

Evaluation of Thoraco Lumbar Fractures of Spine Managed With Pedicle Screw Fixation

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ABSTRACT

Background: *The thoracolumbar junction is the most common area of injury to the spine. The forces through kyphotic stiff spine (thoracic) spine switch abruptly into the mobile lordotic lumbar spine at the thoracolumbar junction. Goals of treatment are to maintain the stability & balance of spine without pain along with good neurological function and maximum mobility of spine. This study evaluates the effectiveness of pedicle screw instrumentation in various fractures around the TL spine to overcome the complications encountered in the conservative line of management of these fractures.*

Materials & Methodology: *20 cases of fractures around the TL spine were operated with posterior pedicle screw fixation one or two level above and below the fracture from November 2012 to March 2014. The cases were followed up for a mean of 7.5 months with radiological and neurological evaluation.*

Results: *The average age groups of the patients studied were 19 to 50 years majority were males, fall from height being the predominant mode of injury involving the T12 and L1 level. Commonest type of fractures are burst unstable fractures. The parameters like radiological sagittal angle & index were recorded before & after the surgery. The ASIA score is used for the grading of neurology condition. Follow-up was done for a minimum of 6 months where sagittal angle reduction achieved was 10.85° at final follow-up from 24.75° pre-operatives. The sagittal index achieved at final follow-up was 71.8% compared to the pre-operative mean of 50.6%. The neurological improvement was regarded to be fair enough for the type of injury sustained and fixation achieved.*

Conclusion: *After applying the posterior instrumentation resulted in a reasonable correction of the deformity with a significant reduction in recumbency associated complications; the limiting factor being the small study group and short follow-up period.*

Keywords: *thoracolumbar, pedicle screw and rod instrumentation.*

INTRODUCTION

The thoracolumbar junction is the most common area of injury to the spine. The forces through long stiff thoracic kyphotic spine switch abruptly into the mobile lordotic lumbar spine at the thoracolumbar junction. Biomechanically, the zone of transition is susceptible to injury and is the most commonly injured portion of spine, road traffic accidents is the major cause of injury followed by falls and sports related injuries.¹ Males are at four times higher risk. The organ injures of other systems encountered is up to 50% of thoracolumbar trauma patients.² High energy injuries such as those causing thoracic level paraplegia, have a mortality rate of 7%.³

Various classifications have been proposed for the treatment of thoracolumbar spine injuries. These classifications all vary in their complexity and ability to help differentiate between the specific treatment options. The goals of treatment are to achieve stability & balance of spine without pain, along with good neurological function and maximum mobility of spine. The existence of controversy significantly about this best method of treatment to achieve these goals. Non-operative treatment includes postural reduction, bed rest, ambulatory bracing and observation. When considering today's hospital environment along with medical complications of prolonged bed rest, an early goal of non-operative treatment is a mobile patient with or without a brace. It is mainly indicated for stable injuries without the potential for progressive deformity or neurological injury. Operative treatment for thoracolumbar fractures is controversial. Surgery is typically employed in

patients with unstable, three-column injuries and significant neurological deficits. The development of reliable and biochemically stable implants for stabilization has evolved over many years beginning from Harrington rod system, interspinous process wiring, serrated spinous process plates, short compression rods, springs, laminar wiring and to the recent addition of pedicle screw implantation.

The advantages of surgical treatment with pedicle screw and rod fixation systems in spine injuries are lesser complications of prolonged immobilization, significantly reduces the period of hospitalization, rehabilitation achieved completely and thus reduces the death rate significantly. This study is needed to explain the benefits of this procedure on the functional outcome of the patients. Twenty cases of unstable thoracolumbar fractures stabilized with pedicle screw and rod fixation system have been performed in our institution.

AIMS AND OBJECTIVES

1. To evaluate the outcome of posterior pedicle screw fixation for unstable thoracolumbar fractures.
2. To evaluate the restoration of the alignment of the spine and Spinal canal.
3. To compare the results of present study with other studies.
4. To evaluate the improvement of neurological level if any following the procedure.

MATERIALS AND METHODS

From November 2012 to March 2014, 20 patients from the Department of Orthopaedics, Narayana Medical College and Hospital, were operated for unstable thoracolumbar fractures with pedicle screw fixation and posterior decompression and were followed up for 3 to 12 months (mean – 7.5 months).

INCLUSION CRITERIA

1. Age below 60 yrs
2. Traumatic unstable thoraco lumbar fractures of spine
3. with neurological deficits

EXCLUSION CRITERIA

1. Age > 60 years
2. Patient not willing for surgery
3. Patient medically unfit for surgery
4. Pathological and osteoporotic fractures

Initial assessment: detailed history pertaining to mode of injury and time of injury were taken, clinical examination which included general examination for head, cervical spine, chest, abdominal injury is completed. Then after the patient is stabilized, examination of the spine with neurological evaluation for motor power, sensory, reflexes and bowel-bladder is done to evaluate the level of spine injury and extent of cord damage. This follows the American Spinal Injury Association of neurological evaluation. Methylprednisolone is administered in cases who presented within 6 hours from injury.

A radiograph of the injured spine in two views is done to classify the fracture type using the Denis

classification. In cases with associated injuries additional radiographs were included to rule out fractures.

There were 18 unstable burst fractures, 1 flexion distraction and 1 translation injuries in our series. One case was associated with distal end radius fracture. Patients with one of the following were considered to have an indication for surgical stabilization of the spine:

- Presence of neurological involvement.
- The patients who are stable neurologically along with the unstable ones with instability criteria of kyphotic deformity (sagittal angle) more than 20⁰, loss of vertebral body height (sagittal index) of more than 50%.

RESULTS

Age & Gender distribution

A total of 20 cases were included of which 2 cases below 20 years of age, 8 were in the age group of 21 to 30, 6 of them in the group of 31 to 40 and 4 cases above 40 and The mean age calculated for the study was 32.5 yrs. In the study of the 20 cases 18 were males and only 2 were females.

Mode & Level of Injury

The most common mode of injury in the study group was fall from a height followed by road traffic accident with only one case. In our study we observed 4 cases with fracture at T-12 level followed by 11 cases at L-1 level, with sum total of 70% of fractures at T-12 and L-1 junction, 6 cases were at L-2 level which constitutes the remaining 30% [Figure 1].

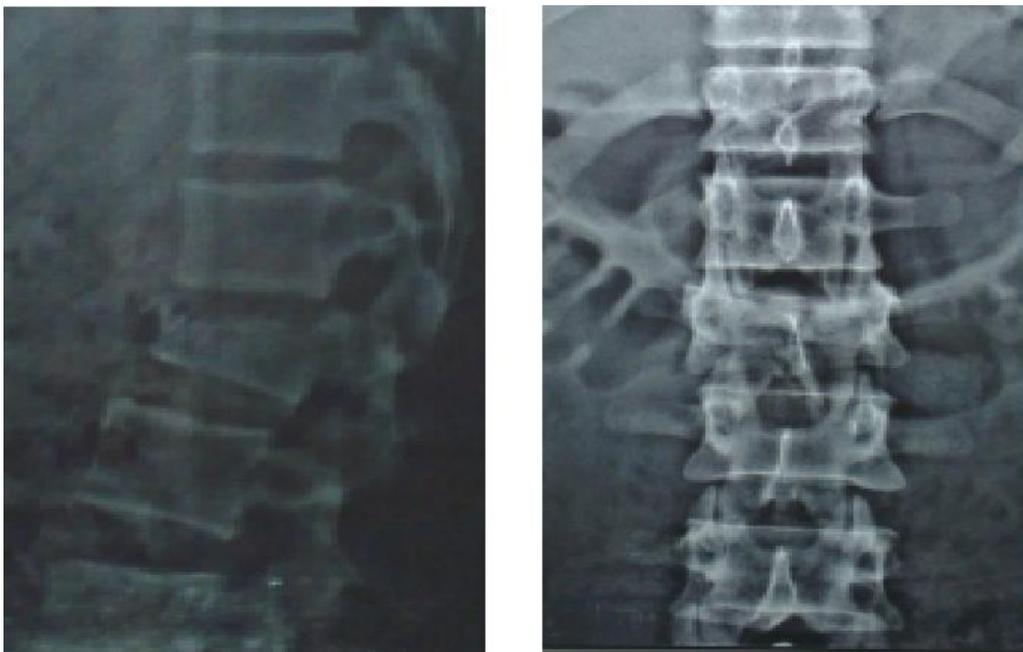
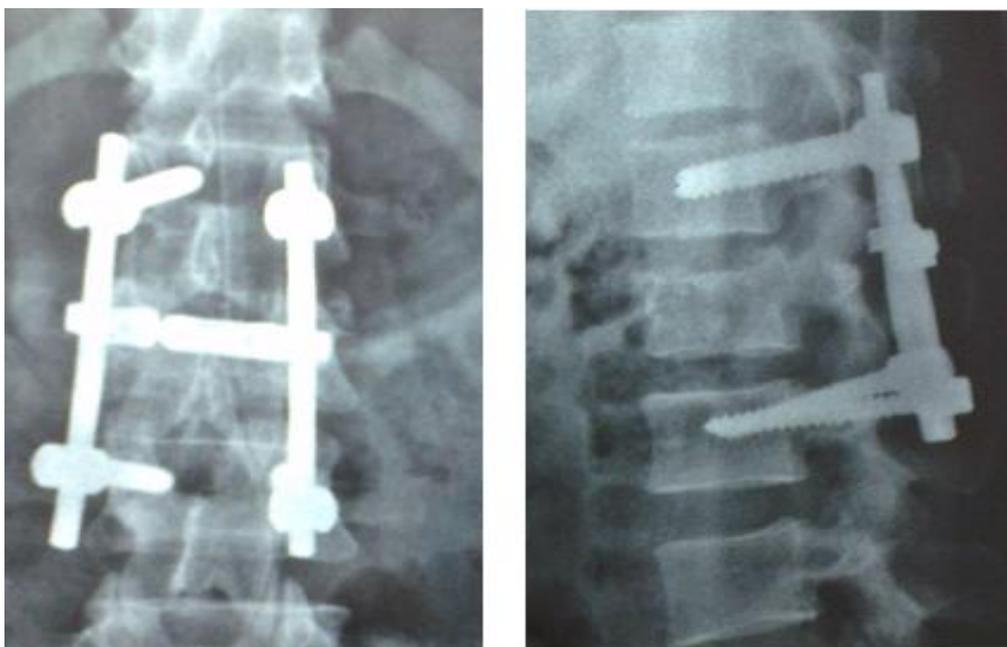
Type of Fracture

Commonest fracture type observed in this study was unstable burst fracture with 18 cases followed by lease with flexion distraction injury and 1 case of translation injury.

Sagittal Angle

The radiological evaluation of sagittal angle and sagittal index was done before the surgery, after

the surgery, and during the follow up stage. Distribution of sagittal angle observed 24.75° (pre-operative); 10.85° (postoperative); and 4.5°(loss at final follow-up. Distribution of sagittal index observed (pre-operative) 0.50; (postoperative) 0.73; (final follow-up) 0.71 [figure 1]

PRE-OPERATIVE**POST-OPERATIVE**

6 MONTHS FOLLOW UP

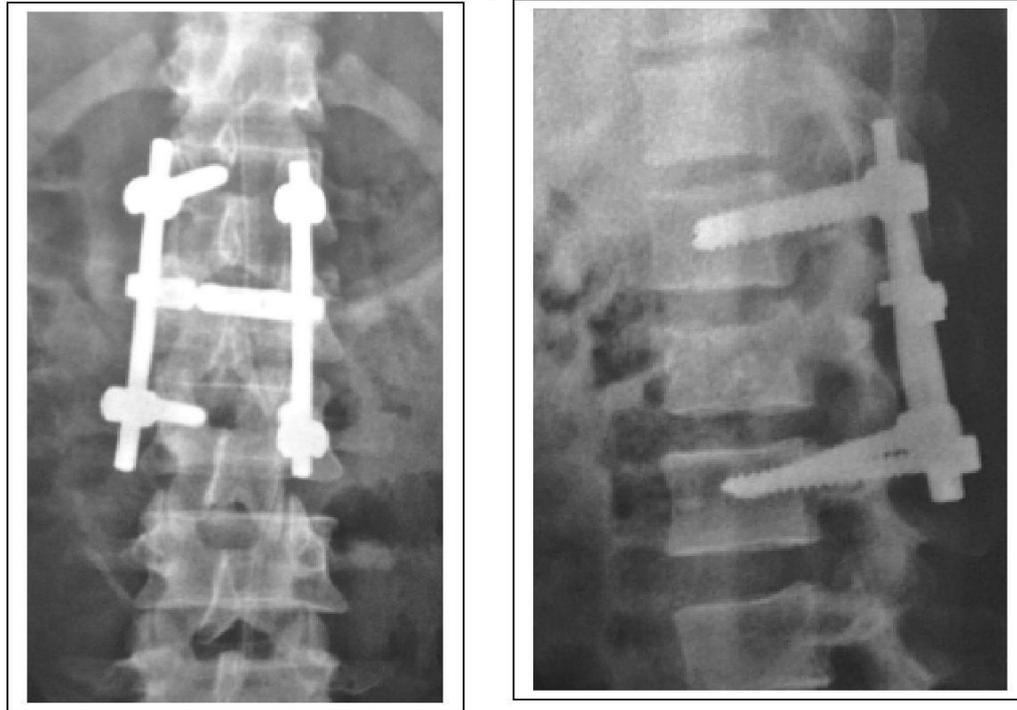


Figure1. Pre-operative x-ray spine and post-operative x-ray spine and 6 months follow-up x-ray spine.

Neurological evaluation

Neurological evaluation was done according to American Spinal Injury Association scale in the pre-operative period and at all follow-ups. 50% cases showed improvement by one grade, 30% showed improvement by two grades, 15% showed no neurological improvement and only 5% showed 3 grade improvement. Mean distribution of injury surgery interval is 4.5 days (1-21 days). Mean distribution of surgical interval is 3.00 hrs (2.00 to 4.00 hrs)

Distribution of associated injuries & Complications

The common complication associated in the study was bed sores and urinary tract infections (45%), there was only one patient with an associated distal end radius fracture in our study.

DISCUSSION

In our study of 20 cases the highest percentage of patients were males and were in the age group of 19 to 50 yrs. These numbers when compared with studies done in developed countries and in developing countries showed consistent results. These results show that males in the working age group are predisposed to trauma. [Rinoldi RL⁴ – 30, Sahu SC⁵ – 35.5, RoyCamille⁶ – 30, Present study – 32.5] The mode of injury comparison with studies done in India also shows association of fall from height being the commonest mode of injury followed by road traffic accidents. Whereas studies done in western countries show road traffic accidents to be the most common mode of injury. The study group includes cases who were involved in climbing trees, and cases who were working at the construction sites hence making fall from height mode of injury more common in the study.

Mode of injury	Dipankar Sen ⁸	Yaser M Behairy ⁷	Present Study
Fall from height	64.7	47	90
Road traffic accident	35.2	52.9	10

The results of our study showed majority of fractures around T-12 and L-1 level which are consistent and comparable with the results of other studies which also shows T-12 -L-1 to be the most common level of fracture [Sahu SC⁹ - 82%, RoyCamille⁶ - 42%, Dipankar Sen⁸ - 82%, Mohammad F. Butt¹⁰ - 88% Present study – 70%]. The type of fracture being the unstable burst fracture being the commonest in our study was also comparable with other studies showing similar results. This correlates with the mode of

injury and the fracture type sustained by patients included in the study. [Gertzbein SD¹¹ - 68%, Viale GL¹² - 55%, Dipankar Sen⁸ - 58.8%, Present study - 90%]. Patients were radiologically evaluated with sagittal (kyphotic) angle and sagittal index (ratio of anterior and posterior height of vertebral body). Pre-operative, post-operative and final follow readings were comparable with various studies. This also proved that stability of fracture and fixation is better assessed with these two parameters.

	Pre-operative	Post-operative	Final follow-up
RoyCamille ⁶	18°	5°	8°
Dipankar Sen ⁸	16°	3.8°	5.8°
Mohammad F. Butt ¹⁰	21.4°	12.8°	16.2°
Present study	24.75°	10.85°	4.5°

Sagittal index comparison

	Pre-operative	Post-operative	Final follow-up
Yaser M Behairy ¹³	0.51	0.85	0.84
Mohammad F. Butt ¹⁰	0.44	0.72	1.02
Present study	0.50	0.73	0.71

The neurological evaluation was according to ASIA scale in our study which showed significant improvement of one grade which is comparable with other studies showing 60 to 70% improvement at the final follow-up. Out of 20 cases studied 4 cases were with complete neurological injury and

16 cases with incomplete injury (B, C, D). 37.5% of these incomplete injuries showed two grade improvements, and 56.25% of them showed one grade of improvement. Of the complete neurological injury cases about 25% (1 case) showed one grade improvement. The limiting factor

in the assessment was the mean of follow-up of 7.5 months compared to a long term follow-up of up to 2 years in various other studies. Associated injuries in various other studies were pelvic injuries, abdominal injuries and long bone fractures. In our study the only associated injury encountered was distal end radius fracture in one patient. Bed sores and urinary tract infection and retention were most common postoperative complications encountered in this study.

CONCLUSION

Fracture and fracture dislocations of the thoracolumbar spine are the most commonly occurring types of osseous injury to spine. The road traffic accidents causing the major percentage and fall from height being the commonest mode of injury. Treatment aims at early stabilization, direct or indirect decompression of the neural elements and early mobilization of the patient to prevent further problems. Thus it avoids the dependency of the patients towards family members & the care givers and reduces the hospital stay compared with that of conservative means of treatment.

Unstable burst fractures were the most common fracture type encountered in the study which leads to deformity and neurology compromise. Evaluations of neurology & radiology were the parameters taken into account to assess the instability and indication for surgery and recovery. There was a drastic improve in the parameters of radiology parameters comparable to other studies done in both Western and Asian countries. Improvement in the neurology is seen to

be fair enough in cases of incomplete neurological injury.

Short segment fixation using the posterior approach with pedicle screw-rod fixation devices with or without bone grafting achieves good stabilization and fair enough neurological recovery in patients with unstable thoracolumbar fractures. Factors like small study group and shorter follow-up period is a limiting factor.

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