Original Research

Lost Time, Lost Function: The Impact of Delayed Referral and Surgical Timing on Outcomes in Caries Spine in a Developing Country

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ABSTRACT

Objective: In Pakistan, delayed referrals are frequent in spinal TB, leading to late presentations with established neurological deficits and vertebral destruction. We investigated the effects of referral delays and surgical timing on neurological outcomes in surgically treated spinal TB patients.

Materials and Methods: This prospective study was carried out at the Punjab Institute of Neurosciences, Lahore, from January to December 2025. Fifty-six surgical spinal TB patients were grouped as early (less than four weeks from first medical contact to surgery) or delayed (more than four weeks). Neurological status was assessed using Frankel Grade. Hospital stays and complications were also recorded. Chi-square test, independent t-test, and multivariate regression were used for analysis.

Results: Mean age was 38.4 years; 64.3% were male. Delayed presentation occurred in 60.7% of patients, commonly due to misdiagnosis as mechanical backache (57.1%) and financial constraints (50.0%). The thoracolumbar junction was the commonest site (50.0%). The early surgery group showed better neurological improvement (86.4% vs. 67.6%, p=0.024), more complete recoveries (54.5% vs. 29.4%, p=0.048), and shorter hospital stay (12.4 vs. 18.6 days, p=0.001). Delayed referral independently predicted poor outcome (aOR 2.6, p=0.034).

Conclusion: Surgery within four weeks of first medical contact leads to better neurological recovery in spinal TB. Training primary care physicians to recognize spinal TB early and refer promptly can improve patient outcomes.

Keywords: Tuberculosis, Spinal; Treatment Outcome; Delayed Diagnosis; Time-to-Treatment; Spinal Cord Compression; Developing Countries

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INTRODUCTION

According to the World Health Organization, TB is a major public health concern, with an estimated 10.6 million new cases occurring globally annually.[1] A disproportionate share of this burden falls on Pakistan, which reports about 500,000 cases annually and ranks fifth out of 30 countries with a high TB burden.[2] Even though pulmonary symptoms are the most common in clinical practice, extrapulmonary tuberculosis accounts for 15–20% of cases, which presents unique challenges for diagnosis and therapy.[3] Among extrapulmonary manifestations, spinal TB, formerly called Pott's disease, accounts for almost half of all musculoskeletal tuberculosis infections but just 1-2% of all tuberculosis cases. The organism's preference for cancellous bone and the rich vascular supply of the vertebral column make it especially vulnerable. In endemic regions like Pakistan, spinal tuberculosis remains a leading cause of neurological morbidity, despite its late manifestations of established deformity or neurological impairment.[4] The epidemiological landscape must be well understood by neurosurgeons managing these complex cases in resource-constrained environments.

Spinal TB, sometimes referred to as Pott's disease, is caused by Mycobacterium tuberculosis spreading hematogenously from a primary lung or extrapulmonary center to the highly vascularized vertebral bodies.[5] The thoracolumbar junction is the most frequently affected region, and because neighboring vertebral endplates share a blood supply, paradiscal lesions account for the majority of cases.[6] As caseous necrosis progresses, the anterior spinal elements are eliminated, resulting in collapse and the characteristic gibbus angular kyphotic deformity. Paravertebral cold abscesses frequently develop from extension beneath the anterior longitudinal ligament, whereas posterior extension into the epidural space causes spinal cord compression.[7] This mechanical compression, inflammatory edema, and vascular impairment lead to the dreaded outcome of Pott's paraplegia. This devastating disease has a natural history of relentless neurological degeneration if treatment is delayed, culminating in complete paralysis and sphincter dysfunction.[8]

Even with advancements in imaging and microbiological procedures, spinal TB is still frequently detected too late in impoverished countries like Pakistan.[9] Because nonspecific symptoms like back pain, low-grade fever, and constitutional malaise can arise quietly and are frequently misinterpreted as degenerative spine disease or mechanical backache, patients may consult several doctors before a final diagnosis is made.[10] This diagnostic conundrum is made worse in remote and rural locations by limited availability to sophisticated imaging modalities like MRI and CT scanning. Patient-related issues like illiteracy, financial hardship, and an early dependence on traditional bone-setters and spiritual healers also cause delays.[11] Other challenges include a lack of well-defined referral pathways, insufficient lab space for mycobacterial culture, and a shortage of qualified spine specialists. Treatment outcomes and long-term quality of life are significantly impacted by this delayed diagnosis, which frequently results in advanced disease presentation with irreversible neurological impairments, kyphotic deformity, and spinal degeneration. [12]

Anti-tubercular medication is still the mainstay of treating spinal TB, although in certain situations, surgery is essential.[13] Surgical indications include cases requiring tissue diagnosis when clinical and radiological findings are inconclusive, large paravertebral or epidural abscesses causing neural compression, spinal instability with significant kyphotic deformity, and progressive neurological deterioration despite appropriate chemotherapy. [14]

Depending on the location and size of the lesion, different surgical techniques might be used, such as posterior decompression with

instrumented stabilization, anterior corpectomy with reconstruction, or a combination of anteroposterior treatments for complicated situations. The best time to perform surgery is still up for dispute. Growing data support early surgical intervention for individuals with neurological impairments, although traditional techniques recommend initial medical therapy with delayed surgery for non-responders.[15] When compared to delayed surgery, early decompression and stabilization have shown better neurological recovery rates and shorter hospital stays, indicating that the time of intervention has a major impact on functional results in cases with spinal TB.[16]

While the benefit of early decompression in spinal TB is well recognized globally, very little data exists from Pakistan on how local factors like traditional healer reliance, fragmented referral systems, and financial barriers contribute to surgical delays.[17] Our setting in Punjab, Pakistan, differs from Chinese and Indian studies in terms of healthcare access and socioeconomic conditions. This study was conducted to assess how referral delays and surgical timing affect neurological outcomes and complications in spinal TB patients operated at a tertiary care facility. We also aimed to identify reasons behind treatment delays and to evaluate neurological recovery using the Frankel grading system.[18] We hypothesized that operating early would produce better neurological results. Our findings may help shape referral policies in Pakistan.

MATERIALS AND METHODS

Study Design and Setting

This prospective observational cohort study was conducted in the Department of Neurosurgery at the Punjab Institute of Neurosciences (PINS), Lahore, Pakistan. PINS serves as a tertiary care referral hospital for neurosurgery cases throughout the state of Punjab and treats a sizable number of spinal TB cases each year. The examination was conducted over the course of a full year, from January to December of 2025.

The Institutional Review Board of PINS granted ethical permission (Reference No. 2128/IRB/PINS/permission/2025, dated 15th April 2025). Before enrollment, each subject provided written informed consent. The study was carried out in compliance with the Declaration of Helsinki's ethical guidelines. For clear and thorough reporting of this observational study, the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) recommendations were adhered to.

PATIENT SELECTION

Inclusion Criteria

We included patients aged 18 to 60 years with a confirmed diagnosis of spinal tuberculosis based on clinical presentation, radiological findings (MRI and/or CT imaging), and/or histopathological or microbiological evidence. All patients were undergoing surgical intervention for spinal tuberculosis and were receiving standard anti-tubercular therapy (ATT) according to national guidelines. Only those willing to provide informed consent and complete the 6-month follow-up period were enrolled.

Exclusion Criteria

Patients managed conservatively without surgery were excluded. Those with a history of previous spinal surgery for unrelated conditions, severe comorbidities contraindicating surgery (e.g., uncontrolled diabetes mellitus, cardiac failure), concurrent malignancy, or other spinal pathology were also excluded. Patients lost to follow-up within 6 months were removed from the final analysis.

Data Collection Variables

Using a standardized proforma, extensive data collection covered several domains. Age, gender,

place of residence (rural or urban), and socioeconomic position were among the demographic factors. Clinical variables included pre-operative neurological condition evaluated using the Frankel grading system (Grades A–E), length of symptoms before presentation, and presenting complaints (back pain, neurological deficit, spinal deformity, constitutional symptoms). Diabetes mellitus, HIV status, and pulmonary tuberculosis were among the associated comorbidities that were recorded.

Time from the onset of symptoms to the first medical contact, the number of medical professionals consulted before a neurosurgical referral, and the interval between the first medical contact and the referral to a specialist were all factors in the referral timeline. A standardized questionnaire was used to record the reasons for the delay. The length of time from neurosurgical referral to surgical intervention and pre-operative workup was included in the surgical timeline. The number of vertebral levels affected, the existence of a paravertebral abscess, the degree of epidural compression, and kyphotic angle measurements using the Cobb method were among the radiological factors noted from the MRI and CT spine.

Surgical Procedures and Post-operative Management

Patients were stratified into two groups based on the total time from first healthcare contact to surgical intervention. Those who underwent surgery within four weeks of their first medical consultation were classified as the Early group, while those operated on after four weeks were classified as the Delayed group.

Surgical strategy was chosen based on lesion site, extent of vertebral damage, and degree of spinal instability. The posterior method included pedicle screw instrumentation and laminectomy with decompression. Expandable titanium cages or structural bone grafts were used in the anterior

approach's corpectomy and anterior column repair. Combined anteroposterior methods were only used in complicated situations when there was substantial multi-column instability.

The length of the procedure, the estimated blood loss, the number of instrumented levels, and problems such as dural rips, cerebrospinal fluid leaks, and major bleeding surpassing 500 mL were all recorded intraoperative factors. Post-operatively, patients continued conventional antitubercular therapy comprising the HRZE regimen for 2 months followed by HR continuation for 10-16 months. Regular neurological evaluations were part of an early mobilization regimen. At one, three, and six months following surgery, clinical and radiological follow-up assessments were carried out.

Outcome Assessment and Statistical Analysis

Excessive bleeding (defined as blood loss over 500 mL, cerebrospinal fluid leak, and dural damage) and postoperative complications (wound infection, implant failure, and need for reoperation) were the main outcomes. Neurological status was evaluated using the Frankel grading system (Grades A–E) at five time points: before surgery, immediately following surgery (at discharge), and at follow-up visits at one, three, and six months. Advancement of at least one Frankel grade was considered neurological progress. Length of hospital stay and duration to ambulation, both expressed in days, were additional secondary outcomes.

SPSS version 27.0 (IBM Corp., Armonk, NY) was used for statistical analysis. For continuous variables, descriptive statistics were given as mean ± standard deviation; for categorical variables, they were expressed as frequencies with percentages. For categorical variables, the chi-square test or Fisher's exact test was utilized; for

continuous variables, the independent samples t-test was utilized. To find predictors of a bad result, multivariate logistic regression analysis was used. The threshold for statistical significance was fixed at $p < 0.05$.

Table 1: *Demographic and Baseline Characteristics (n=56).*

Characteristic	Value
Age (years), mean ± SD (range)	38.4 ± 11.2 (19-58)
Male gender, n (%)	36 (64.3)
Rural residence, n (%)	34 (60.7)
Socioeconomic status - Low/Middle/High, n	31/21/4
Symptom duration (months), mean ± SD	4.2 ± 2.8

RESULTS

Patient Demographics and Baseline Characteristics

A final cohort of 56 patients completed the study protocol out of the 60 patients who were initially recruited for the study; however, 4 patients were lost to follow-up. The age range was 19–58 years, with a mean of 38.4 ± 11.2 years. The bulk (n=36, 64.3%) were men. The majority of patients had low socioeconomic status (n = 31, 55.4%) and were from rural areas (n = 34, 60.7%). Before presentation, the average duration of symptoms was 4.2 ± 2.8 months (Table 1).

Clinical Presentation and Radiological Findings

Back pain was the most common presenting symptom (96.4%), followed by lower limb weakness (85.7%) and constitutional symptoms (67.9%). Pre-operative neurological assessment revealed Frankel Grade D in 18 patients (32.1%), Grade C in 16 (28.6%), Grade B in 8 (14.3%), Grade A in 6 (10.7%), and Grade E in 8 (14.3%). Associated pulmonary tuberculosis was present in 12 patients (21.4%).

The thoracolumbar junction (T10-L2) was the most commonly affected region (50.0%), followed by the thoracic spine (25.0%) and lumbar spine (14.3%). Two-level vertebral involvement was most frequent (46.4%). Epidural compression was present in 85.7%, paravertebral abscess in 75.0%, and vertebral collapse in 67.9%. The mean kyphotic angle was 28.4° ± 14.6° (Table 2).

Table 2: *Clinical and Radiological Characteristics (n=56).*

Parameter	n (%) or Mean ± SD
Presenting symptoms	
Back pain / Lower limb weakness	54 (96.4) / 48 (85.7)
Constitutional symptoms / Gibbus	38 (67.9) / 24 (42.9)
Bladder-bowel dysfunction	18 (32.1)
Pre-operative Frankel Grade (A/B/C/D/E)	6/8/16/18/8
Spinal level involved	
Thoracolumbar (T10-L2) / Thoracic	28 (50.0) / 14 (25.0)
Lumbar / Cervical / Lumbosacral	8 (14.3) / 4 (7.1) / 2 (3.6)
Vertebrae involved, mean ± SD	2.3 ± 0.9
Epidural compression	48 (85.7)
Paravertebral abscess	42 (75.0)
Kyphotic angle (degrees), mean ± SD	28.4 ± 14.6

Delay Analysis and Patient Grouping

The mean time from symptom onset to first healthcare contact was 6.2 +/- 4.8 weeks. Patients consulted an average of 2.8 +/- 1.4 healthcare providers before neurosurgical referral. The mean interval from initial contact to referral was 8.4 +/- 6.2 weeks. Factors contributing to delay included: misdiagnosis as mechanical back pain (57.1%), financial constraints (50.0%), lack of awareness (46.4%), treatment by traditional healers (39.3%), and distance from tertiary centers (32.1%).

Patients were categorized into Early (<4 weeks, n=22, 39.3%) and Delayed (>4 weeks, n=34, 60.7%) groups based on time from first healthcare contact to surgery.

Surgical Procedures

The posterior approach was performed in 32 patients (57.1%), anterior in 8 (14.3%), and combined anteroposterior in 16 (28.6%). Mean levels instrumented were 4.2 ± 1.4. Titanium cages were used in 42.9%, and bone grafts in 32.1%.

Mean operative time was 186.4 ± 52.8 minutes with blood loss of 428.6 ± 186.4 mL. Intraoperative complications included dural tear (10.7%) and excessive bleeding >500mL (25.0%) (Table 3).

Outcomes: Early vs Delayed Surgery

Post-operative complications included wound infection (14.3%), hardware complications (7.1%), CSF leak (5.4%), revision surgery (3.6%), and one mortality (1.8%). Overall, 75.0% improved by at least one Frankel grade.

The Early group showed significantly better outcomes: higher neurological improvement (86.4% vs 67.6%, p=0.024), more complete recovery to Frankel E (54.5% vs 29.4%, p=0.048), shorter hospital stays (12.4 vs 18.6 days, p=0.001), and faster ambulation (3.6 vs 5.6 days, p=0.008). Complication rates were similar between groups (Table 4).

Neurological Recovery

Patients with Frankel Grade E increased from 8 (14.3%) preoperatively to 22 (39.3%) at 6-month follow-up. Improvement rates varied by preoperative status: Grade C (87.5%), Grade D (88.9%), Grade B (75.0%), and Grade A (33.3%). Patients with incomplete deficits (Grade C/D) had significantly better outcomes than those with complete/severe deficits (Grade A/B) (p=0.008).

Prognostic Factors

Two independent predictors of poor outcome were found by multivariate analysis: delayed referral >4 weeks (aOR 2.6, 95% CI: 1.1-6.2, p=0.034) and pre-operative Frankel grade A/B (aOR 3.6, 95% CI: 1.2-10.8, p=0.024). There was a trend toward significance for symptoms lasting longer than three months (aOR 2.4, 95% CI: 0.9-6.2, p=0.068).

Functional Recovery

The average length of hospital stay was 16.2 +/- 6.4 days. At the 6-month mark, 4 patients (7.1%) were still wheelchair-dependent, 8 patients (14.3%) needed walking assistance, and 44 patients (78.6%) were able to walk independently. In terms of work status, six (10.7%) were unable to return to work, twelve (21.4%) partially returned, and 38 (67.9%) resumed full activity.

Representative Case Examples

Two typical cases from our sample are shown here to highlight how surgical timing affects clinical outcomes. In these patients, the results of early and delayed surgery for spinal TB are shown to differ.

Table 3: *Surgical Parameters (n=56).*

Parameter	Value
Surgical approach - Posterior/Anterior/Combined, n	32/8/16
Levels instrumented, mean ± SD (range)	4.2 ± 1.4 (2-8)
Reconstruction - Cage/Bone graft/None, n	24/18/14
Operative time (min), mean ± SD	186.4 ± 52.8
Blood loss (mL), mean ± SD	428.6 ± 186.4
Blood transfusion required, n (%)	22 (39.3)
Dural tear/CSF leak, n (%)	6 (10.7)
Excessive bleeding >500mL, n (%)	14 (25.0)

Table 4: *Comparison of Outcomes Between Early and Delayed Surgery Groups.*

Outcome	Early (n=22)	Delayed (n=34)	p-value
Neurological improvement, n (%)	19 (86.4)	23 (67.6)	0.024*
Complete recovery (Frankel E), n (%)	12 (54.5)	10 (29.4)	0.048*
Hospital stays (days), mean +/- SD	12.4 +/- 4.2	18.6 +/- 6.8	0.001*
Time to ambulation (days), mean +/- SD	3.6 +/- 1.8	5.6 +/- 2.8	0.008*
Wound infection, n (%)	2 (9.1)	6 (17.6)	0.362
Hardware failure, n (%)	1 (4.5)	3 (8.8)	0.544
Revision surgery, n (%)	0 (0)	2 (5.9)	0.248

*Statistically significant (p<0.05)

Case 1: Early Surgical Intervention with Favorable Outcome

A 41-year-old female presented with a history of back pain and progressive lower limb weakness of 3 weeks' duration. She was referred promptly to our tertiary neurosurgical center after initial evaluation at a district hospital. Neurological examination revealed Frankel Grade D (motor function present but not useful for ambulation). MRI of the spine demonstrated vertebral body changes at the L1-L2 level with paravertebral collection but relatively preserved spinal canal (Figure 1A). CT scan confirmed the vertebral involvement with maintained spinal alignment (Figure 1B). Given the early presentation and preserved neurological function, surgical intervention was performed within 2 weeks of symptom onset. Posterior decompression with pedicle screw fixation and interbody cage placement was performed (Figure 1C, D). Postoperatively, the patient showed progressive neurological improvement. At 3-month follow-up, she achieved complete neurological recovery (Frankel Grade E) with independent ambulation and return to normal daily activities.
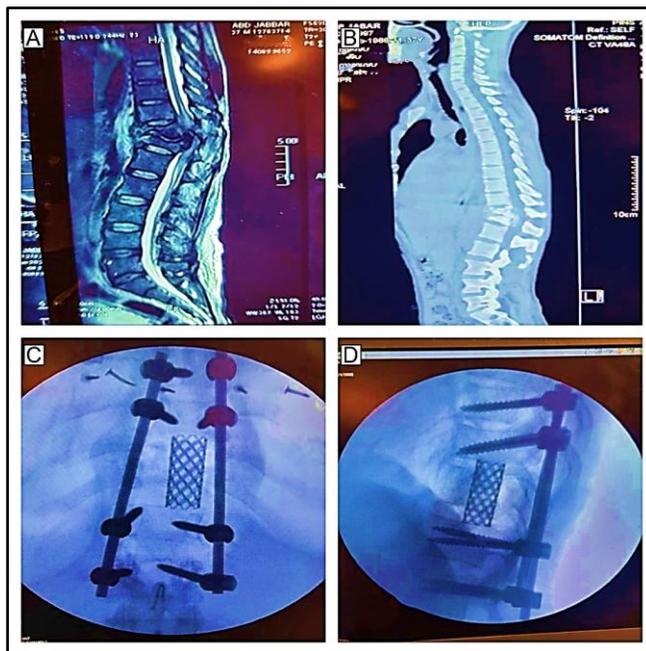

Figure 2: *Delayed surgical intervention in thoracolumbar spinal tuberculosis. (A): Pre-operative sagittal T2-weighted MRI demonstrating severe spinal cord compression with near-complete effacement of the thecal sac at the thoracolumbar junction. (B): Pre-operative sagittal CT showing extensive vertebral destruction with significant kyphotic deformity. (C): Post-operative anteroposterior radiograph showing posterior instrumentation with an expandable titanium mesh cage. (D): Post-operative lateral radiograph demonstrating partial correction of kyphosis with residual deformity.*
Written informed consent was obtained from the patient for publication of these clinical images.

Case 2: Delayed Surgical Intervention with Suboptimal Outcome

A 37-year-old male presented with progressive back pain and severe lower limb weakness of 4

Figure 1: *Early surgical intervention in lumbar spinal tuberculosis. (A): Pre-operative sagittal T2-weighted MRI demonstrating vertebral body changes at L1-L2 with paravertebral collection but relatively preserved spinal canal. (B): Pre-operative sagittal CT showing vertebral involvement at the L1-L2 level with maintained spinal alignment. (C): Post-operative anteroposterior radiograph showing bilateral pedicle screw fixation with an interbody cage. (D): Post-operative lateral radiograph demonstrating satisfactory spinal alignment and instrumentation.*
Written informed consent was obtained from the patient for publication of these clinical images.

months' duration. He had initially sought treatment from traditional healers and homeopathic practitioners before being referred to our center. By the time of presentation, neurological examination revealed Frankel Grade B (sensory function preserved but motor function absent). MRI of the spine demonstrated severe spinal cord compression with near-complete effacement of the thecal sac at the thoracolumbar junction (Figure 2A). CT scan showed extensive vertebral destruction with significant kyphotic deformity (Figure 2B). Despite the advanced disease, surgical decompression with posterior instrumentation and an expandable titanium mesh cage was performed (Figure 2C, D). Postoperatively, the patient showed limited neurological improvement. At the 3-month follow-up, he improved only to Frankel Grade C (motor function present but non-functional for ambulation), requiring walking aids for mobility. The suboptimal outcome was attributed to prolonged and severe spinal cord compression before surgical intervention.

DISCUSSION

In patients with spinal TB who needed surgical treatment, this study looked at the connection between clinical outcomes and the time of surgical intervention. Most of our patients had delayed treatment. Many waited a long time between their first doctor visit and being referred for surgery. Those who had early surgery recovered better neurologically. Similar patterns have been reported from other high-burden regions, where operating on time made a clear difference in how well patients recovered.[19] Furthermore, shorter hospital stays were associated with early surgery, which resulted in less patient burden and use of medical resources. Patients who received prompt surgical care had a much better complete neurological recovery rate, highlighting the significance of accelerated referral paths.[20] Delayed referral was found to be an independent

predictor of adverse outcomes in multivariable analysis, indicating that the prognosis of spinal TB is significantly influenced by systemic healthcare delays rather than illness variables alone.[21]

Our 75% neurological improvement rate agrees with reports from other TB-endemic regions: 70-85% in Indian studies (Rajasekaran et al, reported 78% recovery),[22] 75-90% in Chinese series,[23] and 65-80% in South African cohorts, where HIV co-infection contributed to poorer outcomes.[24] Our complication rates (wound infection 14.3%, hardware failure 7.1%) are comparable to published literature. These findings support the growing consensus that early surgery improves functional recovery in spinal TB.[25]

The delay pattern in our cohort reflects structural healthcare problems in Pakistan. Misdiagnosis as mechanical back pain was the commonest delay factor (57.1%),[26] while financial constraints forced half the patients to choose between household needs and specialized care. The reliance on traditional healers (39.3%) reflects cultural preference for alternative medicine in rural areas, driven more by accessibility than distrust of modern healthcare.[27] With patients consulting a mean of 2.8 providers before correct referral, our findings highlight the need for primary care education on red flag symptoms and streamlined referral pathways.[28]

Neurological deterioration in spinal tuberculosis occurs through three processes: mechanical compression by granulation tissue, abscess, and sequestrated bone; vascular compromise causing cord ischemia; and inflammatory edema with secondary damage.[29] This supports the concept of a "therapeutic window" where decompression can reverse neurological decline before permanent gliosis and axonal loss occur.[30] In our study, patients with incomplete deficits (Frankel C/D) improved at rates of 87-89%, compared to 33-75% in those with complete deficits (Frankel A/B). This difference likely reflects the presence of salvageable neuronal pathways in partial lesions. Longer compression

duration worsens outcomes due to progressive demyelination and fibrosis within the cord.[31] Early stabilization also prevents progressive kyphosis, which can cause ongoing mechanical stretch injury to the cord.

The posterior approach was used in most cases (57.1%), while combined anteroposterior procedures were reserved for severe instability or significant kyphosis (28.6%). Choice of approach was guided by lesion location, extent of destruction, and the surgeon's experience. Regardless of approach, neurological outcomes were similar when adequate decompression was achieved. Posterior-only techniques with titanium expandable cages now allow effective anterior column reconstruction without the morbidity of a separate anterior surgery.[32-34]

Our series' overall complication profile was similar to that found in published research. 14.3% of patients had wound infections, 7.1% had hardware failures, 5.4% had CSF leaks, 3.6% needed revision surgery, and 1.8% died from sepsis. These rates are consistent with reported rates of 10–20% for wound infections and 5–10% for hardware problems following spinal TB surgery.[35] Malnutrition, immunocompromised status, extended surgical time, and multilevel involvement are some of the factors that increase the risk of complications in this population.[36] Although there was no statistically significant difference, the delayed surgery group experienced a considerably higher rate of wound infection (17.6% vs. 9.1%). These findings demonstrate how important it is to maximize nutrition before surgery. Antitubercular therapy must also be continued during the perioperative period to minimize illness flare-ups and encourage wound healing.

Study Limitations and Strengths

This study has several limitations. The sample size of 56 patients from a single tertiary center limits generalizability to other settings. Since only surgically treated patients were included, our results cannot be extended to those managed conservatively, and this introduces selection bias. The six-month follow-up may miss late complications, and referral delay calculations partly relied on patient recall. Future multicenter studies including both surgical and non-surgical patients would provide a more complete picture. Strengths include prospective design with standardized data collection, use of validated Frankel grading, and comprehensive analysis of delay factors from a high-volume center handling a large number of spinal TB cases annually.

CONCLUSION

Patients operated within four weeks of their first hospital visit recovered considerably better neurologically. Those who came late for surgery did worse. The main reasons for the delay were misdiagnosis, financial difficulties, and prior reliance on traditional healers. All three independently contributed to poor outcomes. Early diagnosis and timely surgical referral can make a real difference in recovery.

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

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AUTHOR'S CONTRIBUTION

Sr.	Author Name	Author Contribution
1.	Usman Ahmad	Paper writing, study design, and methodology.
2.	Muhammad Irfan	Literature review, data analysis, and discussion.
3.	Irfan Razzaq	Interpretation of results.
4.	Tehreem Asif	Data collection.
5.	Anosh John	Data analysis and referencing.
6.	Prof. Syed Shahzad Hussain Shah	Quality insurer.