

ORIGINAL ARTICLE

Study of course of Deformity in Dorsolumbar Spinal Injuries Managed by Internal Fixation

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ABSTRACT

Background: Dorsolumbar spinal injuries are a major cause of morbidity and disability, often leading to progressive spinal deformity despite surgical stabilization. Internal fixation aims to restore stability and correct deformity; however, loss of correction over time remains a concern. **Aim of the study:** To assess the progression of spinal deformity in patients with dorsolumbar spinal injuries managed by posterior short-segment pedicle screw fixation. **Methods & Materials:** This retrospective study included 12 patients with dorsolumbar spinal trauma treated surgically. Cobb's angle and anterior wedge compression angle were measured preoperatively, postoperatively, and at follow-up. Neurological status (Frankel grading) and functional outcomes (Oswestry Disability Index) were also evaluated. Data were analyzed using Student's t-test and regression analysis. **Result:** Mean Cobb's angle improved from 20.95° preoperatively to 10.1° postoperatively but increased to 17.7° at follow-up ($p=0.0001$). A similar trend was observed in anterior wedge compression angle ($p=0.001$). Neurological status improved in most patients, while some experienced residual deficits. Functional outcomes varied, with higher disability scores in patients with severe deformity or neurological impairment. **Conclusion:** Posterior short-segment fixation significantly corrects deformity initially; however, partial loss of correction occurs over time. Progressive kyphosis and variable functional outcomes highlight the necessity for careful surgical planning, optimal sagittal alignment restoration, and long-term follow-up to prevent deformity progression.

Keywords: Deformity progression, Denis evaluation score, Dorsolumbar injuries, Short-segment pedicle screw fixation

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INTRODUCTION

Dorsolumbar spinal injuries represent one of the most frequent and clinically significant traumatic lesions of the axial skeleton, accounting for nearly 60–70% of all spinal fractures [1,2]. About 250,000 to 500,000 people sustain spinal cord injuries (SCI) every year, with the majority resulting from preventable causes such as road traffic accidents, falls, and violence globally [3]. In Bangladesh, a spinal cord injury accounts for 5–10% of all traumatic hospital admissions. Spinal injuries are a growing cause of morbidity and disability in Bangladesh, largely due to road traffic collisions (RTCs), falls from height, and occupational accidents [4]. The primary goals in managing dorsolumbar spine fractures are to restore spinal stability, achieve neural decompression, correct deformity, and facilitate early mobilization [5]. With the evolution of spinal instrumentation, posterior internal fixation using pedicle screws and rods has become the most widely accepted surgical method for achieving immediate stability and facilitating fusion [6]. About 30–40% of patients with post-traumatic thoracolumbar kyphosis develop persistent pain and reduced functional capacity, even after surgical fixation [7].

In cases of thoracolumbar burst fractures, kyphotic correction often deteriorates over time, even with posterior fixation. Patients treated with short-segment posterior fixation (SSPF) experienced an average loss of approximately 10.4° in the segmental kyphotic angle (SKA) at final follow-up. [8]. The progression of spinal deformity following dorsolumbar trauma carries serious clinical, functional, and psychosocial implications. Kyphotic deformity, which frequently develops after unstable dorsolumbar fractures, can lead to chronic pain, sagittal imbalance, and functional impairment, even in patients who initially achieve neurological recovery. In Bangladesh, patients managed conservatively experienced a mean increase of approximately 7° in kyphosis, while those treated operatively showed a significant correction of around 16°, emphasizing the importance of surgical stabilization in preventing post-traumatic deformity progression [9]. Progressive deformity after internal fixation is not merely a cosmetic concern; it alters spinal biomechanics, increases load on adjacent segments, and predisposes to secondary degeneration and chronic instability. This biomechanical stress can also result in late-onset neurological deterioration,

as demonstrated in long-term follow-up studies of thoracolumbar fractures, where up to 15% of patients developed recurrent neurological symptoms due to canal compromise or implant failure [7]. The extent and morphology of the fracture are also key determinants. Injury to the intervertebral disc adjacent to the fractured level strongly correlates with postoperative loss of correction and segmental collapse [10]. Patient-related factors such as osteoporosis, advanced age, and delayed surgical intervention have been consistently identified as independent predictors of worsening deformity. Poor bone quality leads to early loosening of pedicle screws and inadequate maintenance of reduction, particularly in elderly or postmenopausal patients. In contrast, early fixation and careful restoration of sagittal alignment during surgery are protective against late deformity [11]. This study aimed to evaluate the progression of spinal deformity in patients with dorsolumbar spinal injuries managed by internal fixation.

METHODS & MATERIALS

This retrospective study was conducted Department of Orthopaedics in Holy Family Red Crescent Medical College Hospital, Dhaka, Bangladesh from January 2024 to December 2025. A total of 12 patients were enrolled and analyzed in this study. All patients had spine injuries (dorsal/dorsolumbar/lumbar spine) and were managed surgically with posterior short-segment pedicle screw fixation. The standard posterior approach was used for short-segment pedicle screw fixation. The spine system used was the One Lock Spine System from Adler or the Spine System from Sharma Surgical (SSEPL). The patient's preoperative and postoperative lateral radiographs and neurological status at admission were reviewed. At follow-up, the patients were examined radiologically on lateral radiographs, neurologically and for pain scales by Denis evaluation score.

Inclusion criteria:

- Patients with dorsal/dorsolumbar/lumbar spine injury.

Exclusion criteria:

- Evidence of infection or tumour.
- Congenital deformities of the spine.
- Degenerative disc disease.

Data Analysis

Measurements of deformity were made by Cobb's angle on lateral radiographs done preoperatively postoperatively and at follow-up. Measurements of reduction of the fractured vertebral body were done by the anterior wedge compression angle. The anterior wedge compression angle was measured on lateral radiographs preoperatively, postoperatively and at follow-up. The reduction of the fractured vertebral body was achieved post-operatively, and the change in the reduction of the fractured vertebral body on follow-up was deduced. The neurological status of the patients at the time of admission and follow-up was assessed, and patients were graded with Frankel's Grading System [12]. The postoperative period after which sitting and standing were initiated and the period for which braces were used by the patients was noted. The patients were also evaluated for pain at the follow-up and were classified according to the Denis evaluation scale [1]. The collected data was analyzed using descriptive analyses. Student's t-tests were applied for a change in follow-up compared to postoperative values. The correlation between the progression of Cobb's angle with a change in anterior wedge compression angle and intervertebral disc heights was analyzed by regression analysis and was.

Statistical Analysis

All data were presented in a suitable table or graph according to their affinity. Each table and the graph were described to understand them clearly. All statistical analysis was performed using the statistical package for social science (SPSS) program, and Windows. Continuous parameters were expressed as mean $\pm$ SD and categorical parameters as frequency and percentage. Comparisons between groups (continuous parameters) were made by Student's t-test. Categorical parameters compared by Chi-Square test. The significance of the results as determined by a 95.0% confidence interval and a value of $P < 0.05$ was considered to be statistically significant.

RESULT

The study included 12 patients with a mean age of 38 ± 9.93 years. Most patients were within the 36–45 years age group (41.67%), followed by 26–35 years (33.33%). A smaller proportion were aged 46–55 years (16.67%) and 15–25 years (8.33%). Sex distribution revealed a marked predominance of females (91.67%), while males constituted only 8.33% of the study population (Table I).

Table I: Age distribution of the study population (n=12)

Age (Years)	Frequency	Percentage
15-25	1	8.33
26-35	4	33.33
36-45	5	41.67
46-55	2	16.67
Total	12	100.00
Mean $\pm$ SD	38 $\pm$ 9.93	

Out of the 12 patients, 11 were female (91.67%), while only 1 patient was male (8.33%) (Figure 1).

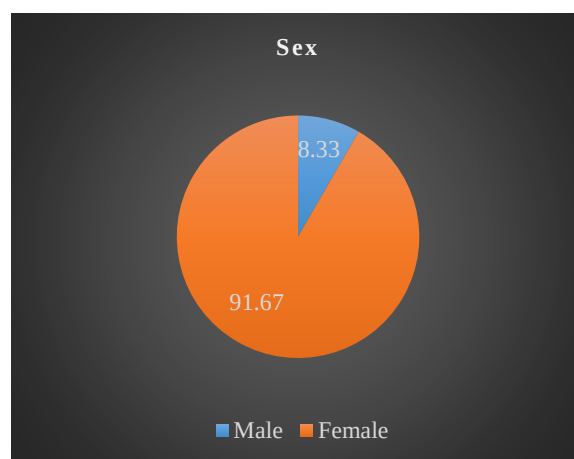


Figure 1: Sex distribution of the study population (n=12)

Preoperative neurological assessment using the Frankel grading system revealed that 2 patients (16.67%) were classified as Grade A and showed improvement to Grade B postoperatively, while another 2 patients (16.67%) remained in Grade A without neurological recovery. One patient (8.33%) in Grade B improved to Grade C, and 1 patient

(8.33%) who was in Grade C preoperatively remained unchanged postoperatively. Additionally, 2 patients (16.67%) improved from Grade D to Grade E. The remaining 4 patients (33.33%) maintained their normal neurological status, staying in Grade E both before and after surgery (*Table II*).

Table II: Distribution of patients according to Frankel grade

Number of patients	Frankel grade pre-op	Frankel grade post-op	Percentage
2	A	B	16.67
2	A	A	16.67
1	B	C	8.33
1	C	C	8.33
2	D	E	16.67
4	E	E	33.33

Table III presented that the mean preoperative Cobb's angle was $20.95^{\circ} \pm 9.79^{\circ}$. This improved significantly to $10.1^{\circ} \pm 6.93^{\circ}$ postoperatively. At follow-up, a mild loss of correction was

observed with a mean Cobb's angle of $17.7^{\circ} \pm 12.87^{\circ}$. The mean preoperative anterior wedge compression angle was $18.45^{\circ} \pm 8.88^{\circ}$, which reduced to $11.95^{\circ} \pm 9.74^{\circ}$ postoperatively.

Table III: Cobb's angle measurement (in degrees)

COBB's Angle	Number of patients	Minimum-Maximum	Mean $\pm$ SD
Pre-operative	12	10-42	20.95 ± 9.79
Post-operative	12	3-28	10.1 ± 6.93
Follow-up	12	6-50	17.7 ± 12.87

At follow-up, a slight increase was noted at $14^{\circ} \pm 11.32^{\circ}$ (*Table IV*). The most commonly affected vertebral level was L1

(50%), followed by D12 (16.67%).

Table IV: Anterior wedge compression angle measurements

Anterior wedge compression angle	N	Minimum-Maximum	Mean $\pm$ SD
Pre-operative	12	5-40	18.45 ± 8.88
Post-operative	12	3-42	11.95 ± 9.74
Follow-up	12	3-46	14 ± 11.32

Other levels involved included D8, D11, L2, and L3 (each 8.33%) (*Table V*).

Table V: Distribution of patients the on basis of the level of the fracture

Level of fracture	Frequency	Percentage
#D8	1	8.33
#D11	1	8.33
#D12	2	16.67
#L1	6	50.00
#L2	1	8.33
#L3	1	8.33
Total	12	100.00

Table VI showed that a statistically significant increase in Cobb's angle was seen from post-operative values ($10.1^{\circ} \pm 6.94^{\circ}$) to follow-up ($17.7^{\circ} \pm 12.87^{\circ}$) with $p=0.0001$. Similarly, anterior wedge compression angle increased significantly from $11.95^{\circ} \pm 9.74^{\circ}$ to $14^{\circ} \pm 11.24^{\circ}$ at follow-up

($p=0.001$). Long-term follow-up (minimum 5 years) showed varied outcomes. Most patients with Frankel Grade E or D achieved good functional recovery with ODI scores ranging from 8 to 22.

Table VI: Change in Cobb's angle and anterior wedge compression angle at follow-up compared to postoperatively

	Post-operative Mean $\pm$ SD	Follow-up Mean $\pm$ SD	p-value
COBBS angle	10.1 $\pm$ 6.943	17.7 $\pm$ 12.872	0.0001
Anterior Wedge Compression Angle	11.95 $\pm$ 9.74	14.00 $\pm$ 11.238	0.001

Patients with persistent neurological deficits (Frankel A or B) had higher disability scores (up to 86). Two patients were lost

to follow-up (Table VII).

Table VII: Oswestry disability index

Patient	Frankel grade at 5 years	ODI at minimum 5 years from date of injury
1	C	20
2	E	22
3	B	78
4	E	8
5	D	12
6	C	28
7	C	18
8	Lost to follow-up	-
9	E	12
10	E	18
11	Lost to follow-up	-
12	A	86

DISCUSSION

Pedicle screw fixation is an effective modality for the treatment of dorsal/dorsolumbar/lumbar spine injuries. Pedicle screw instrumentation makes it possible to reduce thoracolumbar burst fractures over a short segment. Shin et al. retrospectively reviewed 19 patients managed surgically for thoracolumbar fractures by the short-segment pedicle screw fixation technique. They concluded that the short-term follow-up results suggest a favourable outcome for short-segment instrumentation [13]. When applied to patients with isolated spinal fractures who were cooperative with 3–4 months of spinal bracing, short-segment pedicle screw fixation using the posterior approach seems to provide a satisfactory result. Khare et al. carried out a prospective study of 25 patients in the age group of 15–65 years with thoracolumbar fractures with the associated neurological deficit or compression fractures. The average preoperative kyphotic angle as measured by the Cobbs method was 20° which improved to 7.8° following instrumentation. The average preoperative vertebral height was 58.65% which improved to 78.55% postoperatively. They concluded that short segment trans-pedicle posterior fixation is helpful for

not only stabilization of the fractures and restoration of anatomy, but also maintaining the same over a period with good functional outcomes [14]. However, the results of a short-segment posterior stabilization are not always good. Recurrent kyphosis has been reported in various studies. In our study, the mean Cobb's angle improved from 20.95° preoperatively to 10.1 degrees postoperatively. The loss of correction in Cobb's angle at follow-up was 7.1° which was statistically significant. So, there was a long-term significant progression of kyphotic deformity in spinal injuries postoperatively with the posterior pedicle screw system. Similar results were seen in various studies in which their loss in the correction of the kyphotic deformity. Xu et al. in their study had an average correction loss of 12.0° , leaving a final average reduction of 5.8° . Speth et al. in their study had a mean loss in the correction of 10° and 11° in two groups [15]. The patients with Cobb's angle of >15 degrees postoperatively had more increase in Cobb's angle at follow-up. So, it is important to achieve good intraoperative alignment and reduction. Also in our study, there was a loss in the reduction of a fractured vertebra with a mean anterior wedge compression angle of 14.0° at follow-up and 11.95°

postoperatively and mean the loss of reduction of 2.05° which was statistically significant. The loss in the correction of Cobb's angle was more than a loss in the reduction of the anterior wedge compression angle. There was also the progressive collapse of upper and lower intervertebral disc spaces adjacent to the fractured vertebra at follow-up compared to postoperatively. This was statistically significant anteriorly, in the middle and posteriorly for both upper and lower intervertebral disc spaces. The collapse of intervertebral disc spaces was also found in studies by Xu et al., Speth et al., and Huang et al. [15-17]. The correlation between loss in the correction of Cobb's angle and loss in the reduction of anterior wedge compression angle and collapse of intervertebral disc spaces was also studied. There was a statistically significant correlation found between loss in the correction of Cobb's angle and loss in the reduction of the anterior wedge compression angle ($p = 0.001$). Similar results were obtained by Lakshmanan et al. in their study where the loss in the reduction of vertebral body correlated with loss of correction of deformity as a decrease in fractured vertebral body heights correlated with an increase in Cobb's angle. They concluded that there is a progressive loss of correction of the angle of kyphosis after posterior stabilization with instrumentation even without implant removal that mainly corresponds to the decrease in the anterior segment height of the fractured vertebral body [18]. Also, the back pain was well tolerated at the follow-up by the patients. 50% of patients had no pain (Denis grade P1), 40% of patients had mild pain (Denis grade P2), and 10% of patients had moderate pain (Denis grade P3). Significant pain (P3 and above) at follow-up was seen in two patients with postoperative Cobb's angle of more than 15°. So, it is important to achieve adequate intraoperative alignment or reduction. Wang et al. had 11 (40.7%) of the 27 patients rated P1 (no pain), 14 (51.9%) rated P2 (occasional pain), 1 (3.7%) rated P3 (moderate pain) and 1 (3.7%) rated P4 (moderate to severe pain) [19].

LIMITATIONS

This study is limited by its small sample size ($N=12$), which reduces the statistical power and generalizability of the findings. Being a single-center retrospective analysis, it is subject to selection and reporting bias. The follow-up duration varied among patients, with some lost to follow-up, potentially affecting long-term outcome assessment. Additionally, factors such as bone mineral density, implant-related complications, and patient rehabilitation protocols were not uniformly evaluated, which may influence deformity progression and functional outcomes.

CONCLUSION & RECOMMENDATIONS

Pedicle screw fixation for dorsal/dorsolumbar/lumbar spine injuries has satisfactory outcomes. Postoperative reduction or alignment is an important predictor for the progression of the deformity. So it is important to achieve adequate intraoperative alignment or reduction. There was a long-term progression of kyphotic deformity after pedicle screw fixation which was positively correlated with loss in the reduction of anterior wedge compression angle and the collapse of intervertebral disc height anteriorly. Significant pain (P3 and above) at follow-up was seen in two patients with postoperative Cobb's angle of more than 15°. So, even as the deformity progresses but the pain is well tolerated by the patients. Significant pain was present in patients who had inadequate postoperative alignment or reduction.

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CONFLICT OF INTEREST

None declared

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

REFERENCES

1. Denis F. The three column spine and its significance in the classification of acute thoracolumbar spinal injuries. *Spine*. 1983 Nov 1;8(8):817-31.
2. Magerl F, Aebi M, Gertzbein SD, Harms J, Nazarian S. A comprehensive classification of thoracic and lumbar injuries. *European Spine Journal*. 1994 Aug;3(4):184-201.
3. World Health Organization, International Spinal Cord Society. *International perspectives on spinal cord injury*. World Health Organization; 2013.
4. Uz-Zaman MH, Rahman A, Yasmin M. Epidemiology of hepatitis B virus infection in Bangladesh: prevalence among general population, risk groups and genotype distribution. *Genes*. 2018 Nov 8;9(11):541.
5. Rajasekaran S. Thoracolumbar burst fractures without neurological deficit: the role for conservative treatment. *European Spine Journal*. 2010 Mar;19(Suppl 1):40-7.
6. McCormack T, Karaikovic E, Gaines RW. The load sharing classification of spine fractures. *Spine*. 1994 Aug 1;19(15):1741-4.
7. Wood KB, Li W, Lebl DS, Ploumis A. Management of thoracolumbar spine fractures. *The spine journal*. 2014 Jan 1;14(1):145-64.
8. Hashimura T, Onishi E, Ota S, Tsukamoto Y, Yamashita S, Yasuda T. Correction loss following short-segment posterior fixation for traumatic thoracolumbar burst fractures related to endplate and intervertebral disc destruction. *BMC Musculoskeletal Disorders*. 2023 Mar 8;24(1):174.
9. Rahman MM, Islam NA, Islam MS, Alam MT, Islam MA, Sarker ZH, Islam S. Management of Post Traumatic Kyphotic Deformity in Thoracolumbar Spine: Conservative versus Operative Treatment. *Mymensingh medical journal: MMJ*. 2018 Oct 1;27(4):715-22.
10. Jin C, He L, Chen X, Zheng J, He W, Han W. Risk factors for progressive kyphosis after percutaneous kyphoplasty in osteoporotic vertebral compression fracture. *Open Medicine*. 2024 Dec 9;19(1):20241107.
11. Zhang J, Ye Z, Mao Y. Factors associated with loss of vertebral height and kyphosis correction after intermediate screws in short segment pedicular fixation for type-A fractures of the thoracolumbar spine: A retrospective study. *Medicine*. 2024 May 31;103(22):e38343.
12. Frankel HL, Hancock DO, Hyslop G, Melzak J, Michaelis LS, Ungar GH, Vernon JD, Walsh JJ. The value of postural reduction in the initial management of closed injuries of the spine with paraplegia and tetraplegia. *Spinal cord*. 1969 Nov;7(3):179-92.
13. Shin TS, Kim HW, Park KS, Kim JM, Jung CK. Short-segment pedicle instrumentation of thoracolumbar burst-compression fractures; short term follow-up results. *Journal of Korean Neurosurgical Society*. 2007 Oct 20;42(4):265.
14. Khare S, Sharma V. Surgical outcome of posterior short segment trans-pedicle screw fixation for thoracolumbar fractures. *Journal of orthopaedics*. 2013 Dec 1;10(4):162-7.
15. Xu BS, Tang TS, Yang HL. Long-term results of thoracolumbar and lumbar burst fractures after short-segment pedicle instrumentation, with special reference to implant failure and correction loss. *Orthopaedic surgery*. 2009 May;1(2):85-93.
16. Speth MJ, Oner FC, Kadic MA, de Klerk LW, Verbout AJ. Recurrent kyphosis after posterior stabilization of thoracolumbar fractures: 24 cases treated with a Dick internal fixator followed for 1.5-4 years. *Acta Orthopaedica Scandinavica*. 1995 Jan 1;66(5):406-10.
17. Huang W, Luo TA. Efficacy analysis of pedicle screw internal fixation of fractured vertebrae in the treatment of thoracolumbar fractures. *Experimental and therapeutic medicine*. 2013 Mar 1;5(3):678-82.
18. Lakshmanan P, Jones A, Mehta J, Ahuja S, Davies PR, Howes JP.

Recurrence of kyphosis and its functional implications after surgical stabilization of dorsolumbar unstable burst fractures. The Spine Journal. 2009 Dec 1;9(12):1003-9.

19. Wang XY, Dai LY, Xu HZ, Chi YL. Kyphosis recurrence after posterior short-segment fixation in thoracolumbar burst fractures. *Journal of Neurosurgery: Spine. 2008 Mar 1;8(3):246-54.*