



A Study on Short Segment Fixation for Thoracolumbar Fractures

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Spine injury is being one of the commonest injuries which pose challenges to the patients and treating clinicians as well. Despite so much research and recent advances, there has not been unanimous consensus regarding the management of spinal injuries. However, the treatment aim of every injury to the spine is to restore of max possible function in patients. This study was conducted to assess the outcome of short segment fixation in fractures of the thoracolumbar spine.

Methods and Materials: This is a prospective cohort study done at our Tertiary Center during the period from April 2018 To September 2020. Patients with thoracolumbar spine injuries were, included in the study. Study on short-segment pedicle screw fixation and inter- transverse fusion for single-level acute thoracolumbar fracture.

Results: Mean age of the sample size was 40.58 years with male preponderance. The FRANKEL SCALE was used to grade the pre-op neurology; 17.2% were graded as E, 24.1% as D, 31% as C, 13.8 % as B, and 13.8% A. ASIA motor and sensory score preoperative and postoperative at one year follow up was compared was found to be significant (p<0.05). Preoperative VAS and Functional independent measures also showed significant improvement.

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Conclusion: Surgical stabilization and decompression are essential strategies for further neuroprotection and recovery after a spine injury. Short segment fixation can be an option for thoracolumbar fracture. However, an unstable fracture may require extended fixation.

Keywords: Spinal cord injury; thoracolumbar; fracture; fixation.

1. INTRODUCTION

The most commonly affected group by spinal cord injuries (SCI) are young males, having a M: F = 4:1, with an average age of 30 years [1,2]. The commonest etiology of these injuries is motor-vehicular accidents, accounting for almost half of all injuries. Classifying site-wise, SCIs are most commonly encountered in the cervical spine followed by the thoracolumbar segment.

The treatment aim of every SCI is restoring of max possible function in patients, helping them lead a disability-free life. For these patients the treatment aims at the protection of healthy neural tissues, recovering of damaged cord and nerves, and providing optimum positioning for the muscle & bone to recover. Surgical stabilization of the spine prevents any more mechanical injury to the already injured cord. The surgical treatment gives the benefit of (a) immediate stabilization of the spine, (b) deformity correction, and (c) aid to the improvement of neurology by relieving any residual compression of the neural tissue.

This study aimed at obtaining clinical, functional, and radiological results of the short-segment fixation (SSF) for thoracolumbar (TL) fractures and to assess the advantages and complications of SSF with intertransverse fusion in TL fractures.

2. METHODS AND MATERIALS

This is a prospective cohort study done at our Tertiary Center during the period from April 2018 To September 2020. Patients with clinical and radiological diagnoses of traumatic thoracolumbar SCIs were, enrolled in the study. A detailed medical history was taken, Detail physical and neurological examination of the patient was done as per the department protocol.

The ASIA impairment scale [3] and Frankel grading system [4] were used for neurological charting. Radiological examination of the patient was done consisting of plain radiograph anteroposterior and lateral view. Fractures were classified using the Magrel classification system [5]. MRI was done to evaluate the injury to the neural structures and thecal sac compression due to hematoma or retropulsion bony fragments. Computed Tomography was used optionally to classify the fracture, calcified ligaments, which need to be decompressed surgically, and to evaluate bony compression or retropulsion fragment in the canal. For Dorsolumbar spine injuries- Posterior decompression and stabilization were done with Pedicle screw fixation and fused with intertransverse fusion. Post-operatively physical,neurological and occupational rehabilitation was provided to every patient and the recovery was assessed by Functional Independence Measure [6].

3. OBSERVATION AND RESULTS

Total 40 patients with thoracolumbar spine fracture presented to our hospital during the study duration. Out of 40 cases, 5 had associated head injuries, 3 patients were denied for surgical intervention, 2 patients had associated fractures of other bones, were excluded. Rest 29 patients were included. One patient died on the 16th week of follow-up.

All the patients presented in the accident and emergency department were initially managed as per the ATLS protocol [7]. This study had an average age of 40.58 years with Male dominance.

The most common etiology was fall from height followed by motor-vehicular accidents.

Table 1. Correlation of type of fracture with Frankel scale for neurologic assessment

| Fracture type | Frankel Scale | | | | | Total |
|-------------------------------------|---------------|---|---|---|---|-------|
| | A | B | C | D | E | |
| Anterior wedge compression fracture | 1 | 3 | 3 | 2 | 4 | 13 |
| Burst fracture | 3 | 1 | 6 | 5 | 0 | 15 |
| Incomplete burst fracture | 0 | 0 | 0 | 0 | 1 | 1 |
| Total | 4 | 4 | 9 | 7 | 5 | 29 |

Table 2. Paired t-test of a variable at admission and 1-year follow-up

| Difference in scores: On admission – after 1 year | Mean difference | Standard Deviation | Standard Error Mean | p-value |
|--|-----------------|--------------------|---------------------|---------|
| ASIA MOTOR on admission - ASIA- MOTOR after 1 year | -11.71 | 12.77 | 2.41 | .001 |
| ASIA SENSORY- LIGHT TOUCH on admission - ASIA SENSORY - LIGHT TOUCH after 1 year | -8.57 | 12.71 | 2.40 | .001 |
| ASIA SENSORY -PINPRICK on admission - ASIA SENSORY- PIN PRICK after 1 year | -6.21 | 8.49 | 1.60 | .001 |
| VISUAL ANALOGUE SCALE on admission - VISUAL ANALOGUE SCORE after 1 year | 8.14 | 1.53 | 0.28 | .001 |
| Functional Independence Measure (FIM) on admission - FIM after 1 year | -39.14 | 12.36 | 2.3 | .001 |
| ANGLE OF ANTERIOR WEDGE (in degree) on admission - after 1 year | 8.46 | 6.49 | 1.22 | .001 |

There was no statistical evidence to conclude that the Frankel scale can be related to a particular type of fracture ($p > 0.05$). Similarly, there was no statistical evidence to conclude that the ASIA motor score can be related to a particular type of fracture ($p\text{-value} > 0.05$).

The ASIA motor score preoperative and post-operative at one-year follow-up were evaluated by paired t-test, and was calculated to be significant ($p < 0.05$). ASIA sensory light touch, ASIA sensory Pinprick, Visual analog scale, Functional Independence Measure, and Anterior wedge angle, assessed pre-op, post-op, and at one-year follow-up were evaluated & found to be significantly improved ($p < 0.05$).

The relation of the type of fracture with vertebra affected was evaluated statistically. The proportion of patients with hardware loosening did not correlate with the level of vertebra involved ($p\text{-value} > 0.05$).

4. DISCUSSION

Management of the spinal injury is very challenging at the same time quite often frustrating. A definite protocol for the management of spine injuries is yet to be established. These patients require individualized care for their rehabilitation and can be achieved at a full-fledged spinal center.

This study had an average age of 40.58 years with male dominance, which is comparable to other studies. The explanation for this can be that the young- middle age group of the population often indulges in outdoor activities [1,2].

In our study, there is a male predominance of the patients, which is comparable to most of the studies. This is again in agreement with world literature and can be explained by the simple fact that the majority of the male is the breadwinner of the family, for which they have to travel, work in industries, etc and so they tend to get more injuries [1,2].

Most of the patients who had fallen were labor by occupation. This can be explained that the fall from height could be related to safety measures they had while working on site.

Our study maximum number of patients had fracture of thoracolumbar junction (T11- 10.3%, T12- 27.5%, L1- 31.3%, L2- 24.1%). Chung OM [8] reported that the most common site of involvement was L1 (35 cases) and L2 (31 cases), Dr.Nitin Kansal et al. [9] and N Basheer et al. [10] also found L1 vertebra to be commonly involved in thoracolumbar spine injuries. Roman Pfeifer et al. [11] noted that most patients had an isolated vertebral body fracture at the thoracolumbar junction (L1 and D12). Alvine et al. [16] found that 70% of fractures were between the level of T11 – L2; Sasso et al. [12] and Razak et al. [13] had similar findings with 80% and 92% fractures were between the level of T11 – L2, respectively.

The predilection of fracture for this area is due to 3 reasons [1,2].

- The curvature of the spine changes from kyphosis to lordosis and hence the concentration of forces occurs.
- This is the junction of the fixed and mobile region with loss of stabilizing effect of rib cage obliterates

(c) Increased sagittal plane mobility due to sagittal orientation of facet joints.

In our study, 44.82% of patients were having wedge compression fractures out of which 30.76% were having bowel and bladder involvement, and burst fracture was reported in 51.72% of patients with 40% of the patient having bowel and bladder involvement. However, there was no statistical correlation between the type of fracture and bowel and bladder involvement.

In our study there were 13.7 % of thoracic spine injuries, 27.5% of lumbar spine injuries, and 58.6% of thoracolumbar junction injury with burst fracture common at the lumbar spine and anterior wedge compression at the thoracolumbar junction. About the level of injury, M. Reinhold et al. [14] found thoracic spine fractures in 19.8%, lumbar spine fractures in 13.2%, and thoracolumbar junction fractures in 67.0%. The fracture type varied with the spinal region involved, with the thoracic spine having more B and C type injuries (Magerl classification).

As per the Frankel scale for neurology, pre-operatively 13.8% were grade A, 13.8 % grade B, 31% as grade C, 24.1% as grade D and 17.2% as grade E.

In this study, at 1 year follow up, 3.57% were grade A, 10.7% B, 7.14% C, 14.28% D, and 64.28% E.

Razak M et al. [13], found that 64.4% of patients with incomplete lesions improved by at least 1 grade. Sasso et al. [12], noted that patients having incomplete neurology deterioration had improvement of at least 1 grade. Alvine et al. [16], documented the neurology improvement being seen in half of the cases. Nasser R et al. [15], found neurology loss patients exhibited minimum improvement of 1 grade on the last follow-up.

In the present study, the average regional angle during the preoperative stage was 14.344° and 2.068° post-op and 5.75° on the last follow-up. Here are the kyphotic angle readings for other similar studies:

| Study | Kyphotic angle (in degree) | | |
|-----------------------|----------------------------|---------|-----------|
| | Pre-op | Post-op | At 1 year |
| Current Study | 14.344 | 2.068 | 5.75 |
| Nasser MG et al. [17] | 23.6 | 7 | 11.5 |
| Alvine et al. [16] | 12 | 1 | 6 |
| Razak M. et al. [13] | 20 | 7 | 9 |



Fig. 1. Pre – operative X – ray of spine suggestive of fracture

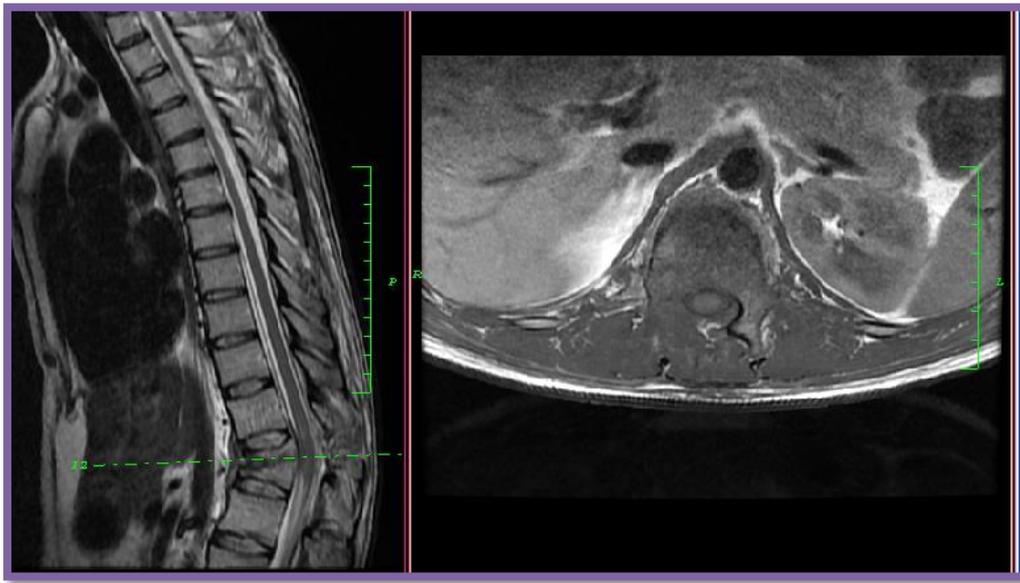


Fig. 2. Pre – operative magnetic resonance of spine

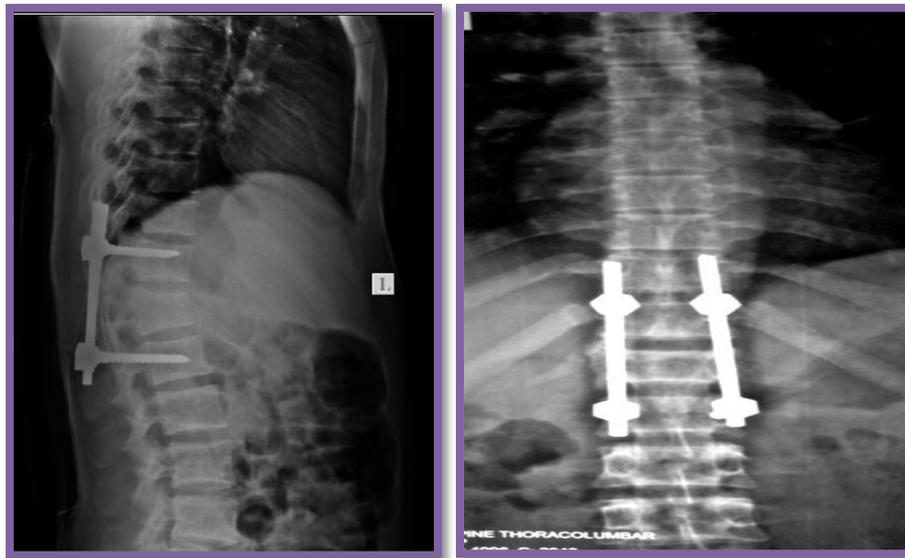


Fig. 3. Immediate post – operative X – ray of spine

In this present study, the mean VAS score pre-op was 9.0, 7.48 post-op, and 0.857 at a 1-year follow-up. Adalberto Bortoletto et al. [18] found the mean VAS was 7 pre-op, 6 at 1-month post-op and, 4 at 6 months post-op.

In our study, the mean FIM on admission was 66.57 and at one year of follow-up was 105.714 with a mean improvement of 93.14. Significant improvement was noted in all the patients. However, the functional betterment was more in patients with time between injury and surgery was less. Gelson Aguiar da Silv et al. [19] found

that more severe injuries gained functionality more comparatively ($p < 0.05$). The mean FIM gain seen in various levels, from lowest to highest, was: thoracic, thoracolumbar junction, and lumbar.

5. CONCLUSION

It can be concluded that SSF can be a good choice for fixation of thoracolumbar fracture fixation, especially for stable type. However, loss of kyphosis corrections is commonly seen with unstable thoracolumbar fracture fixation.

CONSENT AND ETHICAL APPROVAL

As per international standard or university standard guideline Patient's consent and ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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