

Transpedicular screw fixation for the treatment of thoracolumbar spine fracture

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Article Info

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Abstract

One of the most popular procedures for treating the unstable thoracolumbar fracture is the short segment pedicle screw fixation. Due to lack of adequate neurological improvement, progressive kyphosis and hardware failure, the efficacy of different methods remain debatable. One hundred patients of thoracolumbar burst fractures were managed from January 2010 to December 2014 by transforaminal thoracolumbar interbody fusion and short-segment pedicle screw stabilization. Each patient was followed-up for a minimum of 2 years. Bony fusion was done in each patient in between two vertebra along with transpedicular fixation. Follow-up radiological images showed good reduction and the fusion of the vertebral body was good. Excellent neurological improvement of the Frankel grade C and D was seen in 81 patients. Eight patients had grade B, improvement which was not satisfactory. Fifteen patients with no paraplegia/hemiplegia on admission remained neurologically intact. For the management of thoracolumbar burst fractures short segment posterior transpedicular fixation with bone graft is very economic and safe procedure with good neurological improvement.

Introduction

Management of thoracolumbar fracture still remains controversial.¹ The patient suffers from the unstable spine and neurological deficit which need for surgical interventions. At present, the most popular operative procedure for the unstable spine is the short-segment posterior transpedicular fixations and posterior bony fusions. Neurological recovery after this surgery is excellent but progressive kyphosis, persistence of neurological deficit and hardware failure remain a concern.² Kyphosis and hardware failure problems can be solved by the bone grafting, balloon-assisted vertebroplasty and corpectomy and cage placement.³ In this study, a consecutive series of 100 thoracolumbar burst fractures with short segment transpedicular screw fixation (one level above and one level below to the fracture) along with posterior thoracolumbar interbody fusion were evaluated the degree of improvement of neurological deficit along with kyphosis correction.

Materials and Methods

One hundred patients (males 70, females 30) with traumatic thoracolumbar fractures attended in the Department of Neurosurgery, Bangabandhu Sheikh Mujib Medical University,

Dhaka Medical College Hospital and some private hospitals from January 2010 to December 2014 were operated. The patients were followed up to 2 years after operation. The mean age was 36.5 years ranging from 20 to 62 years. Selection criteria for surgery were: 1) Presence of neurological deficit with vertebral fractures and spinal canal stenosis; 2) More than 50% loss of anterior vertebral height or local kyphosis angle exceeds 25 degrees. Plain X-Ray and computed tomography (CT) scan of affected level were done to show the fracture morphology before surgery. MRI was done to see the condition of the spinal cord and associated soft tissues injuries (Figure 1A). All patients underwent plain radiography in the early post-operative period within 7 days and then after 3, 6, 9 and 12 months as per demand (Figure 1B-C). CT scan and magnetic resonance imaging (MRI) of respective level done only for the selected patients. For clinical assessment, the neurologic deficit was assumed using the Frankel grade motor score system.

Surgical technique

The patient was placed in the prone position. With the help of C-arm, the localization of fracture was done. A posterior midline longitudinal incision was made over the affected area, more length above the fractured body and less below. Then the fascia was cut and retraction of



the spinal muscle as far as to see the transverse process. Marking image was taken after putting a device in the pedicle area which showed the direction of the pedicle up to the vertebral body. Then the spinous process was removed to decompress the posterior aspect of the thecal sac. The thecal sac and nerve root were gently retracted to expose the inter-vertebral disc which was completely removed subsequently. The retracted fragments of the fractured vertebral body were removed. Then the bone cheeps grafts were inserted in between the vertebral bodies. When the decompression procedure was finished, the final verification of the screws and rod position was done. Muscle, fascia and skin were closed by layers remaining a drain.

cases, 2 rods extruded subcutaneously in one case) and remaining four patients experienced cerebrospinal fluid leakage because of primary dural injury while introducing pedicle screw.

Discussion

Spine trauma patient in the developing country usually comes from the poor socio-economic conditions group of people. Most of the time, fresh spine trauma patient is not found. The patient may come to the neurosurgery department a few days to months after trauma. This reason, we did operation some fresh case and some old case (within 30 days) but our study carried out very good neurological outcome. Most of the patient after operations showed autonomic improvement, as well as muscle power and kyphosis corrections. Full neurological recovery from Frankel A was 2, B was 3, C was 19 and D was 26. Partial improvement from the Frankel A was 0, B was 6, C was 21 and D was 15. Rest of the patient did not show improvement during follow up period. 90 patients showed without any complications after this procedure, remaining 10 cases with some complications, like hardware failure in 6 cases and 4 cases showed CSF leakage while introducing pedicle screw. This study includes the loss of 50% anterior vertebral body height or kyphosis exceeds 25 degree.⁴

Frankel grades were used for clinical assessment of each patient.⁵ The fractures of thoracolumbar spine can cause neurological complications and kyphotic deformity which may have a great impact on the patient's quality of life.⁶ The treatment option of the thoracolumbar fracture (where the height of vertebral body loss >50% and kyphotic angulation deformity >25 degree) is the posterior short segment transpedicular screw fixation by one level above and one level below the affected level with transforaminal thoracolumbar interbody fusion.² It is a common surgical option and its acceptability is established. There are other surgical techniques but each technique has its own advantages and disadvantages. Although the combination of both anterior and posterior approach can provide the

Results

The unstable fractures were D12 level in 30 patients, L1 in 40, L2 in 18, L3 in 12 (Table I). The neurologic deficit was graded according to Frankel motor score system. Eleven patients were classified as Frankel B, 41 as Frankel C and 42 as Frankel D. There were 6 patient classified as Frankel A in the series. The cause of injury included 60 cases due to fall from a height, 32 cases due to road traffic injury, 8 cases were suffering from direct trauma to back. The average injury to surgery interval was 12 days, ranging from 2 to 30 days. Each patient was operated by transpedicular fixations one level above and one level below from the fractured body along with interbody fusions by bone grafts.

The average hospital stay was 42 days ranging from 20 to 60 days. In neurologically intact patient, the average hospital stay decreased to 18 days, ranging from 15 to 30 days. Full neurological recovery from Frankel A was 2, B was 3, C was 19 and D was 26. Partial improvement, from Frankel A was 0, B was 6, C was 21 and D was 15. The rest of the patient did not show improvement during the follow-up period. Ninety patients showed without any complications after this procedure, remaining 10 cases with some complications, like hardware failure in 6 cases (screw broken in 2 cases, screw dislodged in 2

Table I	
Characteristics of injury	
	n
<i>Level of injury</i>	
D12	30
L1	40
L2	18
L3	12
<i>Frankel grade</i>	
A	6
B	11
C	41
D	42
E	0
<i>Causes of injury</i>	
Fall from height	60
RTA	32
Direct injury	8

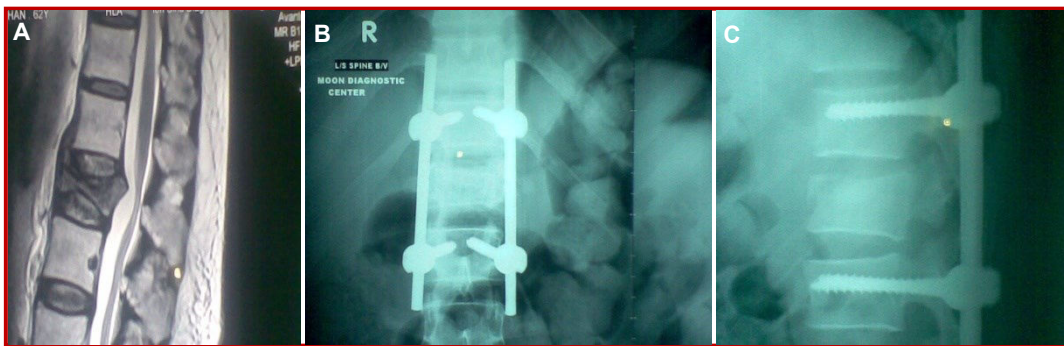


Figure 1: Shows pre-operative MRI (A); X-Ray post-operative AP view (B) and lateral view (C)

most stable biomechanical repair but the operation time, complications and morbidity are higher than that of a single approach. Considering everything, the standard is the posterior approach which relatively is an easy procedure where reduction of fractured vertebral body and augmentation of the anterior column without any complications is possible.⁸ The posterior approach instrumentation can be a) Short-segment fixation involving one level above and one level below from the fractured level and b) Long-segment fixation involving more than two upper and lower level below the fractured segment. Now-a-days short segment pedicle screw instrumentation is a well described and popular technique to reduce and stabilize thoracolumbar spine fracture.⁹ Short segment fixation offers the advantage of saving motion segments when compared with longer instrumentations. But disadvantages are earlier impact failure and correction loss of kyphotic angle.^{10,11} Neurological improvement of our series is similar to L Wang et al.³

Conclusion

Short-segment posterior transpedicular fixation with bone graft is a safe procedure with good neurological improvement for the management of thoracolumbar burst fractures.

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