated in the instrumentation. Temporary stabilization of spine was done by connecting the pedicle screws on left side so as to prevent collapse during debridement and permit transforaminal approach from right side. Laminectomy and of the affected level is done and debridement of the infected tissues, pus, sequestrum and disc is done through transforaminal approach with help of curettes. Autograft harvested from the laminectomy bone is inserted. Screws are connected with connecting rods and the affected vertebral level is compressed. Drainage tube is placed and wound is sutured.

In the immediate postoperative period blood pressure, pulse, amount of drainage and motor and sensory responses of lower extremities were monitored in all patients.

All patients were given antituberculous therapy for a period of 18 months. Drainage tube was removed when the drainage volume was less than 50 ml in 24 hours. All the patients were given braces to be worn for a period of 1 year. Liver function tests and ESR were monitored at regular interval. Follow up examination was done at six week interval for first 3 months then every 3 months for a period of 18months. X-rays of the involved vertebral level was used to assess fusion.

For statistical analysis, chi-squared test and t-tests were used and a p value <0.05 was considered statistically significant.

3. Results

All cases were followed up for 12 to 27 months (mean 18.8±4.4months). Mean age of the study was 44.0±12.3 years. The study group consisted of 23 male and 18 female patients. Mean duration of hospital stay was 21.0±4.8 days. Skip lesions were observed in 9% of patients. Average blood loss was 714.6±80.8 ml. D12-L1 was the most common vertebral level involved in the dorsolumbar region accounting for 22% of all cases (Table 1).

Of the 9 patients of Frenkel A preoperatively, 2 improved to Frenkel B, 1 to Frenkel C and 6 to Frenkel D out of 9 patients of Frenkel B, 1 improved to Frenkel C, & to Frenkel D and 1 to Frenkel E. Of the 4 patients with Frenkel C, 2 patients improved to Frenkel D and 2 to Frenkel E. Of the 5 patients of Frenkel D, 2 improved to Frenkel E and 3 patients showed no improvement. No patient showed any deterioration of the neurological symptoms after surgery (Table 2).

Complete paraplegia was seen 44% of patients and had an equal incidence in both male and female patients. It was also commonly seen (55%) in patients having dorsal spine lesion (D5 to D10).

Mean preoperative kyphotic angle was 23.8±4.2 degrees which improved to a mean of 8.1±2.7 degrees. The average improvement in the kyphotic angle was 15.6±8.0 degrees (Table 1).

Fusion was assessed using the Bridwell criteria [15]. Of the 41 patients, 37(90.2%) patients showed definitive fusion and 4(9.7%) patients showed probable fusion.

Functional outcome was assessed using the Prolo scale [16]. A good functional outcome was seen in 29 (70.7%). 27 (65.8%) patients were able to return to their previous work capacity after a period of 1 year followup.

At 1 year follow up the mean kyphotic angle was 12.3±3.9 degrees with a mean loss of kyphotic correction by 4.4±2.8 degrees (Table 1, Figure 2).

In group A, nerve root injury was seen in 2 patients, dural tear in 5 patients. Implant loosening was observed in 1 patient which was removed at a later stage after radiological evidence of fusion was seen. Drug resistance to Isoniazid was seen in 1 patient and drug reaction to ethambutol was seen in 1 patient. In both these patient the resistant/offending drug was replaced by Ofloxacin 400mg/day. Superficial wound infection was seen in 1 patient, deep vein thrombosis was seen in 3 patients.

Table 1: Stratification of pre-operative and post-operative data

	Male	Female	Mean
Age (in years)	41.1±11.7	47.8±12.3	44.0±12.3
Blood Loss(in ml)	721.7±88.9	705.5±70.4	714.6±80.8
Hospital Stay(in days)	21.6±4.7	20.1±4.8	21.0±4.8
Pre op Kyphosis (in degrees)	22.4±4.2	25.6±3.5	23.8±4.2
Post op Kyphosis (in degrees)	8.3±2.6	7.8±3.0	8.1±2.7
Improvement in Kyphosis (in degrees)	14.0±5.2	17.6±4.8	15.6±8.0
Post op kyphosis at 1 year (in degrees)	12.9±4.5	12.2±3.1	12.6±9.9
Loss of kyphotic correction (in degrees)	4.6±3.3	4.3±1.9	4.4±2.8

Table 2: Pre and Post operative Frenkel Grading

No. of Patients	Frenkel Grading				
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
Pre operative status	9	9	4	5	14
Post operative status	0	2	2	18	19

Fig 1: Pre operative X Ray and MRI

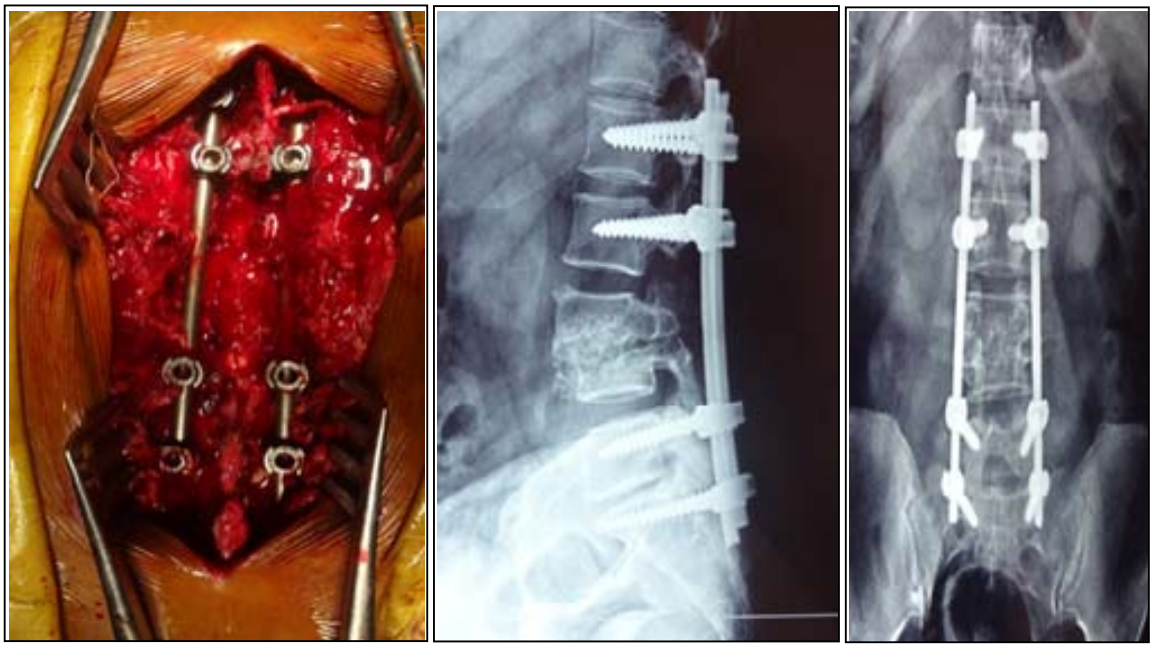

Fig 2: Intra operative image and follow up X rays

4. Discussion

Medical management of thoracolumbar tuberculosis should always be the treatment of choice for eradicating the infection, restoring and preserving the structure of spine, and alleviating pain after the development of anti-tuberculous therapy. Also when surgery is indicated, concomitant medical therapy is essential [17]. Approach for surgical treatment of thoracolumbar tuberculosis has always been controversial. The aims of treating spinal tuberculosis are to eradicate the infection, prevent or treat neurological deficits, correct kyphosis deformities, and finally to achieve normal sagittal contours of the spinal column, unrestricted motility, and achieve full activities of daily living as soon as possible [18]. Spinal tuberculosis can be treated surgically by anterior instrumented fusion, combined anterior-posterior procedure, extrapleural anterolateral procedure or posterior procedures [19]. Tuberculosis almost always affects the anterior part of vertebral body, the disc and the adjacent vertebral bodies; therefore, the traditional and logical thinking had long been to use an anterior surgical approach to reach the spine to evacuate an abscess, excise the diseased tissues, decompress the neural tissues, and to insert a bone graft to correct kyphosis, achieve solid fusion and minimize disease recurrence [20].

Instrumentation in spinal tuberculosis is a new concept. Oga *et al*. studied the adherence capacity of *Mycobacterium Tuberculosis* to stainless steel and concluded that adherence was negligible and the use of implants in active tuberculosis may be safe [21]. Many surgeons favour the anterior approach as it allows direct visualization of the lesion and permits an under vision debridement. Several studies have demonstrated a high corrective rate of deformity and their maintenance using anterior instrumentation in active thoracolumbar tuberculosis [22-28]. Mehta and Bhojraj *et al*. came up with a classification system to guide the type of surgical technique to be applied. Its main drawback was it took in consideration only the tuberculosis of the thoracic vertebrae. Oguz *et al*. gave their classification to overcome this limitation. Although they gave a practical classification, there was no focus on the posterior lesions and was the main limitation of this classification [29-31].

Posterior instrumentation is considered superior to anterior instrumentation in correcting the kyphosis deformity of the thoracic and lumbar spine and in maintaining that correction. The probable reason for this might be that pedicle screws cross the vertebral body pedicle, the strongest part of the vertebral body, providing three-dimensional correction and strengthening the spinal three-column stability, which is much stronger than anterior instrumentation [19]. Pang *et al*. analyzed the clinical efficacy and feasibility of patients with thoracolumbar tuberculosis treated by posterior transforaminal debridement in 18 patients and reported 100% fusion rate in their study [14]. Kumar *et al*. in their study on 25 patients operated by posterior approach found improvement in kyphotic angle from 32.4 to 7.2 degrees. Interbody fusion was seen in all patients at final follow up [32]. Zhang *et al.* studied 60 patients operated by posterior approach and found a better correction of saggital index by this approach. The stability provided by posterior fixation, particularly transpedicular fixation, protects the vertebral correction, and patients are able to return to normal activities within a short period of time.[33] In general, transpedicular screws can be placed in an affected vertebra if the upper part of the vertebral body is not destroyed by the infection thereby reducing the surgical exposure and the extent of fixation. Since the approach is extra pleural, this approach can also be used in patients with low lung reserve which is a contraindication for anterior approach. Posterior approach is also has less blood loss as compared to anterior approach. Disadvantage of posterior approach is that, debridement of the diseased site is not under direct vision. The posterior approach also requires fixation of more vertebrae as compared to the anterior approach [34].

Though the anterior approach is the preferred method for debridement and decompression of the lesion, it is associated with an increased morbidity. The posterior approach allows a 270^0 view of the lesion for debridement and allows a reasonable decompression. Better functional outcome and better correction of the kyphotic angle are strong points favoring the use of posterior approach.

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