Clinical and Radiological Outcome of Thoracolumbar Fractures Treated by Transpedicular Fixation

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Abstract

Background: The injuries involving the spinal cord are generally challenging to manage. The aim of this study was to analyze and compare the clinical including neurological and radiological outcome of thoracolumbar burst fractures treated by short segment and long segment transpedicular instrumentation and posterolateral fusion.

Methods: 34 patients with or without neurological deficit were studied. Gaines scoring, American Spinal Cord Injury Association impairment scale was used for study.

Results: The mean intra-operative correction of K-angle in the short segment group was 14.68° and the loss of correction observed at the last follow-up evaluation was 6.62° with a final gain of 8.06°. The mean intra-operative correction in the long segment group was 19.76° and the loss of correction observed at the last follow-up evaluation was 6.61°. Final gain was 13.15°. On radiological evaluation of wedge angle, mean correction loss of 3.87° and 3.4% implant failure was noted in the short segment group while the long segment group had 1.53° of mean correction loss and no implant failure. There was no positive correlation found between Gaines score with progression of deformity. Neurological Outcome in the short segment group four grades of improvement was found in 1 patient, three grades in 1 patient, two grades in 2 patients and one grade in 6 patients. In the long segment group, three grades of improvement were found in 3 patients, two grades in 2 patients and one grade in 2 patients. 1 of the grade D patient showed improvement within the grade and 3 patients did not show any improvement. Average ASIA motor score improved with treatment from 28.31 to 39.56 points (11.25 points) in short segment group and from 19.91 to 28.46 points (8.55 points) in long segment group.

Conclusion: Transpedicular fixation is a stable, reliable and less surgically extensive construct for addressing thoracolumbar burst fractures. About 6-8° loss of correction was observed with both short and long segment stabilizations in our study. Long segment has better results in terms of maintenance of reduction and final gain. The length of instrumentation does not seem to have any effect on the neurological outcome.

Key Words: Thoracolumbar fractures, Clinical, Radiological out come.

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Introduction:

Thoracolumbar burst fractures are usually a result of substantial axial loading force that results in compression failure of anterior and middle spinal columns. Majority of these injuries occur as a result of fall from height and motor vehicle accidents. Burst fractures have a predilection for thoracolumbar spinal segments. The sudden application of supra physiological load results in vertebral end-plate failure as adjacent disc tissue is driven into the vertebral body. These fractures are associated with some degree of canal compromise, typically as a result of retropulsion of an osseous fragment or fragments from the superior endplate [1]. Prevention and limitation of neurological injury as well as restoration of spinal stability are the primary goals of management in such fractures. Secondary issues of concern include deformity correction, minimizing motion loss, and facilitating rapid rehabilitation. The treatment option chosen should also provide a biological and biomechanical environment conductive to osseous and soft tissue healing, in order to recreate a stable pain free spinal column. Stabilization has evolved greatly during the years. Initially, fixation devices including Harrington rods, hooks and sub laminar wires were used. However, these were associated with issues such as loss of number of motion segments, lack of correction in the sagittal plane, and increase in neurological deficit after a few years [2]. The introduction of transpedicular instrumentation systems were considered highly beneficial because of its distinct advantages such as rigid segmental fixation, stabilization of the three columns, least failure at bone metal interface, early post-operative mobilization with efficient nursing care and least complications. Additionally, pedicle screw fixation does not require the presence of intact lamina, facet joints or spinous processes. The pedicle withstands all of the transmitted stresses of rotation, side bending, and extension of the spine. Thus, the pedicle has been labeled by Steffee as the "force nucleus" of the vertebral body [3]. It is an ideal structure to lock into and control with posterior instrumentation when spinal fixation is needed. Short segment instrumentation pedicle screw fixation one level above and below the injured vertebra was introduced with an aim to preserve the number of motion segments along with an attempt to improve fusion rates, ability to obtain reduction, and maintain sagittal contour which would eventually lead to a lower incidence of residual back pain. Although there are several studies which have evaluated the benefits and drawbacks of transpedicular instrumentation, there is a lack of studies which have made a direct comparison between the short and long segment methods. Hence, the aim of this study was to analyze and compare the clinical including neurological and radiological outcome of thoracolumbar burst fractures treated by short segment and long segment transpedicular instrumentation.

Materials And Methods:

34 patients who underwent posterior spinal stabilization with transpedicular instrumentation and posterolateral fusion for unstable thoracolumbar burst fractures with or without neurological deficit were studied prospectively during the period April 2002 to October 2004. Patients having Kyphosis angle >11 degrees, Loss of anterior vertebral body height by at least 30%, 2 or 3 column involvement, Presence of neurological deficit, who underwent surgery were included in the study. Four patients who underwent anterior surgery during the above period were not included in the study. A detailed history was obtained from the patient and the relatives. The history included details of date and time of Injury, mode of injury, bowel and bladder details, co-morbid factors like systemic disorders and the type of treatment given earlier. Physical examination along with plain AP and lateral radiographs, CT scans and MRI scans were carried out in patients. Following primary survey attention was paid to the examination of injuries in relation to spine. Any abrasions, lacerations, swelling, deformity, tenderness, step off, gaps, mal-alignment were looked for by log rolling the patient. Neurological evaluation was done and patients were graded according to ASIA (American Spinal Cord Injury Association) impairment scale as a part of physical examination. Additionally, trauma series X-rays were done to assess for any associated injuries of the skeletal system. Initial radiographic assessment included interpedicular distance on an AP view, loss of vertebral body height both anterior and posterior, Kyphus angle and wedge angle on a lateral view. CT imaging was done to demonstrate the amount of comminution, apposition of fragments and retropulsion of fragments in to the canal in all the patients and MRI was done for patients with a neurological deficit to identity possible spinal cord or cauda equina injury, haemorrhage, or epidural haematoma. Among the 29 patients evaluated, 22 were male (76%) and 7 were female (24%). The mean age was 28.5 years for short segment fixation patients and 28 years for long segment fixation patients. Randomly 16 of the 29 patients underwent short segment stabilization (56%) while the rest 13 of them underwent long segment stabilization (44%). The injured levels were D11 in 4 patients (13.8%), D12 in 5 patients (17.2%), L1 in19 patients (65.5%), and L2 in 1 patient (3.4%). The vertebral level most commonly involved was D12-L1 (82.7%). Calcaneal fracture (22.2%) was the most commonly associated skeletal injury. All the patients underwent surgery on an elective basis within 1-27 days following the injury average being 7 days.

Patients who were having above mentioned criteria Surgery was performed as an elective procedure at the earliest after assessing fitness for surgery. Prophylactic antibiotics were administered prior to induction. A self-retaining Foley's catheter was maintained during and after surgery. Adequate amount of blood was kept available. Under general anaesthesia, patients were positioned in a prone position over Four Post frame. Fracture site anatomy was checked using c-arm image intensifier and incision line was marked. Exposure of the spinous processes was carried out two levels above and below the fractured site through a standard posterior midline approach for a short segment fixation, while 3 levels above and below were exposed for long segment fixation. Sub periosteal erasure of Para spinal muscles was done up to the facets of the respective segments. Capsulotomy of the facets with dissection up to the tips of the transverse processes was done bilaterally. Under image intensifier control, levels were confirmed and pedicle screws were inserted bilaterally.

This procedure was repeated as necessary depending on short segment or long segment construct. Laminectomy was done at the fracture level to achieve posterior decompression wherever necessary. Decortication of the spinous process, transverse processes, and lamina was done along with facetectomy. Adequate quantity of corticocancellous bone graft harvested from iliac crest was used to augment fusion. Care was taken to ensure that all the slots of the screws were aligned. The rod was contoured depending on the sagittal contour of the zone of fixation and was loaded into the universal top loading connecting post of the screws. Rod pusher was used when required to facilitate correct seating, secured in that position by tightening inner and outer nuts. Rods were inserted bilaterally over the screws. Connecting blocks were placed over the rods. Connecting rod was used to augment torsional rigidity and prestressing was done to prevent the parallelogram effect. Wherever posterior longitudinal ligament was intact on MRI, indirect reduction technique by distraction was done. Haemostasis was achieved, and the wound was closed in layers with a suction drain in situ. The implants used were, transpedicular screw fixation with rod-screw system (Moss Miami). Size of the pedicle screws most commonly used were 4.5 and 5.5 mm. postoperatively antibiotics and analgesics were administered as per schedule. Suction drain was removed usually after 48 hrs. Vital signs input and output, abdominal charts were maintained in the immediate postoperative period as a routine. Patients were log rolled in the bed for the first 2 days along with passive stretching exercises of both lower limbs and active exercises of both upper limbs. Neurological assessment was done when pain had subsided and patient was able to move the lower limbs without distress. If bladder sensation was regained, hourly clamping was done. Otherwise patient was taught to clean self-catheterization intermittently. Suppository was needed for bowel clearance. Otherwise digital evacuation was done and taught to the attendant. Sutures were removed on 12th post-operative day. Patients were kept in the hospital considering their response to the treatment instituted, progress in rehabilitation programme, complications if any, socioeconomic conditions and were discharged when considered fit enough to sustain himself independently at least at house environment. Patients were mobilized postoperatively with supporting TLSO brace from the time patient was pain free and this was continued for 6 months. Rehabilitation training continued for other normal daily activities. Standard AP and lateral films were taken to assess position of the implant, degree of correction achieved in the early post-operative period. Later follow-ups included assessment of progression of deformity, loss of correction, final gain and implant failure. Four radiological parameters were assessed; Anterior and posterior vertebral body heights in mm and Cobb's & wedge angles in degrees. These parameters were assessed in terms of: Intraoperative gain i.e. difference between pre and post-operative values, reduction loss i.e. difference between post-operative value and the value at last follow up and final gain i.e. difference between intra operative gain and reduction loss. Progression of the deformity was measured as a change in the sagittal alignment of the spine from the initial post-operative radiographs, to the most recent follow up radiographs. Progression was considered to be absent, minor, or major. Absent progression was defined as Kyphosis measuring 0–4°, while minor progression was defined as kyphosis measuring 5-9° and major progression was defined as increase of 10° or more. Patients were asked to come for follow up at 3 weeks, 6 weeks, 3 months, 6 months, 1 year and then every 6 months. Each patient was assessed radiologically and parameters were noted at three months and final follow up (Table 1, 2). Load sharing classification i.e. Gaines scoring was used retrospectively to correlate fracture comminution and displacement with progression of the deformity (Table 1, 2). Neurological assessment was done using ASIA impairment scale (Table 3).

Results:

Among 34 patients who were included in the study, 5 patients were lost for follow up. The average length of hospital stay for these patients was 28.6 days, range from 12 to 58 days. Average follow-up period of the remaining 29 patients was 13.81 months and 18.15 months for short and long segment groups, respectively.

Radiological Outcome in Short Segment Group was the mean average pre-operative K angle deformity was 16.63° (SD 13.24). The mean intra-operative correction was 14.68° (SD 9.54) and the loss of correction observed at the last follow-up evaluation was 6.62° (SD 5.86) with a final gain of 8.06° (SD 11.29). Average pre-operative wedge angle was 20.1° (range 12° to 31°, SD 5.26) which was corrected intra operatively by 12.43°(SD 5.04). Loss of correction was 3.87° (SD 5.89) with a final gain of 8.56° (SD 6.56). Average pre-operative anterior vertebral body height was 16.25 mm (range 10 to 27 mm, SD 4.76) and the intra-operative correction was 7 mm (range 1 to 16 mm, SD 4.91). Correction loss was 1.37 mm (SD 3.68) with a final gain of 5.62 mm (SD 5.56) (Table 4, Figure 1, 2).

Outcome in Long Segment Group was the mean average pre-operative K angle deformity was 23.92° (range 8 to 40°, SD 8.84). The mean intra-operative correction was 19.76° (SD 7.56) and the loss of correction observed at the last follow-up evaluation was 6.61° (SD 4.07). Final gain was 13.15° (SD 7.94). Average pre-operative wedge angle was 25.08° (range 18 to 35°, SD 5.02) which was corrected intra operatively by 16° (SD 7.88). Loss of correction was 1.53° (SD 4.33) with a final gain of 14.46° (SD 6.26). Average pre-operative anterior vertebral body height was 13 mm (range 8 to 20 mm, SD 4), intra-operative correction was 8.46 mm (range 2 to 15mm, SD 4.13). Correction loss was 1.76 mm (SD 2.52) with a final gain of 6.69 mm (range 1 to 12 mm, SD 3.66) (Table 4, Figure 3, 4, 5).

Combined Outcome was the mean average pre-operative K angle was 19.9° (SD 11.9). The mean intra-operative correction was 16.96° (SD 8.94). Mean correction loss was 6.62° (SD 5.05) with a mean final gain of 10.34° (SD 10.10). Average pre-operative wedge angle was 22.34° (range 12 to 350, SD 5.65) which was corrected intra operatively by 14.03° (SD 6.59). Mean loss of correction was 2.82° (SD 5.29) with a final gain of 11.20° (SD 6.98). Average pre-operative anterior vertebral body height was 15 mm (range 8 to 27 mm, SD 4.57), intra-operative correction was 7.65 mm (range 1 to 16 mm, SD 4.56). Average correction loss 1.55 mm (SD 3.16) with a final gain of 6.1 mm (SD 4.75) (Table 4). There was no positive correlation found between Gaines score with progression of deformity (Table 5).

Neurological Outcome in the short segment group, four grades of improvement was found in one patient, three grades in one patient, two grades in 2 patients and one grade in 6 patients. 3 of the patients showed improvement within the grade, and one grade D patient did not show any improvement. In the long segment group, three grades of improvement were found in 3 patients, two grades in 2 patients and one grade in 2 patients. one of the grade D patient showed improvement within the grade and 3 patients did not show any improvement. Overall, there were 7 patients with ASIA grade A, of whom one improved to E, 4 improved to D and 2

Table 1: Short-segment group master chart

Anterior body height				Posterior body height				Kyphosis angle				Wedge angle				Gaines score
Pre -operative	Post -operative	3 months	LFU	Pre -operative	Post -operative	3 months	LFU	Pre -operative	Post -operative	3 months	LFU	Pre -operative	Post -operative	3 months	LFU	
12	24	24	21	31	31	31	31	18	4	4	9	26	10	10	18	1, 2, 3, 6
14	26	26	23	30	30	30	30	20	4	6	10	26	10	12	18	1, 2, 3, 6
18	25	23	19	29	29	29	29	18	8	12	18	18	0	14	18	1, 2, 3, 6
10	14	14	11	31	32	32	32	14	8	8	8	26	23	23	24	1, 2, 3, 6
18	19	19	18	26	26	26	26	12	0	0	10	15	8	12	12	2, 1, 3, 6
12	25	22	23	26	26	26	26	12	0	0	0	18	0	0	0	2, 1, 3, 6
20	24	24	24	36	36	36	36	30	5	0	0	18	4	4	4	1, 2, 3, 6
16	29	29	29	31	31	31	31	14	0	0	6	17	8	8	8	1, 2, 2, 5
19	25	22	22	25	25	25	25	14	0	6	10	22	4	6	10	1, 2, 3, 6
10	20	20	18	21	21	21	21	22	8	8	12	16	0	0	4	1, 2, 3, 6
15	31	31	31	30	31	31	31	-20	20	18	18	16	4	0	0	2, 2, 1, 5
27	30	30	28	32	32	32	32	8	4	0	4	12	6	6	10	2, 2, 2, 6
19	23	23	23	37	37	37	37	25	0	0	10	16	4	4	6	1, 2, 3, 6
21	25	20	18	32	32	32	32	12	6	24	30	20	8	10	22	2, 2, 3, 7
19	20	18	20	33	33	33	33	22	12	12	12	25	20	20	20	1, 2, 3, 6
10	12	19	22	20	26	26	26	45	10	16	16	31	14	22	11	2, 1, 3, 6

LFU: Last follow-up

Table 2: Long-segment group master chart

AVBH				PVBH				Kyphosis angle				Wedge angle				Gaines score
Pre -operative	Post -operative	3 months	LFU	Pre -operative	Post -operative	3 months	LFU	Pre -operative	Post -operative	3 months	LFU	Pre -operative	Post -operative	3 months	LFU	
13	28	20	20	27	27	27	27	30	0	6	6	28	0	8	8	1, 2, 3, 6
20	26	26	22	30	30	30	30	10	0	0	4	20	0	0	0	1, 2, 3, 6
10	19	15	18	27	29	29	27	30	10	14	25	28	18	30	12	2, 1, 3, 7
10	17	19	19	27	28	28	28	8	0	6	6	18	14	8	8	2, 2, 1, 5
11	18	18	17	31	31	31	31	40	8	14	18	30	12	12	18	1, 2, 3, 6
8	22	20	20	27	27	27	27	27	6	6	6	35	14	14	14	1, 2, 3, 6
11	19	19	21	21	21	21	21	22	6	6	11	25	6	6	4	1, 2, 3, 6
18	32	32	29	32	32	32	32	30	0	0	6	22	0	0	6	1, 2, 3, 6
11	22	22	20	30	30	30	29	18	4	6	16	24	8	8	12	1, 2, 3, 6
18	20	20	19	33	33	32	32	23	0	8	10	24	12	14	14	2, 2, 3, 6
11	20	20	18	26	26	28	28	25	6	6	10	30	6	7	10	2, 2, 3, 6
18	21	19	20	31	31	31	31	18	4	6	7	18	16	20	18	1, 2, 3, 6
16	21	21	19	30	30	30	30	30	10	12	15	24	10	10	12	1, 2, 3, 6

AVBH: Anterior vertebral body height, PVBH: Posterior vertebral body height, LFU: Last follow-up

Table 3: Neurological master chart

Short segment ASIA grade Pre-operative	Short segment ASIA grade LFU	Short segment Motor Pre-operative	Short segment Motor LFU	Short segment Sensory Pre-operative	Short segment Sensory LFU	Short segment Progression of deformity	Long segment ASIA grade Pre-operative	Long segment ASIA grade LFU	Long segment Motor Pre-operative	Long segment Motor LFU	Long segment Sensory Pre-operative	Long segment Sensory LFU	Long segment Progression of deformity
E	E	50	50	56	56	Absent	A	D	8	17	20	53	Minor
D	E	42	50	56	56	Minor	B	B	0	0	0	0	Absent
B	D	0	40	20	56	Minor	A	D	40	45	44	50	Minor
C	C+	7	18	38	54	Absent	A	A	0	0	20	20	Minor
D	D	38	38	46	52	Minor	A	A	0	0	20	20	Minor
D	E	46	50	43	49	Absent	C	D	6	44	46	56	Absent
D	E	40	50	56	56	Absent	E	E	50	50	56	56	Absent
A	E	44	50	50	56	Minor	C	D	10	20	44	42	Minor
C	E	32	50	47	56	Minor	C	E	40	50	56	56	Absent
D	E	50	50	50	56	Absent	B	D	12	24	40	48	Minor
D	D+	32	42	54	55	Absent	A	D	0	32	26	44	Absent
A	D	0	40	22	56	Minor	D	D+	31	38	46	50	Absent
E	E	50	50	56	56	Minor	E	E	50	50	56	56	Absent
C	C+	6	14	38	42	Major							
C	D	15	26	46	48	Absent							
B	C	1	15	38	47	Minor							

LFU: Last follow-up, ASIA: American Spinal Cord Injury Association

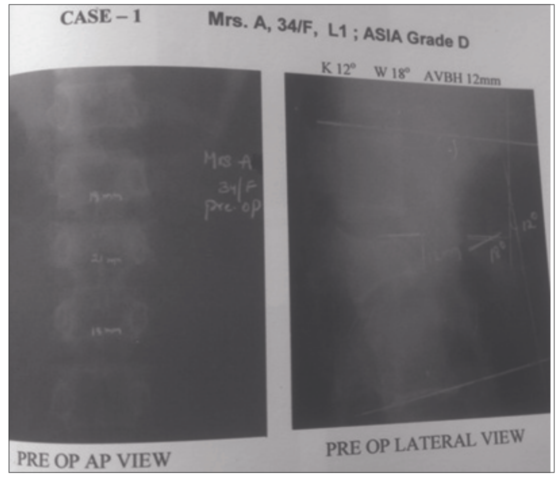

Figure 1: Short-segment pre-operative radiograph.

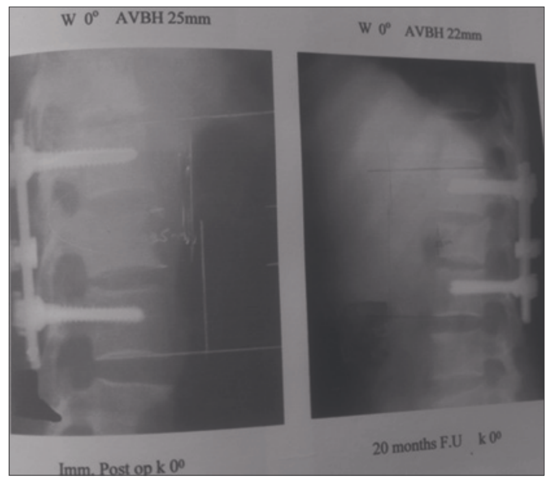

Figure 2: Short-segment post-operative radiograph both immediate and long follow-up.

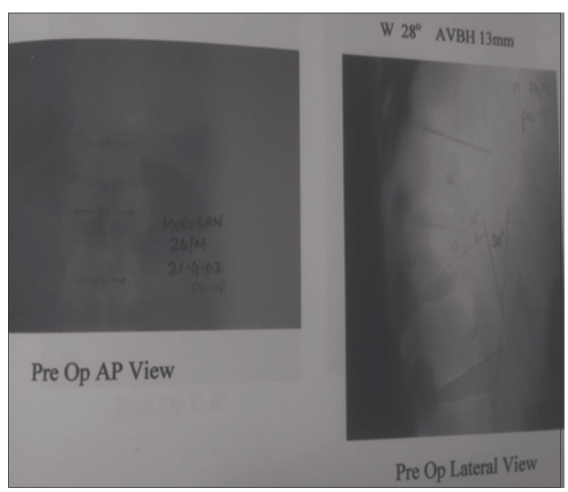

Figure 3: Long-segment pre-operative radiograph.

Table 4: Radiological outcome

Characteristics	Heights and angle	Short segment			Long segment			Combined		
		Mean	Range	Standard deviation	Mean	Range	Standard deviation	Mean	Range	Standard deviation
AVBH	Pre-operative	16.25	10-27	4.76	13	8-20	4	15	8-27	4.57
	Post-operative	23.25	12-31	5.23	21.92	17-32	4.29	22.7	12-32	4.8
	3 months	22.75	14-31	4.59	20.85	15-32	4.16	21.9	14-32	4.43
	LFU	21.87	11-31	4.87	20.15	17-29	2.96	21.1	11-31	4.15
	Gain immediate	7	1-16	4.91	8.46	2-15	4.13	7.65	1-16	4.56
	Correction loss	1.37	−10-6	3.68	1.76	−2-8	2.52	1.55	−10-8	3.16
	Final gain	5.62	−3-16	5.56	6.69	1-12	3.66	6.10	−3-16	4.75
PVBH	Pre-operative	29.38	20-37	4.74	28.62	21-33	3.20	29	20-37	4.08
	Post-operative	29.87	21-37	4.19	28.85	21-33	3.13	29.41	21-37	3.72
	3 months	29.88	21-37	4.19	28.92	21-32	2.92	29.44	21-37	3.65
	LFU	29.88	21-37	4.19	28.69	21-32	2.95	29.34	21-37	3.67
	Gain immediate	0.5	0-6	1.50	0.30	−1-2	0.85	0.41	−1-6	1.23
	Correction loss	0	0	0	0.23	0-2	0.59	0.10	0-2	0.40
	Final gain	0.5	0-6	1.50	0.07	−1-2	0.75	0.31	−1-6	1.22
Kyphosis angle in degrees	Pre-operative	16.63	−20-45	13.24	23.92	8-40	8.84	19.9	−20-45	11.9
	Post-operative	1.94	−20-12	7.68	4.15	0-10	3.88	2.93	−20-12	6.27
	3 months	4.9	−18-24	9.2	6.92	0-14	4.36	5.79	−18-24	7.41
	LFU	8.6	−18-30	5.3	10.8	4-25	6.14	9.55	−18-30	8.46
	Gain immediate	−14.68	−35-0	9.54	−19.76	−32-−8	7.56	−16.96	−35-0	8.94
	Correction loss	6.62	−24-0	5.86	−6.61	−15-0	4.07	−6.62	−24-0	5.05
	Final gain	8.06	−30-2	11.29	−13.15	−24-−2	7.94	−10.34	−30-2	10.10
Wedge angle in degrees	Pre-operative	20.1	12-31	5.26	25.08	18-35	5.02	22-34	12-35	5.65
	Post-operative	7.68	0-23	6.69	8.9	0-18	6.2	8.24	0-23	6.39
	3 months	6.44	0-23	7.48	10.5	0-30	8.01	9.93	0-30	7.6
	LFU	11.16	0-24	7.70	10.5	0-18	5.24	11.07	0-24	6.62
	Gain immediate	12.43	−18-−3	5.04	−16	−28-−2	7.88	−14.03	−28-−3	6.59
	Correction loss	3.87	−18-3	5.89	−1.53	−8-6	4.33	−2.82	−18-6	5.29
	Final gain	8.56	−20-2	6.56	−14.46	−21-0	6.26	−11.20	−21-2	6.98

AVBH: Anterior vertebral body height, PVBH: Posterior vertebral body height, LFU: Last follow-up

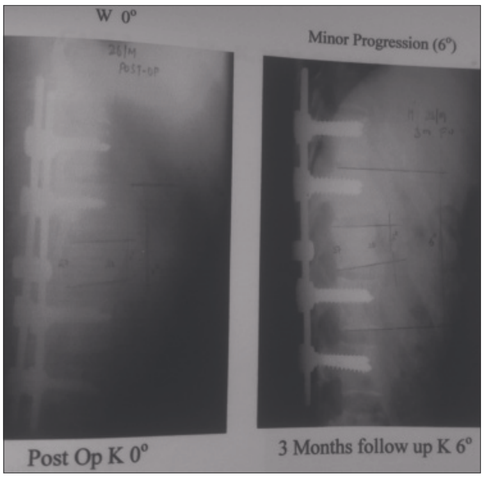

Figure 4: Long-segment immediate and 3-month post-operative radiograph.

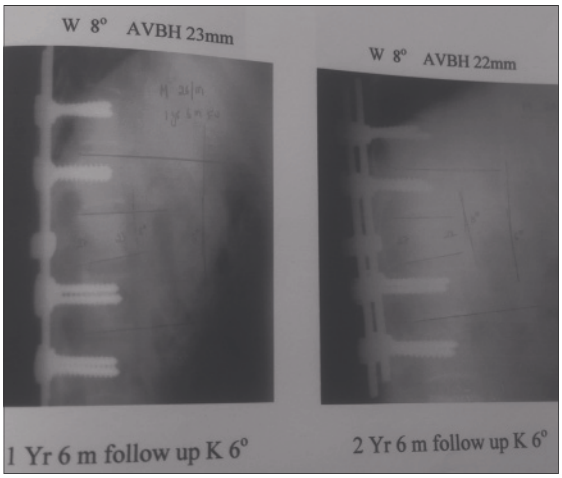

Figure 5: Long-segment long-term post-operative radiograph.

Table 5: Gaines score with progression of deformity

Characteristics	Short segment			Long segment		
Load sharing score	5	6	7	5	6	7
Number of patients	2	13	1	1	11	1
Deformity progression						
Absent (0-4°)	7			8		
Minor (5-9°)	8			5		
Major (>10°)	1			0		

showed no improvement. Of the 4 patients with ASIA grade B, 2 improved to grade D, one improved grade C and one remained in grade B. 2 of the 7 grade C patients improved to grade E, 3 to grade D and 2 remained in the same grade. Of the 7 patients with grade D, 4 improved to E, 2 improved within the grade and one did not show any improvement. 4 grade E patients had no neurological deficit.

Ten of the patients (62.5%) in short segment group had improved at least by one grade and 7 of the patients (53.8%) in long segment group had improved by at least one grade (Table 6). Average ASIA motor score improved with treatment from 28.31 to 39.56 points (11.25 points) in short segment group and from 19.91 to 28.46 points (8.55 points) in long segment group. Similarly, average ASIA sensory score improved with treatment from 44.75 to 53.18 points (8.43 points) in short segment group and from 36.42 to 42.38 points (5.96 points) in long segment group (Table 3).

One intraoperative complication of faulty screw placement, i.e. out of the pedicle was noted, while there were 6 complications during early postoperative period and 7 during the late post-operative period were noted. In early post operative period there were three patients who had bed sore one patient had Chest infection, one patient had superficial infection and one patient had wound dehiscence. In the late Post-operative period one patient had deep infection, four patients had UTI, one patient had Implant failure, one patient had Loss of correction >10 degrees. In short segment group, mean correction loss of 3.87 degrees of wedge angle and 3.4% implant failure was noted. In contrast, long segment group had 1.53 degrees of wedge angle mean correction loss and no implant failure was noted.

Discussion:

In the treatment of patients with thoracolumbar burst fractures, the absolute goal must be to stabilize an unstable spine and a relative goal of treatment is to decompress a compromised spinal canal and correct the deformity. It has been well shown that essential key to the reduction of intracanal fragment in burst fractures is distraction. 29 patients who underwent posterior spinal stabilization with transpedicular instrumentation and posterolateral fusion for unstable thoracolumbar burst fractures with or without neurological deficit were studied.

The mean average preoperative K angle was 16.63° in the short segment and 23.92° in the long segment. Preoperative K angle was more in the long segment. The intraoperative gain in the K angle was 14.68° in the short segment and 19.76° in long segment. The mean average K angle at the last follow up was 8.6° and 10.8° in the short and long segment, respectively. The mean average loss of correction K angle by the last follow-up was 6.62° in the short segment and 6.61° in the long segment; whereas in Mirjanli et al study, the values were 16.2° and 5.7° respectively [4]. In Louis et al study, loss of correction was 9.3° and 10.5° [5]. In our study, loss of correction was observed to have occurred more in the early post-operative period i.e. 3 months than in the late post-operative period. The mean final gain of K angle in our study was 8.06° and 13.15° in the short and long segments, respectively. These values in Louis et al study were as low as 2° and 2.9°, respectively [5]. Long segment had better results in terms of prevention of loss of correction and final gain in spite of extensive collapse. The mean average preoperative wedge angle was 20.1° in the short segment and 25.08° in the long segment. The mean average intraoperative gain was 12.43° in short segment and 16° in long segment. The loss of correction of wedge angle was 3.87° and 1.53° in short segment and long segments, respectively. In Louis et al study there was not much of a difference in the loss of correction with the mean values of 4.8° and 4.84°, in the short and long segments respectively [5]. The final gain of wedge angle was 4.5° and 5.36° in short and long segments, respectively, in Louis et al study [5]. While the corresponding values in our study were 8.56° and 14.46°. The mean final gain in anterior vertebral body height was 5.62 mm in short segment versus 6.69 mm in long segment. There was no significant difference between the two groups in achieving reduction or maintenance of reduction of posterior vertebral body height. Parker et al in their review of 46 patients with a mean follow-up period of 66 months concluded that load sharing classification is a straight forward way to describe the amount of bony comminution in a spinal fracture and can help the surgeon to decide on short segment pedicle screw based fixation for less comminuted injuries [6]. They also concluded that a low load sharing score of 6 or less indicates adequate sharing of load through the injured vertebral body when instrumented posteriorly and a score of 7 points or more indicates poor transport of load and points to the necessity for anterior instrumentation and strut grafting [6]. In our study there were 2 patients with a load sharing score of 7, one in short segment and one long segment. There was major progression of the deformity in one patient treated with short segment due to faulty screw placement and implant failure later. One patient in long segment with load sharing score of 7 had minor progression. There were 15 patients and 12 patients in short and long segments, respectively, with a load sharing score of 6 or less.

In our study there was no positive correlation between Gaines

Table 6: Neurological outcome

Type of surgery	Before surgery	LFU				
		A	B	C	D	E
Short segment	A=2	0	0	0	1	1
	B=2		0	1	1	0
	C=4			2	1	1
	D=6				2	4
	E=2					2
Long segment	A=5	2	0	0	3	0
	B=2		1	0	1	0
	C=3			0	2	1
	D=1				1	0
	E=2					2

LFU: Last follow-up

score and progression of deformity, although long segment was better in preventing progression of deformity. We had one patient with implant failure (3.4%) in short segment which was due to faulty screw placement intraoperatively leading to screw pullout and major progression of deformity (>10°). There was one patient in the long segment with screw bending. However, a higher incidence of implant failure was reported in earlier studies. In Mirjanli et al study, mean implant failure of 22.3% and 3.6% was reported in short segment and long segment groups, respectively [4].

Decompression is particularly important in those cases associated with neurological deficit. Although some authors have shown no relationship between spinal canal narrowing and neurological deficit, there is an increasing body of literature that suggests otherwise.

Gertzbein et al studied over 104 patients to assess neurological recovery with and without decompression and proposed that the recovery occurred independently of the treatment [7]. In our study, all the patients underwent stabilization with decompression and bone grafting, except for 4 patients without neurological deficit. Therefore, the role of decompression in determining the neurological outcome could not be assessed. In our study, 62.5% and 53.8% patients, in the short and long segment groups, respectively, showed improvement to the next ASIA grade. Complete neurological recovery in patients with incomplete injury was observed in 41.6% of patients in the short segment group and 16.6% patients in the long segment group. In a similar study, Louis et al reported 66% complete recovery in patients with incomplete injury [5]. None of the patients in our series had a neurological decline, during the course of the treatment. Mean average ASIA motor score and ASIA sensory score improved by 11.25 and 8.43 points, respectively in the short segment group in comparison with 8.55 and 5.96 points, respectively in the long segment group. In the Louis et al study the mean average Asia motor score improved by 14.6 points and mean average sensory score improved by 10.3 points [5]. Neurological outcome was better in short segment group in terms of improvement in ASIA grade as well as ASIA motor and sensory indices. The probable cause for the better neurological outcome, in the short segment group could be due to the presence of less number of patients with ASIA grade A, complete injury and more number of patients with ASIA grade D incomplete injury. There were almost equal number of patients with ASIA grade B and grade C in both the groups.

Conclusion:

Based on the outcomes noted in our study, it was clear that transpedicular fixation is a stable, reliable and less surgically extensive construct for addressing thoracolumbar burst fractures. However, such procedures require a thorough understanding of fracture pattern, pedicle morphometry and proper intraoperative technique. In general, 6-8° loss of correction was observed with both short and long segment stabilizations in our study. Nevertheless, long segment has better results in terms of maintenance of reduction and final gain. There was no significant difference in neurological recovery between short and long segments. Therefore, it can be concluded that the length of instrumentation does not seem to have any effect on the neurological outcome.

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Conflict of Interest: Nil.
Source of Support: None

How to Cite this Article

Surapaneni SB, Tummala VSB, Makkena R. Clinical and Radiological Outcome of Thoracolumbar Fractures Treated by Transpedicular Fixation. Trauma International Jan-Apr 2017;3(1):38-45.