J Orthop Spine Trauma. 2023 September; 9(3): 129-32. DOI: 10.18502/jost.v9i3.13033

Research Article

Early Mobilization in Thoracolumbar Burst Fractures without Neurological Deficit Managed Conservatively

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Received: 17 December 2022; **Revised:** 24 February 2023; **Accepted:** 10 April 2023

Abstract

Background: Since long, thoracolumbar burst fractures have been treated either by prolonged bed rest or by surgical fixation. In this study, outcomes of early mobilization with non-operative treatment are evaluated to avoid unnecessary surgery and complications of prolonged bed rest.
Methods: This prospective observational study included 40 patients with thoracolumbar burst fractures with no neurological deficit. Patients were mobilized with Taylor's brace as soon as acute pain subsided and reviewed for at least two years with standing radiographs. They were evaluated for anterior vertebral height loss (VHL), kyphotic angle (KA), pain by Visual Analogue Scale (VAS), Oswestry Disability Index (ODI), and neurological deterioration at presentation, one month, six months, and two years.
Results: The mean progression of kyphosis over two years was 7.8 degrees. The mean VHL also progressed from a mean of 51.9% at presentation to 60.4% at the two-year follow-up, a mean progression of 8.5%. At two years of follow-up, the mean ODI and the mean VAS score were 10.1% and 0.7, respectively. No patient developed a neurological deficit.
Conclusion: Even though there is some deterioration in radiological parameters, there is constant improvement in functional parameters. For these fractures, non-operative management using a brace and early mobilization promises comparable results without the cost and risk of surgery.

Keywords: Early Ambulation; Spinal Fractures; Thoracic Vertebrae; Lumbar Vertebrae; Treatment Outcome

Citation: Kumar S, Saini NK, Chadha M. **Early Mobilization in Thoracolumbar Burst Fractures without Neurological Deficit Managed Conservatively.** *J Orthop Spine Trauma* 2023; 9(3): 129-32.

Background

An annual incidence of spinal fractures has been found to range from 64 per 100000 to 190 per 100000 people. Treatment of thoracolumbar fracture can differ globally, depending on institutional or individual practices, and can vary from bracing to 360° surgical fusion. The total spectrum of traumatic thoracolumbar spine management includes non-surgical management, posterior reduction and stabilization, anterior decompression and stabilization, and combined anterior and posterior surgery (1, 2).

The proponents of surgical stabilization suggest that surgery results in early mobilization, and thus minimizes recumbency-associated complications (3). If early mobilization with conservative treatment proves to be as effective as has been shown in a few Western studies, then the same can be advocated for thoracolumbar burst fracture without neurological deficit (4, 5). This will not only minimize the cost of surgical treatment to the patient and healthcare infrastructure but also prevent complications from occurring that are attributable to surgical intervention. The aim of this study was to assess the functional and radiological outcomes with early mobilization in thoracolumbar burst fractures without any neurological injury managed non-operatively.

Methods

This prospective observational cohort study was conducted from 2016 to 2019 in UCMS and GTB Hospital, Delhi, India.

The study protocol was approved by the Institutional Ethical Committee-Human Research (IEC-HR), University College of Medical Sciences at the University of Delhi, India.

Patients aged 18-50 years of either sex who had traumatic thoracolumbar burst fractures with intact neurology were included in our study. Informed consent was obtained from the patients or their guardians. Patients with more than one vertebral level involvement, pathological fractures, or coexisting injuries which precluded the patient from sitting or standing (for example, head and pelvic injuries), and those who did not turn up in follow-up were excluded from the study. We included 40 patients who were treated between October 2016 to October 2017 for this study. The patients were followed up till December 2019 (average: two-year follow-up).

On arrival at the hospital, a detailed evaluation was done to rule out other major and minor injuries. Patients were stabilized, neurological charting was done, and a clinical diagnosis was made. Antero-posterior (AP) and lateral radiographs of the thoracolumbar spine of all the patients were obtained. Lateral radiographs were evaluated for kyphotic angle (KA) and anterior vertebral height (VH) (Figure 1).

The average anterior height of two adjacent vertebrae subtracted by the anterior height of the fractured vertebrae was considered as anterior VH loss (VHL). Criteria of instability taken are a height loss of more than 50% or kyphosis of more than 30 degrees (5). The fracture was further classified primarily according to AO classification, and a clinico-radiological diagnosis was established. Magnetic resonance imaging (MRI) was done to assess primarily the posterior ligamentous complex disruption.

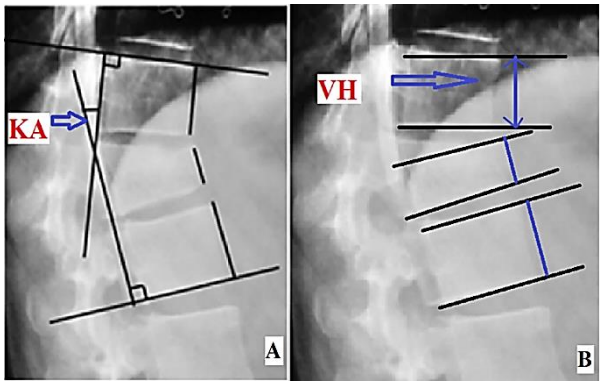

Figure 1. Methods of radiographic measurements of kyphotic angle (KA) (A), and vertebral height (VH) (B)

For pain, analgesics, such as nonsteroidal anti-inflammatory drugs (NSAIDs) and opioid analgesics, were given initially on a regular basis and later as and when required, and the patient was advised to complete bed rest. Relevant measures were taken to prevent complications of prolonged recumbency, such as bed sores, pneumonitis, etc. Patients were allowed to sit, as soon as pain permitted, with Taylor's spinal brace and gradually mobilized within two weeks of being injured.

Patients were followed up clinically at every month for clinical assessment and were evaluated for anterior VHL, KA, pain by Visual Analogue Scale (VAS), Oswestry Disability Index (ODI), and neurological deterioration at presentation, one month, six months, and two years. Two observers recorded data on the above parameters. Microsoft Excel data sheet was used for data collection. To summarize the data for continuous variables, mean and standard deviation (SD) and for categorical variables, percentage were used. We calculated intra-class correlation coefficient (ICC) to determine inter-observer agreement.

Results

The baseline demographic data are summarized in table 1.

Table 1. Baseline demographic data of patients

Variables		Value
Age (year) (mean ± SD)		37.00 ± 7.72 (range: 20 to 50)
Gender [n (%)]	Women	26 (65.0)
	Men	14 (35.0)
BMI (kg/m2) (mean ± SD)		26.48 ± 3.29 (range: 21.8 to 32.9)
	T10	6 (15.0)
	T11	2 (5.0)
	T12	6 (15.0)
	L1	11 (27.5)
	L2	15 (37.5)

SD: Standard deviation; BMI: Body mass index

Inter-observer agreement was very good (ICC: 0.95). The mean ODI score was significantly improved (P < 0.0001) at one-month, six-month, and two-year follow-ups as compared to the initial presentation. The mean percentage of VHL progressed significantly (P < 0.0001) at one and six months of the follow-up but remained almost constant at the two-year follow-up as well as compared to six-month follow-up. The mean KA significantly increased (P < 0.0001) at one and six months of follow-up but remained almost constant at the final follow-up as well as compared to six months of follow-up. All the patients had considerable improvement in pain (Table 2).

None of the patients deteriorated neurologically. Figures 2 and 3 present the functional outcomes of two cases of the study.

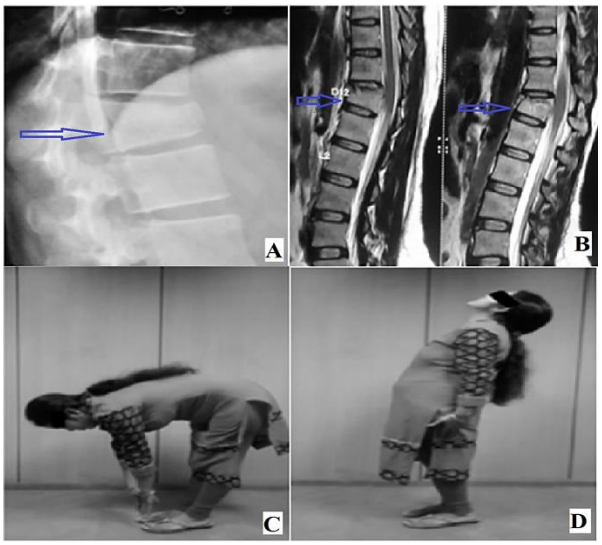

Figure 2. A) Radiograph; B) Magnetic resonance imaging (MRI) of D12 burst fracture in a female patient at presentation; C and D) Functional outcome at two years in the patient

None of the patients had any complications, such as urinary tract infection (UTI), bed sore, or pneumonitis.

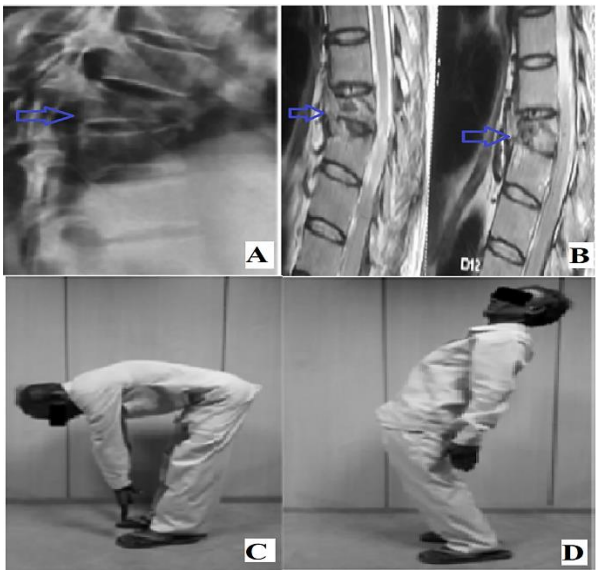

Figure 3. A) Radiograph; B) Magnetic resonance imaging (MRI) of D9 burst fracture in a male patient at presentation; C and D) Functional outcome at two years in the patient

Table 2. Functional and radiological outcome charting at different time intervals

	At presentation	One month	Six months	Two years
Pain by VAS (mean ± SD)	9.10 ± 0.84	4.95 ± 0.90	2.20 ± 0.41	0.70 ± 0.52
ODI (%) (mean ± SD)	90.00 ± 4.27 (82 to 96)	49.50 ± 8.58 (34 to 66)	30.70 ± 7.34 (20 to 46)	10.10 ± 3.99 (4 to 20)
Kyphosis (mean ± SD)	17.70 ± 12.17° (-10 to 33)	21.50 ± 11.11° (-4 to 38)	25.30 ± 10.34° (-3 to 40)	25.50 ± 10.39° (-3 to 40)
VHL (%) (mean ± SD)	51.90 ± 2.62 (50 to 60)	56.70 ± 5.10 (51.5 to 77.5)	60.00 ± 5.39 (52.5 to 80)	60.40 ± 5.78 (53 to 81)
Number of patients with neurological deficit	0	0	0	0

VAS: Visual Analogue Scale; ODI: Oswestry Disability Index; VHL: Vertebral height loss; SD: Standard deviation

Discussion

Prolonged bed rest for 6-8 weeks or more is still being practiced for thoracolumbar burst fractures at many centers (6).

However, recent trends in the literature show that early mobilization is important for better clinical outcome (7-9). This study will further strengthen this fact.

In the present study, the mean pain score by VAS improved significantly at each follow-up. Wood et al. compared the outcome of operative and non-operative management of burst fracture and reported a mean VAS of 3.29 in operative and 2.1 in non-operative cases at final follow-up (7).

In another study by Agus et al., 29 patients were managed non-operatively with early ambulation and bracing, and it was concluded that non-operative treatment could be an alternative method for neurologically intact thoracolumbar burst fracture (10). Observations of these studies are similar to the results of the present study.

Different indices were used in various studies to quantify the functional outcome. Eno et al. did short segment fixation in 25 thoracolumbar burst fracture cases and observed an ODI of 52.63% at one month and 5.5% at the last follow-up (11). Kim et al. documented an ODI of 29.82% at the last follow-up in their long-segment fixation group (12). In our study, mean ODI improved from 90 (at presentation) to 49.5 (at one month) and 10.1 (at final follow-up), which was a significant improvement in functional outcome and comparable to them.

It is seen that although there is a progression of kyphosis with non-operative means, there is a poor correlation with the functional outcome. A hyperextension brace was used in nine (of 38 patients) by Shen and Shen (13). The patients were allowed to ambulate as soon as the pain was tolerable, with no restrictions on any activity. 76% of the patients returned to their occupation, with an average of 4-degree increase in the final deformity.

Studies comparing operative and non-operative management of burst fracture conclude that even though short- and long-term radiological results may be marginally better in the operative group, there is no significant difference in treatment outcome regarding back pain and functionality between the groups (8, 14-17). A case-control study found that all patients in the non-operative group were satisfied, while 15% of the surgical group were unsatisfied with the outcome (16).

A significant number of complications were reported in surgically-treated patients (9, 14, 17, 18). The risk of cord injury during surgery is always there but often under-reported; however, neurological deficit by conservative treatment is mostly unknown. Other major disadvantages are post-operative infection, intra operative dural tears, pseudo arthrosis, instrumentation failure, and anesthesia-related complications, including atelectasis (8, 9, 17). Moreover, many patients require second-stage surgery to remove the implants.

Another major advantage of conservative treatment is the low cost of treatment which is an important issue for patients with spinal fractures in developing countries. It was pointed out that hospital expenses were four times higher in the surgically-treated patients compared to the nonoperatively-treated group (13). More eminently, this study put emphasis on early mobilization which resulted in the absence of complications such as bed sores, UTI, or pneumonitis.

From the results of our study, it can be observed that there was an appreciable improvement in functional outcome parameters (i.e., ODI and VAS) despite worsening radiological parameters (KA and percentage of VHL). Even in studies on surgically-treated patients in the literature, authors have reported similar observations of some worsening of radiological parameters over time. In addition, they reported several major complications like infection, neurological worsening, and implant failure, which may need intervention.

The strength of the study is a long follow-up period. Its limitation is a small sample size, and the results hold true only for Taylor's brace. Similar studies have been done by some researchers in the west but none included all the parameters we have described (10, 19). Table 3 shows the comparison of the outcomes of this study with various previous studies.

Conclusion

Thoracolumbar burst fractures managed non-operatively showed improvement in the functional outcome as evaluated by ODI and VAS in our study, even though we observed that there was some worsening of the radiological parameters. Results are comparable to those reported in the literature for both operatively and nonoperatively-managed patients. Complications of surgery and prolonged recumbency were avoided with our regimen of early mobilization with bracing. Based on our results, we would recommend that these patients should be treated by early mobilization with a brace which is a low-cost treatment modality with equally good functional outcomes. However, long-term results still need to be evaluated.

Conflict of Interest

The authors declare no conflict of interest in this study.

Acknowledgements

The authors thank the participants for their cooperation and permission to publish the images.

Table 3. Functional and radiological outcome of various studies

		Operative studies			Non-operative studies			Present study
		Wood et al. (7)	Li et al. (20)	Kim et al. (12)	Cantor et al. (21)	Tezer et al. (22)	Celebi et al. (23)	
Total patients		18	45	32	33	48	26	40
Follow-up (month)		43.5	37.0	22.2	19.0	77.0	43.0	24.0
KA	(At presentation)	10.0°	5.1°	7.1°	19.0°	15.8°	NA	17.7°
	(At last follow-up)	13.0°	20.1°	12.1°	20.0°	17.2°	NA	25.5°
	Progression	3.0°	15.0°	5.0°	1.0°	1.4°	8.3°	7.8°
Percentage of VHL	(At presentation)	NA	3.4 (post-op)	39.8	36.0	19.0	NA	51.9
	(At last follow-up)	NA	37.5	43.8	59.0	21.0	NA	60.0
VAS score at the last follow-up		3.2	NA	NA	NA	NA	NA	0.7
ODI at the last follow-up		21.4	NA	29.8	NA	NA	NA	10.1
Neurological deterioration		3	NA	0	0	0	0	0
Implant failure		4	9	7	NA	NA	NA	NA

KA: Kyphotic angle; VHL: Vertebral height loss; VAS: Visual Analogue Scale; ODI: Oswestry Disability Index; NA: Not available

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