

## FUNCTIONAL OUTCOME OF THORACOLUMBAR FRACTURES TREATED BY SHORT SEGMENT STABILIZATION WITH OR WITHOUT CEMENT AUGMENTATION

Udepto Lodh<sup>1</sup>, Subrat Mohapatra<sup>2</sup>, Siddharth Sekhar Moharana<sup>3</sup>, Indraneel De<sup>4</sup>, Shivam Chawla<sup>5</sup>, Chaitanya Khandelwal<sup>6</sup>

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Corresponding Author:

Dr. Udepto Lodh,

Email: lodh.udepto@gmail.com

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<sup>1</sup>Senior Resident, Department of Orthopaedics, IMS and Sum Hospital, Bhubaneswar, India.

<sup>2</sup>Associate Professor, Department of Orthopaedics, IMS and Sum Hospital, Bhubaneswar, India.

<sup>3</sup>Senior Resident, Department of Orthopaedics, IMS and Sum Hospital, Bhubaneswar, India.

<sup>4</sup>Senior Resident, Department of Orthopaedics, Howrah Orthopaedic Hospital, Kolkata, India.

<sup>5</sup>Junior Resident, Department of Orthopaedics, IMS and Sum Hospital, Bhubaneswar, India.

<sup>6</sup>Junior Resident, Department of Orthopaedics, IMS and Sum Hospital, Bhubaneswar, India.

### Abstract

**Background:** To evaluate the functional outcome of short segment fixation with or without Cement Augmentation in a patient suffering from fractures of thoracolumbar spine. **Materials and Methods:** It was a Prospective Observational Study, conducted in the Department of Orthopedics, Institute of Medical Sciences & SUM Hospital, Bhubaneswar, a total 30 Patients with diagnosis of fracture of Thoraco-lumbar Spine admitted in our hospital during the study period June 2021 to December 2022, were enrolled for the study. **Results:** In our study L2 vertebra was involved in 33.3% (10 cases). L1 vertebra was involved in about 20% (6 cases) and D12 was involved in 20% (6 cases). D11 and L3 vertebra was involved in 13.3% (4 cases each) of cases. In the present study 5 (16.7%) of our patients had complete neurological deficit while 15 (50%) had incomplete neurological deficit and 10 (33.3%) patients were neurologically intact. the time of admission 4 (13.3%) patients were presented with grade A of ASIA scoring, ASIA scoring B, C, D, and E was observed in 3 (10%), 6 (20%), 8 (26.7%) and 9 (30%) cases respectively. None of the patients deteriorated neurologically in this study. None of the patient in the present study was completely disabled. **Conclusion:** The observation of the present study suggests that Short segment fixation with or without cement augmentation preserves the motion segment well, improves functional outcome and rehabilitate the patients with minimal surgical morbidity. It also provides better outcome in terms of Denis pain score and work scale as well. However in patients with ASIA type A neurological deficits the procedure did not improve neurological status but it helped to stabilize and early mobilization of patient.

## INTRODUCTION

Thoracolumbar fractures can cause significant morbidity and mortality, and their management remains a challenge for spine surgeons. Short segment stabilization with or without cement augmentation is a commonly used technique for the treatment of these fractures. The technique aims to restore spinal stability and alignment while preserving spinal motion.<sup>[1]</sup> Short posterior stabilization with vertebroplasty is one treatment option for thoracolumbar burst fractures.<sup>[2]</sup> A case series evaluated the treatment of osteoporotic compression fractures at the thoracolumbar junction with short-segment stabilization.<sup>[3]</sup> However, there is a lack of long-term follow-up studies evaluating

the functional outcome of this technique.<sup>[4]</sup> A study evaluated four fixation methods for decompression in patients with thoracolumbar burst fractures and presented the most suitable fixation method for different types of fractures.<sup>[5]</sup>

The goal of operative treatment is to protect neurological function and restore spinal stability and alignment.<sup>[1]</sup> Short segment stabilization with or without cement augmentation is a commonly used technique for the treatment of these fractures.<sup>[6]</sup> However, there are controversies regarding the superiority of conservative versus operative therapy.<sup>[6]</sup> There is no general consensus on the most suitable method for treating thoracolumbar burst fractures.<sup>[4]</sup> The current status of short segment fixation in the management of thoracolumbar

injuries and strategies to decrease failure rates and increase effectiveness.<sup>[1]</sup>

## MATERIALS AND METHODS

It was A Prospective Observational Study, conducted in the Department of Orthopedics, Institute of Medical Sciences& SUM Hospital, Bhubaneswar, a total 30 Patients with diagnosis of fracture of Thoraco-lumbar Spine admitted in our hospital during the study period June 2021 to December 2022, were enrolled for the study. Inclusion Criteria: Male and female patients who are willing for operative treatment and Patients who are medically fit for surgery. Exclusion Criteria: Fractures without neurological deficit (including stable fractures of spine), Patients with proximal or distal fractures of other vertebra, Patient treated elsewhere for the same or with inadequate documentation, Pathological fractures, Osteoporotic Fractures, Patient unfit for Surgery due to Poor Anaesthetic Risk or unwilling.

### Methodology

- A fully radiolucent table is used Position the patient to allow for postural reduction when placed prone using a four-post frame or chest rolls placed transversely or longitudinally, depending on the extent of postural support desired.
- Obtain images of the spine to confirm the degree of postural spinal reduction after positioning and determine the limits of the incision.
- Make a straight incision from one spinous process above the area to be instrumented to one spinous process below the area to be instrumented after infiltration of local anaesthesia.
- Continue the dissection with electrocautery to the fascia Delineate the fascia for later closure.

Continue the dissection through the fascia and subperiosteally expose the necessary levels.

- Use electrocautery to release the muscle from the bone carefully at the level of the fracture. Watch for evidence of a cerebrospinal fluid leak or the presence of free nerve root.
- Continue to widen the dissection to the tips of the transverse processes in the thoracic and lumbar spine.
- Use image intensification to identify levels and continue with instrumentation. After exposure of laminae and facets of the index level with one level above and one level below, the transpedicular screws have been inserted under C-arm guidance for all three levels.
- Laminectomy was done to decompress the canal ,then postero-lateral fusion using bone graft was done.

### Postoperative care

Postoperatively a Xray scan was obtained to verify screw position and to determine if there is any residual neural compression in a patient with a neurologic deficit. Drain removal and patient mobilisation done on the second postoperative day with an orthosis unless other injuries preclude this The orthosis is continued 12 weeks depending on resolution of pain and radiographic follow-up for evidence of healing and maintenance of spinal alignment. Evaluation of the patient done with regular visits and parameters charted as per ASIA Scale, Dennis Work and Pain scales.

### Statistical Analysis

The Statistical Package for the Social Sciences (SPSS) IBM version 26 was used to analyze the study's data. Data were tabulated in excel sheet, frequency and percentage was analysed. Mean & SD also use for age mean one sample test was applied.

## RESULTS

**Table 1: Demographic profile**

Age Distribution	Frequency	Percentage
18-30 years	3	10.0
31-40 years	9	30.0
41-50 years	11	36.7
51-60 years	5	16.7
>60 years	2	6.7
Sex Distribution		
Male	22	73.3
Female	8	26.7
Mode of Injury		
Fall from Height	20	66.7
RTA	10	33.3
Level of Fracture		
D11	4	13.3
D12	6	20.0
L1	6	20.0
L2	10	33.3
L3	4	13.3
Type of Fracture		
Compression Fracture	6	20.0
Burst Fracture	16	53.3

Flexion Distraction	4	13.3
Fracture Dislocation	4	13.3
Neurological Involvement		
Intact	10	33.3
Incomplete	15	50.0
Complete	5	16.7
Associated Fracture		
Calcaneum Fracture	4	13.3
Distal Radius Fracture	3	10.0
Pubic rami fracture	2	6.7
Femur	2	6.7
Tibia	2	6.7
No associated Fracture	17	56.7

In the present study patients were aged from 18 to 63 years. The most common age group was 41-50 years with 11 patients comprising 36.7% of the study population followed by 31-40 years with 9 patients comprising 30% of the study subjects. Out of 30 study participants 22 (73.3%) were males and 8 (26.7%) were females. The male to female ratio was 2.75: 1. The most common mode of injury was fall from height (66.7%) followed by road traffic accident (33.3%). In our study L2 vertebra was involved in 33.3% (10 cases). L1 vertebra was involved in about 20% (6 cases) and D12 was involved in 20% (6 cases). D11 and L3 vertebra was involved in 13.3% (4 cases each) of cases. In the present study 16(53.3%) had burst fractures, 6 (20%) had wedge compression fractures, 4 (13.3%) had flexion distraction and 4 (13.3%) had fracture dislocations. 5 (16.7%) of our patients had complete neurological deficit while 15 (50%) had incomplete neurological deficit and 10 (33.3%) patients were neurologically intact. Regarding the incidence of associated fractures we observed that along with the spine fracture 4 patients had calcaneum fracture, 3 had distal radius fracture, 2 had pubic rami fracture, 2 had femur fracture and 2 had fracture in tibia. 17 out of 30 cases had no associated fracture.

**Table 2: Neurological Status ASIA Impairment Scale at the time of Admission**

ASIA Impairment Scale	Frequency	Percentage
ASIA A	4	13.3
ASIA B	3	10.0
ASIA C	6	20.0
ASIA D	8	26.7
ASIA E	9	30.0
Total	30	100.0

In the present study at the time of admission 4 (13.3%) patients were presented with grade A of ASIA scoring, ASIA scoring B, C, D, and E was observed in 3 (10%), 6 (20%), 8 (26.7%) and 9 (30%) cases respectively.

**Table 3: Neurological Status ASIA Impairment Scale at Final Follow Up**

ASIA Impairment Scale	Frequency	Percentage
ASIA A	4	13.3
ASIA B	0	0.0
ASIA C	3	10.0
ASIA D	7	23.3
ASIA E	16	53.3
Total	30	100.0

In our study 4 patients presented with grade A of ASIA scoring and remained as grade A throughout the study. None of the patients deteriorated neurologically in this study. Among the whole group the remaining patients showed some improvement in neurological status.

**Table 4: Denis Pain Scale**

Denis Pain Scale	Frequency	Percentage
P1	0	0.0
P2	12	40.0
P3	12	40.0
P4	6	20.0
P5	0	0.0
Total	30	100.0

In our study Denis pain scale showed that 40% of patients had minimal pain, 40 % of patient had moderate pain and 20 % had moderate to severe pain with significant changes in daily activities.

**Table 5: Denis Work Scale**

Denis Work Scale	Frequency	Percentage
W1	9	30.0

W2	11	36.7
W3	7	23.3
W4	3	10.0
W5	0	0.0
Total	30	100.0

Denis work assessment scale showed that 30 % of patients returned to previous employment, 36.7% patients were able to return to previous employment or returned to heavy labor with restrictions, 23.3% were unable to return to previous employment but works full time at new job and 10% of the patients were unable to return to full time job. None of the patient in the present study was completely disabled.

**Table 6: Complications**

Complications	Frequency	Percentage
Urinary Tract Infection	3	10.0
Paralytic Ileus	2	6.7
Grade I Bed Sore	1	3.3
Superficial Wound Infection	1	3.3

Regarding the post-operative complications, we found 3 (10%) had urinary tract infection, 2 (6.7%) had paralytic ileus, 1 (3.3%) had grade I bed sore and 1 (3.3%) had superficial wound infection.

## DISCUSSION

The appropriate treatment for the thoracolumbar fracture is important. The successful diagnosis and management of thoracolumbar fractures depend on an accurate assessment of spinal stability and the neurologic state of the patient.<sup>[7]</sup>

Therefore, the present study was conducted in the Department of Orthopedics, Institute of Medical Sciences & SUM Hospital, Bhubaneswar with the aim to evaluate the functional outcome of short segment fixation with or without Cement Augmentation in a patient suffering from fractures of thoracolumbar spine. A total of 30 patients with diagnosis of fracture of Thoraco-lumbar Spine admitted to IMS & SUM Hospital were enrolled for study after obtaining their informed written consent.

In the present study patients were aged from 18 to 63 years. The most common age group was 41-50 years with 11 patients comprising 36.7% of the study population followed by 31-40 years with 9 patients comprising 30% of the study subjects. Out of 30 study participants 22 (73.3%) were males and 8 (26.7%) were females. The male to female ratio was 2.75: 1. The most common mode of injury was fall from height (66.7%) followed by road traffic accident (33.3%).

A study by Senturk et al also showed similar gender distribution, 66% of burst fractures in males and 34% in females.<sup>[8]</sup> The overall mean age of patients was 49 in the study by Senturk et al, the mean age in males was 49(16-84) while in females it was 49(20-72).<sup>[8]</sup>

Sallam et al in their study reported Ninety-one patients were included in this study: 80 males (87.9%) and 11 females (12.1%) with a mean age 38 ± 9 years.<sup>[9]</sup>

In a study by Scheer et al (34-54% ) of the burst fracture occurred secondary to fall from height and (51-65%) of fracture secondary to motor vehicle accident and around 9% of the injury due to high intensity sports.<sup>[10]</sup> Study by Khurjekar et al in

Indian population had similar results as our study such as the most common mechanism of injury was fall height constitute about 50%(fall from building or tree ) and in 46% secondary to road traffic accident.<sup>[11]</sup> Aligizakis et al study showed 75% of burst fracture secondary to fall from height and 25% of the fracture secondary to motor vehicle accident.<sup>[12]</sup>

In the present study 16 (53.3%) had burst fractures, 6 (20%) had wedge compression fractures, 4 (13.3%) had flexion distraction and 4 (13.3%) had fracture dislocations. In the present study 5 (16.7%) of our patients had complete neurological deficit while 15 (50%) had incomplete neurological deficit and 10 (33.3%) patients were neurologically intact. Regarding the incidence of associated fractures we observed that along with the spine fracture 4 patients had calcaneum fracture, 3 had distal radius fracture, 2 had pubic rami fracture, 2 had femur fracture and 2 had fracture in tibia. 17 out of 30 cases had no associated fracture.

Aligizakis et al showed 25% of lower limb fractures associated with burst fractures, 10% of upper limb injuries and 5% of other system involvement was seen.<sup>[12]</sup>

The highest incidence of thoracolumbar vertebrae fracture was at the level of L1 (37.7%) then L2 (29.6%) followed by D12 (23%) and least incidence in D11 (6.6%) and D10 (3.3%). The type of fractures were variable, 38 patients presented with burst fracture (41.75%), 26 patients with wedge fracture (28.57%), 15 patients had hyperextension fractures (16.48%), and 12 patients with shears fracture (13.18%). Most of burst and wedge fractures were due to falling from a height while most of hyperextension and shears fractures were due to road traffic accident as reported by Sallam et al.<sup>[9]</sup>

Regarding the neurological state according to ASIA impairment scale pre and postoperatively we found at the time of admission 4 (13.3%) patients were presented with grade A of ASIA scoring, ASIA

scoring B, C, D, and E was observed in 3 (10%), 6 (20%), 8 (26.7%) and 9 (30%) cases respectively. 4 patients presented with grade A of AISAS scoring and remained as grade A throughout the study. None of the patients deteriorated neurologically in this study. Among the whole group the remaining patients showed some improvement in neurological status.

Sallam et al in their study reported seven patients have shown alteration of their neurological state, five of them (5.4%) had some improvements and the other two patients (2.2%) were worse; while the other 84 patients remained with the same pre-operative ASIA score.<sup>[9]</sup>

In the present study postoperative improvement was assessed through Denis pain scale and work scale. The observation of the present study regarding the above is as follows:

In our study Denis pain scale showed that 40% of patients had minimal pain, 40 % of patient had moderate pain and 20 % had moderate to severe pain with significant changes in daily activities.

Denis work assessment scale showed that 30 % of patients returned to previous employment, 36.7% patients were able to return to previous employment or returned to heavy labor with restrictions, 23.3% were unable to return to previous employment but works full time at new job and 10% of the patients were unable to return to full time job. None of the patient in the present study were completely disabled.

Although short-segment stabilization approach, one level above and one level below, has high failure rate, it become preferred approach after renovation by addition of screws into the fractured level (index level). Several studies were done to ensure biomechanical stability of this short construct, and most of studies revealed its low failure rate and high pull out resistance.<sup>[13]</sup>

A short segment fixation with pedicle screw achieves reasonable stability till the segment is fused. This is so because a pedicle screw achieves a three column fixation and proper stability than the other posterior systems that were used previously. The main advantage of short segment posterior instrumentation is that it preserves the motion segment resulting in less spinal stiffness and also avoiding flat back syndrome.<sup>[14,15]</sup>

McLain et al and McCormack et al reported that the use of short-segment posterior spinal instrumentation without restoration of the anterior column for the treatment of unstable thoracolumbar burst fractures has been associated with a high rate of early implant failure and progressive deformity.<sup>[16,17]</sup>

## CONCLUSION

- Thoracolumbar fractures occur when the vertebra is subjected to a significant axial and possibly flexion force vector that brings the failure of the

anterior vertebral body in compression. Spine fractures commonly occur in the thoracolumbar region, and burst fractures are the most common fracture at the thoracolumbar junction.

- However the ideal management for thoracolumbar fractures is still remain a matter of debate. The successful management depends upon a perfect assessment of spinal stability and the neurologic state of the patient. Severe thoracolumbar deformities and/or neurologic deficits are usually indicated for surgery.
- The advantages of surgery over conservative management include shorter period of bed rest and hospitalization, initial kyphotic deformity correction, decompression of the neural element (direct or indirect), avoidance of external immobilization with brace and early return to work.
- In the present study we tried to evaluate the functional outcome of short segment fixation with or without Cement Augmentation in a patient suffering from fractures of thoracolumbar spine. The observation of the present study suggests that segment fixation with or without cement augmentation preserves the motion segment well, improves functional outcome and rehabilitate the patients with minimal surgical morbidity. It also provides better outcome in terms of Denis pain score and work scale as well. However, in patients with ASIA type A neurological deficit the procedure did not improve neurological status but it helped to stabilize and early mobilization of patient.

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