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Surgical Outcome of TB Spine Treated by Decompression, Stabilization & Fusion by Bone Graft with Instrumentation

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Abstract

Background: Tuberculosis (TB) remains a primary global health concern, with Bangladesh ranking among the top ten high-burden countries. Spinal TB, or Pott's disease, accounts for 1-3% of all TB cases and can cause severe morbidity, including vertebral collapse and neurological deficits. Management involves anti-tubercular chemotherapy and surgery in severe cases. Initially used for degenerative conditions, TLIF has shown promise in spinal TB treatment by ensuring adequate debridement, spinal stability, and improved neurological outcomes. Recent studies suggest TLIF effectively corrects deformities and promotes fusion, making it a viable surgical approach for managing spinal TB.

Aim of the study: This study aims to evaluate the surgical outcomes of Bangladeshi patients with spinal TB treated using the TLIF procedure.

Methods: This retrospective observational study analyzed surgical outcomes in 25 patients with spinal tuberculosis (TB) treated with Transforaminal Lumbar Interbody Fusion (TLIF) at Bangabandhu Sheikh Mujib Medical University Dhaka, Bangladesh. Inclusion criteria required TB confirmation via MRI, CT, or biopsy, TLIF as the primary intervention, and at least 12 months of follow-up. Surgery involved pedicle screw fixation, infected tissue debridement, interbody cage placement, and posterior instrumentation. Functional and neurological outcomes were assessed using ASIA, VAS, and ODI scores. Data analysis was conducted using SPSS version 26.0, with paired t-tests and chi-square tests employed. A p-value <0.05 was considered statistically significant.

Result: The study evaluated 25 spinal TB patients treated with TLIF, with most aged 21-60 years and a male predominance (72%). Preoperatively, 32% had severe neurological impairment (ASIA A/B), while

16% had normal function (ASIA E). Postoperative assessments showed significant improvements in pain and disability scores, with severe pain (VAS 7-10) decreasing from 64% to 4% and minimal disability (ODI 0-20%) increasing from 4% to 60% ($p<0.05$). Complications occurred in 28% of cases, mainly infections (12%) and implant failure (8%). Despite this, 52% reported excellent and 32% good outcomes, supporting TLIF's effectiveness in spinal TB management.
Conclusion: Transforaminal Lumbar Interbody Fusion (TLIF) effectively improves neurological function, pain, and disability in spinal tuberculosis (TB) patients. Severe pain decreased from 64% to 4%, and minimal disability increased from 4% to 60% ($p<0.05$). Despite a 28% complication rate, TLIF remains a viable option for stabilization and functional recovery in TB spine cases.
Keywords: Tuberculosis (TB) Spine, Transforaminal Lumbar Interbody Fusion (TLIF), and Outcome.

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INTRODUCTION

Tuberculosis (TB) remains a formidable global health challenge, with an estimated 10 million people affected worldwide in 2020, of whom 89% were adults. Bangladesh ranks among the top ten countries with the highest TB burden, reporting 267,143 new and retreatment cases in 2018 alone. While pulmonary TB is the most prevalent form, extrapulmonary manifestations, particularly spinal tuberculosis (Pott's disease), pose significant health concerns due to their potential to cause severe morbidity [1,2]. Spinal TB accounts for approximately 1-3% of all TB cases and represents about 50% of all skeletal TB cases. The disease primarily affects the anterior aspects of the vertebral bodies, leading to osteolysis, vertebral collapse, and kyphotic deformities. If left untreated, these structural changes can result in neurological deficits, including paraplegia, due to spinal cord compression [3]. In Bangladesh, spinal TB predominantly affects younger individuals, with the usual age of presentation being in the second and third decades of life. The socio-demographic characteristics of these patients often include low socioeconomic status, malnutrition, and limited access to healthcare facilities, which can delay diagnosis and treatment [4]. The management of spinal TB involves a combination of anti-tubercular chemotherapy and surgical intervention. While chemotherapy remains the cornerstone of treatment, surgery is indicated in cases with significant neurological deficits, spinal instability, or severe kyphotic deformities. Surgical approaches have evolved over the years, with posterior-only approaches gaining popularity due to their ability to achieve adequate debridement, decompression, and stabilization [3,5]. Transforaminal Lumbar Interbody Fusion (TLIF) is a posterior surgical technique initially developed for degenerative lumbar conditions. Its application in spinal TB has been explored in recent years. It offers the advantages of direct visualization of the disc space, effective debridement, and restoration of spinal stability through interbody fusion. Studies have demonstrated that TLIF can effectively correct spinal deformities, maintain correction, and promote bone graft fusion in spinal TB patients [3]. A study by Zhang et al. evaluated the efficacy of posterior transforaminal debridement and interbody fusion with instrumentation in treating thoracic spinal TB [6]. The results indicated that this approach effectively eradicates infection, achieves spinal stability, and improves neurological function. Similarly, another study reported that posterior transforaminal lumbar interbody fusion combined with lesion clearance and chemotherapy via catheter yielded satisfactory clinical and radiological outcomes in patients with active thoracolumbar spinal TB [7–9]. Despite these advancements, data on the outcomes of TLIF in the Bangladeshi population are limited. Given the high burden of TB in Bangladesh and the unique socio-demographic characteristics of its population, it is imperative to assess the efficacy and safety of TLIF in this context. Understanding the surgical outcomes will aid in optimizing treatment protocols and improving patient care. This study aims to evaluate the surgical outcomes of Bangladeshi patients with spinal TB treated using the TLIF procedure.

METHODOLOGY & MATERIALS

This is a retrospective observational study analyzing the surgical outcomes of patients with spinal tuberculosis (TB) treated with Transforaminal Lumbar Interbody Fusion (TLIF). The study was conducted at Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from June 2021 to July 2022. During the study period, 25 patients with spinal TB underwent TLIF surgery. The study was approved by the Institutional Review Board (IRB) of and an informed consent was obtained from all patients.

Inclusion Criteria:

- Patients diagnosed with spinal TB confirmed by MRI, CT, or biopsy.
- Patients who underwent TLIF as the primary surgical intervention.
- Patients with available preoperative and postoperative follow-up data for at least 12 months.
- Patients aged 18 years or older.

Exclusion Criteria:

- Patients with incomplete medical records.
- Patients undergoing other surgical procedures instead of TLIF.
- Patients with other spinal pathologies unrelated to TB.
- Patients lost to follow-up.

Surgical Procedure:

Under general anesthesia, patients were placed in the prone position on a spinal table. The affected vertebral levels were confirmed using fluoroscopy, ensuring accurate localization. A midline posterior approach was utilized to expose the involved segment. To maintain stability during decompression, pedicle screws were placed bilaterally, and a temporary rod was secured on one side. Depending on the surgical requirement, either hemi-zygapophysial or bilateral zygapophysial joints were preserved while minimizing lamina resection. The infected granulation tissue was meticulously debrided, and any abscess present was drained through the inter-transverse space. Vertebral reconstruction was performed using an interbody cage filled with autograft and/or allograft. Posterior instrumentation was then applied with pedicle screws and rods, followed by controlled compression to correct kyphotic deformity, utilizing a zygapophysial joint bone graft or lamina bone graft for additional structural support. An intraoperative biopsy was obtained and sent for histopathological examination to confirm the diagnosis and guide further management. All intraoperative and postoperative complications were meticulously recorded.

Data Collection and Outcome Measures: Data collection encompassed comprehensive patient demographics, including age, sex, and underlying comorbidities, and a detailed clinical presentation assessment. Functional and neurological status was evaluated preoperatively and postoperatively using the American Spinal Injury Association (ASIA) score, Visual Analog Scale (VAS) for pain, and Oswestry Disability Index (ODI) for functional impairment. Surgical parameters such as intraoperative blood loss, operative duration, and complications were meticulously documented. Additionally, radiological assessments were performed to confirm fusion status, ensuring the evaluation of postoperative structural integrity and surgical outcomes.

Statistical Analysis: All statistical calculations were performed using SPSS version 26.0 (SPSS, Inc., Chicago, IL, USA). Descriptive statistics were employed to summarize baseline patient characteristics.

To assess changes in scores between preoperative and postoperative time points, paired t-tests were used for normally distributed data. Chi-square tests were utilized to examine associations between categorical variables. A p-value of <0.05 was considered statistically significant for all analyses.

RESULTS

The study analyzed the surgical outcomes of tuberculosis (TB) spine patients treated with the TLIF procedure. The majority of patients were between 21-40 years (40%) and 41-60 years (36%), with a male predominance (72%). Preoperatively, ASIA scores indicated significant neurological impairment, with 32% of patients classified as ASIA A or B, while 16% had an ASIA E score (Table 2). Postoperatively, there was a significant improvement in pain and disability scores, as reflected in the Visual Analog Scale (VAS) and Oswestry Disability Index (ODI). The proportion of patients with severe pain (VAS 7-10) dropped from 64% to 4%, and those with minimal disability (ODI 0-20%) increased from 4% to 60% (p<0.05). Complications were observed in 28% of cases, with infection (12%) and implant failure (8%) being the most common (Table 5). Despite this, postoperative satisfaction was high, with 52% reporting excellent outcomes and 32% reporting good results (Figure 2). These findings highlight the effectiveness of TLIF in improving functional outcomes and quality of life in TB spine patients.

Table 1: Patient Age Distribution

Age Range	Frequency (n)	Percentage (%)
0-20	2	8.00
21-40	10	40.00
41-60	9	36.00
61≥	4	16.00

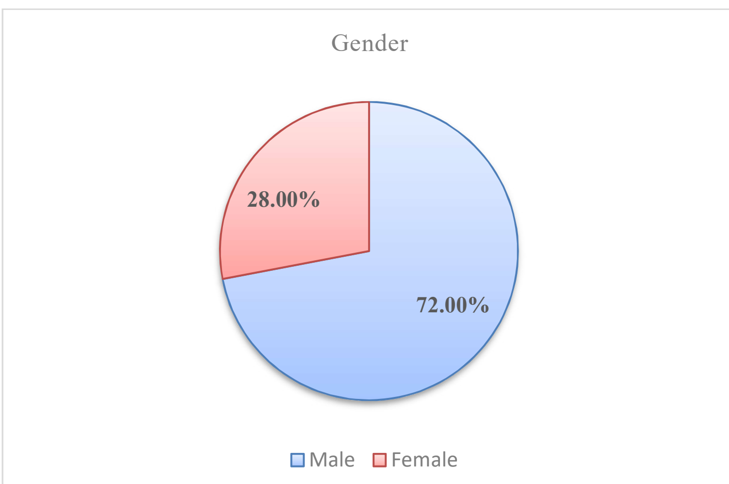

Figure 1: Gender Distribution of Patients

Table 2: Preoperative ASIA Score Classification

ASIA Score	Frequency (n)	Percentage (%)
A	3	12.00
B	5	20.00
C	6	24.00
D	7	28.00
E	4	16.00

Table 3: Comparison of Preoperative and Postoperative VAS Scores

VAS Score Range	Pre-op Frequency		Post-op Frequency		P-value
	n	%	n	%	
0-3	2	8.00	18	72.00	<0.05

4-6	7	28.00	6	24.00	
7-10	16	64.00	1	4.00	

Table 4: Comparison of Preoperative and Postoperative ODI Scores

ODI Score Range	Pre-op Frequency		Post-op Frequency		P-value
	n	%	n	%	
0-20%	1	4.00	15	60.00	<0.05
21-40%	4	16.00	7	28.00	
41-60%	9	36.00	3	12.00	
61-80%	7	28.00	0	0.00	
81-100%	4	16.00	0	0.00	

Table 5: Postoperative Complications

Complication Type	Frequency (n)	Percentage (%)
Infection	3	12.00
Implant Failure	2	8.00
Neurological Deficit	1	4.00
Other	1	4.00

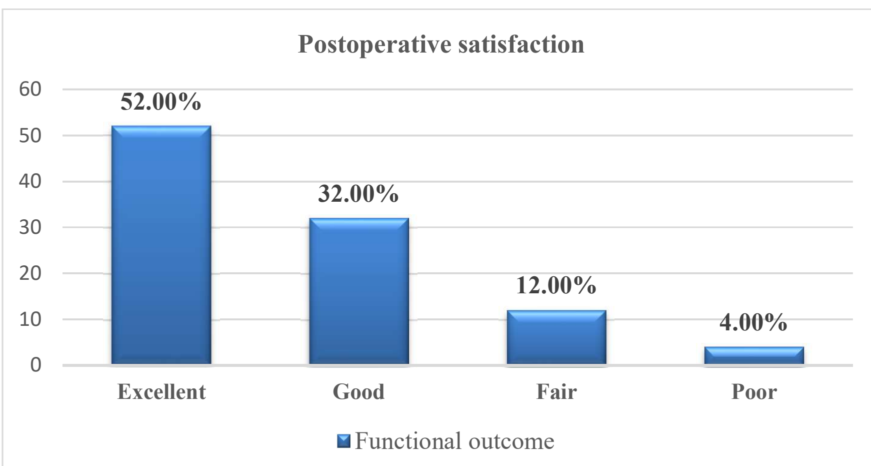

Figure 2: Post-operative Outcome to the study (N=25)

DISCUSSION

The findings of this study indicate that Transforaminal Lumbar Interbody Fusion (TLIF) is an effective surgical intervention for spinal tuberculosis (TB). It significantly improves neurological function, pain levels, and disability scores while maintaining an acceptable complication rate. These results align with existing literature supporting TLIF as a viable option for managing spinal TB in cases requiring surgical intervention. The patient cohort in this study exhibited a predominance of individuals in the 21–40-year (40%) and 41–60-year (36%) age groups, consistent with global epidemiological trends showing that TB disproportionately affects young and middle-aged adults [10]. The male predominance (72%) also aligns with studies suggesting a higher prevalence of TB in males due to increased occupational exposure and immunological factors [11]. Neurologically, the preoperative ASIA score distribution highlighted significant deficits, with 32% of patients in the ASIA A or B categories. Postoperatively, substantial neurological recovery was observed, demonstrating the efficacy of TLIF in decompression and stabilization, consistent with prior research by Byvaltsev VA et al. (2022), which reported significant ASIA score improvements following TLIF in spinal TB cases [12]. Pain and functional disability are significant concerns in spinal TB patients. The preoperative Visual Analog Scale (VAS) and Oswestry

Disability Index (ODI) scores demonstrated substantial pain and disability, with 64% of patients reporting severe pain (VAS 7-10) and 80% experiencing moderate to severe disability (ODI >40%). Postoperatively, there was a significant improvement in both metrics ($p<0.05$), with 72% of patients achieving minimal pain (VAS 0-3) and 60% experiencing only mild disability (ODI 0-20%). Similar improvements have been reported by Rajasekaran et al. (2016), who demonstrated that early surgical intervention in spinal TB led to rapid pain relief and improved function [13]. The fusion achieved via TLIF provides structural stability, reducing pain and preventing progressive deformity [14]. The overall complication rate in this study was 28%, with infection (12%) and implant failure (8%) being the most frequent issues. This complication profile is comparable to other surgical series on spinal TB, where infection rates range from 8-15% [15]. While the TLIF approach minimizes surgical trauma compared to traditional anterior-posterior approaches, infection remains a concern, particularly in immunocompromised TB patients. Prophylactic antibiotic protocols and meticulous surgical techniques mitigate these risks [16]. Patient satisfaction levels were high, with 52% reporting excellent and 32% good outcomes. These findings correlate with studies emphasizing that early surgical intervention in spinal TB improves long-term quality of life by preventing severe kyphotic deformity and neurological deterioration [17]. The fusion provided by TLIF ensures better spinal alignment and stability, thereby contributing to better postoperative satisfaction scores.

Limitations of the study: This study is limited by its retrospective design and relatively small sample size, which may affect generalizability. The follow-up duration was short, preventing long-term outcome assessment. Additionally, variability in surgical techniques and patient comorbidities may have influenced results. Further multicenter, long-term studies are needed to validate these findings.

CONCLUSION

This study demonstrates that Transforaminal Lumbar Interbody Fusion (TLIF) is a practical surgical approach for managing spinal tuberculosis (TB). Significant improvements were observed in neurological function, pain levels, and disability scores, with a marked reduction in severe pain (VAS 7-10) from 64% to 4% and an increase in minimal disability (ODI 0-20%) from 4% to 60% ($p<0.05$). Despite a 28% complication rate, including infection (12%) and implant failure (8%), overall patient satisfaction was high. These findings support TLIF as a viable option for stabilizing the spine, enhancing functional recovery, and improving the quality of life in TB spine patients.

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Ethical approval: The study was approved by the Institutional Ethics Committee.

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