ORIGINAL ARTICLE

Transpedicular Decompression And Spinal Fixation In Thoracolumbar Burst Fractures

Ahmed Tashfeen Ashraf

ABSTRACT:

Objective: To evaluate the results of transpedicular decompression and single stage pedicle screw fixation in burst fractures of thoracolumbar spine.
Materials & Methods: This study was carried out at PNS Shifa from Dec 2010 to Jan 2013. All consecutive traumatic burst fractures that underwent surgery were included in the study. Twenty three consecutive patients aged 17 to 57 (mean, 41) years who had burst fractures in the thoracolumbar (n=13) and lumbar (n=10) regions and were surgically treated were included in this study. There were 18 males and 5 females. Fractures were classified according to the AO classification. The extent of spinal canal compromise was assessed by computed tomography, and the neurological status by the modified Frankel grading for traumatic paraplegia. All patients underwent posterior transpedicular decompression and same stage pedicle screw fixation. Outcome was assessed on Frankel grading scale.

Results: The extent and level of neurological injury varied. It did not correlate with extent of canal compromise, age and sex of the patient. Neurological injury was greater with T11 and T12 injuries than Lumbar fractures. No worsening of neurological grade was observed after surgery; rather 20 of 23 patients (86.9%) improved to the next higher grade. Screw malposition to the extent warranting readjustment was noted in 2 cases. Hardware failure occurred in 1 case after 6 months, bed sores in 3 cases and deep vein thrombosis in 1 case.

Conclusion: Single stage Transpedicular decompression and spinal fixation from a posterior approach gives good results in burst fractures of thoracolumbar spine.

Key Words: Transpedicular; Spinal fixation; Pedicle screws.

INTRODUCTION:

Spinal injuries have greatly increased as a result of high speed vehicle accidents. They generally involve younger population and therefore are more tragic as it makes the patient bed ridden in the prime of his youth. However many recent advances have enabled the surgeons to greatly reduce the morbidity and improve the outcome in these injuries. A specific subset of spinal fractures are consists of Burst fractures of thoraco-lumbar spine. Burst fractures, as defined by Denis [1], involve compression failure of the anterior and middle columns of the spine. Most burst fractures of the spine are associated with varying degrees of bone fragment retropulsion into the neural canal leading to neurological deficit. Although burst fractures can occur at any spinal region, their occurrence at thoraco-lumbar region presents specific problems as well as opportunity for neurological improvement and recovery due to involvement of lower motor neurons in injury [2]. The optimal initial treatment of thoracolumbar burst fractures continues to be strongly debated [3,4]. Although some centers choose to treat these injuries conservatively [5], vast majority of centers treat them surgically. The surgical approach has varied from anterior decompression alone or with staged posterior fixation or posterior fixation and indirect reduction by ligament taxis. The transpedicular decompression and single stage pedicle screw fixation is another approach to treat these fractures. This was the only approach used in our series of patients. The transpedicular decompression and fixation represents an attempt to restore the anterior column without the need for anterior decompression or strut grafting [6]. In fact it combines decompression and fixation through a single approach and avoids morbidity of anterior or combined approach. The use of pedicle screws increases the biomechanical strength of the fused segments more than any anterior construct alone[7,8].

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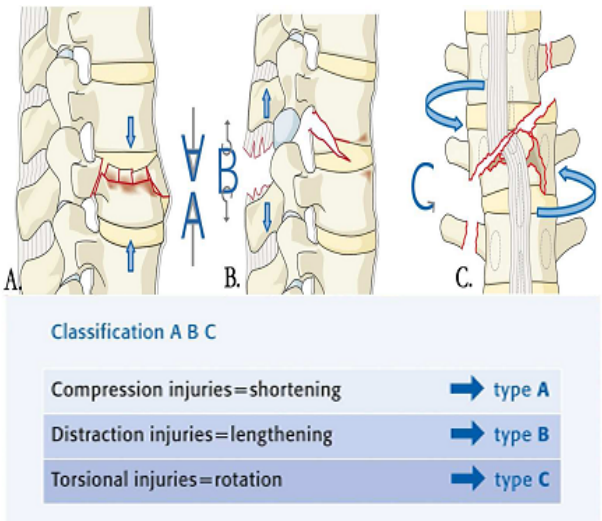
MATERIALS AND METHODS:

After departmental approval twenty three patients aged 17 to 57 (mean, 41) years were included in this study from December 2010 to January 2013. They had burst fractures in the thoracolumbar (n=13) and lumbar (n=10) regions. There were 18 males and 5 females. Upon admission, the complete medical history with a detailed clinical evaluation was recorded and radiological examinations were performed. Fractures were classified according to the AO classification (FIG 1).

Fig 1: The AO Spine classification system



The extent of spinal canal compromise was assessed by computed tomography, and the neurological status according to the modified Frankel grading for traumatic paraplegia. The most common mechanism of injury was a motor vehicle accident followed by fall from a height. The most common vertebra involved was L1 (41%) (Table 1), and the most common type of burst fracture (Fig 2a), was type A3 (Table 2).

Fig 2a: Burst Fracture of LV1

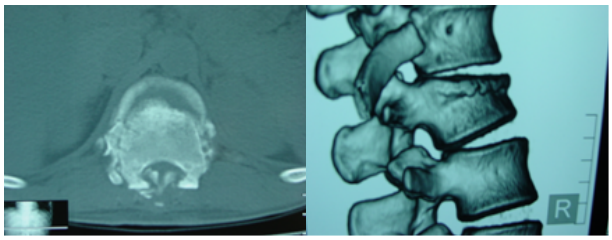


Table 1. Distribution Of Thoracolumbar Injuries

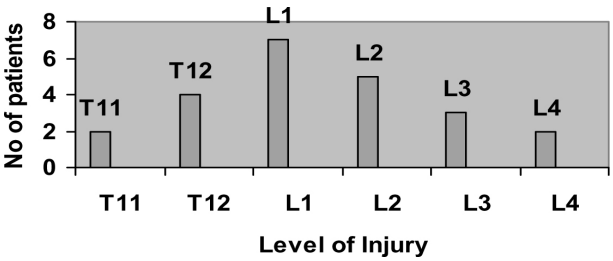


Table 2. Distribution of thoracolumbar fractures according to AO classification

A	-	6	9
B	3	5	-
C	-	-	-

According to the AO classification, 6 patients had the A2 fracture, whereas 9 patients were diagnosed with the A3 fracture. 3 patients were diagnosed with B1 type fracture, and 5 patients were diagnosed with the B2 fracture. No patient was diagnosed with the type C fracture.

All patients were assessed according to Frankel grading system (Table 3).

Table 3: Frankel classification

Grade A: No motor or sensory function

Grade B: No motor but sensory present

Grade C: Sensory normal but motor useless

Grade D: Useful motor function present

Grade E: Normal motor and sensory function

The pre and post-operative neurological status of the patients is given in fig 3a & 3b

Fig 3 a: Pre-operative Frankel Grade of the patients

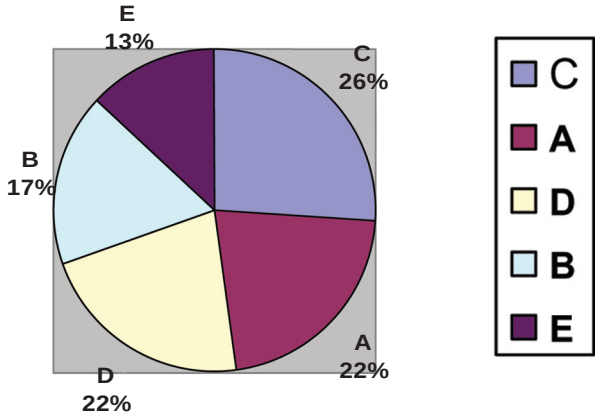
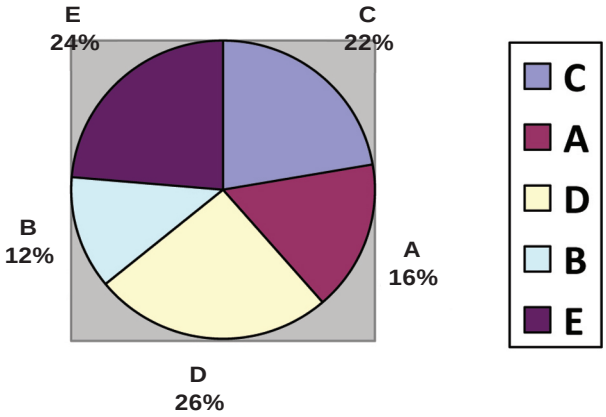


Fig 3 b: Post-operative Frankel Grade of Patient



Surgical Technique

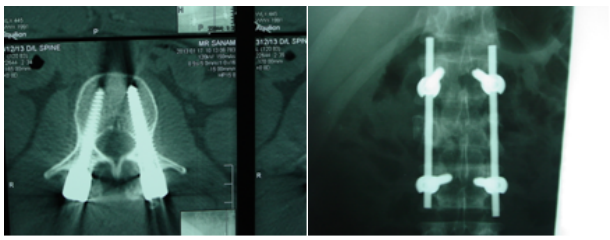
Preoperative evaluation: All patients were thoroughly assessed prior to surgery. Several of these patients had multiple injuries including head injury in 3 patients, abdominal injuries in 4 and limb injuries in 7 patients. Surgery was undertaken as soon as the patient became hemodynamically stable.

Intraoperative Positioning: Following endotracheal intubation, the patient was positioned prone on a spinal frame. All osseous prominences were padded and the eyes were protected. Prior to beginning the surgery, AP and lateral fluoroscopic (C-arm) images were obtained at the intended operative levels to ensure that all osseous landmarks could be adequately visualized.

Surgical Approach: A standard midline approach was followed. A subperiosteal exposure was performed from two levels above to two levels below the intended

vertebrae to be instrumented. Care was taken to avoid disruption of the interspinous ligaments and facet joint capsules at levels not included in the fusion. After the exposure was completed, the facet joints, lamina and transverse process of the level to be decompressed were removed taking care to protect the exiting nerve roots. This was best achieved by circumferential subperiosteal dissection in which a Penfield elevator and small angled curettes were used. At the completion of the posterior element resection, the cauda equina, exiting nerve roots, and descending nerve roots were clearly visualized.
Pedicle Screw (PS) placement: Using C-arm guidance, PS was inserted bilaterally into the vertebrae one level above and one level below the fractured vertebrae. We used fixed angle 5.5mm titanium screws in all patients.
Transpedicular decompression: Using high speed pneumatic drill with long angled attachment and cutting 5mm burrs, bone was removed from the vertebral body (VB) through the pedicles and created a sort of defect in the central and anterior part of VB. Caution was exercised to prevent the drill from 'wandering' outside the confines of the VB. Lastly the posterior most or retro pulsed fragments were 'pushed' into the defect thus created, by using angled curettes and Penfield dissectors. All steps were monitored on the C-arm.
Postosteotomy Instrumentation and Bone Grafting: 4mm Titanium rods were then contoured and secured to the PSs on each side. Some times cross-connectors were used to secure additional torsional stability. Locally harvested well morcelized bone graft was placed on a well prepared bed. Final check was made on C-arm before closure (Fig 2b).

Fig 2b: Post op CT scan of LV1 burst fracture



RESULTS
Follow-up: The follow-up of the operated patients was between 6 and 24 months (14.12 on average). All patients were given a custom-made thoracolumbar orthoses for 3 months postoperatively. Physical therapy was initiated in the hospital and continued for 6 weeks on an outpatient basis. After hospital discharge, clinical and radiographic follow-up evaluations were scheduled every 4 weeks for first six months and then three monthly.
Complications: Mean duration of hospitalization was 10.5 days (range, 3 to 25 days). During the postoperative recovery, we had two cases of a mechanical complication which were overcome successfully by means of reintervention and refixation. We also had one case of deep venous thrombosis, two cases of hospital acquired pneumonia, three cases of catheter related complications and three cases of bed sores.
Outcome: The final anatomical and functional outcome was good in all patients, considering the severity of the inflicted injuries (Table 4). No patient worsened after surgery. Only one patient in Frankel grade A had return of some power in legs. Other than that almost all patients improved neurologically to the next or even higher grade.
DISCUSSION
Thoracolumbar burst fractures pose some unique problems. Although there are still some advocates of conservative treatment of these fractures,[9] however most of these fractures are treated operatively. Operative treatment of these fractures is aimed at spinal canal decompression along with solid and adequate spinal fixation. Surgical decompression in patients with incomplete lesion of the spinal cord is the greatest possible benefit for the patient. The route of decompression can be posterior, anterior or a combination of the posterior and anterior approaches. However fixation after decompression is almost always required. Both these parameters are fulfilled through a single stage posterior approach. Most of these patients have sustained a high velocity accident and have associated other systemic and limb injuries. Anterior approach in these patients can lead to significant morbidity.[10,11,12,13] The main advantages of the internal fixation of these unstable spine fractures are shorter hospitalization stay, early rehabilitation, deformity prevention and prevention of other complications which may occur in non - surgically treated patients. There are some advocates of fixation without fusion,[14,15] however in our experience fracture fixation with fusion lead to better neurological functioning in patients with the spinal cord injury, especially in early surgical decompressions, stabilizations and fixations.[16] Moreover short segment posterior fixation has a higher rate of failure.[17,18]
In our study, the most common type of burst fracture was type B, whereas the least common was type C. 87% of our patients had some neurological deficit, which was higher than the previously reported incidence of 30 to 60%.[19] However canal compromise as assessed on CT scan was found to vary and did not have any correlation with the type of burst fracture or with neurological deficit. Spinal cord injury occurs at the time of trauma rather than being a result of pressure from fragments persisting in the canal thereafter. Radiological and computed tomography images taken a few hours after injury merely reflect the final resting position of the retro pulsed fragments after trauma. These phenomena may explain why there is no correlation between the extent of canal

compromise and the severity of neurological deficit. [20] Moreover our study compares favorably with other studies comparing morbidity of anterior approach to these fractures [21,22]

The modern systems for transpedicular fixation include transpedicular screws which are placed in pedicle, and a rod which is fixed with screws after the distraction. In that way, fracture correction and reduction are performed and stabilization is achieved. Many systems for transpedicular screw fixation have been described. We used PSs of 5.5 diameter and titanium rod of 4mm diameter. They were of local make but with very good titanium quality and finish. The use of transpedicular approach to decompress the bone fragments in the spinal canal requires high speed drill with angled attachment and angled curettes. Mean operating time of 130 minutes and mean blood loss of 500ml in our study compares well with similar studies.[23,24,25] We did not encounter any problem in canal decompression through the posterior transpedicular route. Even those burst fractures in which spinal canal was almost completely occupied by the bone fragments could be adequately decompressed and fixed through this approach alone.

CONCLUSION

Transpedicular decompression and spinal fixation is a viable alternative to anterior approach or staged approach, when dealing with burst fractures of thoracolumbar spine. It is safe, technically easy and gives good long term results.

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