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Clinical Profile and Disease Characteristics of Thoracolumbar Spinal Tuberculosis Managed Surgically

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Abstract
Background: *Tuberculosis (TB), particularly spinal TB affecting the thoracolumbar region, can cause severe deformity and neurological deficits if not managed appropriately. The purpose of the study was to evaluate the clinical profile, radiological features, and surgical outcomes of patients with thoracolumbar spinal tuberculosis.*
Methods: *This prospective interventional study at the Department of Orthopaedic Surgery, Dhaka Medical College Hospital, Dhaka, Bangladesh (July 2017–June 2019) included 18 patients with thoracolumbar spinal tuberculosis who underwent posterior decompression and pedicle screw fixation, with outcomes assessed by ASIA grading, Modified Macnab criteria, and radiographs. Data were analyzed with SPSS v20.0 ($p < 0.05$).*
Results: *Among 18 surgically managed thoracolumbar spinal tuberculosis patients, the mean age was 37.6 ± 15.2 years, with a female predominance (66.7%). Pain was the most common symptom (94.4%), followed by weakness and gibbus deformity (38.9% each). Lesions predominantly involved the dorsal spine (61.1%), most commonly at D9–D10 and L1–L2 (16.7% each). Postoperatively, neurological status improved significantly, mean kyphotic angle decreased from 28.7° ± 4.5° to 12.5° ± 3.5°, and functional outcomes were excellent or good in 94.5% of patients.*
Conclusion: *Surgical management of thoracolumbar spinal tuberculosis effectively restores neurological function, corrects spinal deformity, and achieves excellent functional outcomes.*
Key words: *Clinical Profile, Disease Characteristics, Thoracolumbar Tuberculosis.*

I. Introduction

Tuberculosis (TB), caused by Mycobacterium tuberculosis, is among the oldest known infectious diseases and continues to be a major global health concern, causing over 2 million deaths annually [1,2]. Extra-pulmonary manifestations of TB account for 15–20% of all cases [3], with spinal involvement, commonly referred to as Pott's disease, being one of the most frequently observed forms. This condition can result in severe clinical consequences, including marked spinal deformity and neurological deficits such as complete paraplegia or tetraplegia [3,4]. The thoracolumbar region, particularly the lower thoracic and upper lumbar vertebrae, is most commonly affected. Typical features of spinal TB include destruction of intervertebral discs and adjacent vertebral bodies, collapse of vertebral elements, and anterior wedging, leading to the characteristic spinal angulation and gibbus deformity [5].

Patients with spinal tuberculosis often present with pain, weakness, paraplegia, and gibbus deformity, which can progress to complete neurological compromise if left untreated [3,4]. Surgical intervention is indicated in cases of significant spinal instability or worsening neurological deficits with evidence of cord compression or structural deformity [6,7]. Severe kyphosis is another frequent complication associated with spinal TB, which not only affects cosmetic appearance but may also lead to psychological distress, cardiorespiratory complications, and delayed onset paraplegia [8].

The diagnosis of spinal tuberculosis is frequently challenging, resulting in potential delays in management. Timely recognition and treatment are essential to prevent irreversible neurological damage and minimize spinal deformities [6]. While antitubercular chemotherapy remains the primary treatment modality, surgery plays a vital role in managing deformities, paravertebral abscesses, instability, and neurological compromise [9]. The surgical approach aims to thoroughly remove infectious lesions, provide standardized

antitubercular therapy, relieve nerve compression, restore neurological function, correct kyphotic deformity, and stabilize the spinal column [10].

Despite these developments, there is still no universally accepted protocol for the surgical management of thoracolumbar spinal tuberculosis [10]. Limited regional studies exist, and comprehensive data combining clinical, radiological, and functional outcomes, especially regarding kyphosis correction and neurological recovery, remain scarce [11-14]. This highlights the need for further research assessing surgical outcomes in thoracolumbar spinal TB to provide evidence-based guidance for clinical practice.

Although several studies have reported on surgical management and outcomes of spinal tuberculosis, most have focused on either radiological correction, neurological recovery, or functional improvement in isolation. Very few investigations have integrated clinical presentation, imaging findings, and postoperative functional outcomes to provide a holistic understanding of thoracolumbar spinal TB. Moreover, regional data, particularly from local populations, remain limited, making it difficult to generalize findings or develop standardized management protocols. To address these gaps, the purpose of the study is to evaluate the clinical profile, radiological features, and surgical outcomes of patients with thoracolumbar spinal tuberculosis.

Objective

- To evaluate the clinical profile, radiological features, and surgical outcomes of patients with thoracolumbar spinal tuberculosis.

II. Methodology & Materials

This prospective interventional study was conducted at the Department of Orthopaedic Surgery, Dhaka Medical College Hospital, and selected private hospitals in Dhaka, Bangladesh, between July 2017 and June 2019. A total of 18 patients diagnosed with thoracolumbar spinal tuberculosis were included to evaluate their clinical profile, radiological features, and surgical outcomes.

Inclusion Criteria:

- Thoracolumbar spinal tuberculosis with neurological deficits, including paraplegia, worsening motor power, spasticity, or severe paraplegia.
- Age between 16 and 75 years.
- Both sexes.
- Unstable spine secondary to spinal tuberculosis.

Exclusion Criteria:

- Patients managed conservatively without surgery.
- Patients with significant comorbidities increasing operative risk.
- Spinal tuberculosis involving regions other than the thoracolumbar spine.

Ethical Considerations:

Ethical approval was obtained from the Ethical Review Committee of Dhaka Medical College. Informed written consent was obtained from all patients or their legal guardians after explaining the study purpose, surgical procedure, and expected outcomes.

III. Data Collection and Follow-up:

Demographic data, clinical presentation, radiological findings, operative details, and follow-up outcomes were recorded using a structured data collection form. Preoperative assessment included history, neurological examination, and imaging studies. Postoperative follow-up was performed at 1, 3, and 6 months. Neurological status was graded using the ASIA system, functional outcomes were evaluated using the Modified Macnab criteria, and radiographs were obtained to assess vertebral fusion, kyphotic angle correction, and instrumentation integrity.

Surgical Procedure:

All patients underwent posterior decompression and internal fixation under general anesthesia in the prone position. Pedicle screws were inserted two levels above and below the involved vertebrae under C-arm guidance. Posterior decompression was performed to remove pus, debris, and necrotic tissue. Titanium rods and interconnecting bars were fixed, and the wound was closed in layers with a drain in situ.

Postoperative Management:

Patients continued antitubercular therapy for 12 months. Early mobilization and physiotherapy were initiated, including isometric exercises and ambulation with a brace. Patients were discharged with instructions regarding brace use, exercises, daily activities, and scheduled follow-up visits.

Outcome Assessment:

Neurological recovery was assessed using the ASIA grading system, and functional outcomes were categorized according to the Modified Macnab criteria. Radiographs were used to monitor deformity correction and implant integrity. Outcomes were classified as satisfactory (excellent or good) or unsatisfactory (fair or poor).

IV. Data Analysis:

Data were analyzed using SPSS version 20. Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. Fisher's exact test was used for associations, with $p < 0.05$ considered statistically significant.

V. Results

Table 1: Demographic Characteristics of the Study Participants (n = 18)

Variable		Frequency	Percent (%)
Age (years)	≤20	3	16.7
	21–30	6	33.3
	31–40	0	0.0
	41–50	5	27.8
	51–60	3	16.7
	>60	1	5.6
Gender	Male	6	33.3
	Female	12	66.7
Occupational Status	Manual Worker	3	16.7
	Businessmen	2	11.1
	Service Holder	4	22.2
	Housewife	7	38.9
	Student	2	11.1

The mean age of the study participants was 37.6 ± 15.2 years (range 16–75). Six patients (33.3%) were aged 21–30 years, five patients (27.8%) were 41–50 years, three patients (16.7%) were ≤20 years, three patients (16.7%) were 51–60 years, and one patient (5.6%) was older than 60 years. Females predominated with 12 patients (66.7%), while six patients (33.3%) were male. Regarding occupational status, seven patients (38.9%) were housewives, four patients (22.2%) were service holders, three patients (16.7%) were manual workers, and two patients each (11.1%) were businessmen and students.

Table 2: Clinical Presentation of the Study Participants (n = 18)

Clinical Presentation	Frequency	Percentage (%)
Weakness	7	38.9
Gibbus	7	38.9
Pain	17	94.4
Weight Loss	4	22.2
Paraplegia	5	27.8
Difficulty in Walking	2	11.1

Pain was the most common presenting symptom, observed in 17 patients (94.4%). Weakness and gibbus were present in seven patients each (38.9%). Paraplegia was seen in five patients (27.8%), weight loss in four patients (22.2%), and difficulty in walking in two patients (11.1%).

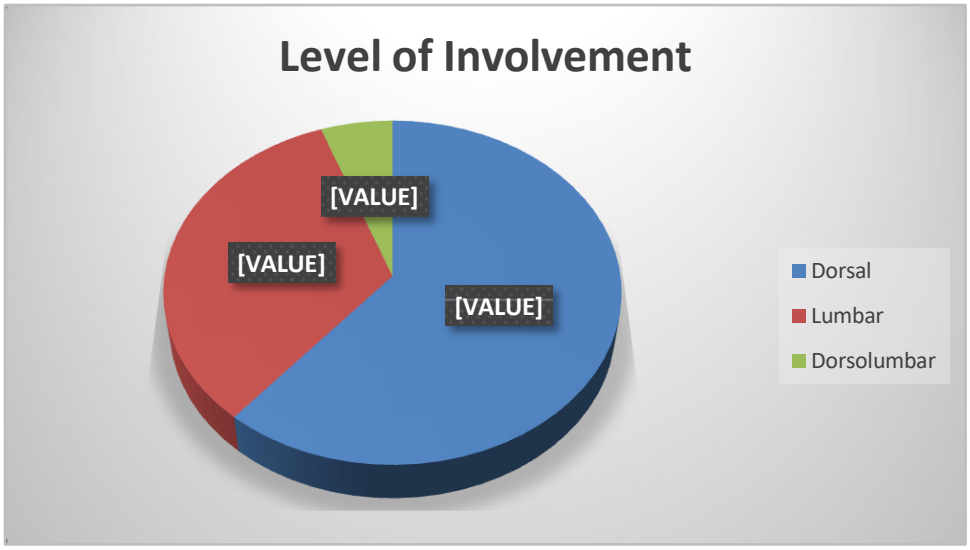

Figure 1: Distribution of Lesion Levels in the Study Participants (n = 18)

The majority of lesions were located in the dorsal spine, affecting 11 patients (61.1%), followed by the lumbar spine in six patients (33.3%). Only one patient (5.6%) had dorsolumbar involvement.

Table 3: Vertebral Levels Affected in the Study Participants (n = 18)

Location	Frequency	Percentage (%)
D6-D7	2	11.1
D9-D10	3	16.7
D9,D10,D12	1	5.6
D10-D11	2	11.1
D11-D12	2	11.1
D10,D11,D12	1	5.6
D12-L1	1	5.6
L1-L2	3	16.7
L2-L3	1	5.6
L3-L4	1	5.6
L4-L5	1	5.6
Total	18	100.0

The most commonly involved vertebral levels were D9–D10 and L1–L2, each affecting three patients (16.7%). Two patients (11.1%) had D6–D7 involvement, two patients (11.1%) had D10–D11 involvement, and two patients (11.1%) had D11–D12 involvement. Single patients (5.6% each) had involvement of D9,D10,D12; D10,D11,D12; D12–L1; L2–L3; L3–L4; and L4–L5.

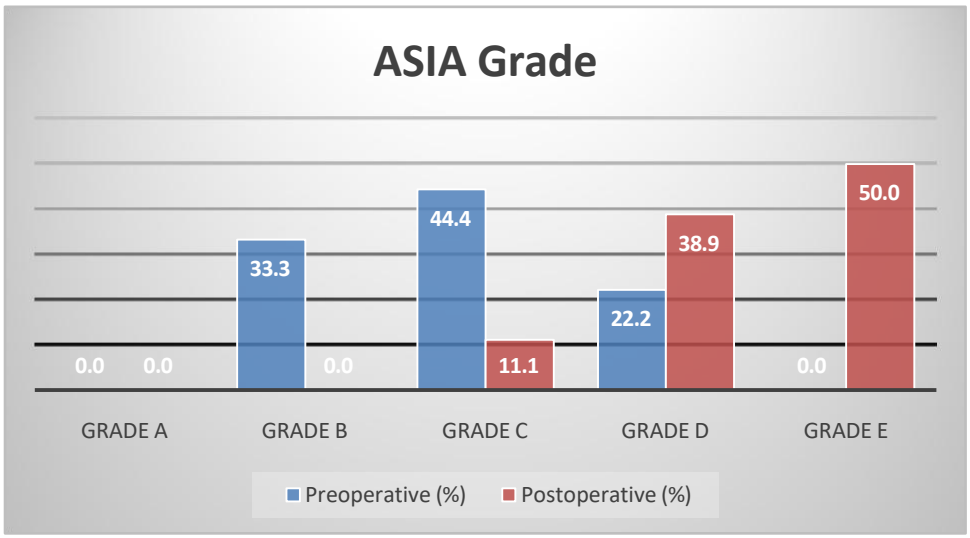

Figure 2: Preoperative and Postoperative Neurological Status (ASIA Grade, n = 18)

Preoperatively, eight patients (44.4%) were ASIA grade C, six patients (33.3%) were grade B, and four patients (22.2%) were grade D. Postoperatively, nine patients (50.0%) improved to grade E, seven patients (38.9%) to grade D, and two patients (11.1%) remained grade C. No patients were grade A pre- or postoperatively.

Table 4: Pre- and Postoperative Kyphotic Angle of the Study Participants (n = 18)

	Mean ± SD
Preoperative K Angle	28.7 ± 4.5
Postoperative K Angle	12.5 ± 3.5

The mean preoperative kyphotic angle was 28.7° ± 4.5°, which decreased to 12.5° ± 3.5° postoperatively.

Table 5: Functional and Final Outcomes of the Study Participants (n = 18)

Variable		**Frequency**	**Percentage (%)**
Functional Outcome	Excellent	14	77.8
	Good	3	16.7
	Fair	1	5.6
	Poor	0	0.0
Final Outcome	Satisfactory	17	94.4
	Unsatisfactory	1	5.6

Functional outcomes according to the Modified Macnab criteria were excellent in 14 patients (77.8%), good in three patients (16.7%), fair in one patient (5.6%), and none had poor outcomes. Overall, 17 patients (94.4%) achieved satisfactory final outcomes, while one patient (5.6%) had an unsatisfactory result.

VI. Discussion

In this prospective interventional study conducted at the Department of Orthopaedic Surgery, Dhaka Medical College Hospital, and selected private hospitals in Dhaka, the majority of patients with thoracolumbar spinal tuberculosis presented with pain, weakness, and gibbus deformity, most commonly affecting the D9–D10 and L1–L2 vertebral levels. Surgical management with posterior decompression and pedicle screw fixation led to significant neurological improvement, kyphotic angle correction, and predominantly satisfactory functional outcomes, highlighting the effectiveness of this approach in managing thoracolumbar spinal TB.

The demographic characteristics of the present study indicate that thoracolumbar spinal tuberculosis predominantly affects young to middle-aged adults, with a female predominance. The mean age of participants was 37.6 ± 15.2 years, with the highest proportion in the 21–30-year age group (33.3%). These findings are comparable with Garg et al.[15], who reported the largest proportion of spinal tuberculosis cases in the 21–30-year age group (33%) in a study of 1,652 patients. Similarly, Panthi et al.[16] observed a mean age of 39.9 ± 14.4 years in patients undergoing surgical treatment for thoracic and lumbar spinal tuberculosis. Female patients accounted for 66.7% of the cohort, while males comprised 33.3%, consistent with Ahmad et al.[17], who reported the same female-to-male ratio in thoracolumbar spinal tuberculosis. Occupational distribution revealed that most patients were housewives (38.9%) and service holders (22.2%), highlighting involvement of economically active individuals, in line with Ahmed et al.[18], who reported a mean age of 38.6 ± 12.7 years and emphasized that spinal tuberculosis commonly affects working-age adults. Overall, these findings indicate that thoracolumbar spinal tuberculosis disproportionately affects young to middle-aged females.

Clinically, pain was the most frequent presenting symptom, observed in 17 patients (94.4%), followed by weakness and gibbus deformity in seven patients each (38.9%). Paraplegia was noted in five patients (27.8%), weight loss in four patients (22.2%), and difficulty in walking in two patients (11.1%). These results are consistent with Patil et al.[19], who reported back pain in 89.5% and weakness in 34.3% of spinal tuberculosis cases, and Turgut et al.[20], who noted leg weakness in 69% and gibbus deformity in 46% of patients, supporting the prevalence of pain, neurological deficits, and spinal deformity as primary clinical features.

Analysis of lesion distribution revealed the dorsal spine to be the most commonly affected region (61.1%), followed by the lumbar spine (33.3%) and dorsolumbar involvement (5.6%). This pattern aligns with Patil et al.[19], who reported dorsal involvement in 61.1%, lumbar in 27.5%, and dorsolumbar in 6% of cases, and Srinivasa et al.[21], who observed thoracic spine involvement in 40%, lumbar in 28.5%, and thoracolumbar in 8.5% of surgically treated cases. The dorsal predominance may reflect the anatomical and biomechanical susceptibility of the thoracic region, including its relatively narrow canal and segmental vascular supply.

Regarding vertebral levels affected, the lower thoracic and upper lumbar regions were most commonly involved, with D9–D10 and L1–L2 each affecting three patients (16.7%), followed by D10–D11, D11–D12, and D6–D7 in two patients each (11.1%). Single patients (5.6%) had multilevel or noncontiguous involvement. This distribution is consistent with Rajasekaran et al.[22], who noted that the thoracolumbar junction (T9–L2) is most frequently affected, reflecting biomechanical vulnerability at the transition zone.

Preoperative neurological assessment showed most patients in ASIA grade C (44.4%), followed by grade B (33.3%) and grade D (22.2%). Postoperatively, 50.0% improved to grade E, 38.9% to grade D, and 11.1% remained grade C. No patient was grade A pre- or postoperatively. These findings are consistent with Islam et al.[23], who reported that the majority of patients improved to ASIA grades D or E after surgery, and Afridi et al.[24], who noted neurological improvement in 95.2% of surgically treated patients, highlighting the efficacy of surgical intervention in restoring neurological function.

The mean preoperative kyphotic angle was 28.7° ± 4.5°, which decreased to 12.5° ± 3.5° postoperatively, demonstrating significant correction of spinal deformity. Dalal et al.[25] reported similar findings, with a preoperative kyphotic angle of 27.45° improving to 6.9° at 1-year follow-up in surgically treated thoracolumbar tuberculosis patients, emphasizing the effectiveness of posterior decompression and instrumentation in correcting deformity.

Functional outcomes were excellent in 14 patients (77.8%), good in 3 patients (16.7%), fair in 1 patient (5.6%), and poor outcomes were not observed. Overall, 17 patients (94.4%) achieved satisfactory final outcomes. These results are in line with Huang et al.[26], who reported excellent or good functional recovery in the majority of patients following posterior modified transfacet debridement and instrumentation, demonstrating that surgical management reliably restores both neurological function and functional status in thoracolumbar spinal tuberculosis.

VII. Limitations of the study

The study had a few limitations:

- Small sample size, limiting the generalizability of the findings.
- Short duration of follow-up, restricting long-term outcome assessment.
- High cost of implants, which may affect the accessibility and applicability of the surgical approach.

VIII. Conclusion

Thoracolumbar spinal tuberculosis is a significant cause of spinal deformity and neurological deficits. In this study, patients most commonly presented with pain, neurological weakness, and gibbus deformity, with lesions predominantly affecting the dorsal spine and lower thoracic to upper lumbar vertebrae. Surgical management led to marked neurological improvement, effective correction of kyphotic deformity, and excellent to good functional outcomes in the majority of patients, demonstrating that timely surgical intervention provides substantial clinical and functional recovery in thoracolumbar spinal tuberculosis.

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