

Original Research

## Outcome of Dual Stability and Decompression through Single Posterior Approach in Tuberculosis of Dorsolumbar Spine

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### ABSTRACT

**Objective:** To evaluate the outcome of dual stability and decompression through a single posterior approach in patients with tuberculosis of the dorsolumbar spine in terms of Oswestry Disability Index and Frankel Neurological Grading.

**Material and Methods:** It was a prospective cohort study involving 34 patients with tuberculosis of the dorsolumbar spine who underwent dual stability and decompression through a single posterior approach. Follow-ups were done at 2<sup>nd</sup>, 6<sup>th</sup>, 12<sup>th</sup> and 16<sup>th</sup> weeks. The outcome was assessed using the Oswestry Disability Index and Frankel Neurological Grading.

**Results:** In 34 patients, the mean age was 36.59±13.51 years. There were 20 (58.8%) males and 14 (41.2%) females. There were 9 (26.5%) patients who had dorsal spine tuberculosis, while lumbar spine TB and dorsolumbar spine TB were diagnosed in 13 (38.2%) and 12 (35.3%) patients respectively. The mean surgery time was 4.20±0.66 hours. According to the Oswestry Disability Index, before surgery, 2 (5.9%) patients had minimal disability while after 16 weeks of follow-ups, these numbers increased to 23 (67.7%) showing statistically significant improvements. According to Frankel Neurological Grading, before surgery, 3 (8.8%) patients had normal function while after 20 weeks of follow-up following surgery, 20 (58.9%) had normal functions.

**Conclusion:** Dual stability and decompression through a single posterior approach were found to have good functional and fusion outcomes according to the Oswestry Disability Index and Frankel Neurological grading.

**Keywords:** Dual stability, decompression, Frankel neurological grading, Oswestry disability index, single posterior approach, tuberculosis, dorsolumbar spine.

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## INTRODUCTION

Spinal tuberculosis remains a scourge among developing countries, especially in South Asian regions.<sup>1</sup> Around 2 million individuals are estimated to be affected by spinal TB.<sup>2</sup> Most frequently, spinal tuberculosis appears among people of young age and children.<sup>3</sup> Tuberculosis (TB) is as old as mankind.<sup>4</sup> Percival Pott was the first man to present the classic description of spinal tuberculosis in the year 1779;<sup>5</sup> hence, spinal tuberculosis is also known as Pott's disease.<sup>6,7</sup> Mycobacterium tuberculosis takes a hematogenous route to develop Pott's disease, which consequently destructs the vertebral body, intervertebral disc, pathological compression fracture, vertebral wedging, kyphoscoliosis, and spinal cord compression, which causes neurological deficits.<sup>8</sup>

Spinal tuberculosis is a frequent and serious extra-pulmonary manifestation.<sup>9,10</sup> Extra pulmonary TB (EPTB) reports in Pakistan range from one-fourth of total TB patients visiting health facilities in Rawalpindi city to one-third of patients with tuberculosis visiting GP (General Practitioner) clinics in the city of Karachi. Tuberculosis of the spine is held responsible for 50 to 60 percent of osteoarticular tuberculosis cases all over the human body.<sup>11</sup> Though the thoracolumbar junction is assumed to be more frequently involved in tuberculosis of the spine, any section of the spine could be involved.<sup>12</sup> The burden of neurological manifestations in spinal TB cases ranges between 10-and 43%.<sup>13</sup>

Spinal tuberculosis clinically presents with the majority of the symptoms, while backache is the main symptom.<sup>14</sup> Due to non-specific and vague clinical presentation of spinal TB,<sup>15</sup> the diagnosis is complex and these cases frequently present at later stages. In establishing the diagnosis and management, delays cause increased complication rates. Most patients have weakness of the lower limbs, pain, palpable masses, gibbus deformity, and kyphotic malformation in persistent cases.<sup>16</sup> Although plain radiography is a

worthy tool for diagnosing spinal TB, magnetic resonance imaging (MRI) and computed tomography (CT) are considered to be more valuable and are widely used methods for investigation. Having emerged as the gold standard, MRI offers a better diagnosis of spinal tuberculosis and assists in adopting relevant interventions.<sup>5</sup>

Spinal TB faces a variety of difficulties in its treatment. Conservative treatment options include immobilization; body casts/plaster beds, a healthy diet, and anti-TB drugs. The course of anti-TB therapy typically lasts 9-18 months.<sup>16</sup> Surgery may be needed in about one-eighth of the patients.<sup>17</sup> In the tuberculosis of the spine, surgical indications include Para-spinal abscess, massive bone destruction, large Kyphosis, progressive neurological deficit caused by compression of the spinal cord, as well as a lack of response to conventional therapy.<sup>18</sup>

Spinal tuberculosis surgery aims to cure neurological disability, repair spinal deformity, and achieve stability of the spine.<sup>19</sup> Surgery can be performed through a posterior or anterior single technique, or the integration of both. Several treatment options, comprising decompression with combined anterior and posterior spinal fusion, anterior spinal fusion alone, single posterior spinal fusion, and posterior spinal fusion after the anterior spinal fusion, have been performed to treat the tuberculosis of the spine.<sup>20</sup> Fixation and anterior decompression have long been presumed to be the gold standard regarding spinal tuberculosis treatment.<sup>21,22</sup>

A single posterior approach has become a popular choice for spinal TB treatment. Keeping in mind the effectiveness of this technique, the result of this study will help us treat spinal tuberculosis by selecting a suitable surgical treatment. The objective of the study is to evaluate the outcome of dual stability and decompression through a single posterior approach in patients with tuberculosis of the dorsolumbar spine in terms of the Oswestry

Disability Index (ODI) and Frankel Neurological Grading.

## **MATERIALS AND METHODS**

### **Study Design & Settings**

This prospective cohort study was executed at the Department of Orthopedic and Spine Surgery, Postgraduate Medical Institute, Lahore General Hospital, Lahore, Pakistan, from July 2019 to July 2020.

### **Sample & Technique**

A sample size of 34 was calculated considering the anticipated proportion of Frankel grades 4 and 5 as 92.2%.<sup>20</sup> The confidence level was kept at 95%, and the margin of error at 10%.

A purposive sampling technique was carried out for sample selection.

### **Inclusion Criteria**

Inclusion criteria were spinal TB patients of either gender, aged between 18-60 years, failing to respond to conservative treatment, and having progressive neurologic deficits along with spinal instability.

### **Exclusion Criteria**

Exclusion criteria were patients who were unfit for anesthesia and surgery based on pre-operative evaluation. Immunocompromised patients and those with uncontrolled comorbid conditions were also excluded.

### **Data Collection**

Informed and written consents were obtained from all patients. Approval from "Institutional Ethical Committee" was also obtained. Demographic information, including age and gender, was recorded for all individuals. Before initiating anti-tubercular drug treatment,

comprehensive hematological investigations, encompassing a complete blood count with erythrocyte sedimentation rate (ESR), random blood sugar, serum creatinine, and liver function tests, were conducted on all patients. Additionally, radiological investigations, consisting of an electrocardiogram (ECG), chest X-ray, X-ray spine, and MRI spine, were evaluated as part of the pre-treatment assessment.

### **Surgical Technique**

All Surgeries were performed under C-arm control. Using general anesthesia and aseptic precautions, patients were positioned prone on the spinal frame, and a posterior midline incision was made. Paravertebral muscles were retracted to insert a pedicle screw in the healthy vertebra, which was one motion segment above and one motion segment below the affected site. By avoiding the unhealthy vertebrae, the loosening of screws that might occur subsequently to abscess formation was prevented. Provisional connecting rod fixation was done on one side. After inserting the pedicle screw, decompression was performed at the diseased level. The surgical procedure commenced with the excision of the inferior part of the neighboring superior vertebra. Subsequently, the removal process included the diseased vertebra along with the upper facet and pedicle. To have clear visibility of exiting nerve roots, a part of the lamina was excised. After retracting the exiting Lumbar nerve roots, the disc, granulation tissue, and sequestered bone were removed by biopsy punch forceps, and then a double rib strut graft/tricortical iliac crest graft/cage was inserted. Specimens were taken for histopathology, culture/sensitivity, and gene expression tests. Once proper contouring was done, each side was fixed with connecting rods using pedicle screws. The wake-up test was routinely performed in every case and patients were counseled about the test before going under general anesthesia by an anesthesia team.

### Follow Up

At every follow-up, ESR and liver function tests were performed so that the disease status and toxic effects of antitubercular therapy could be monitored. The outcome was calculated using the Oswestry Disability Index (ODI) and Frankel Neurological Grading. The ODI is a valid and reliable tool that has been used in several studies to measure functional disability in patients with back dysfunction. The Frankel neurological grading is a valid tool to measure neurological function in spinal cord injury. Follow-ups were done at 2 weeks, 6 weeks, 12 weeks, and 16 weeks.

### Data Analysis

Statistical analysis was made using "Statistical Package for Social Sciences (SPSS)", version 26.0. Categorical data like gender, site of TB, ODI classification, and Frankel Neurological Grading were shown as frequency and percentages. Age was shown as mean and standard deviation.

## RESULTS

### Baseline Characteristics

In 34 patients, the mean age was 36.59±13.51

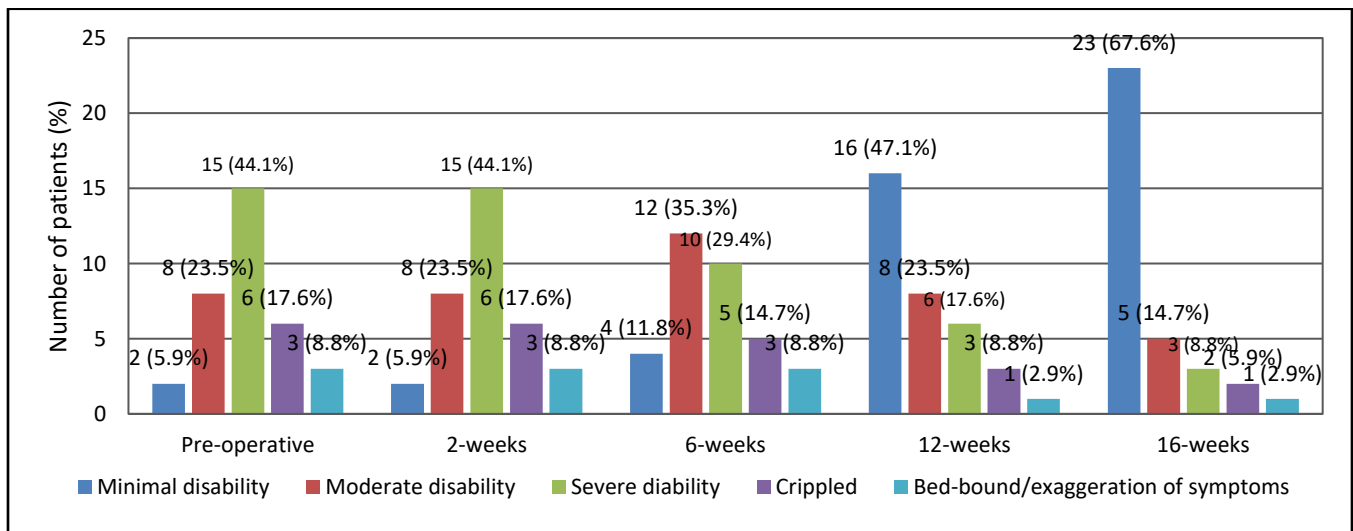
years. There were 20 (58.8%) males and 14 (41.2%) females. The mean surgery time was 4.20±0.66 hours. Baseline characteristics of patients are shown in Table 1.

**Table-1:** Base-line Characteristics (n=34)

Study variables	Frequency (%)	
Age (years)	≤30 years	15 (44.1%)
	31-50 years	11 (32.4%)
	51-60 years	8 (23.5%)
Gender	Male	20 (58.8%)
	Female	14 (41.2%)
Site of TB	Dorsal spine	9 (26.5%)
	Lumbar spine	13 (38.2%)
	Dorso-lumbar spine	12 (35.3%)

### Oswestry Disability Index (ODI)

According to ODI, minimal disability decreased among the proportion of patients during follow-ups. Severe disability assessment during follow-ups also showed a clear decrease during follow-ups. According to ODI, before surgery, 2 (5.9%) patients had minimal disability while after 16 weeks of follow-ups, these numbers increased to 23 (67.6%). The details of the assessment before surgery and after the surgery during follow-ups according to ODI are shown in Figure 1.



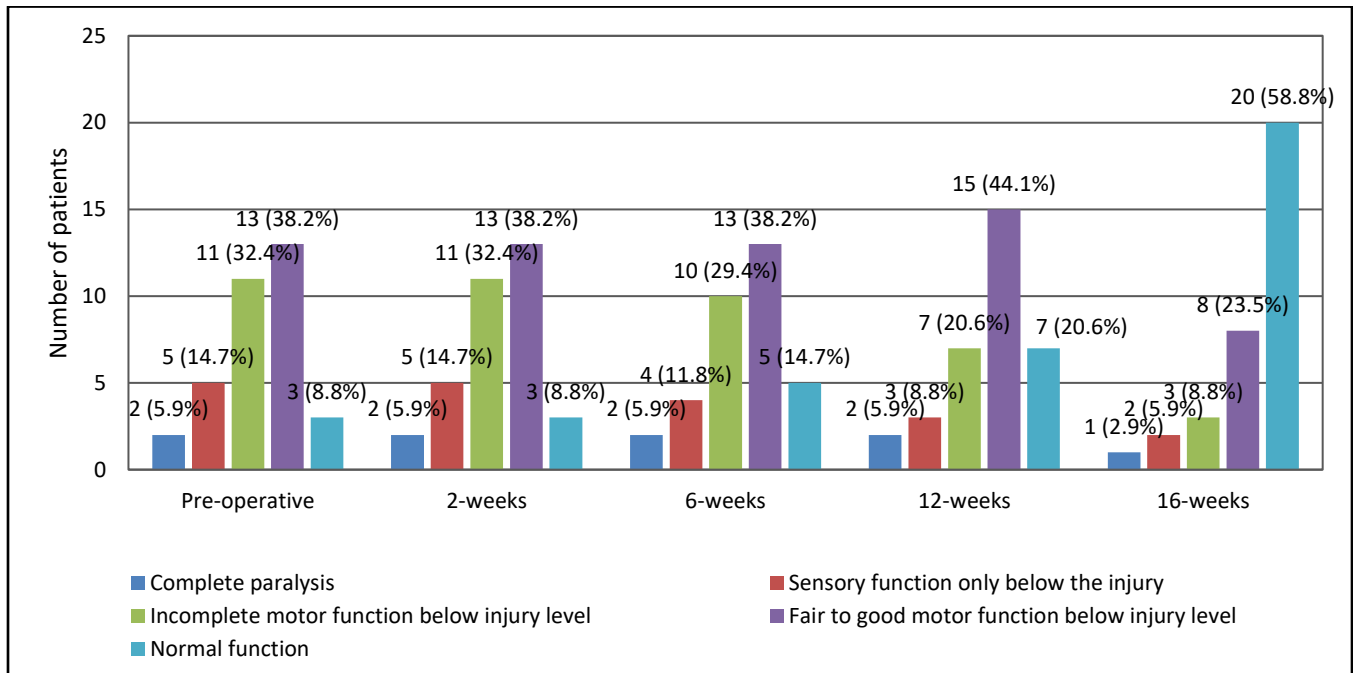
**Figure 1:** Frequency Distribution of Patients According to the Oswestry Disability Index (n=34).

### Frankel Neurological Grading

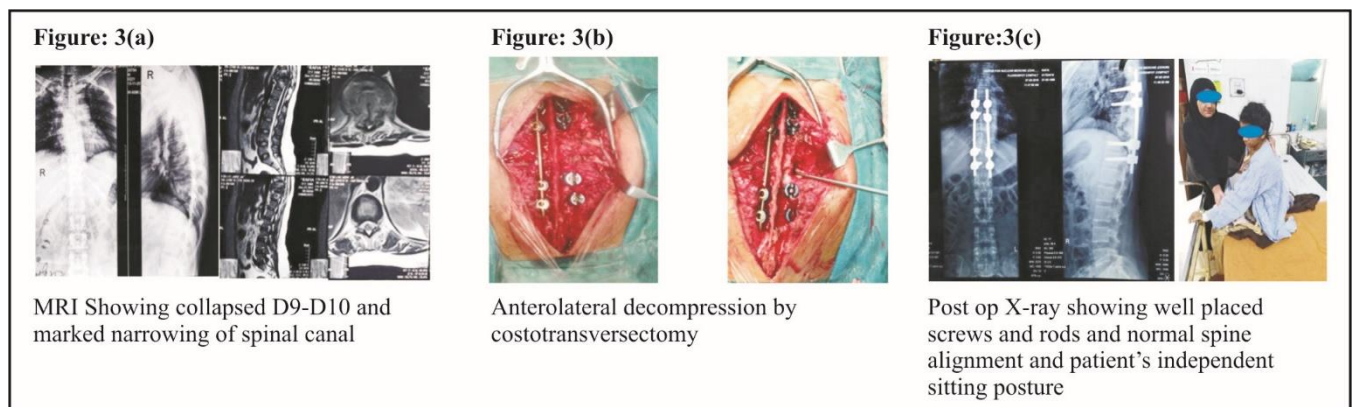
According to Frankel Neurological Grading, normal functioning improved during follow-ups. According to Frankel Neurological Grading, before surgery, 3 (8.8%) patients had normal function while after 16 weeks of follow-up following surgery, 20 (58.9%) had normal functions. The details of the frequency distribution of patients as per Frankel

Neurological Grading pre-surgery and during the follow-ups are shown in Figure 2.

Figure 3 (a-c) shows a typical cries spine involving D9-D10 she was on Frankel -3 due to marked compression over the spinal cord, drainage and anterior decompression were performed. patient improved dramatically over 16 week period with Frankel grade E.



**Figure 2:** Frequency Distribution of Patients According to Frankel Neurological Grading (n=34).



**Figure 3:** Case of a 24-year-old female patient with caries spine D9-10. (a): Pre-op, (b) Per-op, and (c) Post-op.



## DISCUSSION

The majority of patients (44.1%) in this study were below 30 years of age, while 32.4% and 23.5% of patients were 31-50 and 51-60 years of age, respectively. The average age of the patients was  $36.59 \pm 13.51$  years. The interpretation of our study is analogous to that of a survey carried out by Jain et al, who revealed that the designated age of the patients was 35.2 years.<sup>23</sup> Another study by Patidar et al also showed a similar scenario by mentioning 37.9 years as the average age of the individuals.<sup>24</sup> But the results of a study undertaken by Das et al reported that the mean age of the patients was 47.2 years.<sup>25</sup> Also, a study conducted by Jain et al highlighted that patients had an increased mean age (44.3 years).<sup>26</sup> A study done by Hanif et al showed different scenarios and reported that patients were from a young age group, as the mean age of the patients was  $24.615 \pm 12.281$  years.<sup>27</sup>

As far as the gender of the patients is concerned, the research outlined that the majority of patients (58.8%) were male and 41.2% were female. A study performed by Hanif et al revealed comparable results: the majority (69.2%) of the patients were male and 32.8% were females.<sup>27</sup> When the site of tuberculosis was identified among patients, the study found that 26.5% of cases were of the dorsal (thoracic) spine, 38.2% of the lumbar spine, and 35.3% of the dorso-lumbar spine. A study undertaken by Das et al indicated that the dorsal spine was involved in 52.8% of cases, the lumbar spine in 18.2% of patients, and the dorso-lumbar spine in 29% of patients.<sup>25</sup> Prolonged surgery time is linked with an increased risk of complications. It is significant to mention that more than half (58.8%) of patients had surgery time between 3½ and 4½ hours, while 41.2% of patients had surgery time between 4½ and 5½ hours. The mean surgery time for the patients was  $4.20 \pm 0.66$  hours. However, the results of a study carried out by Patidar et al elucidated that among patients, the mean surgery

time was 2.6 hours.<sup>24</sup> Post-operative improvement was significant, as observed in the Oswestry Disability Index. The study revealed that among patients, 67.7% had minimal or no disability, 14.7% had moderate disability, 8.8% had severe disability, 5.9% were crippled, and 2.9% were bed-bound until the last follow-up. It is important to mention that there was no mortality during the study period.

The study further disclosed that according to Frankel Neurological Grading, 5.9% of patients had complete paralysis before surgery, 14.7% had sensory function only below the injury level, 32.4% had incomplete motor function below the injury level, and 38.2% had fair to good motor function below the injury level, while 8.8% patients had normal function. But after surgery 2.9% of patients had complete paralysis, 5.9% had sensory function only below the injury level, 8.8% had incomplete motor function below the injury level, and 23.5% had fair to good motor function below the injury level, while the majority (58.9%) of the patients had normal function at final follow-up. A similar study conducted by Patidar et al revealed that, before undergoing surgery, 5% of patients had complete paralysis, 10% had sensory function exclusively below the injury level, 30% exhibited incomplete motor function below the injury level, and 45% demonstrated fair to good motor function below the injury level. Additionally, 10% of patients displayed normal function. However, post-surgery, the scenario changed, with 5% of patients showcasing incomplete motor function below the injury level, 20% demonstrating fair to good motor function below the injury level, and the majority (75%) exhibiting normal function during the final follow-up.<sup>24</sup>

Being a single-center study conducted on a small sample size was one of the limitations of this study. The follow-up duration of 16 weeks was relatively modest so further trials are necessary encompassing long follow-up evaluations.

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## CONCLUSION

Dual stability and decompression through a single posterior approach were found to have good functional and fusion outcomes according to the Oswestry Disability Index and Frankel Neurological grading.

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### Additional Information

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

**Institutional Ethical Review Board Approval:** The study complies with the ethical review board requirements.

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

**Conflict 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 relationship 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 no other relationships or activities could appear to have influenced the submitted work.

**Data Sharing Statement:** For data sharing, interested researchers can contact the corresponding authors.

### AUTHORS CONTRIBUTIONS:

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Adeel Hamid	1. Study design and methodology.
2.	Muhammad Shakeel	2. Paper writing.
3.	Waqar Ahmed	3. Data collection and calculations.
4.	Khizer Ghalib	4. Analysis of data and interpretation of results.
5.	Muhammad Khalid Syed	5. Literature review and referencing.
6.	Muhammad Qasim	6. Editing and quality insurer.