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Original Research Article

Role of Posterior Stabilisation and Anterior Fusion in Thoracolumbar Burst Fracture

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ABSTRACT

Background and objectives: Lately consensus is evolving around the world for stabilization of spine with instrumentation in cases of thoracolumbar burst fractures allowing early mobilization aiding limitation of neurological injury and restoring spinal stability. The use of pedicular screws and rod system and titanium cage allows adequate 3 dimensional control of each motion segment and allows rigid fixation.
The objective of the study was to evaluate the mode, level, efficacy of posterior stabilization with pedicle screw and rod system and anterior fusion with titanium cage, the radiological, neurological and functional out come in order to recreate a stable pain free spinal column.
Methods: A prospective study of 21 cases of thoracic and lumbar spine fractures admitted to Yenepoya hospital between October 2009 and November 2011. Patients were treated with posterior stabilization using pedicle screw and rod system and anterior fusion with titanium cage and followed up for one year.
Results: Twenty one patients (20 males and 1 female) with traumatic thoracolumbar burst fractures with an average age of 33.34 years were studied. 15 cases due to fall from height. In our study we had 38.6% of patients with American spinal injury association (ASIA) Grade-A, 4.8% with Grade-B, and 28% with Grade-C at admission and follow up showed at least 1 ASIA Grade improvement. The radiological parameters assessed using Lee scoring, showed 66.7% possible fusion and 33.3% probable pseudoarthrosis at 3 months post-surgery and fusion was observed at the end of the one year in all patients.
Conclusion: As there was no neurological deterioration in any of the patients post operatively, we recommend posterior stabilization using pedicle screw and rod system and anterior fusion with titanium cage in management of thoracolumbar burst fractures.

Key words: thoracolumbar burst fractures; pedicle screw; titanium cage;

INTRODUCTION

Spinal trauma is one of the grave injuries that cause infinite morbidity and disability resulting from high energy trauma. 30-60% of all spinal injuries are concentrated in the thoracic and lumbar spine and 15-20% is associated with neurological injury. Holdsworth described

burst fractures in 1963. [1] These fractures are most common at thoracolumbar junction and often associated with high velocity trauma. [2] The treatment of thoracolumbar and lumbar burst fractures has remained controversial due to different options of nonoperative or operative management. [3] Though anterior corpectomy and fixation has shown good results, it requires technical expertise and associated with prolonged morbidity. Posterior fixation too has its own draw backs like implant failure but technically less demanding and associated with less morbidity. [4,5] In cases without neurologic deficits indirect reduction with posterior transpedicular instrumentation is recommended. [6-9]

The neurological improvement is independent of treatment modality. Lately consensus is evolving around the world for stabilization of spine with instrumentation allowing early mobilization, prevention and limitation of neurological injury as well as restoration of spinal stability. A number of fixation systems have been advocated. [10-12] The use of pedicular screws and rod system and titanium cage allows adequate 3 dimensional control of each motion segment and allows rigid fixation. Acceptable results have been reported in majority of patients treated with pedicle screw and rod system and anterior fusion with cage (titanium) with good neurological recovery. Short-segment posterior fixation (SSPF) and anterior fusion are the methods offering the advantage of incorporating fewer motion segments in the fusion. [10,13] Though there are many advisers for each of the treatment modalities, this study tries to answer a specific question – what's the outcome of combined anterior and posterior fixation in such thoracolumbar burst fractures.

The objectives of the present study were to evaluate neurologic recovery, radiological outcome after combined posterior and anterior surgery in thoracolumbar burst fractures. This study documents the morbidity and complications of such injuries.

MATERIALS AND METHODS

Patients with traumatic thoracolumbar burst fracture admitted in Yenepoya medical college and neighbouring institutions between October 2009 and November 2011 were evaluated. All patients were treated with posterior stabilization using pedicle screw and rod system and anterior fusion with titanium cage. 20 patients were followed up for one year. All patients with neural compression from causes other than trauma were excluded. Patients who were treated with only posterior or anterior surgery were excluded. Patients who presented one month after the injury were also excluded.

Operative procedure: After initial evaluation, the patient is placed in the lateral decubitus position with the left side up on a standard operating table. The approximate level of the injury was positioned over the break of the table to facilitate intraoperative exposure. The iliac crest was included in the preparation and draping of the skin.

The intercostal approach was employed with one to two levels above the level of the fracture. For example, a T11 burst fracture was approached by a thoracotomy between the T9 and T10 ribs. The segmental vessels at the injured and adjacent levels were ligated at the midvertebral body level. This step was to preserve important arterial anastomotic branches that supply the artery of Adamkiewicz. The borders of the disc spaces above and below the fracture were then delineated via subperiosteal dissection. Posterior bony exposure was done to include the base of the pedicle.

After complete discectomy, the majority of fractured bone was removed with a large rongeur. This bone was saved

for subsequent grafting. The remainder of the anterior, posterior, and lateral vertebral body was then removed with a high-speed burr if necessitated. A shell of anterior and lateral vertebral body was left to potentiate blood supply to the interbody graft. Finally, the posterior vertebral body fragments were removed with straight and angled curettes. When surgery was performed early, these fragments are usually quite mobile and were easily removed.

At this point, the first stage of instrumentation was begun. A titanium mesh cage was used. It was filled with salvaged corpectomy bone in addition to harvested iliac crest. With gentle overdistraction applied through the screw-staple device, the cage was tamped into place. Optimally, it was centered along the endplates of the cranial and caudal vertebrae. Once the strut was place, the distractor removed. If a gap persisted at the strut/endplate interface, gentle compression was applied through the screws. Rods were then cut to the appropriate length and inserted into the screw holes. A single cross-connector was then applied to increase the torsional rigidity of the construct.

With rigid fixation, postoperative bracing was usually not necessary. Particularly after a thoracotomy or thoracolumbar approach in which a chest tube has been placed, fitting the patient with a thoracolumbar orthosis was usually not possible. The patient was mobilized as needed. The chest tube was removed once drainage has diminished, and a follow-up chest x-ray was obtained to rule out pneumothorax.

All cases were followed up at regular interval and findings were recorded accordingly. Neurological evaluationwas based on the American spinal injury association (ASIA) scale and X- ray follow-up was graded according to Lee et al scoring. According to Lee scoring, the X-ray fusion of vertebral elements were classified as definite fusion (Continuous intersegmental bridging bone), probable fusion (Doubtful intersegmental bridging bone) and possible psudoarthrosis (No intersegmental bridging bone) based on X-ray findings. [14]

Table 1: ASIA impairment scale for patients with spinal cord injuries (modified From Frankel) [15]

Grade A	Absent motor (Grade 0/5) and sensory function below the injury level.
Grade B	Sensation present, motor function absent (grade 0/5).
Grade C	Sensation present, motor function active but not useful (grade 1 to 2/5).
Grade D	Sensation present, motor function active and useful (grade 3 to 4/5).
Grade E	Normal motor (Grade 5/5) and sensation function.

RESULTS

Twenty one patients (20 males and 1 female) with thoracolumbar burst fractures were included in the study. The mean age was 34.3years (SD 12.2 years; range 16 to 62 years). Fifteen patients in the series had burst fractures due to fall from height. Five patients had road traffic accidents as causative event. One had fall of heavy object on the back. Five patients had associated injuries. 18 patients had fractures between T11-L2 levels with or without paraplegia. All patients in the study underwent posterior stabilization using pedicle screw and rod system and anterior fusion with titanium cage. The neurological evaluation at monthly intervals is tabulated in

Table 2. One patient was not followed after 8 months.

There was significant recovery in neurological conditions 12 months after the surgery in all patients in comparison to their

initial evaluation according to Friedman test. According to Wilcoxon signed ranks test there was no significant improvement in neurology between pre and post-operative neurological conditions in patients but significant improvement is observed at 1, 3 and 9 months post operatively and at the end of 12 months the improvement in neurology is found to very highly significant. (
Table 3)

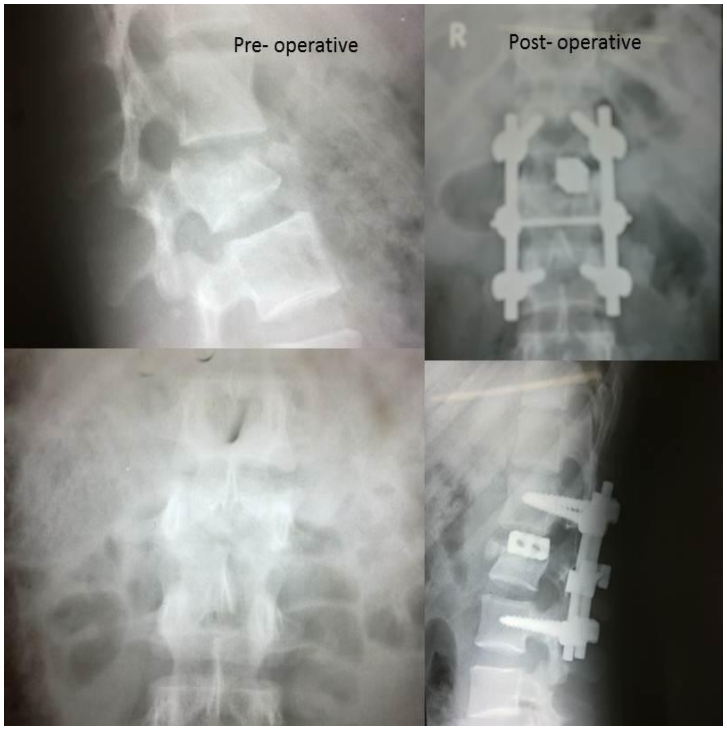

Fig 1: Anterior and lateral view of spine of spine of a patient with thoracolumbar burst fracture – preoperative and postoperative.

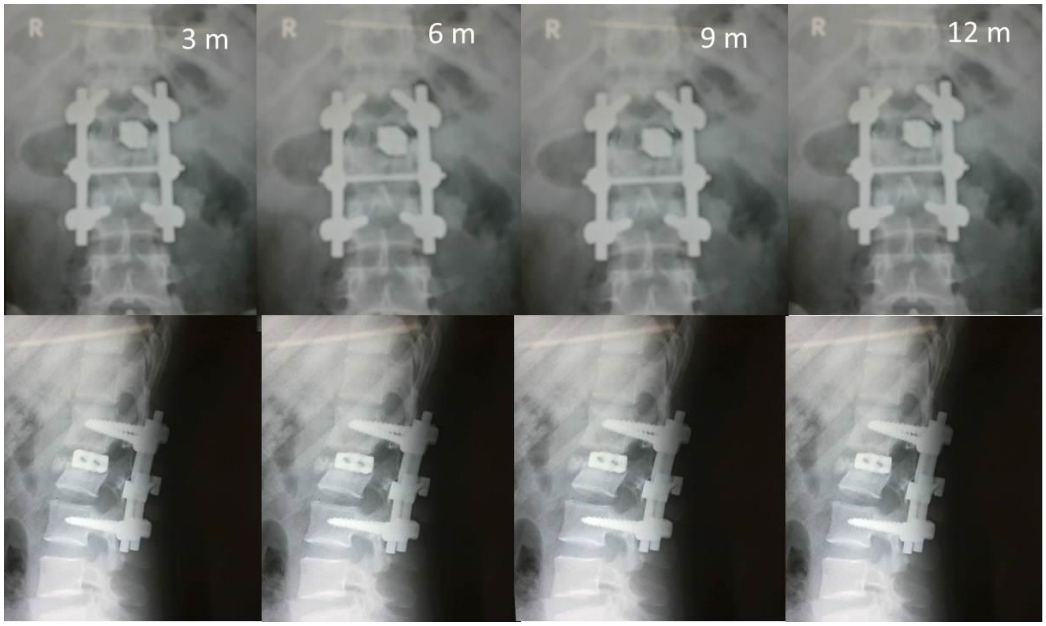

Fig 2: Anterior (upper panel) and lateral (lower panel) view of spine of spine of a patient with thoracolumbar burst fracture at regular intervals postoperatively (m-months) shows progressive fusion of vertebral elements.

Table 2: tabulation of neurological assessment at monthly intervals.

	Pre-operative	Post-operative	At the end of 1 month	At the end of 3 months	At the end of 6 months	At the end of 9 months	At the end of 12 months
Complete	8	8	5	3	2	1	1
Incomplete (S4-S5)				1	2	1	1
Incomplete grade<c	1	1	1	2	1	1	1
Incomplete grade>=c	6	6	7	4	4	5	4
Normal	6	6	8	11	12	12	13
Total	21	21	21	21	21	20	20

Table 3: tabulation of Wilcoxon signed ranks test values of neurological status (ASIA) at different intervals in comparison to pre-operative state.

	Post - pre	1m - pre	3m –pre	9m - pre	12m -pre
Z	.000	-2.271	-3.022	-3.115	-3.247
Asymp Sig (2-tailed)	1.000	0.023	0.003	0.002	0.001

The X-ray follow-up was noted according to Lee scoring at 3 months interval and tabulated in Table 4.

Table 4: tabulation of Lee scoring at 3 months interval.

	at the end of 3 months	at the end of 6 months	at the end of 9 months	at the end of 12 months
Definite fusion		6	14	20
Probable fusion	14	12	6	
Possible pseudoarthrosis	7	3		
Total	21	21	20	20

Table 5: tabulation of Wilcoxon signed ranks test values of Lee scoring at different intervals in comparison to X ray at 3rd month, * - highly significant.

	9m– 3m	12m– 3m
Z	-4.379	-3.626
p	<0.001*	<0.001*

According to Wilcoxon signed ranks test there was no significant radiological fusion between pre and 3 month post op patients. Significant improvement in fusion was observed at 6 and 9 months post operatively and at the end of 12 months (Table 5)

Overall six patients had bedsores at the end of 12 months.

DISCUSSION

In our study we noted fall from a height in 70% patients as the most common mode of injury. Road traffic accident was the second commonest cause 20% of patients and fall of heavy object in 10%. Similar etiological factors have been reported in literature. Gregory F. Alvine and Razak have reported 52% and 69 % burst fractures from fall from height. [16,17] In our series we had 80% of patients with fractures between T11-L2 levels. 20% of the fractures were between L3-L5 levels. Similar thoracolumbar junctional fractures have been reported in the past. [5,6,8,13,18]

In our study we had 38.6% of patients with ASIA Grade-A, 4.8% with Grade-B, and 28% with Grade-C at admission and at latest follow up showed at least 1 ASIA Grade improvement.

Nasser M.G. et al, noted that patients who had neurological deficits showed at least 1 grade improvement at latest follow up. [19] Gregory F Alvine et al, noted that neurological improvement was seen in 50% of cases with 40% improving with 1 grade and 20% with 2 grades and none had decrease in neurological level. [16] Rick C. Sasso et al, in their study noted that all patients with incomplete neurological deterioration improved at least by 1 grade. [18] Razak M et al, noted that 64.4% of those with incomplete lesions showed an improvement of at least 1 grade. [17] Khan I et al., noted that 20 grade improvement in 18 patients (1.1 Grade improvement). [20]

In our series the radiological parameters were assessed using Lee scoring showed two third possible fusion and one third probable pseudoarthrosis after 3 months post op and fusion was observed in all cases at the end of the study. Rick C.Sasso et al, noted in their study that average time interval between time of injury to time of surgery was 4 days and mean hospital stay was 16 days. [18] Razak M et al, noted that average time duration to surgery was 5.6 days and average hospital stay was 24 days. [17]

CONCLUSIONS

Our study had 18 patients with fractures between T11-L2 levels with or without paraplegia. Our study noted that patients with neurological deficit improved by at least 1 ASIA grade improvement. In this series there was radiological fusion at the end of 1 year in all patients after posterior stabilization and anterior fusion.

There was no neurological deterioration in any of the patients post operatively, hence though it requires meticulate surgical skills it is a relatively safe procedure. We recommend it in all the patients with thoracolumbar burst fracture.

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