https://doi.org/10.29309/TPMJ/2026.33.11.11033 www.theprofesional.com

ORIGINAL ARTICLE

Postoperative complications of transpedicular screw fixation in spinal patients.

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ABSTRACT… Objective: To determine the frequency and pattern of postoperative complications following transpedicular screw fixation in patients with spinal pathology. **Study Design:** Descriptive (Cross-sectional) study. **Setting:** Department of Neurosurgery, Lady Reading Hospital, Peshawar. **Period:** 1st November 2025 to 30th April 2026. **Methods:** A total of 133 patients aged 15–80 years who underwent transpedicular screw fixation for spinal pathology were enrolled through non-probability consecutive sampling. Data were collected using a structured proforma, history, clinical examination and postoperative X-rays. Complications recorded included screw breakage, screw misplacement, surgical site infection and neurological deficit. Neurological status was assessed using Frankel Grading. Data were analyzed using SPSS v25; the chi-square test was applied to determine the association between age and complications, with p≤0.05 taken as significant. **Results:** Of 133 patients, 96 (72.2%) were male and 37 (27.8%) were female. The thoracolumbar region was the most common site of injury. Postoperative complications included back pain (26.3%), surgical site infection (6.8%), misplaced screws (2.3%), screw breakage (1.5%) and nerve root injury (0.75%). On Frankel grading, 61.6% of patients had no neurological deficit (Grade E) postoperatively. No significant association was found between age and postoperative complications (χ^2=0.198, p>0.05). **Conclusion:** Transpedicular screw fixation performed under fluoroscopic guidance is associated with a high rate of favorable outcome and a low rate of technical and neurological complications, although postoperative back pain and surgical site infection remain notable challenges.

Key words: Complications, Frankel Grading, Spinal Fixation, Transpedicular Screw Fixation.

Article Citation: Ahmad M, Azam F, Khan Z, Bilal M. Postoperative complications of transpedicular screw fixation in spinal patients. Professional Med J 2026; 33(11):2162-2166. https://doi.org/10.29309/TPMJ/2026.33.11.11033

INTRODUCTION

Transpedicular screw fixation, also known as posterolateral fusion, is a widely performed technique for stabilization of fractured or unstable vertebrae. First introduced by Harrington and Tullos in 1969 and later modified by Roy-Camille et al., it has since become the mainstay of spinal instrumentation for the management of vertebral instability.[1] Beyond traumatic fractures, screw fixation is also used for neoplastic, degenerative, infectious and malaligned pathologies causing spinal instability. The most common approach remains open, internal screw fixation, although minimally invasive techniques have increasingly been introduced to reduce associated complications.[3] Despite these advances, transpedicular screw fixation remains associated with complications such as screw breakage, screw misplacement, nerve injury, postoperative backache, muscle stiffness and infection, with misplaced screws being the most frequently reported, occurring in 0–40% of cases across various studies.[2]

Reported complication rates in the literature are clinically significant. Screw malposition has been documented in up to 42% of cases, with pedicle wall violation in 32.18% of screws; nerve root injury with associated radicular pain has been observed in 15.9% of cases, and irritation from nerve root injury in 3.2%. Computed tomography evaluation has shown cortical penetration in 40% and medial wall penetration in 29% of cases, with neurological injury (sensory or motor deficit) reported in 15.09%.[4] The thoracolumbar spine, particularly the T11–L1 segment, accounts for more than half of all vertebral fractures owing to its transitional biomechanical properties between the rigid thoracic and mobile lumbar segments.[4]

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Article received on:
07/08/2026
Accepted for publication:
10/10/2026

Other studies have reported focal neurological deficit, worsening spinal stenosis, increased vertebral body pressure, and kyphosis with resultant pain and radiculopathy following transpedicular fixation.[5] Indications for transpedicular screw fixation include spinal instability, degenerative conditions, vertebral body fracture, metastatic tumors and infection.[6] Since the screw trajectory passes directly through the pedicle, an intact pedicle is essential,[7] and passing the screw without fluoroscopic guidance risks damage to surrounding neural structures.[8] Considerable attention must therefore be given to screw-passing technique to minimize postoperative complications.[9]

Given the wide range of reported complication rates and the paucity of local data from Pakistan, this study was conducted to determine the frequency and pattern of postoperative complications following transpedicular screw fixation among patients presenting to the Department of Neurosurgery, Lady Reading Hospital, Peshawar.

METHODS

This descriptive, cross-sectional study was conducted at the Department of Neurosurgery, Lady Reading Hospital – MTI, Peshawar, Pakistan, a tertiary care referral centre for Khyber Pakhtunkhwa province, over a period of six months, from 1st November 2025 to 30th April 2026, following approval of the study synopsis; recruitment was completed slightly earlier than the planned duration as the calculated sample size was reached ahead of schedule. The study was approved by the Institutional Review Board (IRB), Lady Reading Hospital – MTI, Peshawar (Ref. No. 366/LRH/MTI, dated 16th July 2025), and was conducted in accordance with the principles of the Declaration of Helsinki. A total of 133 patients aged 15 to 80 years of either gender who underwent transpedicular screw fixation for spinal pathology were enrolled through non-probability consecutive sampling; the sample size was calculated using the WHO sample size calculator, with a 95% confidence level and a 3% margin of error. Patients below 15 years of age, those with pre-existing focal neurological deficits, and those with spinal tumors were excluded.

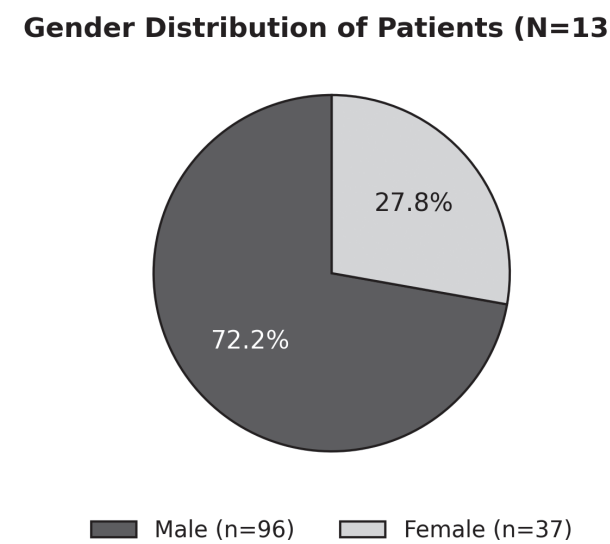
After obtaining informed consent from each patient, data were recorded on a pre-designed structured proforma covering age, gender, occupation, type of surgery, number of screws inserted, and postoperative complications, including screw breakage, screw misplacement, rod breakage, surgical site infection and CSF leak. Diagnosis and outcome were confirmed through history taking, clinical examination and postoperative X-rays, and neurological status was assessed pre- and postoperatively using Frankel Grading for spinal cord injury. All patients were followed for six months through clinical history, examination and postoperative radiographs to document complications. Data were analyzed using SPSS version 25; categorical variables were expressed as frequencies and percentages with 95% confidence intervals, continuous variables as mean ± standard deviation, and patients were stratified into four age groups with the chi-square test applied to assess the association between age and postoperative complications, $p \leq 0.05$ being considered statistically significant.

RESULTS

Transpedicular screw fixation was performed in 133 patients, comprising 96 (72.2%) male and 37 (27.8%) female patients, a male-to-female ratio of 2.5:1 (Figure-1).

FIGURE-1

Gender distribution of patients (N=133).



Patients aged 15 to 80 years were included, with the majority between 30 and 60 years (mean ± SD:

45 ± 10 years). The thoracolumbar region was the most common site of injury (Table-I).

TABLE-I

Distribution of vertebral levels involved (N=133)

Vertebral Level	No. of Patients
D8	10
D11	12
D12	15
D1 + L1 (combined)	18
L1	35
L2	29
L3	14
Total	133

Postoperative neurological outcome was assessed using Frankel Grading (Table-II). The majority of patients, 82 (61.6%), were classified as Grade E (no neurological deficit).

TABLE-II

Postoperative frankel grading (N=133)

Frankel Grade	No. of Patients	Percentage
A	29	21.8%
B	5	3.7%
C	7	5.2%
D	10	7.5%
E	82	61.6%

All patients were followed for six months to document complications through clinical history, examination and postoperative X-rays. Back pain was the most frequent complication, occurring in 35 (26.3%) patients, followed by surgical site infection in 9 (6.8%), bed sores in 5 (3.8%), misplaced screws in 3 (2.3%), screw breakage and CSF leak in 2 (1.5%) each, and nerve root injury, dural tear and deep vein thrombosis (DVT) in 1 (0.75%) patient each. Seventy-four (55.6%) patients had no complications (Table-III, Figure-2).

The association between age and postoperative complications was analyzed using the chi-square test, with age stratified into four groups (Table IV). The calculated χ^2 value was 0.198 (df=3, critical value 7.815 at α=0.05), corresponding to a p-value of 0.978. There was, therefore, no statistically significant association between age and the occurrence of postoperative complications.

TABLE-III

Postoperative complications with 95% confidence intervals (N=133)

Complication	No. of Patients (n=133)	Percentage	95% CI
Back pain	35	26.3%	19.6–34.4%
Surgical site infection	9	6.8%	3.6–12.4%
Bed sores	5	3.8%	1.6–8.5%
Misplaced screws	3	2.3%	0.8–6.4%
Screw breakage	2	1.5%	0.4–5.3%
CSF leak	2	1.5%	0.4–5.3%
Nerve root injury	1	0.75%	0.1–4.1%
Dural tear	1	0.75%	0.1–4.1%
Deep vein thrombosis (DVT)	1	0.75%	0.1–4.1%
No complications	74	55.6%	47.2–63.8%

FIGURE-II

Distribution of postoperative complications (N=133).

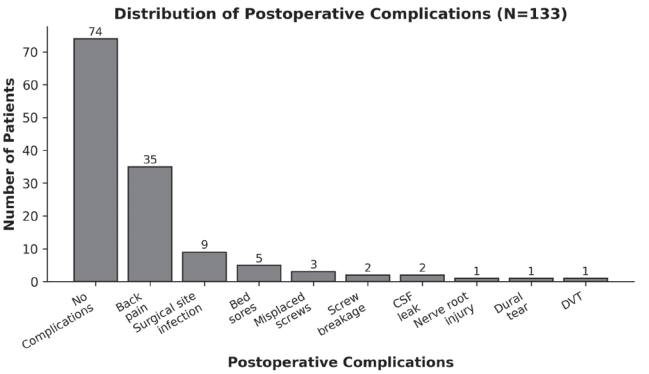


TABLE-IV

Association between age group and postoperative complications (χ^2=0.198, df=3, p=0.978)

Age Group	With Complications	Without Complications	Total
15–30 years	8	12	20
31–45 years	20	25	45
46–60 years	22	26	48
61–80 years	9	11	20
Total	59	74	133

DISCUSSION

The primary aim of transpedicular screw fixation is spinal stabilization, but the procedure continues to carry certain complications and risks. This study

documented the postoperative complications of transpedicular screw fixation in 133 patients at Lady Reading Hospital, Peshawar. A wide range of complications was noted, the most frequent being postoperative back pain (26.3%), followed by surgical site infection (6.8%). Rates of implant-related failure were relatively low, with screw breakage in 1.5%, misplaced screws in 2.3% and nerve root injury in 0.75% of patients.

The demographic distribution in our study showed a male predominance (72.2%), reflecting greater exposure of young and middle-aged males to high-energy trauma such as road traffic accidents and falls from height.[10] The most common site of injury was the thoracolumbar junction (T11–L2), the transition zone between the rigid thoracic and mobile lumbar spine.[10]

Postoperative back pain most likely results from muscle dissection, facet joint injury, the implant acting as a foreign body, or degenerative change.[11] This is generally managed conservatively, underscoring the need for optimized postoperative pain-management protocols and patient counselling. Surgical site infection remains a serious concern, associated with increased morbidity, prolonged hospital stay and compromised surgical outcome; adherence to perioperative antibiotic protocols, aseptic technique, proper instrument sterilization and postoperative wound care may help reduce its incidence.[12]

Our study showed a comparatively low incidence of screw malposition (2.3%) and nerve root injury (0.75%), in contrast to several studies cited in our introduction, which reported screw malposition in up to 40% of cases and neurological deficit in up to 15.09% of patients.[2,4] This difference may be attributed to the routine use of intraoperative fluoroscopic guidance at our center, which improves the accuracy of screw trajectory.[13] The low rate of screw breakage (1.5%) similarly suggests that adequate biomechanical stability was achieved in most patients.[14]

Frankel grading showed that 61.6% of patients had no neurological deficit (Grade E) postoperatively, while 21.8% remained in Grade A (complete spinal cord injury).[15] This distribution indicates that the primary goal of surgery is stabilization rather than neurological recovery, and confirms that the procedure itself does not contribute to neurological decline, as reflected by the very low rate of new nerve root injury.[16]

Statistical analysis showed no significant association between age and the development of postoperative complications.[17] This suggests that, within the age range studied (15–80 years), factors such as surgical technique, bone quality, the nature of the spinal injury and patient comorbidities may be more relevant to postoperative complications than age alone.[18] This observation is of value for preoperative planning and risk assessment in patients being considered for transpedicular screw fixation.[19]

This study has certain limitations, including its single-center design and the relatively small sample size. The six-month follow-up period was adequate for detecting early and mid-term complications such as surgical site infection and implant failure, but was insufficient for assessing long-term outcomes such as adjacent-segment disease, chronic pain and late hardware failure. Multi-center studies with longer follow-up and advanced imaging assessment are recommended to more comprehensively characterize the risk factors and outcomes of this common procedure.

CONCLUSION

Transpedicular screw fixation performed under fluoroscopic guidance is associated with a favorable outcome and a low rate of technical and neurological complications. Postoperative back pain and surgical site infection remain the most significant challenges, highlighting the continued importance of meticulous surgical technique, infection control and postoperative care.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Mansoor Ahmad:** Conceptualization, data collection, drafting.
2	**Farooq Azam:** Supervisor, proof reading.
3	**Zahid Khan:** Data analysis.
4	**Muhammad Bilal:** Data curation, revisions.