

Comparative Study of Thoracolumbar Burst Fractures Treated with Short Segment Posterior Instrumentation With and without Transpedicular Hydroxyapatite and Tricalcium Phosphate Augmentation

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Abstract: ***Background:** This study is to evaluate and compare the radiological and functional outcome of the management of acute thoracolumbar burst fractures with and without transpedicular hydroxyapatite & tricalcium phosphate (triosite) grafting following short segment pedicle screw fixation. **Methods:** This study was conducted in 39 consecutive cases of short segment fixation with or without transpedicular augmentation and comparison by using ASIA impairment scale, Cobbs angle and the low - back outcome scale of Greenough and Fraser¹. **Results:** The difference in both the groups in terms of neurological recovery and the Greenough low back outcome score at the time of follow up found to be statistically insignificant. Transpedicular augmentation increases the mean operative duration by 25 minutes. Kyphotic deformity remains the same in both groups. mean loss of correction was higher in patients without transpedicular augmentation. **Conclusion:** Transpedicular hydroxyapatite grafting with short segment pedicle screw fixation could provide reliable neurologic improvement in patients with incomplete neurologic deficit and could prevent the development of kyphosis.*

Keywords: ASIA grade, Greenough low back scoring, burst fracture, Cobbs angle

1. Introduction

Thoracolumbar burst fracture is a 2 or 3 column injury, according to Denis 3 - column concept², which may yield an unstable spinal column if there is progressive neurologic deficit, associated posterior element disruption, kyphosis progressing 20degree or more in the presence of neural deficit, greater than 50% loss of vertebral body height with facet joint subluxation, or ct demonstrated free bony fragments within a compromised spinal canal associated with an incomplete neurological deficit.15 to 20% patients with fracture of thoracolumbar level have associated neurological injury.3 the goals of surgical management can be achieved through either anterior, posterior or antero - posterior procedures. In the treatment of thoracolumbar burst fractures, posterior instrumentation system have allowed a decrease in the number of fused segments, and indirect reduction technique has enabled higher correction of kyphosis. Despite these advantages, failure to support the anterior column leads to the eventual loss of correction and high rate of failure of posterior instrumentation.4⁵ cancellous bone grafting to the fractured body with the transpedicular approach was thought to provide some additional support to the anterior column.6 studies have

reported that transpedicular vertebral body reconstruction with ha cement reduced pedicle screw - binding moments and increased initial stiffness in the flexion extension plane significantly.7 TCP crystals are preferred over ha due to their excellent resorbability, which allows their dissolution in the surrounding body fluid and eventual replacement by body tissues. Posterior indirect reduction, transpedicular ha grafting, and pedicle screw fixation could provide reliable neurologic improvement in patients with incomplete neurologic deficit, and could prevent the development of kyphosis.

2. Material and Methods

Hospital based prospective randomised comparative study between two groups of short segment pedicle screw fixation with transpedicular HA+TCP augmentation (group A) or without transpedicular HA+TCP augmentation (group B) in patients with acute burst fracture of thoracolumbar junction. Sample size was calculated to be 18 cases in group A and 21 cases in group B and follow up at 2 weeks, 1 month, 3 month and 6 months in each group. Neurological status was charted out by using asia assessment at each follow up and improvement of neurological status was noted in both the

groups. Radiologically the patients were evaluated with a measurement of initial angle of kyphosis of the injured vertebral segment, correction obtained during immediate postoperative period and its maintenance during follow up. B) incidence of implant failure. Functionally the patient was evaluated with Greenough low back outcome scale.

3. Results

The present comparative study was conducted on patients with vertebral burst fractures admitted in department of orthopaedics, S. M. S. Hospital, Jaipur during April 2012 to June 2013. This study was conducted on 18 cases in group A and 21 cases in group B.

Most of the patients in both the age groups belonged to the productive age group (20 - 50 years). Mean age in both the groups is comparable being 38.28 years in group A and 37.24 years in group B with no significant difference (p= 0.9). In our study in group A total 14 male (77.28%) and 4 female (22.2%) patients and in group B total 32 male

(82.05%) and 7 female (17.95%). The most common mode of injury was fall from height in both groups (66.7% in group A and 76.2% in group B). The most common vertebral level affected in our series was L1 comprising 25.6% of total. D12 was the next most frequent (23.1%) involved vertebra, showing thoracolumbar junction is the most common site of injury due to biomechanics involved in this region.

Functional and Neurological Assessment

In Group A pre operative, based on the ASIA scale, at admission 4 patients (22.2%) had ASIA A, 7 patient (38.9%) had ASIA C, 5 patients (27.8%) had ASIA D and post operative Follow - up neurological status was assessed as following: ASIA D (9 patients: 50%), ASIA E (4 patients: 22.2%). In group B preoperative group 1 patient (4.8%) ASIA A, 5 patient (23.8%) ASIA B, 6 patient each (28.6%) ASIA C & D and post operative follow up, 7 patients (33.3%) had ASIA C, 6 patient (28.6%) ASIA D, 4 patient (19%) has ASIA E, Statistical analysis showed no difference between the two groups.

Table 1: Preoperative and postoperative neurological status American Spinal Injury Association (ASIA) scores for groups A and B

Score	Group A (with Augmentation)					Group B (without augmentation)					P
	A	B	C	D	E	A	B	C	D	E	
Pre operative	4 (22.2%)	0	7 (38.9%)	5 (27.8%)	2 (11.2%)	6 (24%)	0	7 (28%)	12 (48%)	0	0.137
Post operative	3 (16.7%)	1 (5.6%)	1 (5.6%)	9 (50.0%)	4 (22.2%)	1 (4.8%)	3 (14.3%)	7 (33.3%)	6 (28.6%) (8%)	4 (19%)	

The mean operative duration was 125.56 min in group A which was significantly higher than group B 100.57 min as tested by T - test. This was mainly due to the additional procedure of transpedicular HA & TCP augmentation of fractured vertebra in group A. Mean blood units required in group A were 1.33 units while it was 1.24 units in group B. The difference may be due to increased operative duration in group A.

radiological results=

Local kyphosis angle: The kyphotic deformity was measured by the Cobb's technique i. e. Angle between the superior endplate of suprajacent vertebra and the inferior endplate of infrajacent vertebra.

During the study measure preoperative kyphotic angle, postoperative kyphotic angle (immediate), postoperative kyphotic angle (last follow up)

Table 2: Mean Local Kyphotic angle (in degree)

Local Kyphosis angle	Group A	Group B
Pre operative	18.78± 5.526	18.19±9.699
Immediate Post operative	1.78±4.609	2.48±8.727
Final follow up	3.83±5.044	7.24±9.612

The overall average preoperative kyphotic angle was measured as 18.46 degrees; 18.78 degrees for those patients in the group A and 18.19 degrees for the group B. The average postoperative kyphotic angle was overall 2.15 degree; 1.78 degree for the group A and 2.48 degree for the group B. There is no significant difference between distribution of preoperative kyphotic angle in both the groups. The post - operative correction obtained in terms of

Cobb's angle were 1.78 degree in group A and 2.48 degree in group B and the difference in correction in both the groups was found insignificant.

The mean loss of correction was 2.06 degree for the group A and 4.76 degree for the group B. The difference between both the groups was observed statistically significant (p value <0.001 by unpaired T - test) showing that transpedicular augmentation of fractured vertebra with triosite has reduced the loss of correction in kyphotic angle in group A.

Table 3: Comparison of the loss of kyphotic angle postoperatively and at final follow up

Group	Loss of kyphotic angle		P Value
	Mean	Std. Deviation	
A	2.06	1.589	<0.001 (Highly Significant)
B	4.76	2.189	
Total	3.51	2.349	

Table 4: Greenough low back score

Group	Mean	Std. Deviation	P Value
A	53.56	15.317	>0.05NS
B	47.57	12.707	
Total	50.33	14.109	

According to the Greenough low back outcome scale, the overall average scores were 50.33 and 53.56 in group A and 47.57 in group B, but this difference was observed non - significant. Transpedicular augmentation of fractured vertebra has no added advantage in terms of improvement of functional score.

No implant failure occurred in both the groups. This is due to thorough anatomical knowledge of surgeons about spine, proper use of intraoperative image intensifier experienced spine team and proper rehabilitation.

One patient in each group had give way of stitch line with discharge post operatively which healed with a course of antibiotics. Only one patient in group B had bed sore of grade 2 which healed with regular dressing and more frequent side to side turning.

4. Discussion

The study was conducted on 39 patients (group A =18 patients and group B = 21 patients) and were reviewed at a mean follow up of 12.21 months. The mean age of the patients in our study was 37.72 years at the time of surgery comparable to mean age in studies done by Weyens et al⁸-36 years, Graziano et al⁹-35 years. In our study there were 82.05% males and 17.95% females and the ratio of M: F was 4.57: 1 which was similar to studies done by McNamara et al¹⁰⁻⁵:5: 1.

The most common mode of injury in our series was a fall from height in 71.8% of cases followed by trauma due to road traffic accident and fall of heavy object, each comprising 12.8% of cases. Thoracolumbar junction (D12 - L1) constitutes around 51.3% of cases. Among them 11 (28.2%) was the most commonly affected vertebra in our study. The mean operative duration in our study was 112.1 min (group A - 125.6 min and group B - 100.57 min). We statistically analyzed our difference in operative duration in both the groups and found out that the p value was <0.05. The mean intra operative and post - operative blood transfusion requirement in our series was 1.24 units.

Comparison of group A and group B on basis of neurological outcome ASIA scoring and radiological outcome Cobb's angle and Greenough low back outcome score. Functional and neurological outcomes on basis of ASIA scoring. The neurological outcome in our study was similar in both group. The mean preoperative kyphotic angle was found to be 18.46 degree. In a similar study by Wang et al¹¹ the mean preoperative kyphotic angle was 18.4 degree. Dai et al¹² found out mean preoperative deformity to be 18.5 degree in their series. In our study mean in both the groups was comparable (group A - 18.78 degree, group B - 18.46 degree). In the present study the loss of correction in group B (4.76 degree) was significantly higher than in group A (2.06 degree). The p value on statistical analysis was found to be <0.05 and hence the difference in loss of correction in the two groups came out to be significant. Greenough low back outcome score was used to evaluate the functional status of the patients at final follow up. It came out to be 53.56 in group A and 47.57 in group B. The difference between the two groups was found statistically non - significant with a p value >0.05.

5. Conclusion

Transpedicular hydroxyapatite grafting with short segment pedicle screw fixation could provide reliable neurologic improvements in patients with incomplete neurologic deficit

and could prevent the development of kyphosis. This technique does not require fusion to a segment, thereby preserves thoracolumbar motion. However as our study group is small therefore we recommend another study with larger sample size comparing the above procedure with a group treated with a different inter body material.

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