Outcomes of Treatment of Thoracolumbar Burst Fractures with Intact Neurology Treated in Karnali Academy of Health Sciences, Nepal

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ABSTRACT

Background

The vulnerability of the thoracolumbar junction for a higher incidence of fracture with neural injury is mainly due to its anatomical peculiarity. The management of thoracolumbar burst fractures remains controversial due to the potential for further neurological deterioration and vertebral collapse at the thoracolumbar junction.

Objective

To investigate the outcomes of treatment of thoracolumbar burst fractures with intact neurology treated in Karnali Academy of Health Sciences, Nepal.

Method

This retrospective comparative study was done at Karnali Academy of Health Sciences, which included patients with thoracolumbar burst fractures classified as AO type A3 and A4, treated conservatively or operatively at 2 years follow-up. Data on demographics, kyphotic angles at injury were collected and at 2 years follow-up, and Patient-Reported Outcomes with the Nepali version (PROST) and Visual Analog Scale (VAS) scores for pain assessment.

Result

The results showed that 32 patients had a mean age of 43.47 years, with a majority in the 30-49 age group, showed a female predominance (56.3%) and fall injuries as the most common cause (78.2%). A total of 18 cases of AO type A3 and A4 were managed conservatively, while 14 cases were managed operatively of AO type A4. There was a significant difference in the kyphotic angle correction in operative cases (19.57 ± 8.19 vs 13.21 ± 5.57 degree (p-value < 0.001). In addition, there was no statistically significant improvement in functional outcome via PROST scores (p-value = 0.718) and VAS score (p-value = 0.450) in conservative and operative treatment.

Conclusion

Surgical intervention significantly improved kyphotic angles in AO type A4 patients, but the conservative management in both AO type A3 and AO A4 showed no significant change in kyphotic angle. However, PROST Nepali score and VAS score among conservative and operative cases were comparable and not statistically significant.

KEY WORDS

Burst fracture, PROST Nepali, Thoracolumbar vertebra, Treatment outcome, Visual analog scale

INTRODUCTION

Thoracolumbar fractures are the most common location of spinal injury, comprising 17% of all spinal fractures.[1] The thoracolumbar junction, spanning from T12 to L2, is a transition zone where the relatively immobile thoracic vertebra meets the more mobile lumbar vertebra. This junctional area is prone to stress forces, leading to high incidence of fractures and associated neural injuries.[1,2]

The treatment of thoracolumbar fractures is subject to debate, particularly regarding burst fractures with intact neurology. The decision between conservative management and surgical intervention hinges on the stability of the fracture. Stability is often assessed using White and Punjabi's criteria and the Dennis three-column concept.[3,4] Universal indication for early surgical decompression and fusion is progressive neurological deterioration and fracture dislocation.[2,4] An incidence of 17% neurological deterioration has been reported in patients with thoracolumbar fractures treated conservatively.[5] Even though the thoracolumbar injury classification and severity score (TLICS) has been postulated to guide whether to go with conservative management or operative management in thoracolumbar burst fracture with intact neurology but controversy still exists.[6] This study aims to find the outcomes of patients with thoracolumbar burst fractures with intact neurology treated in Karnali Academy of Health Sciences (KAHS).

METHODS

This is a retrospective comparative study done at Karnali Academy of Health Sciences done from February to May 2024. Ethical approval was obtained from the Institutional Review Committee of Karnali Academy of Health Sciences, Nepal (Ref no 081/082/07). Convenient sampling done with inclusion of all the patients with thoracolumbar burst fracture and classified as per Arbeitsgemeinschaft für Osteosynthesefragen (AO) type A3 and A4 treated in KAHS either conservatively or operatively. The inclusion criteria include all patients above 18 years with thoracolumbar fractures with intact neurology and those who have completed 2 years post-injury. Those patients with fractures associated with other spinal pathologies or comorbidities were excluded from the study.

Patient's demographic data, age, sex, mode of injury, and treatment given were collected from admission notes and OT case notes. Radiographs of the patient's anterior-posterior (AP) and lateral views were evaluated. In the lateral view, the amount of regional kyphosis angle using Cobb's method5 was measured using the radiographs taken at the time of admission and at 2 or more years of follow up as shown in figures 1 and 2. Regional kyphosis Cobb angle (measured as the angle between the superior endplate of the vertebra above the fracture and the inferior endplate of the vertebra below the fracture) was measured.[5]

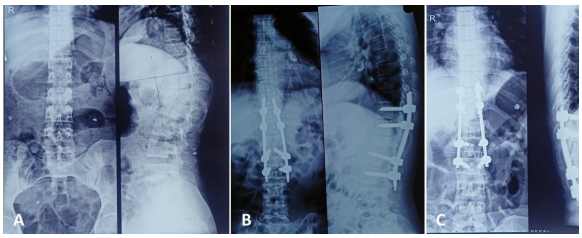

Figure 1. Operative treatment of D12 AO A4 type fracture. A: D12 burst fracture with Cobb's angle calculation. B: Immediate Post Operative X-ray. C: X-ray at 2-year follow-up.

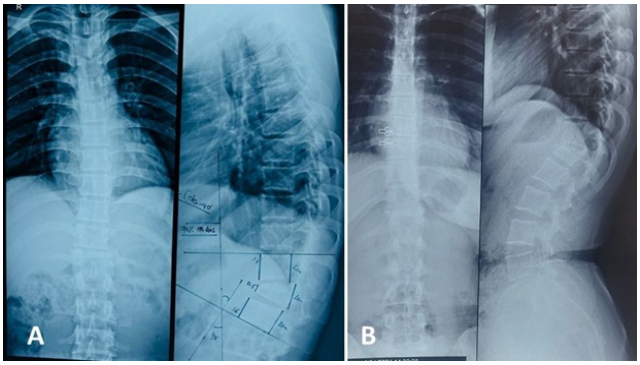

Figure 2. conservative management of L1 AO A3 type fracture. A: L1 burst fracture with Cobb's angle calculation. B: L1 burst fracture at 2-year follow-up.

Patients were followed at 2 years after the injury, and they were asked to fill out the form PROST (Patients Reported Outcomes of Spinal Trauma) in the Nepali version.[6] PROST in Nepali consists of 19 questionnaires, each question scoring from 0 to 100. The Score was calculated from the total score divided by the number of questions answered.[7] The Visual analog scale at the 2-year follow-up was also taken to record the pain level. VAS score is 0 to 10, 0 being no pain to 10 being the severe pain.[8]

Patient's demographic data, age, sex, mode of injury, and treatment given were collected from admission notes and the patient's chart. Data were collected and entered in MS Excel. Statistical analysis of data was done using SPSS 20. Descriptive statistics were used to summarize demographic data. A paired t-test was done to study the change in kyphotic angle before and after treatment in conservative and operative cases. An independent t-test was used to compare the results of the VAS and PROST questionnaires in conservative and operative cases to study the treatment outcome. A p-value of 0.05 was considered statistically significant.

RESULTS

A total of 32 patients were included in the study. The mean age was 43.0 ± 4.7 years (Table 1). Females comprised 56.3% of the study population. Fall injury, being the commonest mode of injury, accounts for 78.2%, followed by Road Traffic Accident (RTA). The total patients managed conservatively and operatively was 18 and 14, respectively. A total of 14 patients were classified as AO type A3, and 18

patients were classified as AO type A4. All patients classified as AO type A4, 4 cases were managed conservatively, and 14 were managed operatively, as shown in table 1. The mean kyphotic angle of patients classified as AO type A3 at presentation was 24.29 ± 7.99 degree, and at two years of follow-up was 23.14 ± 6.31 degree after the conservative treatment. The average kyphotic angle for patients classified as AO type A4 and managed conservatively was 23.5 ± 11.81 degrees at the initial presentation and 25 ± 6.83 degrees at the 2-year follow-up. For patients with AO type A4 who underwent surgery, the average kyphotic angle was 19.57 ± 8.19 degrees initially and 13.21 ± 5.57 degrees at the 2-year follow-up. The changes in mean kyphotic angle for conservatively treated patients with AO type A3 and A4 were not statistically significant, with p-values of 0.718 and 0.450, respectively. In contrast, the surgical cases for AO type A4 showed significant correction of the kyphotic angle at the 2-year follow-up. As shown in table 2 while comparing the effect of treatment on kyphotic angle at final follow up found that those patients operated on had significant improvement in the kyphotic angle at 2-year follow-up, with p-value < 0.001 compared to those managed conservatively in both A3 and A4. In the A3 conservative group, the mean difference in Kyphotic angle was 1.15 degrees, but the 95% CI (-4.73 to 7.03) included 0, indicating no significant effect. For A4 conservative, the mean difference was -1.50 degrees, with the 95% CI (-23.22 to 20.22), also showing no significant effect. In contrast to these, A4 Operative showed a mean difference of 6.36 degrees, with a 95% CI (0.64 to 12.08), indicating a significant improvement in the Kyphotic angle, as shown in table 2.

Patient-related Outcome of Spinal Trauma patients in the Nepali version and VAS score showed no significant difference whether managed conservatively or operatively in both AO type A3 or A4, as shown in table 3. As shown in table 3, the average VAS score at 2-year follow-up was 2.83 ± 1.543 and 2.43 ± 1.399 in both conservative and operative groups, respectively, showing no significant difference in VAS score at 2-year follow-up with p-value 0.450 with CI (-674 to 1.484) as in table 3. The average PROST score in the Nepali version in patients managed conservatively and operatively in both A3 and A4 was 82.983 ± 6.104 and 83.700 ± 4.651, respectively, with no significant improvement in the functional outcome of patients, with a p-value of 0.718 with CI (-4.73 to 3.301) as in table 3.

Table 1. Demographic details of the study.

Characteristic		Frequency (%)
Age group	< 30 years	7 (21.9)
	30 - 49 years	15 (46.9)
	> 50 years	10 (31.2)
Sex	Male	14(43.8)
	Female	18 (56.2)
AO classification	A3	14 (43.8)
	A4	18 (56.2)
Treatment	Conservative	18 (56.2)
	Operative	14 (43.8)
Mode of injury	Fall from hill	15 (46.9)
	Fall from roof	10 (31.2)
	RTA	7 (21.9)

Table 2. Result of the kyphotic angle in two treatments.

Treatment	Diagnosis AO Type	Kyphotic Angle at Presentation (mean ± SD)	Kyphotic Angle at 2 Years (mean ± SD)	Mean Difference (°)	95% Confidence Interval (°)	p-value
Conservative (18)	A3 (14)	24.29 ± 7.995	23.14 ± 6.311	1.15	(-4.73, 7.03)	0.718
	A4 (4)	23.50 ± 11.818	25.00 ± 6.831	-1.50	(-23.22, 20.22)	0.450
Operative (14)	A4 (14)	19.57 ± 8.197	13.21 ± 5.577	6.36	(0.64, 12.08)	<0.001*

Statistical analysis done using the paired t-test. *Significant at p-value < 0.05.

Table 3. Result of VAS and PROST Nepali in conservative and operative treatment.

	Treatment	N	Mean	SD	SEM	95%CI	p-value
VAS	Conservative	18	2.83	1.54	0.36	-6.74 to 1.484	0.450
	Operative	14	2.43	1.4	0.37		
PROST Nepali	Conservative	18	82.983	6.10	1.44	-4.73 to 3.301	0.718
	Operative	14	83.700	4.65	1.24		

CI = Confidence Interval, SD = standard deviation,
SEM = Standard Error Mean
Statistical analysis done using the Independent t-test.
Significant at p-value < 0.05.

DISCUSSIONS

Treatment of thoracolumbar burst fractures is debatable in cases of AO type A3 and A4. Various studies have been conducted to review the functional outcome of patients treated either conservatively or operatively using various scoring systems like Oswestry Disability Index (ODI), Roland Morris Low Back Pain and Disability questionnaires (RMDQ), which were mainly used for degenerative spine pathology.[2,9,10] This study mainly uses the Nepali version of PROST initially produced and validated by Sadiqi et al. and later translated and validated in Nepali by Dhakal et al.[6,7]

In this study, female patients in their productive age group had a higher incidence of thoracolumbar burst fracture (56.3%). Parajuli et al. found a similar result; however,

Wood et al., Gnanenthiran et al., Siebenga et al., and Dai et al. found male predominance in thoracolumbar burst fractures.[9-13] Fall injury (78.2%) was the most common mode of injury leading to thoracolumbar burst fracture in this study, followed by RTA (21.8%). Various epidemiological studies done in Nepal by Parajuli et al. and Devkota et al. found similar results.[11,14] However, the study done by Wood et al. and Zileli et al. found RTA to be the commonest mode of injury in patients with thoracolumbar burst fracture.[4,15] This difference in female dominance with fall injury, the commonest mode of injury in this study, stems from the fact that females in this part of the world frequently travel to the hills to collect wood for firing and to gather food for cattle.

In this study, there was no significant change in kyphotic angle between patients treated conservatively in both AO type A3 and A4. Patients with AO type A4 managed operatively had significant correction of kyphotic angle, but this improvement did not show a significant difference in either the PROST in the Nepali version or the VAS score, as shown in table 1. The radiological correction of a thoracolumbar burst fracture, whether treated conservatively or surgically, did not alter the patients' functional outcome. Hitchon et al. found no significant change in neurology, even after a 7-degree loss of angulation.[16] Bedbrook et al. did a study on 147 thoracolumbar fractures, noting that the 40 degrees of angulation were well tolerated without functional impairment.[24] Chou et al. conducted a meta-analysis in which they found that the surgery group had a kyphotic angle 6.35 degrees lower than the non-operative group and experienced a 4.5 degree regression at each 10-year follow-up, although this regression was not significant.[17,18] A similar study done by Giordan et al. and Lan et al. compared the two surgical fixation methods for the treatment of thoracolumbar burst fractures in neurological intact patients, found no significant difference in mean kyphotic angle change between the groups at 24-month follow-up.[19,20] In a retrospective study, Shen et al. also failed to find any correlation between the change in kyphosis angle and clinical outcome.[2] A study by Siebenga et al. found the operative group of patients had better functional outcome as per the RMDQ questionnaire in comparison to the non-operative group; however, this study could not find any correlation between kyphotic angle regression with clinical outcome in both groups.[9] Studies performed before 2000 showed the operative group had significant improvement radiographically, but that too didn't correlate significantly with functional outcome.[21-23] While this study provides valuable insights into the outcomes of thoracolumbar burst fractures in patients with intact neurology, it has a few limitations. Being retrospective and involving a small number of patients, the findings may not be widely generalizable. The treatment approach was not randomized, introducing potential selection bias, and the two-year follow-up may not capture longer-term issues such as late kyphotic progression or persistent pain.

This is a retrospective study with a small sample size due to our inclusion criteria, in addition to the fact that it was very difficult to get such cases. But this is the first study with a retrospective design in patients with thoracolumbar burst fractures classified as AO type A3 and A4, treated conservatively or operatively at 2 years follow-up at KAHS, Nepal. This study can be extended in the future in a larger sample size and a multicenter study in a prospective design.

CONCLUSION

In this study, surgical intervention significantly improved kyphotic angles in AO type A4 patients but did not enhance functional outcomes (PROST and VAS scores). Conservative management showed no significant kyphotic angle changes in AO type A3 and minimal collapse in AO type A4, with comparable functional outcomes to surgical cases.

REFERENCES

1. Rajasekaran S. Thoracolumbar burst fractures without neurological deficit: The role for conservative treatment. *Eur Spine J.* 2010;19(SUPPL. 1):40-7.
2. Shen WJ, Shen YS. Nonsurgical treatment of three-column thoracolumbar junction burst fractures without neurologic deficit. *Spine* (Phila Pa 1976). 1999 Feb 15;24(4):412-5. doi: 10.1097/00007632-199902150-00024. PMID: 10065527.
3. Panjabi MM, White AA 3rd. Basic biomechanics of the spine. *Neurosurgery.* 1980 Jul;7(1):76-93. doi: 10.1227/00006123-198007000-00014. PMID: 7413053.
4. Wood K, Buttermann G, Mehbod A, Garvey T, Jhanjee R, Sechriest V. Operative compared with nonoperative treatment of a thoracolumbar burst fracture without neurological deficit. A prospective, randomized study. *J Bone Joint Surg Am*. 2003 May;85(5):773-81. doi: 10.2106/00004623-200305000-00001. Erratum in: J Bone Joint Surg Am. 2004 Jun;86-A(6):1283. Butterman, G [corrected to Buttermann, G]. PMID: 12728024.
5. Soultanis K, Thano A, Soucacos PN. "Outcome of thoracolumbar compression fractures following non-operative treatment." *Injury* [Internet]. 2021;52(12):3685-90. Available from: https://doi.org/10.1016/j.injury.2021.05.019
6. Dhakal GR, Sadiqi S, Dhakal R, Dhungana S, Yadav PK, Shah G, et al. Reliability and Validity of the Adapted Nepali Version of the AO Spine Patient Reported Outcome Spine Trauma. *J Nepal Health Res Counc*. 2022;19(4):730-9.
7. Sadiqi S, Lehr AM, Post MW, Dvorak MF, Kandziora F, Rajasekaran S, et al. Development of the AOSpine Patient Reported Outcome Spine Trauma (AOSpine PROST): a universal disease-specific outcome instrument for individuals with traumatic spinal column injury. *Eur Spine J*. 2017;26(5):1550–7.
8. Jensen MP, Karoly P, Braver S. The measurement of clinical pain intensity: a comparison of six methods. *Pain* [Internet]. 1986;27(1). Available from: https://journals.lww.com/pain/fulltext/1986/10000/the_measurement_of_clinical_pain_intensity__a.10.aspx

9. Siebenga J, Leferink VJM, Segers MJM, Elzinga MJ, Bakker FC, Haarman HJTM, et al. Treatment of traumatic thoracolumbar spine fractures: A multicenter prospective randomized study of operative versus nonsurgical treatment. *Spine* (Phila Pa 1976). 2006;31(25):2881–90.
10. Wood KB, Buttermann GR, Phukan R, Harrod CC, Mehbod A, Shannon B, et al. Operative compared with nonoperative treatment of a thoracolumbar burst fracture without neurological deficit: a prospective randomized study with follow-up at sixteen to twenty-two years. *J Bone Joint Surg Am*. 2015 Jan 7;97(1):3-9.
11. Parajuli B, Kayastha S, Thapa J, Shrestha D. Traumatic Thoracic and Lumbar Spine Injury in Adult Population Presenting to a Tertiary Care Hospital. *J Nepal Health Res Counc*. 2022;20(2):392-8.
12. Gnanenthiran SR, Adie S, Harris IA. Nonoperative versus operative treatment for thoracolumbar burst fractures without neurologic deficit: A meta-analysis. *Clin Orthop Relat Res*. 2012;470(2):567-77.
13. Dai LY, Jiang LS, Jiang SD. Conservative treatment of thoracolumbar burst fractures: A long-term follow-up results with special reference to the load sharing classification. *Spine* (Phila Pa 1976). 2008;33(23):2536-44.
14. Devkota P, Manandhar H, Khadka P. Spinal Injuries in a Tertiary Care Referral Center of Western Nepal. *Nepal J Med Sci.* 2013;2(2):156-9.
15. Zileli M, Sharif S, Fornari M. Incidence and Epidemiology of Thoracolumbar Spine FracturesWFNS Spine Committee Recommendations. *Neurospine*. 2021;18(4):704–12.
16. Hitchon PW, Torner JC, Haddad SF, Follett KA. Management options in thoracolumbar burst fractures. *Surg Neurol*. 1998;49(6):619-27.
17. Chow GH, Nelson BJ, Gebhard JS, Brugman JL, Brown CW, Donaldson DH. Functional outcome of thoracolumbar burst fractures managed with hyperextension casting or bracing and early mobilization. *Spine* (Phila Pa 1976). 1996 Sep 15;21(18):2170-5.
18. Chou TY, Tsuang FY, Hsu YL, Chai CL. Surgical Versus Non-Surgical Treatment for Thoracolumbar Burst Fractures Without Neurological Deficit: A Systematic Review and Meta-Analysis. *Glob Spine J.* 2024;14(2):740-9.
19. Giordan E, Verme J Del, Pastorello G, Gallinaro P, Zanata R, Canova G, et al. Treatment of thoracolumbar burst fractures: SpineJack vs. posterior arthrodesis comparison of clinical and radiological outcomes. *J Spine Surg*. 2022;8(2):242-53.
20. Lan T, Chen Y, Hu S yu, Li A lin, Yang XJ. Is fusion superior to non-fusion for the treatment of thoracolumbar burst fracture? A systematic review and meta-analysis. *J Orthop Sci* [Internet]. 2017;22(5):828-33. Available from: http://dx.doi.org/10.1016/j.jos.2017.05.014
21. Yazici M, Atilla B, Tepe S, Çalisir A. Spinal canal remodeling in burst fractures of the thoracolumbar spine: a computerized tomographic comparison between operative and nonoperative treatment. *Clin Spine Surg.* 1996 Oct 1;9(5):409-13.
22. Denis F, Armstrong GW, Searls K, Matta L. Acute Thoracolumbar Burst Fractures in the Absence of Neurologic Deficit A Comparison Between Operative and Nonoperative Treatment. *Clin Orthop Relat Res*. 1984;189:142-9.
23. Domenicucci M, Preite R, Ramieri A, Ciappetta P, Delfini R, Romanini L. Thoracolumbar fractures without neurosurgical involvement: surgical or conservative treatment? *J Neurosurg Sci.* 1996 Mar 1;40(1):1-0.
24. Bedbrook GM. Spinal injuries with tetraplegia and paraplegia. *J Bone Joint Surg Br.* 1979;61B (3):267-84.