



Original Article

Long-segment fixation versus short-segment fixation with instrumentation of index vertebra for thoracolumbar fractures

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ABSTRACT

Background: We assessed and analyzed the clinical, perioperative, functional, and radiological outcomes of long- versus short-segment (SS) fixation of thoracolumbar spine fractures that included the index vertebra.

Methods: We retrospectively evaluated 119 patients with thoracolumbar spine fractures (i.e., using AO classification system). The patient was followed up for a minimum of 1 year at which time the angles of correction were measured on lateral X-rays (i.e., using Cobb's method). Neurological grading employed the Frankel's grading system. Operative time, perioperative blood loss, and time to mobilization were also analyzed.

Results: After 1 year, the loss of kyphosis was not significantly different between the two groups. Although there were no statistical differences in terms, regarding neurological outcomes, time to mobilization, or duration of hospitalization, the operative times and perioperative blood loss were significantly reduced in patients undergoing SS fixation.

Conclusion: We determined the efficacy of SS fixation for thoracolumbar fractures including the index vertebra.

Keywords: Fixation, Pedicle screws, Spine trauma, Thoracolumbar fracture, Treatment

INTRODUCTION

The goals for treating thoracolumbar fractures include; the restoration of vertebral column stability, obtaining adequate decompression of the spinal canal, and early mobilization of the patient. The classical "long-segment" constructs include instrumenting two or three levels above and below the injured level,^[7,8] while short-segment (SS) fusions (i.e., one level above/1 below) preserve more motion segments and may potentially reduce morbidity.^[3] Here, we retrospectively compared the outcomes of long versus SS fixation in 119 thoracolumbar fractures.

MATERIALS AND METHODS

We evaluated 119 adults who sustained single level posttraumatic thoracolumbar fracture/fracture dislocation. The CT scans had to document that at least one side of the fractured

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vertebra/pedicle was intact. Where feasible, patients also underwent MRI scans to evaluate spinal cord compression, the status of the anterior/posterior longitudinal ligaments, and the intervertebral disk.

Clinical data

Multiple baseline parameters were also recorded [Table 1]. Mechanisms of spinal injury included; motor vehicle accidents (68 patients), falls from a height (49 patients), and falls from bicycles (two patients). Preoperative Frankel grades included 24 Grade A through 23 Grade E patients. Of the 24 Grade A patients, 10 underwent SS fixation versus 14 who had long-segment fusions. Neurological grading used the Frankel system and patients were evaluated at 6 weeks, 3 months, 6 months, and 1 year interval following surgery. L1 was most commonly fractured followed by T12 in both groups.

	Short segment	Long segment
Number of patients	54	65
Age (years)	31.72±11.17	32.01±11.15
Gender		
Male	43	56
Female	11	9
Level of fracture		
T11	5	9
T12	16	22
L1	26	26
L2	7	8
Neurological deficit complete/incomplete	10/44	14/51
Frankel grade		
A	10	14
B	12	10
C	19	17
D	5	9
E	8	15

Fracture patterns using AO spine injury classification systems

We used the AO spine injury classification systems for evaluating fractures. Patients underwent either SS fixation or long-segment fixation at the discretion of the surgeon (i.e., not randomized). A plain radiographs were evaluated preoperatively and postoperatively for kyphotic angulation using the Cobb method.^[2]

Short- and long-segment fixation

SS fixations included pedicle screws placed one level above and one level below the fracture site, pedicle screws inserted into the index vertebra, followed by rod application (i.e., contoured rods using ligamentotaxis to correct kyphosis and perform lordotic distraction) [Figures 1 and 2]. Long-segment fusions included pedicle screws placed in vertebrae 2 above and 2 below the index fracture level, with added screws placed in the fractured vertebral body [Figures 3 and 4].

RESULTS

Improvement was based on achieving a postoperative Frankel Grade C or above, and comparable neurological recoveries were noted in both groups. Although there were no statistical difference between the two groups in terms of duration from injury to surgery, time to mobilization, and duration of hospitalization, operative time and perioperative blood loss were significantly reduced for SS fusions ($P < 0.0001$) [Table 2]. The mean preoperative kyphosis for both short- and long-segment fixation, mean postoperative kyphosis, and 1-year follow-up kyphosis were comparable for both groups. No statistical differences were found between two groups.

Postoperative complications

Complications were encountered in 20 patients. Eight dural tears were managed with Prolene 5-0 sutures reinforced with

	Short	Long	P value
Duration from injury to surgery (days)	3.8±1.3 (2–7)	3.8±1.5 (2–7)	>0.05
Operative time (minutes)	156±27 (98–216)	193±32 (119–282)	0.0001
Perioperative blood loss (mL)	436±106 (220–700)	513±127 (240–780)	0.0001
Time to mobilization (days)	3.54±0.2 (3–4)	3.56±0.3 (3–4)	>0.05
Duration of hospitalization (days)	14.4±3.6 (11–15)	14.6±4.5 (11–16)	>0.05
Preoperative kyphosis, Degrees	18.74±10.5	18.74±10.5	0.47
Postoperative kyphosis, degrees	3.08±10.77	3.66±10.59	0.3859
Follow-up kyphosis, degrees	2.94±10.63	3.45±10.17	0.3974
Neurological recovery	20/54	17/65	0.201

fat; all dural leak repairs proved successful.^[4] Nine patients had suture site complications which were managed conservatively. Three patients developed deep vein thrombosis treated with compression stockings and pharmacological agents. There were postoperative infections – superficial or deep.

DISCUSSION

Although many studies have documented the efficacy of long-segment fixation for the treatment of thoracolumbar fractures, SS fusions have increasingly proved as effective

Table 3: Clinical summary of the literature.

Author Reference Journal Year	Patients Sex	Average age Level of fractures	MR findings CT findings	Surgical procedures	Outcomes/ conclusion
Sanderson <i>et al.</i> Short-segment fixation of thoracolumbar burst fractures without fusion Eur Spine J Volume 8, 1999	24 patients 16 males 8 females	33.1 years (±14.2, range 18–62) T12: 8, L1: 12, L2: 4	Kyphotic deformity >20° Anterior body collapse >50%	Short-segment fixation without fusion 15 patients – Steffee plates 5 patients – Cotrel-Dubousset screws and Sofamor rods 3 patients – AO universal spinal system	Cobb angle Injury – 20.75±9.4 Follow-up – 13.9±7.6 Anterior body height loss (%) Injury – 38±14.2 Follow-up – 21.4±8.7 20 patients had satisfactory results for low back outcome scale Routine fusion with SS fixation of TL fracture is not necessary
Wang <i>et al.</i> Is fusion necessary for surgically treated burst fractures of the thoracolumbar and lumbar spine? Spine Volume 31, 2006	58 patients 42 males 16 females	39.8±11.6 years T12: 9, L1: 21, L2: 24, L3: 3, L4: 1	Kyphotic deformity >20° Anterior body collapse >50% Canal compromise >50%	Short-segment transpedicular fixation with “lordorizing screw” in fractured vertebra to correct kyphotic deformity with or without posterolateral fusion	Correction of kyphosis on follow-up – 10.7±7.4° Correction of vertebral body height on follow-up (%) – 33.0±11.0 No significant difference between Greenough low back outcome scale Short-segment fixation of TL burst fractures without fusion was satisfactory
Chokshi and Shah Outcomes of including fracture level in short-segment fixation for thoracolumbar fracture dislocation Asian Spine Journal Volume 13, Feb 2019	50 patients 33 males 17 females	33.4 years (range, 18–68 years) T11-L2: 41, nine cases in remaining TL region	Fracture dislocation of TL spine McCormack load-sharing score ≤6	Short-segment fixation with fusion using autologous bone graft and decompression	Kyphosis angle Preoperative –26.80°±14.50° Follow-up – 5.50°±110° VAS score Preoperative – 8.6 Follow-up – 2.4 Including the fracture level in short-segment fixation for TL fracture dislocation (with a McCormack load-sharing score ≤6) achieves good kyphosis correction and correction maintenance
Li-Yang <i>et al.</i> Posterior short-segment fixation with or without fusion for thoracolumbar Burst Fractures A 5–7-years prospective randomized study JBJS Volume 91, 2009	73 patients 56 males 17 females	34.6 years (range, 24–57 years) T11: 5, T12: 11, L1: 41, L2: 16	Single level Denis Type B burst fracture McCormack load-sharing score ≤6	Short-segment pedicle screw fixation with or without posterolateral fusion	Local kyphosis angle (degree) No significant difference between fusion and nonfusion group at any interval No significant difference in neurological recovery, VAS score, and SF-36 physical and mental component scores between groups



Figure 1: Anteroposterior and lateral X-ray showing L1 vertebral body fracture.

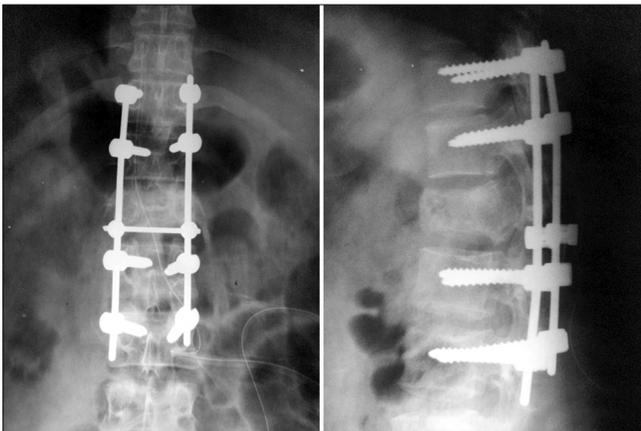


Figure 2: Postoperative X-ray showing long-segment fixation without instrumentation of index vertebra of L1 vertebra fracture.

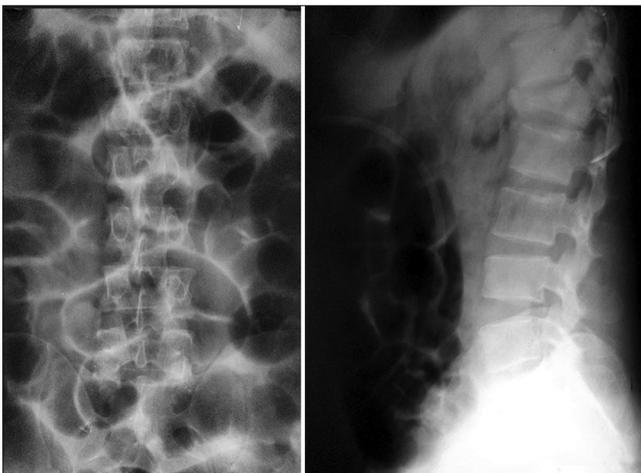


Figure 3: Anteroposterior and lateral X-ray showing L2 vertebra fracture.

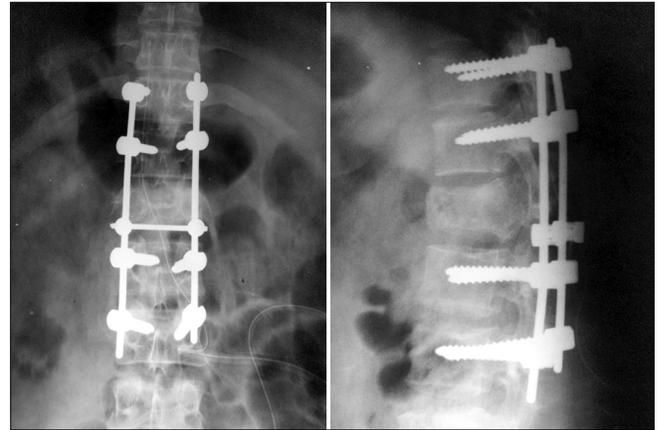


Figure 4: Postoperative X-ray showing short-segment fixation with instrumentation of index vertebra.

[Table 3]. Sanderson *et al.*^[6] determined that routine fusion in SS fixation of thoracolumbar burst fractures (i.e., posterior or posterolateral fusion) was unnecessary. Wang *et al.*^[9] similarly found that short-term results of SS fixations without fusion were satisfactory. Chokshi and Shah^[1] successfully treated 50 patients with thoracolumbar fractures with SS constructs and index screws. Li-Yang *et al.*^[5] also demonstrated satisfactory outcome of 73 patients treated by SS fixation without fusion. Here, we have also documented the relative efficacy of short- versus long-segment fusion for treating thoracolumbar fractures.

CONCLUSION

We concluded that SS fixation was as effective as long-segment fusion for treating thoracolumbar fractures.

Declaration of patient consent

Patient's consent not required as patient's identity is not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

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