



Original Article

## Surgical Outcome of Spinal Tuberculosis Regarding Pain, Neurological Deficit, and Spinal Instability

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### ABSTRACT

**Objective:** The most prevalent type of skeletal TB, which accounts for nearly half of all cases, affects the spinal column. Regarding pain, neurological deficit, and spinal instability, the study sought to determine the surgical outcome of spinal tuberculosis.

**Material and Methods:** This study was conducted in the Department of Neurosurgery, Ayub Teaching Hospital. A total of 42 patients with ages ranging from 24 – 66 years were included in the study. Information about the patient was gathered to determine indications (neurological impairments) about the ASIA Grading Scale and frequently affected areas.

**Results:** Commonest location was a thoracolumbar junction in 42.8%, followed by the lumbar spine in 23.8%. The pain was found in all subjects. The main indication of surgery was neurological deficit which is seen in 57% of patients followed by spinal instability or deformity in 16.6% of patients and patients with failed chemotherapy in 4.7% of patients. The preoperative KA was between 30 – 60° with a mean of 43.06 ± 4.11 degrees and 9.45 ± 3.99 degrees for postoperative KA (p-value < 0.0001). Most fixations of the cord were done through a posterior approach that was in 83.3% of patients. The neurological improvement according to ASIA grading was seen in 95.2% and no improvement was seen in 4.7% of patients upon 3 months follow-up.

**Conclusion:** Surgical treatment of the caries spine improves pain, lowers neurological compression, and successfully reverses deformities like kyphosis, resulting in better clinical results. It also helps to remove the Tuberculous burden from the body.

**Keywords:** Spinal Tuberculosis, Extrapulmonary Tuberculosis, Kyphotic Angulation, ASIA (American Spinal Injury) Scale.

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### INTRODUCTION

Tuberculosis (TB) of the spinal column is the most common form of skeletal tuberculosis accounting for about half of the cases of skeletal tuberculosis. This is a serious form of the disease if left

untreated can lead to severe morbidity and mortality<sup>1</sup>. Once believed to be a health endemic problem in developing countries. Now TB is an international concern, because of its spread all over the world due to the global migration phenomenon<sup>2</sup>. The incidence of extrapulmonary tuberculosis is low as 3%, but there is no reduction in the incidence of EPTB when it is compared to pulmonary TB<sup>3</sup>.

Tuberculosis of the skeleton is around 10% of overall EPTB, and tuberculosis of the spine remains the common site of EPTB (Extrapulmonary tuberculosis), which amounts to half of skeleton TB<sup>4</sup>. The commonest site to be involved in spinal tuberculosis is the thoracolumbar junction followed by the lumbar spine and cervical spine<sup>5</sup>.

The intraosseous venous plexus, which is generated from the Batson paravertebral venous plexus, is linked to vertebral body infection. The most prevalent variety of ST is the paradiscal type, which affects almost 90 – 95 percent of patients and involves the infection of the subchondral plaque and anterior vertebral body with the tuberculous bacillus. From this area of concentration, the infection traveled to the body's center and intervertebral disc. The posterior type, non-skeletal type, and central tuberculosis are further types.<sup>6-7</sup>

Spinal tuberculosis is a chronic condition with a sneaky development. The illness might last anywhere between four and eleven months on average, but it can also last for years. Back pain is typically the most common manifestation, and according to multiple studies, it typically accounts for 90% to 100% of cases. Neurological dysfunction is documented in 32% to 76% of cases of spinal TB and is the most severe and dreaded sign.<sup>8-9</sup>

For the diagnosis and treatment of spinal TB, radiography, which ranges from computed tomography to magnetic resonance imaging, typically gives sufficient information. Laboratory investigation, including tissue analysis, the

Mantoux skin test, ESR, PCR, and the Elisa test. Simple debridement, decompression fusion, and various types of fixation from both the front and posterior sides are all surgical approaches used in ST.<sup>10-11</sup> The study attempted to examine the surgical result of spinal TB in terms of pain, neurological deficiency, and spinal instability.

## **MATERIAL AND METHODS**

### **Study Setting and Patients**

This study was conducted in the department of Neurosurgery, Ayub Teaching Hospital from September 2016 to August 2022. A total of 42 patients were included in the study with informed consent. The study was duly approved by the Hospital's ethical review committee. The study conformed to the ethical requirements.

### **Selection Criteria**

Cases refractory to chemotherapy or with severe persistent pain were included in this study. Unstable spine or cases with Kyphosis of more than 60° were included. Cases of large paravertebral abscesses refractory to chemotherapy were also included. Cases of cervical abscesses leading to respiratory compromise or quadriplegia.

### **Patient Follow-up and Clinical Management**

The patients were followed up for the reduction of pain in the immediate postoperative period using the visual analog scale (VAS) scores. Improvement in spinal angulation was seen by measuring kyphotic angle pre and post-operatively, and improvement of neurological deficit was seen in the immediate postoperative period and upon 3 months of follow-up by using ASIA Grading.

## Data Collection and Analysis

The patient's information was collected to gather information presenting indications (such as neurological deficits) concerning ASIA Grading Scale and common locations involved in spinal tuberculosis.

## Surgical Management: Transpedicular Screw Fixation with Pontes Osteotomies

Midline incisions over the involved spinal vertebrae, followed by soft tissue dissection and muscle retraction were carried out. The dissection involves the removal of muscle tissue from bony attachments using monopolar diathermy. So that laminae and facet joints are exposed to the transverse processes. The levels are identified using an image intensifier or C arm fluoroscopy. bony structures were nibbled to expose the spinal cord at the caudal end. Kerrison rongeurs were used to remove the laminae in a piecemeal fashion. Articular facet joints were preserved as much as possible to maintain the stability of the spine.

## RESULTS

### Age & Gender Distribution

A total number of 42 patients were included with 30 (71.4%) males and 12 (28.5%) females with ages ranging from 24-66 years with a mean age of  $44 \pm 3.1$  years.

### Most Frequent Sites of Spinal Tuberculosis

The most common location involved was a thoracolumbar junction that is 18 (42.8%) followed by the lumbar spine in 10 (23.8%), and then the lower thoracic in 9 (21.4%), cervical in 3 (7.1%), and upper thoracic in 2(4.7%) involved.

**Table 1:** Sites Involved in Spinal Tuberculosis.

Sites of Spinal Tuberculosis	Percentage
Thoracolumbar junction	18 (42.8%)
Lumbar Spine	10 (23.8%)
Lower Thoracic	9 (21.4%)
Cervical	3 (7.1%)
Upper Thoracic	2 (4.7%)

## Presenting Indications

The pain was found in all subjects. 57% had neurological deficits. The patients were categorized into Grades, these were ASIA Grade A to E. Most patients were in grade D with 24 (57%) patients. In our study, the main indication of surgery was neurological deficit which is seen in 57% of patients followed by spinal instability or deformity in 16.6% of patients and patients with failed chemotherapy in 4.7% of patients. See Table 2 for further grading distribution.

**Table 2:** Distribution in ASIA Scale (n = 42).

ASIA Scale	Percentage
Grade A	5 (12%)
Grade B	6 (15%)
Grade C	3 (7%)
Grade D	24 (57%)
Grade E	4 (9%)

## Kyphotic Angulation (KA) & Fixation Approaches

Kyphotic angulation (KA) between  $30^\circ - 60^\circ$  was seen in 72% of patients with kyphotic angulation more than  $60^\circ$  was seen in 9% and kyphotic angulation  $< 30^\circ$  was seen in 19% of patients. The preoperative KA was between  $30 - 60^\circ$  with a mean of  $43.06 \pm 4.11$  degrees. This was seen to be a minimum of  $2^\circ$  and maximum of  $16^\circ$  with a mean postoperative kyphotic angle of  $9.45 \pm 3.99$  degrees. The difference was statistically significant ( $p \text{ value} < 0.0001$ ) by the t-test.

Mostly fixations and decompression of the cord were done through a posterior approach that was in 35 (83.3%) of patients followed by a

combined anterior and posterior approach in 3 (7.1%). The anterior approach in 2 (4.7%) and only abscess drainage in 2 (4.7%) of patients.

## Outcome

The neurological improvement according to ASIA grading was seen in 40 (95.2%) and no improvement was seen in 2 (4.7%) of patients upon 3 months follow-up.



**Figure 1 (a):** MRI lumbosacral spine showing L2 disc disease, possibly caries spine.

**Figure 1(b):** X-ray of lumbosacral spine showing pott's disease.

**Figure 1(c):** It shows X Rays of the lumbosacral spine after multilevel Pedicle screw fixation.

## DISCUSSION

Spinal tuberculosis is the most common type of extrapulmonary tuberculosis and in our region, these patients initially present to primary care providers, where these patients are treated just symptomatically. So every patient with a prolonged history of backache, and spinal tuberculosis should be excluded, considering the morbidity and mortality related to this disease. It is always necessary for a neurosurgeon to be well-versed with the latest guidelines, principles, and trends in the management of this tricky disease.<sup>12</sup> Most of the patients involved in our study were male population (71.4%) which closely matches the results shown by Rezai et al,<sup>13</sup> and that could be because of our society in which the male is dominant in the family. In our study, the

most common presenting symptom was pain, followed by a neurological deficit. Most of our patients presented with an aneurological deficit with ASIA Grade D and this could be due to, that our patients presented late to the tertiary care hospital and took medicine blindly for a prolonged period, and because of this reason most of our patients (72%) had kyphotic angle ranging between 30° – 60°. In the current study, the commonest site involved is a thoracolumbar junction which is 42.8% followed by the lumbar spine in 23.8% of patients.

Park et al,<sup>14</sup> investigated the impact of disease severity and treatment strategy on the outcome of patients with spinal tuberculosis. Although anti-TB chemotherapy is currently the standard treatment for spinal TB, it may not be appropriate in all cases, particularly in individuals who are at risk of deformity, instability, and neurologic impairment development. During the research period, 137 individuals were diagnosed with spinal tuberculosis. The lumbar spinal region was the most commonly implicated (44.8%). The average number of affected vertebrae was 2.25. The average kyphosis angle was 21.58°. 37 individuals (35.1%) reported severe symptoms. In 62.2% of cases, radical surgery was performed. Their findings revealed that being younger and undergoing extensive surgery in combination with anti-TB treatment were important prognostic variables. Since Percivall Pott's original description of spinal TB, much has changed. However, there is still substantial debate over the best ways to prevent abnormalities. The goals of the study were to analyze the clinical and X-ray features of patients with vertebral TB and to compare conservative treatment alone to surgical treatment combined with antibiotic therapy, especially in terms of residual deformity and neurological deficiency. The baseline and end-point X-ray examinations, as well as the medical data, were evaluated retrospectively. The ASIA scale was used to assess the neurological state, while the Cobb technique was used to measure

abnormalities. Thirty-eight individuals were assessed, with 11 receiving surgical treatment and the remaining 27 receiving merely antibiotics. Regardless of the therapy strategy used, fifteen individuals with neurological deficits improved. At baseline, the mean focal and regional thoracic kyphosis were  $48.8^\circ$  and  $47.86^\circ$ , respectively. After 5 years, the incidence of thoracic deformity increased from  $6.3^\circ$  focal to  $9.8^\circ$  regional, making it the most afflicted section. This kind of therapy did not affect the advancement of kyphosis. Patients under the age of 15 and with kyphosis greater than  $30^\circ$  had a poor prognosis for deformity advancement. Medeiro et al.<sup>15</sup>

Spinal tuberculosis (TB) accounts for around 2% of all TB cases. Magnetic resonance imaging (MRI) and percutaneous needle biopsy are two new diagnostic procedures that have evolved. There are two types of spinal tuberculosis: the conventional form, known as spondylodiscitis (SPD), and an increasingly prevalent atypical variety defined by spondylitis without disk involvement (SPwD). In 24% of patients, surgery was performed. There were two TB-related fatalities. The findings by Pertuiset et al.<sup>16</sup> implied that SPwD is currently the most frequent pattern of spinal tuberculosis in foreign-born people in developed nations. The causes behind this are yet unknown. We operated on the majority of the patients using the posterior route, which was used in 83.3% of instances for decompression, fusion, and fixation because we are quite familiar with this technique. Second, the majority of our patients had TB of the lower thoracic and lumbar spines. Our patients showed improvement in neurological deficit by using ASIA grade and that is 95.2% of patients. Bodapati et al,<sup>17</sup> showed it to be 100%. In 4.7% of our patients, there was no improvement in neurological deficit and that is because these patients presented late with Asia grade A. Li et al,<sup>18</sup> studied 66 patients with thoracolumbar TB who were treated with single-stage transpedicular debridement, bone graft fusion, and pedicle screw fixation. Thirty-five

instances were treated with long-segment fixation (A group), while 31 cases were treated with short-segment fixation (B group) (B group). During the follow-up, all patients were entirely cured. At the last follow-up, all patients' neurological conditions and visual analog scale pain ratings were significantly improved. The average surgery length and blood loss were greater in group A than in group B. After surgical care, both groups' kyphosis Cobb angle was considerably corrected. At the time of the immediate post-operative period or the final follow-up, the correction rate of the Cobb angle in group A was substantially greater than that in group B.

Extreme lateral interbody fusion (XLIF) is a minimally invasive intervertebral fusion method that has gained popularity in recent years. Deng et al,<sup>19</sup> described the use and efficacy of XLIF in the treatment of thoracic tuberculosis (TB), since this may be a future therapeutic option for thoracic TB. They describe the instance of a 75 – year – old man who had been experiencing chest and back pain for one month. Imaging examinations revealed that the T12 and L1 vertebral bodies, as well as the T12 – L1 intervertebral disc, had been destroyed, along with the development of a paravertebral abscess. Following 2 weeks of normal anti-TB medication, the patient underwent lesion debridement, XLIF, and percutaneous pedicle screw fixation. The procedure considerably reduced the patient's chest and back discomfort. For the treatment of thoracic tuberculosis, XLIF coupled with percutaneous pedicle screw fixation allows for TB lesion debridement, discectomy, and interbody fusion under direct observation, which can significantly improve patient prognosis.

## CONCLUSION

Surgical treatment of the caries spine favorably reduces pain, reduces neurological compression, and restores deformity like kyphosis effectively

leading to better clinical outcomes. It also debulks the Tuberculous load from the body.

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### Additional Information

**Disclosures:** Authors report no conflict of interest.

**Ethical Review Board Approval:** The study was conformed to the ethical review board requirements.

**Human Subjects:** Consent was obtained by all patients/participants in this study.

**Conflicts of Interest:**

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

**Financial Relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

**Other Relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

### AUTHOR CONTRIBUTIONS

Sr. No.	Author's Full Name	Intellectual Contribution to Paper in Terms of
1	Ehtisham Ahmed	Study Design, Methodology, and Paper Writing.
2	Ahsan Aurangzeb	Data Calculation and Data Analysis.
3	Ehtisham Ahmed	Interpretation of Results.
4	Ehtisham Ahmed	Statistical Analysis.
5	Saadia Maqbool, Khadija Ehtisham	Literature Review.
6	Nusrat Shaheen	Literature Review and Quality Insurer.