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Research Article

Clinical and Functional Outcomes of Thoracolumbar and Lumbosacral Spine Surgeries (Decompression, Laminectomy, and Fixation) in Neglected Cases of Trauma, Infection, and Listhesis in a Rural Population

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ABSTRACT

Background: Thoracolumbar and lumbosacral spine disorders are a major cause of morbidity, particularly in rural populations where delayed presentation of trauma, infection, and degenerative conditions is common. Neglected cases often present with neurological deficits and spinal instability, posing significant challenges in management.

Aim: To evaluate the clinical and functional outcomes of thoracolumbar and lumbosacral spine surgeries, including decompression, laminectomy, and fixation, in neglected cases of trauma, infection, and listhesis in a rural population.

Methods: A prospective observational study was conducted in the Department of Orthopaedics at Kalpnath Rai Institute of Medical Sciences, Mau, Uttar Pradesh, from February 2025 to January 2026. A total of 50 patients with thoracolumbar and lumbosacral spine pathologies were included. Detailed clinical, neurological, and radiological assessments were performed. All patients underwent appropriate surgical intervention based on pathology. Outcomes were evaluated in terms of neurological improvement, functional recovery, radiological alignment, and postoperative complications. Data were analyzed using descriptive and inferential statistical methods.

Results: The majority of patients were aged 46–60 years (36%), with male predominance (64%) and rural residence (78%). Trauma was the most common etiology (44%), followed by infection (32%) and listhesis (24%). Thoracolumbar involvement was seen in 62% of cases. Neurological improvement was observed in 68% of patients postoperatively, while 24% showed no change and 8% worsened. Functional outcomes were good in 52%, fair in 32%, and poor in 16% of patients. Radiological alignment was maintained in 76% of cases. Postoperative complications were seen in 22% of patients, with infection being the most common (10%). Statistically significant associations were observed between functional outcome and factors such as age, etiology, neurological status, duration of presentation, comorbidities, and postoperative complications ($p < 0.05$).

Conclusion: Surgical management of thoracolumbar and lumbosacral spine pathologies provides satisfactory neurological and functional outcomes even in neglected cases. Early diagnosis, timely intervention, and improved healthcare accessibility are essential to enhance outcomes, particularly in rural populations.

Keywords*: Thoracolumbar spine, Lumbosacral spine, Decompression, Laminectomy, Spinal fixation, Neglected spinal injury, Spinal tuberculosis, Listhesis, Functional outcome, Rural population.*

INTRODUCTION

Thoracolumbar and lumbosacral spine disorders constitute a major cause of morbidity and disability worldwide, particularly in low- and middle-income countries where trauma, infection, and degenerative spinal conditions are highly prevalent. The thoracolumbar junction is biomechanically vulnerable due to the transition from the relatively rigid thoracic spine to the more mobile lumbar spine, making it the most common site for spinal injuries. Globally, thoracolumbar fractures account for nearly 20–60% of all vertebral fractures, highlighting their clinical significance and burden on healthcare systems [1].

Spinal injuries represent a major public health concern, with an estimated global incidence of 15–40 cases per million population annually. These injuries often lead to long-term disability and impose a substantial socioeconomic burden. In developing countries, the incidence is rising due to increasing motorization and occupational hazards. In India, it is estimated that approximately 20,000 new cases of spinal cord injury occur every year, with a higher prevalence among young and economically productive age groups [2].

The epidemiological pattern of spinal disorders varies between regions. In developed countries, road traffic accidents are the leading cause of spinal trauma, whereas in India and other developing regions, falls from height—particularly from trees, construction sites, or rooftops—are more commonly reported. Studies from India have shown that thoracolumbar injuries constitute nearly 70–90% of all spinal fractures, reflecting their predominance in clinical practice [3,4].

In addition to trauma, spinal infections—especially tuberculosis of the spine—remain a significant concern in India and other endemic regions. Spinal tuberculosis accounts for nearly 50% of all skeletal tuberculosis cases and is a major cause of spinal deformity and neurological deficit when diagnosis and treatment are delayed [5]. Degenerative conditions such as listhesis are also increasingly observed due to aging populations and lifestyle changes, further contributing to the burden of spinal morbidity.

Neglected spinal conditions are particularly common in rural areas due to delayed healthcare access, lack of awareness, socioeconomic constraints, and dependence on traditional treatment methods. Such delays often result in advanced disease at presentation, with complications such as neurological deficits, spinal instability, deformity, and chronic pain. These factors significantly worsen prognosis and increase the complexity of management [6].

Surgical intervention plays a crucial role in the management of thoracolumbar and lumbosacral spine disorders, especially in cases of instability, neurological compromise, or failed conservative treatment. Procedures such as decompression, laminectomy, and spinal fixation aim to relieve neural compression, restore spinal alignment, and provide stability. With advances in surgical techniques and instrumentation, outcomes in terms of neurological recovery and functional improvement have significantly improved in recent decades [7].

Early surgical intervention has been associated with better neurological recovery, reduced hospital stay, and improved quality of life. However, in neglected cases, surgical management becomes more challenging due to delayed presentation, deformity, fibrosis, and poor general condition of patients. Despite these challenges, studies have demonstrated that appropriately planned surgical intervention can still provide significant functional benefits even in delayed cases [8].

In the Indian context, especially in rural regions such as Uttar Pradesh, limited access to specialized spine care, inadequate referral systems, and financial constraints continue to affect timely management. There is a lack of sufficient regional data evaluating outcomes of surgical management in neglected spinal conditions in rural populations, which is essential for planning healthcare strategies and improving patient outcomes [9].

The present study aims to evaluate the clinical and functional outcomes of thoracolumbar and lumbosacral spine surgeries, including decompression, laminectomy, and fixation, in neglected cases of trauma, infection, and listhesis in a rural population. The objectives are to assess postoperative neurological recovery, functional improvement, radiological alignment, and complication rates, and to compare outcomes across different etiologies and surgical interventions. The justification of this study lies in the high burden of neglected spinal disorders in rural areas due to delayed presentation, limited healthcare access, and socioeconomic constraints, which often result in advanced disease and poor prognosis. There is a paucity of region-specific data evaluating surgical outcomes in such neglected cases, particularly in resource-limited settings like rural Uttar Pradesh. The findings of this study are expected to contribute to better understanding of disease patterns, guide clinical decision-making, improve surgical planning, and promote early referral strategies. Ultimately, the study may help in strengthening spine care services in rural regions, reducing disability, improving quality of life, and providing evidence for developing standardized management protocols for neglected spinal pathologies.

MATERIALS & METHODOLOGY

A prospective observational study was conducted in the Department of Orthopaedics at Kalpnath Rai Institute of Medical Sciences, Mau, Uttar Pradesh, over a period of one year from February 2025 to January 2026. The institute caters predominantly to a rural population and receives a considerable number of patients presenting with neglected spinal conditions. A total of 50 patients diagnosed with thoracolumbar and lumbosacral spine pathologies, including trauma, infection, and listhesis, were included in the study based on predefined eligibility criteria. Patients aged 18 years and above with clinical and radiological evidence of spinal pathology and presenting after a delay (neglected cases) were

included, while patients unwilling to participate, those with acute injuries managed conservatively, or those medically unfit for surgery were excluded.

All patients initially received conservative management as per standard protocols prior to surgical intervention. Conservative treatment included bed rest, anti-tubercular therapy (ATT) in cases of spinal infection, spinal traction where indicated, and physiotherapy aimed at pain relief and maintaining joint mobility. Despite adequate conservative management, patients who showed persistent symptoms, neurological deficits, spinal instability, or progressive deformity were subsequently planned for surgical intervention.

After obtaining informed consent, all patients underwent detailed clinical evaluation including history taking, duration and mode of presentation, neurological status, and associated comorbidities. A thorough general and systemic examination was performed. Neurological assessment was carried out using standard clinical parameters, and functional status was evaluated using appropriate scoring systems. Radiological investigations included X-ray of the spine and magnetic resonance imaging (MRI) to assess the level, type, and severity of pathology, degree of neural compression, and spinal instability.

All patients were managed surgically using appropriate procedures such as decompression, laminectomy, and spinal fixation, depending on the underlying pathology and surgeon's discretion. The choice of surgical approach and instrumentation was individualized based on the type of lesion, level of involvement, and patient condition. Intraoperative parameters including duration of surgery, blood loss, and any complications were recorded. Postoperatively, patients received standard care including antibiotics, analgesics, and physiotherapy as per institutional protocol.

Patients were followed up at regular intervals, and outcomes were assessed in terms of neurological recovery, pain relief, functional improvement, radiological alignment, and postoperative complications. Data were recorded using a structured proforma and entered into Microsoft Excel for analysis. Statistical analysis was performed using appropriate methods, with results expressed in terms of frequencies, percentages, and mean values where applicable. Associations between variables were assessed using suitable statistical tests, and a p-value of less than 0.05 was considered statistically significant. Ethical approval for the study was obtained from the Institutional Ethics Committee, and confidentiality of patient information was maintained throughout the study.

RESULTS

A total of 50 patients with thoracolumbar and lumbosacral spine pathologies were included in the study. The majority of patients were in the age group of 46–60 years (36%), followed by 31–45 years (28%), while 16% belonged to 18–30 years and 20% were above 60 years. Males constituted 64% of the study population, while females accounted for 36%. A large proportion of patients were from rural areas (78%), and most were engaged in labor-intensive occupations such as farming and manual work (52%), indicating increased risk of spinal injuries in this group.

With regard to clinical profile, trauma was the most common etiology (44%), followed by spinal infections (32%) and listhesis (24%). The thoracolumbar region was involved in 62% of patients, while 38% had lumbosacral involvement. Neurological assessment at presentation revealed that 36% of patients had intact neurological status, 44% had incomplete neurological deficits, and 20% had complete deficits. A significant proportion of patients presented late, with 42% presenting between 1–3 months and 40% after more than 3 months, reflecting the neglected nature of cases in the rural setting. Comorbidities were present in 34% of patients.

In terms of surgical management, decompression with fixation was the most commonly performed procedure (60%), followed by laminectomy with fixation (28%), while 12% underwent decompression alone. Postoperative outcomes showed that 68% of patients experienced improvement in neurological status, 24% had no change, and 8% showed worsening. Functional outcomes were good in 52% of patients, fair in 32%, and poor in 16%. Radiological alignment was successfully maintained in 76% of cases, indicating effective stabilization. Postoperative complications were observed in 22% of patients, with infection being the most common (10%), followed by implant failure (6%) and neurological deterioration (6%).

Analysis of factors associated with functional outcome revealed that patients aged ≤45 years had better outcomes (53.8%) compared to those >45 years (46.2%), and this association was statistically significant ($p = 0.040$). Trauma cases showed better outcomes (53.8%) compared to infection and listhesis ($p = 0.018$). Patients with intact neurological status had significantly better outcomes (53.8%) compared to those with complete deficits (7.7%) ($p = 0.010$). Early presentation (≤3 months) was associated with better outcomes (69.2%) compared to delayed presentation (30.8%) ($p = 0.033$). Absence of comorbidities was also significantly associated with good outcomes (76.9%) ($p = 0.045$). Furthermore, patients without postoperative complications had significantly better outcomes (88.5%) compared to those with complications (11.5%) ($p = 0.025$). Gender did not show a statistically significant association with outcome ($p = 0.396$).

Overall, the findings indicate that timely surgical intervention, even in neglected spinal cases, can lead to satisfactory neurological and functional recovery, although delayed presentation, comorbidities, and complications significantly influence the prognosis.

Table 1: Demographic Profile of Study Participants (n = 50)

Variable	Category	Frequency (n)	Percentage (%)
Age Group (years)	18–30	8	16.0
	31–45	14	28.0
	46–60	18	36.0
	>60	10	20.0
Gender	Male	32	64.0
	Female	18	36.0
Residence	Rural	39	78.0
	Urban	11	22.0
Occupation	Laborer/Farmer	26	52.0
	Homemaker	12	24.0
	Service/Other	12	24.0

Table 2: Clinical Profile and Etiology of Spine Pathology (n = 50)

Variable	Category	Frequency (n)	Percentage (%)
Etiology	Trauma	22	44.0
	Infection (Spinal TB)	16	32.0
	Listhesis	12	24.0
Level of Involvement	Thoracolumbar	31	62.0
	Lumbosacral	19	38.0
Neurological Status at Presentation	Intact	18	36.0
	Incomplete Deficit	22	44.0
	Complete Deficit	10	20.0
Duration before Presentation	<1 month	9	18.0
	1–3 months	21	42.0
	>3 months	20	40.0
Comorbidities Present	Yes	17	34.0
	No	33	66.0

Table 3: Surgical and Functional Outcomes (n = 50)

Variable	Category	Frequency (n)	Percentage (%)
Type of Surgery	Decompression + Fixation	30	60.0

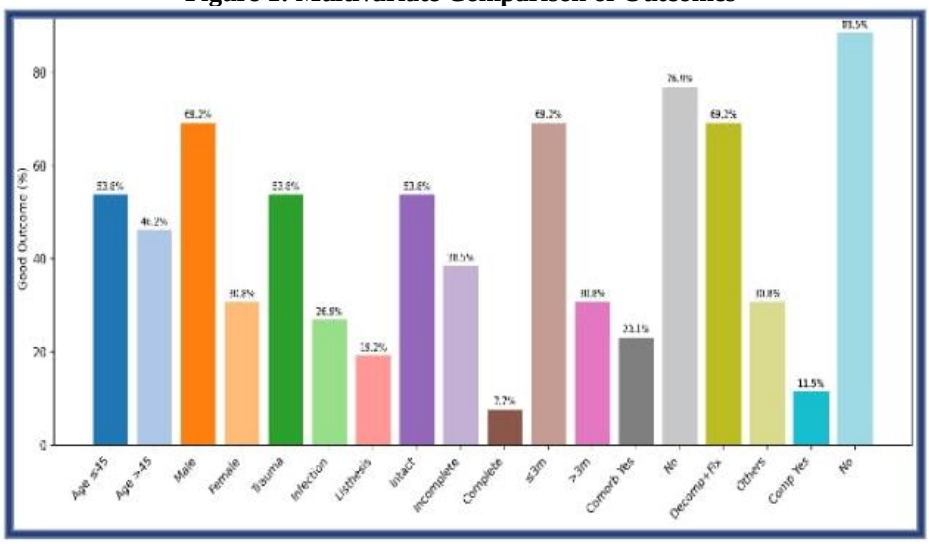
	Laminectomy + Fixation	14	28.0
	Decompression only	6	12.0
Neurological Outcome (Post-op)	Improved	34	68.0
	No Change	12	24.0
	Worsened	4	8.0
Functional Outcome	Good	26	52.0
	Fair	16	32.0
	Poor	8	16.0
Radiological Alignment	Maintained	38	76.0
	Not Maintained	12	24.0
Postoperative Complications	Present	11	22.0
	Absent	39	78.0
Type of Complication	Infection	5	10.0
	Implant failure	3	6.0
	Neurological worsening	3	6.0

Table 4: Association Between Clinical Variables and Functional Outcome (n = 50)

Variable	Category	Good Outcome (n=26)	Poor/Fair Outcome (n=24)	χ^2 value	p-value
Age Group (years)	≤45	14 (53.8%)	8 (33.3%)	4.21	0.040*
	>45	12 (46.2%)	16 (66.7%)		
Gender	Male	18 (69.2%)	14 (58.3%)	0.72	0.396
	Female	8 (30.8%)	10 (41.7%)		
Etiology	Trauma	14 (53.8%)	8 (33.3%)	5.63	0.018*
	Infection	7 (26.9%)	9 (37.5%)		
	Listhesis	5 (19.2%)	7 (29.2%)		
Neurological Status	Intact	14 (53.8%)	4 (16.7%)	9.12	0.010*
	Incomplete deficit	10 (38.5%)	12 (50.0%)		
	Complete deficit	2 (7.7%)	8 (33.3%)		
Duration of Presentation	≤3 months	18 (69.2%)	12 (50.0%)	4.56	0.033*
	>3 months	8 (30.8%)	12 (50.0%)		
Comorbidities	Present	6 (23.1%)	11 (45.8%)	4.02	0.045*
	Absent	20 (76.9%)	13 (54.2%)		
Type of Surgery	Decompression + Fixation	18 (69.2%)	12 (50.0%)	3.89	0.048*

	Others	8 (30.8%)	12 (50.0%)		
Post-op Complications	Present	3 (11.5%)	8 (33.3%)	5.01	0.025*
	Absent	23 (88.5%)	16 (66.7%)		

Figure 1: Multivariate Comparison of Outcomes



Case 1: Potts spine case had complete paraplegia was decompressed and Fixed recovered in day 2 with his motor function

IMAGE 1: Pre- Operative image of Case 1

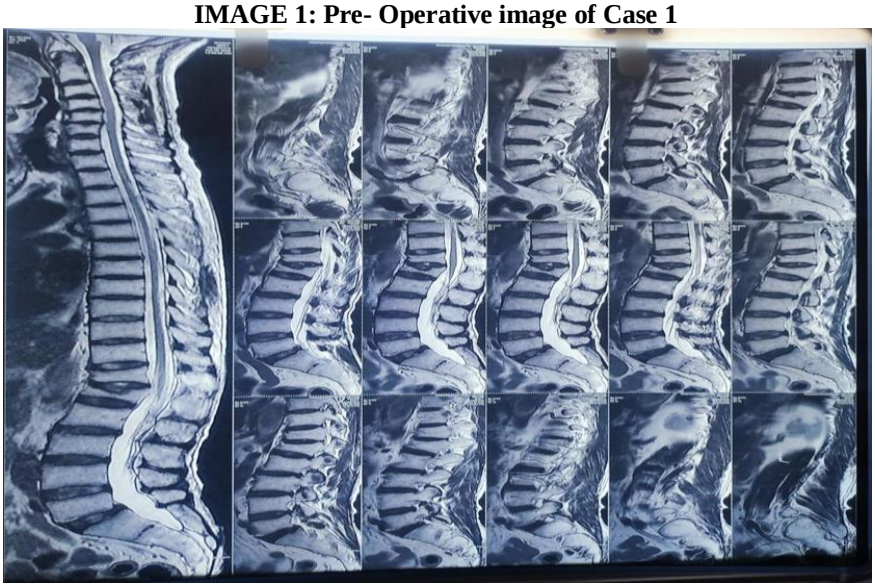
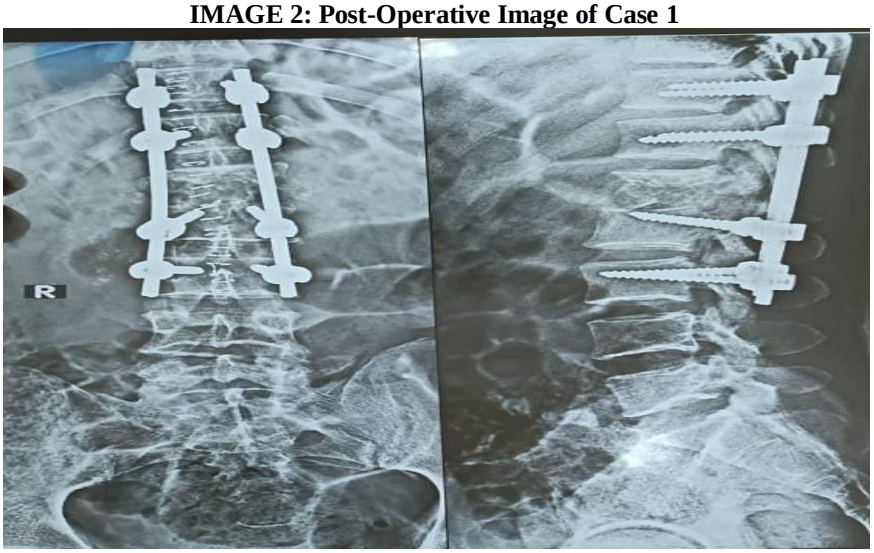


IMAGE 2: Post-Operative Image of Case 1



Case 2: Old L1-L2 collapse had history of Fall from height unable to sit n walk properly Paraparesis with Grade 1 Listhiasis was decompressed distracted and fixed with multiple level ambulated after five days.

IMAGE 3: Pre-Operative Image of Case 2

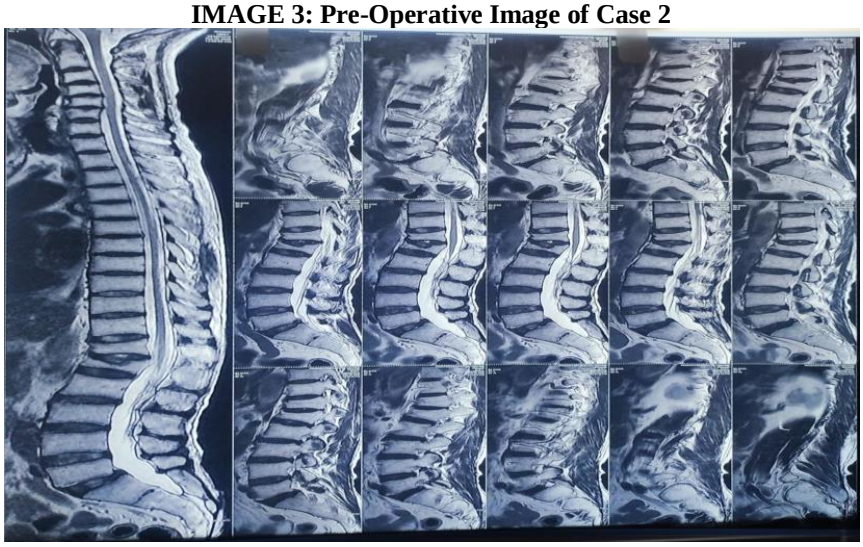
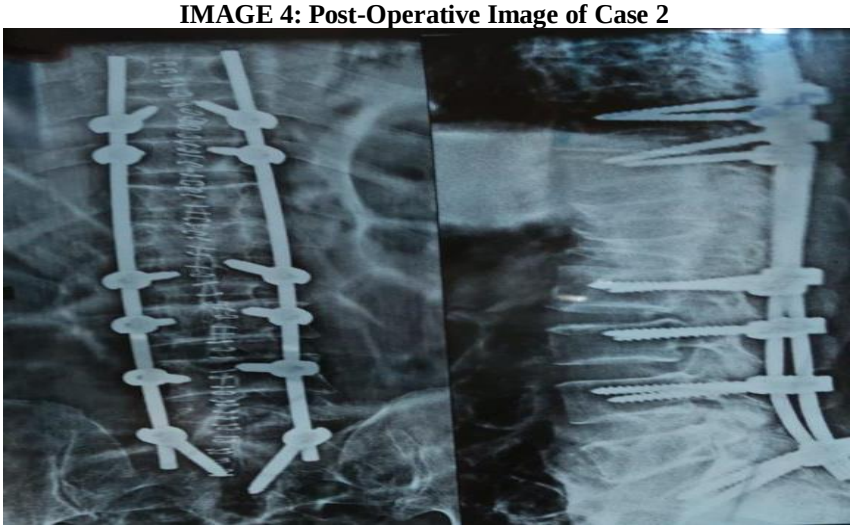


IMAGE 4: Post-Operative Image of Case 2



Case 3: Listhiasis Garde 2, Unable to walk, pain 20 yrs with radiation. Decompressed and fixed with pedicle screws

IMAGE 5:Pre-Operative Image of Case 3

IMAGE 6: Post-Operative Image of Case 3

DISCUSSION

In this study, the majority of patients were aged 46–60 years (36%), males constituted 64%, and 78% belonged to the rural population. A large proportion of cases also presented late, with 42% reporting within 1–3 months and 40% after more than 3 months. These findings are comparable to the Indian analysis of post-traumatic spinal cord injury, where 85% of patients were male, the mean age was 34 years, and the average delay in presentation to a specialized spinal unit was 45 days. The present study also reflects the effect of delayed presentation in rural populations, which likely contributed to the higher proportion of neurological deficit and neglected pathology observed at admission. [10]

Trauma was the most common etiology in this study (44%), followed by infection (32%) and listhesis (24%). Thoracolumbar involvement was seen in 62% of patients, showing that the thoracolumbar junction remained the most frequently affected region. Similar findings were reported in a study of thoracolumbar fractures managed with posterior decompression and instrumented fusion, where 30 patients were evaluated and significant improvement was seen in functional, neurological, and radiological parameters. In that study, the mean Oswestry Disability Index improved from 87.40 preoperatively to 13.33 at final follow-up, and the mean kyphotic angle improved from 24.37° to 9.87°, with minimal loss of correction. Compared with that series, this study showed maintained radiological alignment in 76% of cases and neurological improvement in 68%, indicating that satisfactory outcomes can still be achieved even in mixed and neglected pathologies. [11]

The present study showed good functional outcome in 52% of cases, fair outcome in 32%, and poor outcome in 16%. These results are broadly comparable with another thoracolumbar trauma study treated with posterior pedicle screw

instrumentation, where 75% of patients returned to previous employment with some restriction and 75% had only occasional minimal pain without the need for medication. That study also reported T11–L2 involvement in 65% of cases, which is close to the thoracolumbar predominance of 62% in this study. The somewhat lower proportion of good outcomes in the present study may be explained by the inclusion of infective and listhesis cases in addition to trauma, along with delayed rural presentation. [12]

Infection accounted for 32% of cases in this study, and many of these patients presented late with neurological deficit or instability. Similar concerns were noted in a retrospective observational study of spinal tuberculosis, which included 70 surgically managed cases with at least one year of follow-up. That study concluded that early surgery, especially within four weeks, resulted in satisfactory clinical outcome with early neurological improvement, whereas delayed presentation was associated with more severe compression and a greater disease burden. In this study too, delayed presentation was common and likely contributed to the incomplete neurological recovery seen in some patients. [13]

In this study, postoperative neurological improvement was documented in 68% of patients, and radiological alignment was preserved in 76%. These findings are similar to a 2024 study of posterior instrumented stabilization and transpedicular decompression in thoracic and lumbar spinal tuberculosis, where the mean age was 46.10 years, neurological grading improved in all cases, and there was no loss of kyphotic correction till final follow-up. Although our study population was more heterogeneous and included trauma and listhesis in addition to infection, the overall clinical message remained similar: decompression with stabilization is effective in improving neurology and maintaining spinal alignment. [14]

The present study demonstrated that decompression, laminectomy, and fixation provided good radiological stability in most cases, with maintained alignment in 76% and postoperative complications in 22%. A prospective study of thoracolumbar spinal tuberculosis managed by single-staged posterior decompression and circumferential fusion reported an average preoperative kyphotic angle of 27.45°, which was corrected and maintained at 6.9° at one year, with 55% of patients showing neurological improvement and none showing postoperative neurological deterioration. Compared with that study, our series showed a slightly higher neurological improvement rate of 68%, although direct comparison must be interpreted cautiously because our cases were etiologically mixed rather than only tuberculous. [15]

This study included both thoracolumbar and lumbosacral involvement, with 38% of cases affecting the lumbosacral region. This is relevant because lumbosacral pathology often presents additional technical challenges and may show greater correction loss over time. In a 50-patient study of extended posterior decompression and fusion for spinal tuberculosis, the mean age was 51±11.4 years, and significant improvement in kyphotic Cobb angle was documented across thoracic, thoracolumbar, lumbar, and lumbosacral segments. The lumbosacral group showed a loss of correction of 7.7°±4.3° at final follow-up, though this was not statistically significant. These findings are in line with the present study, where alignment was maintained in most cases but a minority still showed radiological compromise, underscoring the importance of careful long-term follow-up. [16]

Listhesis constituted 24% of the cases in this study. In this subgroup, decompression and fixation contributed to overall functional improvement and stabilization. Comparable results were reported in a prospective study on lumbar spondylolisthesis treated with pedicle screw fixation and posterolateral fusion, where the mean age was 46 years and 90% of patients achieved excellent to good functional outcome. Good mechanical alignment and solid fusion were achieved in the majority of those cases. The slightly lower good outcome rate in the present study can be explained by the inclusion of neglected trauma and infective cases, which generally carry a poorer baseline prognosis than elective listhesis surgery. [17]

In this study, postoperative complications were seen in 22% of patients, including infection in 10%, implant failure in 6%, and neurological worsening in 6%. Functional outcome was good in 52%, fair in 32%, and poor in 16%. A recent prospective series on posterior stabilization and fusion for spondylolisthesis reported clinically successful and radiological/clinical fusion in 80.7% of patients, with an average time to bony fusion of 5.58 months. That study also reported relatively few intraoperative complications, including one screw slippage and one dural tear. Compared with those findings, the present study had a somewhat higher complication burden and lower overall functional success, which is likely related to delayed presentation, mixed pathology, and the rural neglected nature of the case load. [18]

Overall, this study supports that thoracolumbar and lumbosacral spine surgeries involving decompression, laminectomy, and fixation can produce satisfactory neurological recovery, functional improvement, and radiological stabilization even in neglected cases from rural areas. However, delayed presentation, neurological deficit at admission, infective etiology, and postoperative complications continue to adversely affect outcome. In comparison with published studies, the present data show acceptable but somewhat lower functional success, which appears to reflect the complexity and chronicity of cases encountered in this rural setting.

CONCLUSION

The present study demonstrates that surgical management of thoracolumbar and lumbosacral spine pathologies using decompression, laminectomy, and fixation provides satisfactory neurological recovery, functional improvement, and radiological stabilization even in neglected cases. A majority of patients showed improvement in neurological status

(68%) and achieved good functional outcomes (52%), with radiological alignment maintained in 76% of cases. Factors such as younger age, trauma as the underlying etiology, intact neurological status at presentation, early presentation, absence of comorbidities, and absence of postoperative complications were significantly associated with better outcomes. However, delayed presentation and advanced disease at admission adversely influenced prognosis. Overall, timely and appropriate surgical intervention plays a crucial role in improving outcomes, even in rural populations with neglected spinal conditions.

LIMITATIONS

The present study was conducted at a single tertiary care center with a relatively small sample size of 50 patients, which may limit the generalizability of the findings. The inclusion of heterogeneous pathologies such as trauma, infection, and listhesis may have influenced the outcome measures and limited direct comparison with disease-specific studies. The duration of follow-up was relatively short, which may not fully capture long-term functional and radiological outcomes, including implant longevity and recurrence. Additionally, the majority of patients belonged to a rural population with delayed presentation, which may have introduced bias related to disease severity at admission.

RECOMMENDATIONS

Larger multicentric studies with a greater sample size and longer follow-up duration are recommended to better evaluate the long-term outcomes of surgical management in thoracolumbar and lumbosacral spine pathologies. Early diagnosis, timely referral, and improved accessibility to specialized spine care services in rural areas are essential to reduce the burden of neglected spinal conditions. Strengthening primary healthcare systems, increasing awareness among the population, and developing standardized treatment protocols can further improve patient outcomes. Advanced surgical techniques and rehabilitation programs should be emphasized to enhance functional recovery and quality of life in these patients.

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