

## Original Research Article

# Retrospective analysis of unstable thoracolumbar fractures treated by postural reduction and posterior short segment pedicle fixation

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## ABSTRACT

**Background:** For unstable dorsolumbar injuries, the controversy in choosing between long versus short segment posterior fixation continues.

**Methods:** 29 patients (13 males, 16 females) with single level unstable thoracolumbar fracture operated by short segment posterior pedicle screw fixation were evaluated retrospectively in terms of kyphosis correction achieved in immediate post-operative period, loss of kyphosis correction at final follow up and clinical outcome on Denis pain scale and any failure of fixation. Average follow up period was 22.07 months (14-40 months).

**Results:** Average age of patient was 35.7 years (15-50 years). Mode of injury was fall from height in 27 patients and road traffic accident in 2 patients. 12 fractures were at L1, 9 at D12, 6 at L2 and 2 at L3. Neurologically 11 had paraparesis, 4 complete paraplegia and 14 were without any deficit. Pre-operative kyphotic angle was  $23.023 \pm 11.14$  (8-50 degrees) which improved to  $7.03 \pm 4.69$  (0-18) post operatively. Kyphosis at final follow up was  $11.759 \pm 5.901$  (2-25). Loss of kyphosis correction at final follow up was  $4.79 \pm 2.042$  (2-10 degrees). Load sharing classification score (LSC) was  $6.89 \pm 1.345$  (4-9). Denis pain scale at final follow up was p1 in 11 patients, p2 in 15 patients and p3 in 3 patients. There was no case of implant failure and only one case had kyphosis correction loss of 10 degrees.

**Conclusions:** Short segment fixation provides stable fixation with good results and there is no correlation between LSC and fixation failure.

**Keywords:** Short segment pedicle fixation, Unstable thoracolumbar fractures, Kyphosis

## INTRODUCTION

Spine fractures occur more commonly at the dorsolumbar region due to transition from rigid dorsal spine to mobile lumbar spine. These fractures are associated with grave morbidity and mortality if not treated well because of threat of injury to neural tissue in unstable injuries.<sup>1</sup> Management plan aims at restoration of spine stability, alignment with protection or decompression of neural tissue as well as preservation of maximum possible mobility.<sup>2,3</sup> Surgical intervention is acceptable treatment

modality for the unstable thoracolumbar fractures with various approaches and options like all anterior, all posterior or combined anterior and posterior interventions.<sup>4-7</sup> Posterior pedicle screw fixation is accepted as a standard treatment method for these fractures owing to less morbidity and all three columns control by pedicle screws but there is controversy in choosing between long segment fixation or short segment fixation.<sup>8</sup> Long segment spinal fixation (2 level above and 2 level below) theoretically has better holding of reduction and less chances of implant failure but more sacrifice of motion segments, more cost more extensive

surgery whereas short segment fixation (one level above and one level below) has more chances of fixation failure but lesser sacrifice of motion segment, lesser cost and less extensive surgery. Review of literature has found 5-54% failure rate in short segment posterior fixation.<sup>9</sup> Few retrospective studies have tried to identify the predictive factors for fixation failures in short segment fixation and found burst fractures and LSC (load sharing classification score) of 6 or more than 6 to be predictive of failure in short segment fixations.<sup>10-12</sup> But recently the short segment posterior fixation has shown equally good results compared to long segment fixation.<sup>13,14</sup> We aim to evaluate our results of short segment posterior fixation done for unstable TL fractures retrospectively in terms of radiological, clinical outcome and to see any failure and its correlation with fracture morphology and LSC.

The aim of this study was to retrospectively evaluate the results of short segment posterior spinal fixation done at our institute in terms of reduction achieved, maintenance of reduction at final follow up, any failure of fixation and any correlation of predictive factors of failure to the fixation.

## **METHODS**

This was a retrospective cohort study from case sheets. The data of patients who had a single level unstable thoracolumbar fracture treated with short segment posterior pedicle screw fixation between January 2013 to December 2016 was retrieved from the record section of Dr. Rajendra Prasad Medical College. Patient's demographic profile, mode of injury, neurological status, pre-operative regional kyphosis angle, immediate post-operative correction of kyphosis angle, pre-operative LSC scoring recorded from X-rays and CT scans was noted. Final evaluation of kyphosis angle and functional outcome on denis pain scale was recorded from the outpatient department follow up record.

### ***Inclusion criteria***

Patients with single level fractures in thoracolumbar region, short segment fixation surgery. Minimum follow up of 1 year post operatively and patients with Vaccaro score 5 or more.

### ***Exclusion criteria***

Patients with multilevel fracture, long segment spinal fixation and Vaccaro score less than 5.

### ***Operative technique***

All patients were operated prone on spinal frame on radiolucent table. After painting and draping, the level

was ascertained under C arm and spine exposed through posterior approach. Pedicle screw entry erred to be lateral so as to have convergence of screw. Superiorly facet capsule was saved diligently. Fixation was done with contouring of rod according to natural curve of spine. No instrumented distraction was done unless there were locked facets or translational /rotational component. Postural reduction was accepted as it is with tightening of screws. Laminectomy (preferably preserving pars and facets) was done where indicated in canal and neural tissue compromise. Wound was closed in layers over a drain.

### ***Post-operative***

Back strengthening exercises started as per tolerance and comfort from day1. Patients mobilized according to capacity with taylor's brace from day 2. Sutures were removed 2 weeks post operatively and brace continued for 6 weeks.

### ***Outcome analysis***

Functional outcome on denis pain scale was recorded and any fixation failure in terms of implant breakage, screw loosening, or loss of kyphosis correction of 10 degree was recorded with minimum follow up period of one year.

## **RESULTS**

The results were analysed using Epi-Info Version 7. In our study 29 patients were included of which there were 13 males and 16 females. The level of fractured vertebrae was from D12 to L3. (12 with L1, 9 with D12, 6 with L2 and 2 with L3 fracture). Age of patients was between 15 to 50 years with average age of 35.7 years. Mode of injury was road traffic accident in 2 patients while rest of the patients sustained injury due to fall from height. Neurologically, 12 patients had paraparesis, 5 had complete paraplegia while 12 patients were without any deficit. Preoperative kyphotic angle was between 8 to 50 degrees with a mean of  $23.023 \pm 11.143$ . Postoperative Kyphotic angle improved to 0 to 18 degrees with mean of  $7.034 \pm 4.69$ . At final follow up this angle was from 2 to 25 degrees with mean of  $11.759 \pm 5.901$ . The loss of correction at final follow up was 2 to 10 degree with mean of  $4.79 \pm 2.042$ . LSC score ranged from 4 to 9 with mean of  $6.89 \pm 1.345$ . Denis pain score at final follow up varied between p1 to p3. 11 patients had p1 while 15 patients had p2 score. Three patients had p3 score requiring medication occasionally for disturbing paresthesia. There was no implant failure and only one case had loss of kyphosis correction of 10 degree.

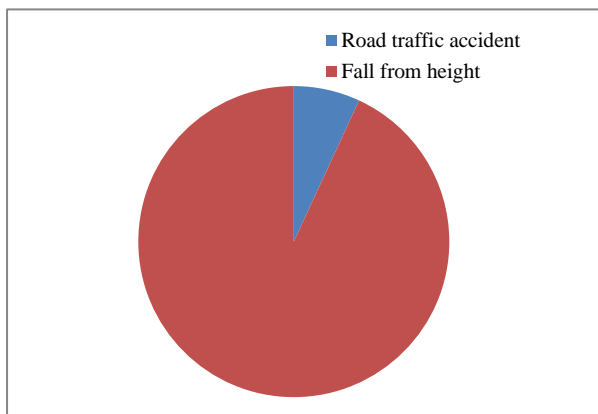


Figure 1: Mode of injury.

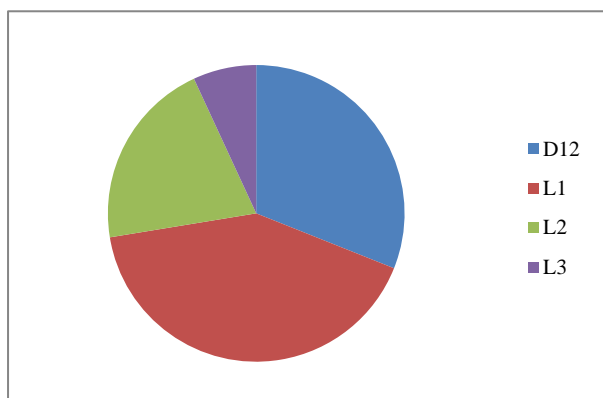


Fig 2: Level of injury.

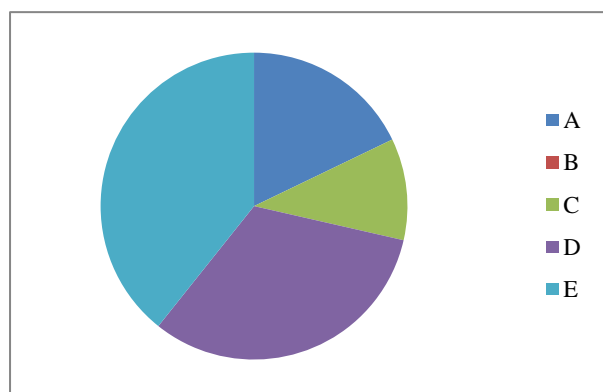


Figure 3: American spine injury score.

Table 1: Radiological kyphosis correction with short segment pedicle screw fixation.

	Min. value	Max. Value	Mean (±SD)
Pre op. COBB angle	8	50	20.03 (±11.14)
Post op. COBB angle	0	18	7.03 (±4.69)
COBB angle at final follow up	2	25	11.7 (±5.9)

Table 2: Correlation between LSC scoring and loss of kyphosis correction.

	Min. value	Max. Value	Mean (±SD)
LSC score	4	9	6.8 (±1.3)
Loss of kyphosis correction at final follow up	2	10	4.79 (±2.04)

Table 3: Denis pain score at final follow up.

P1-No pain	11
P2-Occasional minimal pain; no need for medication	15
P3-Moderate pain; occasionally medication without interrupting ADL	3
P4-Moderate to severe pain ;significant changes in ADL	.Nil
P5-Constant severe pain; chronic medication	Nil

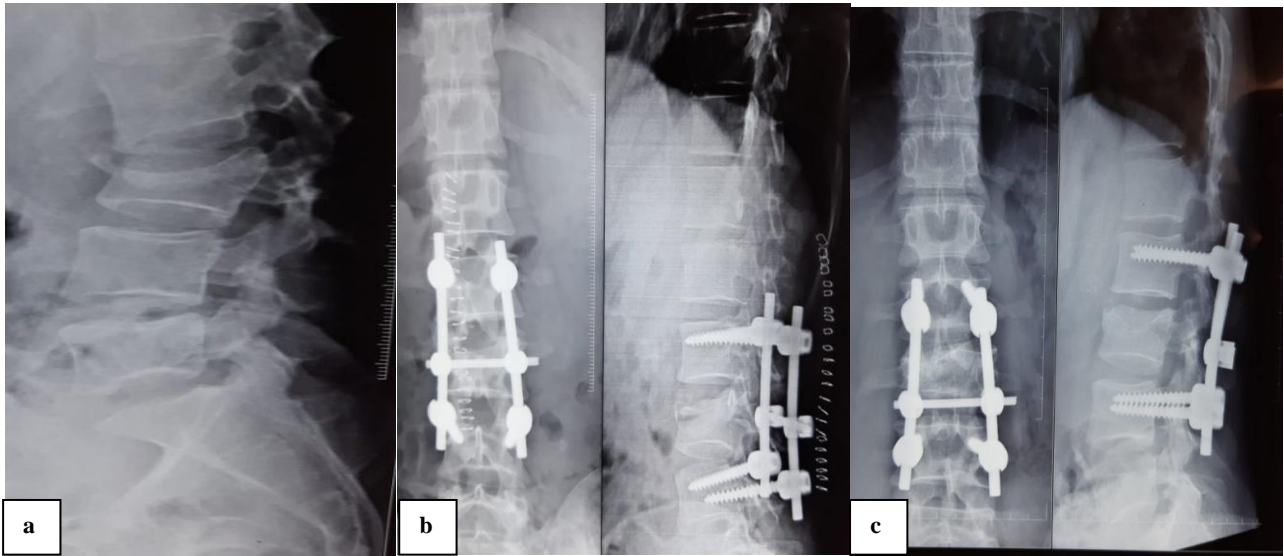
### DISCUSSION

Management of unstable thoracolumbar fractures has always been a controversial issue and recent trend is to fix these fractures with pedicle screw fixation using posterior approach with good outcome as well as avoiding morbidity of anterior approach. The controversy of choosing between long segment posterior fixation (LSPF) and short segment posterior fixation (SSPF) still exists with various studies reporting conflicting outcomes. Tezeren G and Kuru in their study compared long versus short segment fixation and concluded that LSPF is better than SSPF in terms of improving kyphosis, sagittal alignment and anterior vertebral height loss. SSPF in their study had 55% failure rate, however clinical outcome was same in both groups.<sup>15</sup> Biomechanical study by Lozarro and Deniz also reported SSPF to be significantly less stable than LSPF and reported that adding screw at fracture site improves stability by 25%.<sup>16</sup> Mclain R F in his study also suggested LSPF to be better than SSPF and SSPF has more failure rate when anterior column integrity is lost.<sup>17</sup> To improve upon decision making in choosing between long segment vs short segment, some studies tried to identify the predictive factors of failures in SSPF. McCormak devised the load sharing classification taking into account the severity of initial trauma and postulated that score of LSC 6 or >6 is associated with higher failure rate if fixed with SSPF.<sup>12</sup> Harsimrat Bir et al in their study retrospectively analysed 91 patients with SSPF and found that burst fracture, LSC>6, fracture dislocation to be predictive factors for failure in SSPF.<sup>18</sup> Gunn Woo Kim et al in their study also found that fractures with high initial kyphosis and LSC >6 to be predictive of failure in SSPF, but with similar clinical outcome.<sup>19</sup> However recent studies have questioned the predictive value of LSC. Osmar et al found no correlation between LSC and SSPF failure.<sup>20</sup>

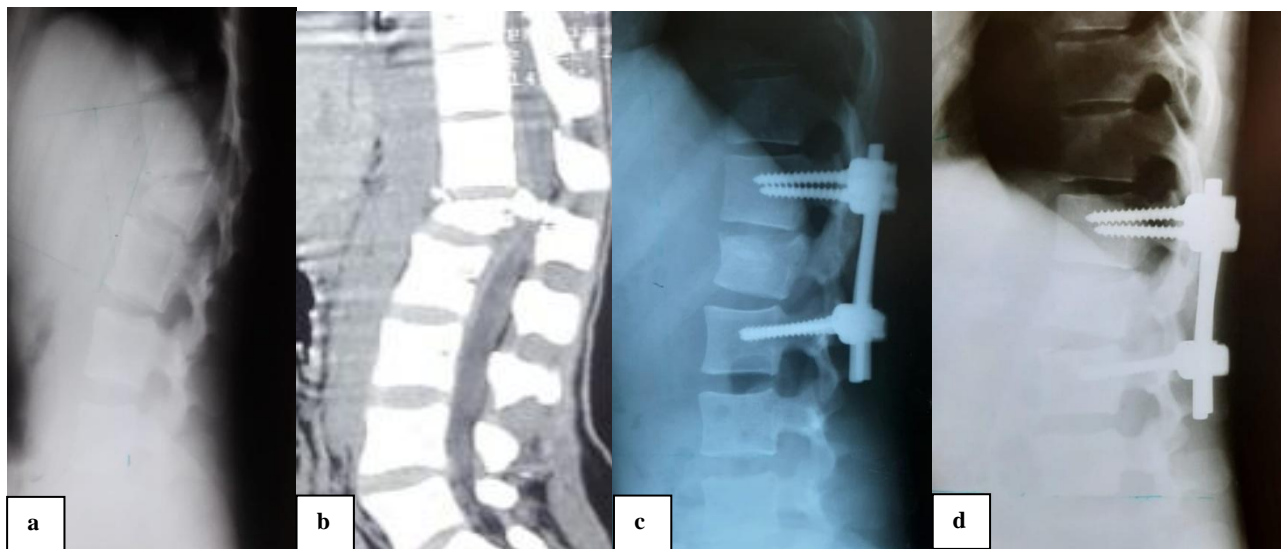
Kanna et al also questioned the relevance of LSC in choosing SSPF.<sup>21</sup> Many studies with SSPF only in unstable dorsolumbar fractures have reported good results.<sup>8,22-25</sup>

In our study the mean kyphosis pre operatively was  $23.03 \pm 11.14$  which improved to mean of  $7.03 \pm 4.59$  in immediate postoperative period. At the final follow up the mean kyphosis angle was  $11.76 \pm 5.90$  and there was loss of kyphosis correction of  $4.70 \pm 2.04$  degrees. There was no implant failure. Only one case had loss of kyphosis correction of 10 degree at the final follow up. Clinical outcome was good in all cases as measured on Denis pain scale. The reason for good results could be that in none of our patients, the fracture was fixed in

instrumented distraction. Rather in all cases the postural reduction was accepted and the middle facets were denuded of cartilage and compressed to achieve fusion. This technically shortened the posterior column which indirectly reduced the stress on tension band of posterior fixation. Sagittal alignment was achieved with contouring of rod according to natural curve of spine. Postural reduction is as effective as instrumental reduction in achieving fracture reduction.<sup>26</sup> According to studies conducted by Youja Xu et al and Cho et al, any further instrumental distraction will only leave a void in cancellous bone of fractured vertebra, which is more prone to collapse under loading stress, thereby leading to fixation failure.<sup>26,27</sup>



**Figure 4: Case 1 (a) pre-operative X-ray, (b) immediate post-operative X-ray and (c) post-operative follow up at 22 months.**



**Figure 5: Case 2 (a) pre-operative X-ray, (b) CT picture, (c) post-operative X-ray at 6 weeks and (d) final follow up at 24 weeks.**



## CONCLUSION

SSPF is effective method of treating unstable thoracolumbar fractures with good results. This is comparatively easier, less extensive and less costly compared to long segment fixation. This preserves more motion segment. The effectiveness of variation in surgical technique of accepting postural reduction and shortening of posterior column by compressing middle facets needs prospective randomized trial to compare this with instrumented distraction.

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*Ethical approval: The study was approved by the institutional ethics committee*

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