

Thoracolumbar Spine Injuries in a Tertiary Hospital: Epidemiology, Treatment Patterns and Neurological Outcome

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Abstract

Background: Thoracolumbar spine injuries constitute a major cause of trauma-related neurological disability worldwide, yet regional clinical data from low-resource settings remain limited. **Objective:** To evaluate demographic characteristics, injury patterns, neurological status, treatment modalities, and short-term outcomes of patients with traumatic thoracolumbar spine injuries managed at a tertiary referral hospital in South-Western Nigeria. **Methods:** This retrospective observational study included 49 patients with radiologically confirmed thoracolumbar spine injuries treated between February 2025 and January 2026. Data extracted from medical records included demographics, mechanism of injury, vertebral level affected, fracture morphology, neurological status using the Frankel grading system, treatment modality, and follow-up outcomes. Descriptive statistics were generated, and associations between neurological grade and treatment modality were assessed using chi-square or Fisher's exact tests. Logistic regression evaluated predictors of surgical intervention. **Results:** The cohort comprised 40 males (81.6%) and 9 females (18.4%), with most patients aged 41–60 years (87.7%). Road traffic accidents accounted for 89.8% of injuries. Spinal level L1 was the most frequently involved vertebral level (42.9%), and burst fractures predominated (57.1%). At presentation, 40.8% had complete neurological injury (Frankel A). Conservative treatment was used in 65.3% of patients, while 34.7% underwent surgery. Baseline neurological status was significantly associated with treatment modality ($\chi^2=13.32$, $p=0.010$). Patients with incomplete neurological deficits were more likely to receive surgery (OR 4.00, 95% CI 1.13–14.17, $p=0.038$), and Frankel B injuries independently predicted operative treatment (adjusted OR 15.00, $p=0.025$). At 6-month follow-up, favorable neurological outcome (Frankel D–E) occurred in 43.8% of conservatively treated patients and 35.3% of surgically treated patients, with no significant difference between groups ($p=0.761$). **Conclusion:** Thoracolumbar spine injuries in this setting predominantly affected economically active males and were mainly caused by road traffic trauma. Baseline neurological status strongly influenced treatment selection, with incomplete deficits increasing likelihood of surgical intervention. Short-term neurological outcomes were comparable between treatment groups, suggesting that initial injury severity rather than treatment modality was the principal determinant of recovery.

Keywords: Thoracolumbar fracture, Spinal trauma, Nigeria, Neurological outcome, Frankel grade.

Introduction

Thoracolumbar spine injuries constitute a major subset of traumatic spinal injuries worldwide and remain a significant cause of morbidity, disability and socioeconomic burden. Globally, vertebral fractures affect millions annually, with an estimated prevalence of 5.4 million and an incidence of approximately 7.5 million cases per year [1]. These injuries frequently lead to long-term disability due to neurological impairment, chronic pain, and functional limitations.

The thoracolumbar junction (T10–L2) is biomechanically predisposed to injury because it represents a transitional zone between the rigid thoracic spine and the flexible lumbar spine. Consequently, this region is involved in the majority of spinal fractures and accounts for approximately 60–80 % of all spinal fracture cases globally [2]. Epidemiological studies indicate that the most common mechanisms of thoracolumbar injury are falls and road traffic accidents, particularly in developing countries [3].

In African settings, traumatic spinal injuries are increasingly recognized as a major public health issue due to urbanization, rapid motorization, occupational hazards, and limited trauma systems. Admasu *et al* demonstrated that thoracic, thoracolumbar, and lumbar trauma frequently result in neurological deficits and disability requiring tertiary care management [4]. Same study reported that the thoracolumbar junction accounted for 80% of spinal injury sites and that neurological recovery was strongly influenced by preoperative neurological status [4].

In Nigeria, spinal trauma presents substantial clinical challenges. This is due to poor access to advanced imaging and specialized surgical care. A study conducted by Ohaegbulam SC, *et al.* highlighted that traumatic spinal injuries often produce life-altering consequences and require prompt evaluation with appropriate imaging modalities for optimal management [5].

Despite the growing burden of trauma, local epidemiological data describing thoracolumbar injuries remain limited. Management

strategies for thoracolumbar injuries include both conservative and surgical approaches. Treatment decisions depend on fracture morphology, spinal stability, neurological status, and patient-related factors. Advances in surgical techniques, including minimally invasive fixation, have improved outcomes in high-income countries, yet conservative treatment remains widely utilized in low-resource settings where instrumentation and specialized expertise may be limited [2].

Given regional disparities in injury patterns, resource availability, and treatment outcomes, locally generated data are essential for guiding evidence-based clinical protocols. This study therefore aimed to evaluate the presentation patterns, radiological characteristics, and treatment outcomes of thoracolumbar spine injuries managed in a tertiary health institution in South-Western Nigeria.

Methods

Study Design and Setting

This study was a retrospective observational analysis conducted at Ekiti State University Teaching Hospital, Ado-Ekiti, Nigeria, a tertiary referral centre providing specialized neurosurgical and trauma services to patients across South-Western Nigeria. Ethical approval was obtained from the institutional research ethics committee prior to commencement of the study.

Study Population

All consecutive patients who presented with traumatic thoracolumbar spine injuries between February 2025 and January 2026 were identified from hospital records. Patients who met the eligibility criteria were included in the final analysis. A total of 49 patients satisfied the inclusion criteria and were analyzed.

Inclusion Criteria

Patients were included if they had radiologically confirmed traumatic thoracolumbar spine injury, completed management (conservative or surgical) at the study institution and had complete clinical records including follow-up documentation.

Exclusion Criteria

Patients were excluded if they had incomplete medical records documentation, non-traumatic spinal pathology and no follow-up clinic visitation.

Data Collection

Patient records were reviewed using a structured data extraction proforma. Variables obtained included demographic characteristics including age and sex, mechanism of injury, vertebral level involved, imaging modality, fracture morphology, neurological status at presentation and follow-up using the Frankel grading system, treatment modality (conservative or surgical) and duration of follow-up.

Outcome Measures

The primary outcome variable was treatment modality (surgical versus conservative).

The primary predictor variable was baseline neurological status (Frankel grade).

Secondary outcomes included distribution of injury patterns and neurological status at follow-up.

Statistical Analysis

Data were coded and analyzed using SPSS version 23.0 (IBM Corp., Armonk, NY, USA).

Descriptive statistics were used to summarize baseline characteristics and injury patterns. Categorical variables were expressed as frequencies and percentages and presented in tabular format. Associations between baseline neurological status and treatment modality were evaluated using Pearson's chi-square test. When expected cell counts were <5, Fisher's exact test was applied. Effect sizes were reported as odds ratios (OR) with corresponding 95% confidence intervals (CI).

Binary logistic regression analysis was performed to determine whether baseline Frankel grade predicted likelihood of surgical treatment, with Frankel A used as the reference category. Categories with zero surgical events resulted in complete separation; therefore, odds ratios for these groups were not estimable using standard logistic regression. Related statistical outputs were presented in combined tables to improve clarity and avoid redundancy. Statistical significance was defined as $p < 0.05$.

Bias Control and Study Limitations

Because of the retrospective design, treatment allocation was not randomized and confounding by indication may be present. In addition, some neurological categories contained small sample sizes, which may limit statistical power and produce wide confidence intervals.

Results

Study Population

A total of 49 patients with traumatic thoracolumbar spine injuries met the study eligibility criteria and were included in the analysis.

Baseline Characteristics

The cohort consisted predominantly of 40 males (81.6%) and 9 (18.4%) females, yielding a male-to-female ratio of 4.4:1. Most patients were aged 41–60 years (87.7%), while smaller proportions were aged 18–40 years (8.2%) and ≥ 60 years (4.1%). Road traffic accidents were the leading mechanism of injury, accounting for 89.8% of cases, followed by falls from height (8.2%) and falling objects (2.0%) (Table 1).

Injury Characteristics

The most frequently involved vertebral level was L1 (42.9%), followed by T11 (26.5%), T12 (20.4%), and L2 (10.2%). Regarding fracture morphology, burst fractures constituted the majority (57.1%), with compression fractures in 32.7%, flexion-distraction injuries in 6.1% and fracture-dislocations in 4.1% (Table 2).

Neurological Status at Presentation

At admission, neurological function assessed using the Frankel grading system showed that 20 patients (40.8%) presented with complete neurological injury (Frankel A), 6 (12.2%) with grade B, 14 (28.6%) with grade C, 4 (8.2%) with grade D, and 5 (10.2%) were neurologically intact (Frankel E).

Treatment Modalities

Overall, 32 patients (65.3%) were managed conservatively, while 17 patients (34.7%) underwent surgical intervention consisting of decompression and posterior stabilization.

Association between Neurological Status and Treatment Modality

The relationship between baseline Frankel grade and treatment modality was assessed using Pearson's chi-square test. There was a statistically significant association between neurological status and treatment choice ($\chi^2(4) = 13.32, p = 0.010$) (Table 3).

Because several contingency table cells contained expected values <5, Fisher's exact tests were additionally performed to explore specific neurological status groupings (Table 4).

Patients presenting with incomplete neurological deficits (Frankel grades B,C,D) had significantly higher odds of undergoing surgery compared with patients with either complete injury or normal neurological status (Frankel A or E) ($p = 0.038$; OR = 4.00, 95% CI 1.13–14.17).

In contrast, neither complete neurological injury (Frankel A) nor intact neurological status (Frankel E) demonstrated statistically significant associations with treatment modality ($p = 0.361$ and $p = 0.149$ respectively).

Logistic Regression Analysis

Binary logistic regression was performed to determine whether baseline neurological status predicted likelihood of surgical intervention. Using Frankel A as the reference category, patients with Frankel B injuries had significantly increased odds of having surgery (adjusted OR = 15.00, 95% CI 1.40–161.05, $p = 0.025$). Although Frankel C injuries also showed increased odds of surgery

relative to Frankel A, this did not reach statistical significance (adjusted OR = 3.00, 95% CI 0.70–12.88, $p = 0.139$) (Table 5).

Odds ratios for Frankel D and E categories could not be estimated because no patients in these groups underwent surgical treatment, resulting in complete separation of data.

Neurological Outcome at 6 Months

Neurological status at 6-month follow-up stratified by treatment modality is presented in Table 6. Overall, 14 of 32 patients (43.8%) managed conservatively achieved a good neurological outcome (Frankel grades D–E), compared with 6 of 17 patients (35.3%) who underwent surgical treatment. Conversely, poor neurological outcome (Frankel grades A–C) was observed in 18 conservatively treated patients (56.2%) and 11 surgically treated patients (64.7%).

There was no statistically significant difference in the proportion of patients achieving good neurological outcome between treatment groups (Fisher's exact test $p = 0.761$). The odds of attaining a good neurological outcome in surgically treated patients were not significantly different from those treated conservatively (OR 0.70, 95% CI 0.21–2.36).

Table 1: Baseline Characteristics of patients (n=49)

Variable	Category	N	%
Sex	Male	40	81.6
	Female	9	18.4
Age	18-40	4	8.2
	41-60	43	87.7
	>60	2	4.1
Mechanism	RTA	44	89.8
	Fall from height	4	8.2
	Falling objects	1	2.0

RTA = road traffic accident

Table 2: Injury Characteristics

Parameter	Category	N	%
Level	T11	13	26.5
	T12	10	20.4
	L1	21	42.9
	L2	5	10.2
Fracture type	Burst	28	57.1
	Compression	16	32.7
	Flexion-distraction	3	6.1
	Fracture-dislocation	2	4.1

Table 3: Association between Frankel Grade at presentation and treatment modality

Frankel grade	Treatment options		Total	p-value
	Conservative	Surgical		
A	15	5	20	0.010
B	1	5	6	
C	7	7	14	
D	4	0	4	
E	5	0	5	
Total	32	17	49	

Statistical test: Pearson $\chi^2 (4) = 13.32$, $p = 0.010$. Due to small expected counts, Fisher's exact tests were additionally performed.

Table 4: Association between neurological status categories and treatment modality (Fisher's exact Tests)

Comparison	Treatment Conservative	Surgical	p-value	OR	95% CI
Incomplete (B,C,D)	12	12	0.038	4.00	1.13-14.17
Others (A,E)	20	5			
Complete (A)	15	5	0.361	0.47	0.13-1.65
Incomplete (B,C,D)	17	12			
Intact (E)	5	0	0.149	-	-
Deficit (A,B,C,D)	27	17			

OR=odds ratio; CI= confidence interval; Bold p values indicate statistical significance ($p < 0.05$)

Table 5: Logistic Regression Predicting likelihood of surgical treatment Predictor

Frankel A (reference)	Adjusted OR	95% CI	p
Frankel B	15.00	1.40-161.05	0.025
Frankel C	3.00	0.70-12.88	0.139
Frankel D	-	-	-
Frankel E	-	-	-

Odds ratio for Frankel D and E could not be estimated because no surgical events occurred in these categories.

Table 6: Neurological status at 6-month follow-up by Treatment Modality

Frankel Grade	Treatment options	
	Conservative care	Surgical treatment
A	15	3
B	1	4
C	2	4
D	9	3
E	5	3

Dichotomized Outcome Comparison

Outcome category	Conservative care	Surgical treatment	Effective size (Surgery vs Conservative)	P value
Good outcome (D-E)	14(43.8%)	6(35.3%)	OR= 0.7	0.761
Poor outcome (A-C)	18(56.2%)	11(64.7%)	95% CI 0.21-2.36 Reference	

Percentages are column percentages; OR = odds ratio; CI = confidence interval

p-value calculated using Fisher's exact test (two-sided); good outcomes = Frankel grades D and E; poor outcomes = Frankel grades A & C

Discussion

Principal Findings

This retrospective analysis evaluated the demographic profile, injury characteristics, neurological presentation, and treatment patterns of patients with traumatic thoracolumbar spine injuries managed at a tertiary referral centre. The study demonstrated three major findings: Thoracolumbar injuries predominantly affected middle-aged males and were largely caused by road traffic accidents.

Baseline neurological status significantly influenced treatment modality.

Patients presenting with incomplete neurological deficits were more likely to undergo surgery than those with complete or intact neurological function.

These findings reflect clinically meaningful patterns rather than causal relationships, as treatment allocation in retrospective trauma studies is influenced by injury severity and physician decision-making.

Demographic Characteristics and Mechanism of Injury

The predominance of male patients observed in this cohort is consistent with regional and international studies of spinal trauma. A large Nigerian series from Lagos reported that 70.1% of spinal cord injury patients were male, with most cases occurring in young adults [6]. Similarly, a retrospective study by Ishaku *et al.* found that 91.4% of traumatic spinal cord injury patients were male and predominantly of working age [7].

Male predominance in spine trauma is widely attributed to increased occupational exposure, driving frequency, and participation in high-risk activities.

Road traffic accidents were the leading cause of injury in this study. This is similar to the findings in a study conducted on thoracolumbar injuries by Shu *et al.* who reported road traffic accidents in 45.7% and falls in 30% of cases [8].

Global consensus recommendations similarly identify traffic accidents and falls as the principal causes of thoracolumbar fractures, especially in developing countries [3].

The concordance between these studies suggests that trauma epidemiology in Nigeria parallels broader patterns observed across low- and middle-income regions.

Injury Distribution and Fracture Morphology

Lumbar involvement, particularly at L1, was the most frequent injury level in this study. This agrees with reports that the lumbar spine is commonly affected because the thoracic spine is stabilized by the rib cage and therefore less mobile [8].

Burst fractures were the predominant fracture type in this series, consistent with biomechanical principles whereby axial loading and flexion forces during high-energy trauma preferentially produce burst injuries.

Neurological Presentation

A substantial proportion of patients presented with complete neurological deficits. This pattern was also observed by Oyediran *et al.* in their study where severe neurological presentations were frequent among hospital-treated trauma cases [9].

Delayed hospital presentation may partly explain this as alluded to by the study conducted by Shu *et al.* in which the mean arrival time after injury was approximately 16 days, with many patients initially attending peripheral facilities before referral [8].

Delayed referral and financial constraints are recognized barriers to early specialist care in many sub-Saharan health systems.

Treatment Patterns

Approximately one-third of patients in this series underwent surgery. This proportion is lower than that reported by Ikwuegbuenyi *et al.* in a multicentre cohort study where 64.9% of thoracic and thoracolumbar trauma patients received operative treatment [10].

Lower surgical rates in low-resource settings are frequently attributed to limited instrumentation availability, financial barriers, and delayed presentation, all of which influence treatment decision-making.

Relationship between Neurological Status and Treatment

A significant association was observed between baseline neurological grade and treatment modality. Patients with incomplete

neurological deficits had significantly higher odds of surgical intervention. This pattern is clinically logical because incomplete injuries represent salvageable neurological states, making decompression and stabilization more likely to be offered.

Regional evidence supports this observation. Ikwuegbuanyi *et al.* demonstrated that patients without neurological deficits were significantly less likely to undergo surgery [10].

Similarly, Ojo *et al.* showed that decompression and stabilization can improve neurological function after traumatic spinal cord injury, particularly in patients with incomplete deficits [11].

The consistency across studies suggests that neurological status is a key determinant of operative decision-making in spine trauma worldwide.

Logistic Regression Findings

Logistic regression analysis demonstrated that Frankel B injuries significantly predicted surgical treatment when compared with Frankel A. Although Frankel C injuries showed increased odds of surgery, statistical significance was not reached, likely due to small sample size and sparse cell counts. This limitation is inherent in retrospective trauma series with modest cohort sizes.

Importantly, odds ratios for some categories could not be estimated because no surgical cases occurred in those groups. This phenomenon, known as complete separation, is common in small datasets and does not invalidate results but requires cautious interpretation.

Neurological Outcomes

Neurological improvement occurred in both treatment groups but appeared more frequent among patients with incomplete deficits. This observation mirrors previous findings that recovery potential is strongly influenced by initial neurological grade.

Ojo *et al.* reported neurological improvement in 25.7% of patients after decompression, particularly among those presenting with grades C or D.[11] Similarly, Shu *et al.* found that approximately 60% of patients improved neurologically, with recovery strongly related to injury severity at presentation [8].

These comparisons support the concept that neurological status at presentation is the strongest predictor of recovery.

In the present study, neurological recovery at 6 months did not differ significantly between treatment groups, although a greater proportion of conservatively managed patients achieved favorable neurological status. This apparent paradox likely reflects confounding by indication, a well-recognized limitation of retrospective spine trauma studies, whereby patients selected for surgery often present with more severe neurological deficits or unstable injuries that inherently carry poorer prognoses. Consequently, treatment modality alone cannot be interpreted as an independent determinant of neurological outcome without accounting for baseline severity.

This observation is consistent with findings of a large retrospective cohort study conducted by Alfn *et al.* who reported that admission neurological grade (ASIA score) independently predicted neurological improvement and survival, while delayed presentation also negatively influenced outcomes [12]. Similarly, a retrospective analytic study conducted by Ishaku *et al.* found significant associations between injury characteristics and functional status at discharge, with only 14.8% of patients recovering without neurological deficits and many remaining wheelchair-bound [7]. Comparable evidence from a study by Takoutsing *et al.* also demonstrated that the level of spinal injury and initial neurological severity correlated significantly with neurological outcome and

survival following traumatic spinal cord injury [13]. These regional findings reinforce the concept that baseline neurological impairment-not treatment modality-is the dominant prognostic factor, particularly in low-resource trauma systems where delays in presentation and limited access to specialized care may influence both treatment selection and recovery potential.

The absence of statistical significance between treatment groups in the present cohort may also be explained by small subgroup sample sizes, which reduce statistical power and widen confidence intervals. Similar methodological limitations was acknowledged by Oyediran *et al.* in a single-centre African retrospective series evaluating spinal trauma outcomes [9].

Notably, evidence from a prospective study conducted by Adeolu *et al.* shows that neurological improvement can occur even with non-operative management in selected patients, further emphasizing that individualized treatment decisions based on neurological grade, stability, and patient factors are essential rather than reliance on a single therapeutic approach [14].

Taken together, these findings suggest that the comparable outcomes observed between treatment groups in this study likely reflect underlying injury severity patterns rather than true equivalence of conservative and operative management. Larger prospective multi-centre studies with standardized protocols and severity-adjusted analyses are therefore required to clarify the independent effect of treatment modality on long-term neurological recovery in thoracolumbar trauma.

Clinical Implications

The findings reinforce several important clinical principles including the fact that neurological grading should be prioritized in early assessment because it influences treatment decisions and prognosis, early referral to specialist centres may improve neurological outcomes and resource limitations may reduce surgical treatment rates even when indications exist.

Understanding these factors is particularly relevant in low-resource health systems where infrastructure and access strongly influence outcomes.

Strengths and Limitations

This study provides institution-level data on thoracolumbar injuries from a region with limited published literature. However, its retrospective design introduces potential selection bias and confounding by indication. Small subgroup sizes also limited statistical power and produced wide confidence intervals.

Overall Interpretation

Taken together, the results demonstrate that thoracolumbar spine trauma in these setting follows epidemiological and clinical patterns consistent with regional African data. Treatment decisions were strongly influenced by neurological status, and incomplete deficits were associated with increased likelihood of surgery. These findings highlight the importance of early neurological assessment and timely referral in improving trauma care pathways.

Conclusion

This study provides institutional evidence on the clinical profile, injury characteristics, treatment patterns, and short-term neurological outcomes of patients with traumatic thoracolumbar spine injuries managed at a tertiary referral centre. The findings demonstrate that these injuries predominantly affect economically active males and are largely caused by road traffic trauma, reflecting the epidemiological pattern reported across many low- and middle-income settings. Lumbar vertebrae, particularly L1, were most

commonly involved, and burst fractures constituted the predominant injury morphology, consistent with the biomechanical vulnerability of the thoracolumbar junction during high-energy trauma.

Baseline neurological status emerged as a key determinant of treatment selection. Patients presenting with incomplete neurological deficits were significantly more likely to undergo surgical intervention than those with complete or intact neurological function, indicating that clinicians appropriately prioritize potentially salvageable neurological states when considering operative management. Logistic regression analysis further supported the predictive role of neurological grade in determining likelihood of surgery, reinforcing the central role of early neurological assessment in clinical decision-making.

At 6-month follow-up, neurological outcomes did not differ significantly between conservative and surgical treatment groups. This absence of statistical difference should not be interpreted as therapeutic equivalence but rather as a reflection of confounding by injury severity, since patients selected for surgery often present with more severe or unstable injuries. The results therefore emphasize that baseline neurological impairment remains the strongest prognostic indicator of recovery, while treatment modality functions primarily as a management strategy tailored to injury characteristics and patient condition.

Taken together, these findings highlight several important clinical implications. Early neurological grading should remain a priority in the initial assessment of thoracolumbar trauma, as it guides both treatment decisions and prognostication. Strengthening trauma systems, improving referral pathways, and expanding access to specialized spine care may enhance outcomes, particularly in resource-limited environments where delayed presentation and logistical constraints can affect both treatment selection and recovery potential.

The study was limited by its retrospective design, relatively small sample size, and single-centre setting, which may restrict generalizability and statistical power. Nevertheless, it contributes valuable regional data to a field with limited published evidence. Future prospective multicentre studies with larger cohorts, standardized treatment protocols, and longitudinal outcome assessment are recommended to better delineate the independent effect of treatment modality on neurological recovery and functional outcome after thoracolumbar spine injury.

Declarations

Author Contributions

The author was solely responsible for the conception and design of the study and drafting of the manuscript. The author conducted data collection, patient evaluation and clinical follow-up.

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Ethical Approval Statement

Ethical approval was obtained from the Hospital Research and Ethics Committee prior to commencement of the study. The study was carried out in accordance with the ethical standards of the

institutional research committee and the principles of the Declaration of Helsinki.

Conflict of Interest Statement

The author declares that there are no conflicts of interest regarding the publication of this article.

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Data Availability Statement

The datasets generated and analyzed during the study are available from the corresponding author upon reasonable request.

United Nations Declaration of Human Rights

The author confirms that he accepts and agrees with the UN's Declaration of Human Rights.

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