

# Functional and Radiological Outcome of Short Same Segment Instrumentation in Thoracolumbar Burst fracture

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## ABSTRACT

**Background:** Thoracolumbar region is important biomechanics transition zone in which rigid thoracic and flexible lumbar spine meet. This area is highly vulnerable to traumatic spinal fracture. Among all spine fracture, compression type is most common and managed conservatively. Thoracolumbar spine fracture can be associated with neurological deficit, spinal instability. The optimal treatment for these injuries is still controversy and subject for research.

**Methods:** This retrospective study included 30 patients with single level thoracolumbar fracture. All the patients clinical and radiological parameters were evaluated preoperative, post-operative and 1 year follow up. Clinical parameters were included Visual analogue score, Oswestry disability index. Radiologic measurement were regional kyphotic angle by Cobb's method and anterior vertebral body height loss (Mumford's anterior body compression equation method) in X-ray. All the data were analysed in SPSS version 20.

**Results:** A total of 30 patients were included in this study, 19 were male. The mean age of the patients were  $40.8 \pm 13$ . The main cause of injury was fall from height, 26 patients. The most common level of fracture vertebra was L1, 11 patients. The mean difference of preop and postop kyphosis was  $11.7^\circ \pm 5^\circ$  with  $P < 0.05$ . The mean difference of preop Oswestry disability index and postop Oswestry disability index score was  $30.7 \pm 7.6$  with T score 22 ( $P < 0.05$ ). The preop and postop Visual analogue score score also improved, mean difference was  $2.8 \pm 1$  ( $P < 0.05$ ).

**Conclusions:** Short segment instrumentation with placement of pedicle screw at fracture vertebra is one option in the treatment of thoracolumbar burst fracture.

**Keywords:** Burst; instability; kyphosis; neurological; thoracolumbar

## INTRODUCTION

Thoracolumbar spine fracture is commonest among all spine fracture.<sup>1</sup> Compression Fracture is common and treated conservatively. Burst fracture are usually unstable with involvement of neurology so need surgical treatment. There are many surgical options like long segment, short segment, short same segment fixation.<sup>2</sup> No technique is superior till date. Short segment fixation has high failure rate.<sup>3</sup> The cause of failure is structural and mechanical deficiency of the anterior column. Short same segment fixation gives equal spinal stability to long segment fixation and reduce the failure rate of pedicle instrumentation.<sup>1</sup> We can also preserve motion segment in short same segment fixation. Thoracolumbar burst fracture with intact motor function can be treated with short same segment fixation.

Many biomechanical studies have shown that short

same segment fixation could significantly improve the spinal stability and decrease stress between pedicle screw after surgery.<sup>4,5</sup> The main objective of this study is to assess clinical outcome of thoracolumbar burst fracture treated with short same segment pedicle screw fixation by measuring VAS score for pain, kyphotic angle by Cobb's method, Functional disability by Oswestry disability index (ODI).

The aim of this study was to assess functional and radiological outcome of thoracolumbar burst fracture treated by posterior short same segment fixation.

## METHODS

This study was approved by Institutional review committee of Nepalese Army Institute of Health Science (NAIHS). This is a retrospective study performed in Shree Birendra Hospital. A total of 30 patients operated

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from June 2017 to January 2020 were enrolled in this study on the basis of the following criteria (Table 1).

**Table 1. Inclusion and exclusion criteria.**

Inclusion criteria	Exclusion Criteria
1. T10 to L2 Fracture	1.Previous Instrumentation at TL junction
2. Single level fracture	2.Multilevel Fracture
3. Age >18 yrs	3. Need anterior decompression
4. Pedicle screw instrumentation at fracture vertebra.	4. old fracture
5. Burst fracture	5. Metastatic fracture
6. Intact Motor function	

All the patients demographic data, mechanism of injury, injury-surgery interval were collected. All patients had preoperative AP and lateral radiographs and CT scan of spine to classify the fracture type and to assess status of pedicles. The preoperative, Immediate postoperative and 1 year follow up x-rays were analysed. Regional kyphotic angle and anterior vertebral height loss were measured in plain radiographs. Kyphotic angle measured by cobb's method and anterior body compression measured by Mumford's anterior body compression equation method. All the pre op, post op and one year follow up data

were compared. All the patients neurological status were recorded according to ASIA grade preoperative, immediate post operative and 1 year follow up. The functional outcome was assessed by VAS score and Oswestry disability index (ODI) scores.

**Mumford's equation method:** It is the percentage loss of anterior vertebral body height. It is calculated as ratio of anterior height of the injured vertebra to mean anterior height of two adjacent intact vertebra. It will be evaluated on lateral X-ray of spine.

**Cobb angle:** It is measured on lateral X ray. It is the angle between the inferior end plate of intact vertebra below the fracture and superior end plate of intact vertebra above the fracture.

## RESULTS

A total of 30 patients were included in this study. There were 19 male patients and 11 female. The age of the patients ranges between 18 to 63 with mean of 40.8±13. All the patients had thoracolumbar burst fracture with ASIA D(12) and E(18). The cause of injury were fall from height in 26 patients and only 4 had road traffic accident. The most common level of involved vertebra is L1(12) followed by L2(8), D12(8) and D11(2).

**Table 2. Descriptive analysis of parameters pre, post and final follow up.**

	N	Minimum	Maximum	Mean	Std. Deviation
Preop kyphosis (degree)	30	17	28	22.40	3.244
Postop kyphosis (Degree)	30	6	14	10.70	2.628
Final kyphosis (Degree)	30	6	17	12.73	2.924
Preop disability score (Percentage)	30	56	74	65.33	4.278
Postop disability score (Percentage)	30	20	50	34.67	7.053
Final disability score (Percentage)	30	10	20	14.43	2.700
Preop back pain (Number)	30	4	8	5.90	.960
Postop back pain (Number)	30	2	5	3.10	.845
Final back pain (Number)	30	1	3	1.63	.669
Preop ant vertebral Height loss (Percentage)	30	34	52	43.20	4.382
Postop vertebral height (Percentage)	30	78	92	83.83	4.078
Final vertebral height (percentage)	30	70	90	79.13	4.547

**Table 3. Paired Samples T Test of preop and immediate post op.**

Pair		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	preopkyphosis - postopkyphosis	11.700	4.970	.907	9.844	13.556	12.894	29	<0.05

Pair 2	preopdisability score - postopdisability score	30.667	7.599	1.387	27.829	33.504	22.104	29	<0.05
Pair 3	preopbackpain - postopbackpain	2.800	1.297	.237	2.316	3.284	11.822	29	<0.05
Pair 4	pre opantvertebral height loss - post opvertebral height	-40.633	5.075	.927	-42.528	-38.738	-43.852	29	<0.05

Table 4. Paired Samples T Test of preop and final 1 year follow up

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	preopkyphosis - finalkyphosis	9.667	4.992	.911	7.803	11.531	10.606	29	<0.05
Pair 2	peropdisability score - finaldisability score	45.700	6.030	1.101	43.449	47.951	41.514	29	<0.05
Pair 3	peropbackpain - finalbackpain	4.267	1.202	.219	3.818	4.715	19.450	29	<0.05
Pair 4	pre opantvertebral height loss - finalvertebral height	-35.933	5.271	.962	-37.902	-33.965	-37.336	29	<0.05

Out of 30 patients only three patients had superficial wound infection responded to conservative treatment.

## DISCUSSION

Thoracolumbar spinal fracture represent approximately 90% of all spinal fracture. These injuries can result in pain, disability, loss of neurological function and deformity.<sup>6</sup> Thoracolumbar junction is transition zone between rigid thoracic column and flexible lumbar column(T11-L2).<sup>7</sup> In our study majority of the patients were male and age ranges between 18 to 63yrs with mean of 40.8±13. This was similar to other study<sup>8</sup> where 26 patients were male out of 36 and mean age were 44.3±1.6.

In this study preoperative kyphosis were 22.4<sup>0</sup>±3<sup>0</sup> improved to 10.7<sup>0</sup>±2.6<sup>0</sup> postoperative and 12.7<sup>0</sup>±3<sup>0</sup> at final follow up. There were mean kyphotic correction of 11.7<sup>0</sup> immediate post operative and 9.7<sup>0</sup> at final follow up. Both preop to postop and preop to final follow up kyphotic correction were statistically significant P<0.05 though there were loss of kyphotic correction from immediate post-op to final follow up. There were other study done by Jonathan james et.al. found immediate post op kyphotic correction were 15.23<sup>0</sup> which is significant P<0.0001 and there were significant degree of correction loss from immediate post op to final up 9.51<sup>0</sup> (P<0,001) but preop to final follow up kyphotic correction were 5.51<sup>0</sup> (p=0.0024).<sup>9</sup>

Back pain measured in VAS score. Mean preop VAS score

was 5.9±0.9 improved to 3.1±0.8 post operative and 1.6±0.7 at final follow up. Mean VAS difference between preop and immediate post op was 2.8±1,3 which was statistical significance P<0.05. There was statistical significant VAS difference between preop and final follow up 4.2±1,2 (P<0.05). The improvement in back pain in our study was similar to other study<sup>2,8</sup> which were statistically significance.

The functional disability was measured by Oswestry Disability Index(ODI).<sup>10</sup> The disability score were 0 to 20% is minimal disability and 81 to 100% is bed bound. In this study immediate postop disability score was 34.67±7, fell in Moderate group and 14.43±2.7 (Minimal Disability) at final follow up. A study done by Jonathan et al. found that one month post op follow up patients were fall in severe disability group and at final follow up they were fall in minimal disability group similar to our study. Mean difference between one months follow up and final follow up was 47.27% (P<0.0001) in Jonathan et al. study.<sup>9</sup>

## CONCLUSIONS

Thoracolumbar burst fracture is common spine injuries. There is no gold standard treatment option. Short segment surgery could be one treatment option in terms of improvement in functional and radiological outcome.

## CONFLICT OF INTEREST

The authors declare no conflict of interest

## REFERENCES

1. Sun C, Guan G, Liu X, Zhang H, Wang B. Comparison of short-segment pedicle fixation with versus without inclusion of the fracture level in the treatment of mild thoracolumbar burst fractures. *International Journal of Surgery*. 2016 Dec 1;36:352-7.[\[Article\]](#)
2. Ahmed M. Sallam, Walid A. Abdel Ghany, Ali Kotb Ali, Mohamed A. Habib, Ahmed F. Toubar, Mohamed S. Kabil, et.al. Short segment posterior fixation with index level screws versus long segment posterior fixation for thoracolumbar spine fracture: angle of correction and pain. *Egyptian Journal of Neurosurgery* 2019;33:11.[\[Article\]](#)
3. Li K, Zhang W, Liu D, Xu H, Geng W, Luo D, et al. Pedicle screw fixation combined with intermediate screw at the fracture level for treatment of thoracolumbar fractures: a meta-analysis. *Medicine*. 2016 Aug;95(33).[\[Article\]](#)
4. Baaj AA, Reyes PM, Yaqoobi AS, Uribe JS, Vale FL, Theodore N, et al. Biomechanical advantage of the index-level pedicle screw in unstable thoracolumbar junction fractures: Presented at the 2010 Joint Spine Section Meeting. *Journal of Neurosurgery: Spine*. 2011 Feb 1;14(2):192-7.[\[Article\]](#)
5. Norton RP, Milne EL, Kaimrajh DN, Eismont FJ, Latta LL, Williams SK. Biomechanical analysis of four-versus six-screw constructs for short-segment pedicle screw and rod instrumentation of unstable thoracolumbar fractures. *The Spine Journal*. 2014 Aug 1;14(8):1734-9.[\[Article\]](#)
6. Lewkonja P, Paolucci EO, Thomas K. Reliability of the thoracolumbar injury classification and severity score and comparison with the denis classification for injury to the thoracic and lumbar spine. *Spine*. 2012 Dec 15;37(26):2161-7.[\[Article\]](#)
7. Solomon L, Warwick D, Nayagam S. *Apley's System of orthopaedics and fracture*. Ninth edition. United Kingdom: CRC press Taylor and Francis group; 2010.
8. Adawi MM, Aboulfetouh I, Saleh A, Younis W. Posterior short-segment fixation with implanting pedicle screw in the fractured level as a feasible method for treatment of thoracolumbar fracture. *Egyptian Journal of Neurosurgery*. 2019 Dec;34(1):1-9.[\[Article\]](#)
9. Eno JJ, Chen JL, Mitsunaga MM. Short same-segment fixation of thoracolumbar burst fractures. *Hawai'i journal of medicine & public health: a journal of Asia Pacific Medicine & Public Health*. 2012 Jan;71(1):19.[\[Article\]](#)
10. Fairbank JC, Pynsent PB. The Oswestry disability index. *Spine*. 2000 Nov 15;25(22):2940-53.[\[Article\]](#)