

ROMANIAN  
NEUROSURGERY

Vol. XXXV | No. 4      December 2021

Outcome of patients undergoing  
posterior spine fixation and  
decompression for posttraumatic  
thoracolumbar spine fractures and the  
factors predicting it

Geo Paul K. Jose,  
Tinu Ravi Abraham,  
P.K. Balakrishnan,  
Irphan Muhammed P.S.,  
Haris T.P.,  
Vala Parth Prakashbhai



# Outcome of patients undergoing posterior spine fixation and decompression for posttraumatic thoracolumbar spine fractures and the factors predicting it

Geo Paul K. Jose, Tinu Ravi Abraham,  
P.K. Balakrishnan, Irphan Muhammed P.S.,  
Haris T.P., Vala Parth Prakashbhai

Department of Neurosurgery, Government Medical College  
Kottayam, Kerala, INDIA

## ABSTRACT

**Background:** Posterior spine fixation and decompression for thoracic and lumbar spine fractures have the advantage of stabilization of the fracture, decompression of neural canal, early mobilization and rehabilitation of the patient. The study aimed to find out the postoperative outcome and complications following posterior spine surgery and the factors affecting the outcome.

**Methods:** A retrospective study was carried out among 44 patients who underwent posterior spine decompression and fusion for thoracic and lumbar spine fracture. The data regarding patient presenting symptoms, comorbidity, associated injuries and imaging finding in CT and MRI were collected. The postoperative outcome of patients after surgery was assessed using ASIA impairment scale, KPS, VAS scale for pain are noted at the preoperative and postoperative period. Other factors like improvement of bowel and bladder symptoms, back stiffness and return to the job after surgery were also found out.

**Results:** There was a significant improvement in ASIA impairment scale (mean = 0.74 grade), KPS score (mean = 40) and VAS pain scale (mean = 6.7) at 6 months follow up after surgery. Improvement in ASIA impairment scale was more in the patient with severe canal compromise (mean = 1.62 grade), patients with translational/ distraction injuries (mean = 1.01 grade) and patients with paraparesis (mean = 1.06). Only one-third of patients with bowel and bladder involvement improved after surgery. Around 56.8% of patients were able to return to jobs at 6 months follow up. Patients who were paraplegic at the initial presentation were mostly not able to return to jobs. The most common reported complication in the study was intraoperative pedicle breakage.

**Conclusion:** Decompression of the spinal cord plus posterior spine fixation is a safe, reliable and effective method in the management of thoracic and lumbar fractures with significant improvement in outcome in terms of motor power, pain and quality of life.

## BACKGROUND

Thoracic and lumbar spine fractures occurring as a result of trauma can lead to pain, neural compromise and deformity. The appropriate

## Keywords

ASIA impairment scale,  
VAS,  
KPS,  
thoracolumbar spine  
fractures



Corresponding author:  
**Tinu Ravi Abraham**

Department of Neurosurgery,  
Government Medical College  
Kottayam, Kerala, India

drtinu@gmail.com

**Copyright and usage.** This is an Open Access article, distributed under the terms of the Creative Commons Attribution Non-Commercial No Derivatives License (<https://creativecommons.org/licenses/by-nc-nd/4.0/>) which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is unaltered and is properly cited.

The written permission of the Romanian Society of Neurosurgery must be obtained for commercial re-use or in order to create a derivative work.

ISSN online 2344-4959  
© Romanian Society of  
Neurosurgery



First published  
October 2021 by  
London Academic Publishing  
[www.lapub.co.uk](http://www.lapub.co.uk)

treatment for these fractures ranges from conservative management with thoracic lumbar corset to surgical management with anterior/posterior instrumentation for fixation plus decompression<sup>1,2</sup>.

Surgical management for these fractures has the advantage of stabilization of fracture with fixation, decompression of neural canal, early mobilization and rehabilitation of the patient<sup>3</sup>. Though there are both anterior and posterior approaches for thoracolumbar spine fractures most spine surgeons advocate posterior fusion and decompression as the treatment of choice for unstable fractures as the approach is less extensive<sup>1,4,5</sup>. Various posterior stabilization procedures are there which include hooks, wires, transpedicular screw and rod fixation, of which transpedicular screw and rod fixation is the preferred technique now<sup>6</sup>.

In traumatic spine fractures the outcome following posterior spine decompression and fusion depends on various factors which includes timing of surgery, patient comorbidities, general condition of the patient, associated injuries. The outcome following the surgery is measured based on the extend of pain relief, to be able to mobilize the patient early, return to work, neurological recovery and development of any postoperative complications.

This study was done to find out the factors affecting the post-operative outcome following posterior spine decompression and fusion surgery in patients with traumatic thoracolumbar spine fractures. The study also aimed to find out the postoperative outcome and complications following posterior spine surgery.

## METHODOLOGY

A retrospective observational study was carried out among 44 patients admitted with thoracic and lumbar spine fracture who had underwent posterior spine decompression and fusion in the department of Neurosurgery, in a tertiary care center in central Kerala, India during the period from 1<sup>st</sup> January 2019 to 31<sup>st</sup> December 2020.

Study involved collecting data regarding those patients who were admitted and operated for traumatic thoracic and lumbar spine fracture using the standard surgical protocol followed in the department. This involved laminectomy and decompression of the spinal cord +/- neural

foraminal decompression and posterior spine fixation two levels above and below using polyaxial screws and rods. The data regarding presenting symptoms, comorbidities, associated injuries and imaging finding in CT and MRI was collected (like type of fracture, canal compromise and level of injury). Type of fractures were divided into posterior element only fractures, anterior wedge compression fracture, burst fracture and translation/ distraction injury. Canal compromise was divided into no/ mild (obliteration in CSF space is <50%), moderate (>/=50% obliteration in CSF space, but not deforming the cord), severe (compressing and deforming the cord). Level of injury was divided into upper dorsal(D1-D6), mid dorsal (D7-D9), dorso-lumbar junction (D10-L2) and lower lumbar(L3-L5). Other details like interval between trauma and surgery, and complications following surgery were also recorded.

The post-operative outcome of patients after surgery was assessed using ASIA (American Spine Injury Association Scale) impairment scale (Table.1b), KPS (Karnofsky Performance Status) scale (Table.1a) and VAS (Visual Analog Scale) of pain (from 0-10), all of which were noted at the preoperative and post-operative (immediate, 1 month and 6 months) periods from the data available in the department. Other factors like improvement in bowel and bladder symptoms, back stiffness and return to job after surgery were also found out.

A) Karnofsky Performance Status Scale <sup>7</sup>		B) ASIA scale <sup>8</sup>	
Score	Findings	Grade	Findings
100	Normal no complaints; no evidence of disease.	<b>A</b> (Complete)	No Sensory or Motor Function is preserved
90	Able to carry on normal activity; minor signs or symptoms of disease.	<b>B</b> (Sensory Incomplete)	Sensory but not Motor Function is preserved below the neurological level and No Motor Function is preserved more than three levels below the Motor Level on either side of the body
80	Normal activity with effort; some signs or symptoms of disease.		
70	Cares for self; unable to carry on normal activity or to do active work.	<b>C</b> (Motor Incomplete)	Motor Function is preserved below the
60	Requires occasional		

	assistance, but is able to care for most of his personal needs.		Neurological Level and More than half of key muscle functions below the Neurological Level of Injury have a muscle grade less than 3 (Grades 0-2)
50	Requires considerable assistance and frequent medical care.		
40	Disabled; requires special care and assistance.		
30	Severely disabled; hospital admission is indicated although death not imminent.	<b>D</b> (Motor Incomplete)	
20	Very sick; hospital admission necessary; active supportive treatment necessary.		
10	Moribund; fatal processes progressing rapidly.	<b>E</b> (Normal)	Motor function is preserved below the neurological level and At least half (half or more) of key muscle functions below the NLI have a muscle grade $\geq 3$
0	Dead		If sensation and motor function as tested are graded as normal in all segments

**Table 1.** showing a) Karnofsky Performance Score b) ASIA Impairment Scale<sup>7,8</sup>

In the end of the study the post-operative clinical, radiological and functional outcome in patients undergoing thoraco-lumbar posterior spine fixation and decompression was determined. The factors affecting post-operative outcome in patients undergoing thoraco-lumbar posterior spine fixation and decompression were also determined. The common complications following thoraco-lumbar spine fixation and decompression were also found out.

**Data Management and Statistical Analysis:** The data collected was entered in Microsoft Excel sheet. Percentage were calculated for categorical data, whereas numerical data represented as mean $\pm$ -SD. Statistical analysis was done to determine significant relationship between clinical and radiological factors to post-operative outcome. Paired T- test was used to compare preoperative and postoperative outcomes. Probability  $\leq 0.05$  ( $p \leq 0.05$ ) was considered significant.

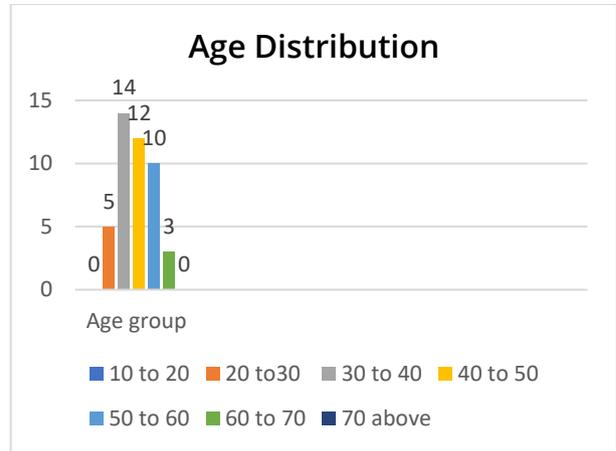
**Inclusion Criteria:** Diagnosed cases of post traumatic thoracic and lumbar spine fracture who had undergone posterior spine decompression and fusion

**Exclusion Criteria:**

- i) Cases without proper history and clinical examination
- ii) Cases without proper imaging
- iii) Cases without follow up
- iv) Children below 13years of age

**RESULTS**

Mean age affected by traumatic thoraco-lumbar spine fracture is 44.30  $\pm$  11.87yrs. Most common age group affected was between 30-50 yrs – (26 patients,59.1%) (table.2, fig.1). The age of the study population ranged from 21yrs to 69yrs.

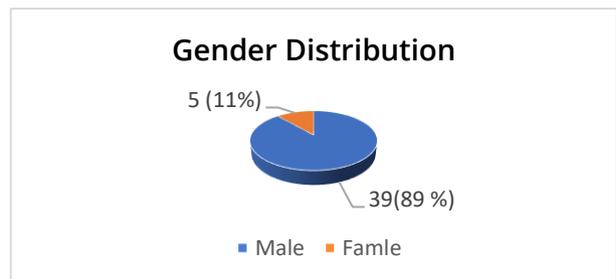


**Figure 1.** showing age distribution.

Age groups	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 to 80
No. patients (%)	0 / 0.0 %	5 / 11.3 %	14 / 31.8 %	12 / 27.3 %	10 / 22.7 %	3 / 6.8 %	0 / 0.0 %

**Table 2.** showing age distribution

**Figure 2.** showing gender distribution



Traumatic thoracolumbar spine fractures mainly affect males (39 patients ,88.6%). Male to female ratio is 7.8:1 (fig.2).

**Table 3.** showing distribution of patients according to a) fracture type, b) canal compromise, c) Level of fracture and d)interval between injury and surgery.

a) Fracture	No. of patients	b) Level	No. of patients
Only Pars #/ posterior element	0 (0.0%)	D1- D6	7 (15.9%)
Anterior wedge compression	11 (25.0%)	D7-D9	6 (13.6%)
Burst	19 (43.2%)	D10-L2	25 (56.8%)
Translational injury/subluxation / Burst # + PLC injury	14 (31.8%)	L3-L5	2 (4.5%)
Total	44 (100.0%)	Multiple levels	4 (9.1%)
C) Canal Compromise	No. of patients	d) Interval between injury and surgery	No. of patients
No / mild	8 (18.2%)	(<=2weeks	16 (36.4%)
moderate	23 (52.3%)	2-4weeks	14 (31.8%)
severe	13 (29.5%)	1-3months	14 (31.8%)
Total	44 (100.0%)	> 3months	0 (0.0%)

Most common fracture type involved in the study was burst fractures (19 patients, 43.2%) (table.3a). Most of the patients (23patients, 52.3%) in the study had moderate canal compromise (more than 50% obliteration of subarachnoid space, but not deforming the spinal cord) (table .3c). Most common level involved was D10 to L2 level (Thoraco-lumbar junction) 25 patients (56.8%) (table.3b). For most of the patients in the study surgery was done within 4weeks duration, (30 patients, 68.2%). For 14 patient surgery was done between 1-3 months duration (table.3d).

Patients who underwent surgery for traumatic thoracolumbar spine fractures showed a mean improvement in grade of 0.43 and 0.76 in ASIA impairment scale postoperatively at 1month and 6 months respectively compared to preoperative status. These findings were found to be statistically significant (table.4a). Patients with paraparesis and paraplegia showed an improvement ASIA impairment scale of 1.06 and 1.25 grade respectively compared to preoperative scale, which was statistically significant Ttable.4b).

a) Parameter	Mean	N	Std. Deviation	Difference	t	p value	
Pre ASIA	3.27	44	1.633	+0.43	5.25	.000	
Post ASIA1*	3.70	44	1.579				
Pre ASIA	3.33	43	1.614	+0.76	6.22	.000	
Post ASIA6*	4.09	43	1.306				
b) Symptom	Parameters	Mean	N	Std. Deviation	mean difference	t	p value
Paraparesis	PreASIA	3.60	15	.632	+1.06	6.95	.000
	Post ASIA6	4.67	15	.488			
Paraplegia	PreASIA	1.00	12	.000	+1.25	4.48	.001
	Post ASIA6	2.25	12	.965			
c) Parameter	Canal Compromise	N	Mean	Std. Deviation	F	P value	
Pre ASIA	No/ mild	8	4.38	.744	17.278	.000	
	moderate	23	3.83	1.370			
	severe	13	1.62	1.193			
Post ASIA6	No/ mild	8	4.75	.463	.463	.001	
	moderate	23	4.43	1.080			
	severe	12	3.00	1.477			
d) Parameter	Level	N	Mean	Std. Deviation	F	P value	
Pre ASIA	D1- D6	7	3.14	1.676	2.255	.081	
	D7-D9	6	1.67	1.633			
	D10-L2	25	3.48	1.584			
	L3-L5	2	4.00	.000			
	Multiple levels	4	4.25	.957			

Post ASIA	D1- D6	7	3.86	1.676	1.449	.237
	D7-D9	6	3.17	1.169		
	D10-L2	24	4.21	1.285		
	L3-L5	2	4.50	.707		
	Multiple levels	4	5.00	.000		
e) Parameters	Fracture type	N	Mean	Std. Deviation	F	P value
Pre ASIA	Anterior wedge compression	11	4.27	1.009	7.29	.002
	Burst	19	3.53	1.467		
	Translational injury/subluxation / Burst # + PLC injury	14	2.14	1.657		
Post ASIA6	Anterior wedge compression	11	4.73	.467	6.38	.004
	Burst	19	4.37	.955		
	Translational injury/subluxation / Burst # + PLC injury	13	3.15	1.725		

**Table 4.** showing a)preoperative and post operative - ASIA impairment scale, . (l 1\*-post operative at 1month, 6\*- post operative at 6month), b))preoperative and postoperative - ASIA impairment scale among paraparesis and paraplegic patients c) relationship of canal compromise with preoperative ASIA (PreASIA) , and postoperative ASIA at 6month (Post ASIA6), d)relationship of level of injury with Pre ASIA and Post ASIA score at 6month, e)relationship of fracture type to Pre operative ASIA (PreASIA) ,Post operative ASIA at 6months (Post ASIA6).

**Table 6.** showing a)pre operative and post operative KPS score (l\*-immediate post operative, 1\*-post operative at 1month, 6\*- post operative at 6months), b) relationship of fracture type to post operative KPS at 6months (PostKPS6) , c)relationship of canal compromise with preoperative KPS (PreKPS) and postoperative KPS at 6months (Post KPS6).

a) Parameter	Mean	N	Std. Deviation	Difference (improvement)	t	p value
Pre KPS	39.8	44	11.91	+5.7	6.03	.000
Post KPS l*	45.5	44	11.30			
Pre KPS	39.8	44	11.91	+25	13.09	.000
Post KPS1*	64.8	44	15.77			
Pre KPS	40.0	43	11.95	+39.8	15.76	.000
Post KPS6*	79.8	43	18.32			
b) Parameters	Fracture type	N	Mean	Std. Deviation	F	P value
Post KPS6	Anterior wedge compression	11	90.9	13.75	7.73	.001
	Burst	19	82.6	15.93		
	Translational injury/subluxation / Burst # + PLC injury	13	66.2	17.58		
c) Parameter	Canal Compromise	N	Mean	Std. Deviation	F	P value
Pre KPS	No /mild	8	46.3	10.61	7.136	.002
	moderate	23	42.6	12.51		
	severe	13	30.8	4.94		
Post KPS6	No/ mild	8	92.5	13.89	10.766	.000
	moderate	23	83.9	14.06		
	severe	12	63.3	17.75		

**Table 8.** a) showing distribution of all patients return to job after surgery, b ) showing distribution of patients having weakness returning to job after surgery.

a) Job	No	Modification	Old same Job	Total		
No. Of patients	19 (43.2)	17 (38.6)	8 (18.2)	44 (100.0)		
b) Weakness	Job			Total	x <sup>2</sup>	P VALUE
	No	Modification	Old same Job			

	No weakness	4 (26.7%)	4 (26.7%)	7 (46.7%)	15 (100.0%)	30.755	.000
	monoparesis	0 (0.0%)	1 (100.0%)	0 (0.0%)	1 (100.0%)		
	paraparsis	3 (20.0%)	11 (73.3%)	1 (6.7%)	15 (100.0%)		
	paraplegia	12 (92.3%)	1 (7.7%)	0 (0.0%)	13 (100.0%)		
<b>Total</b>		19 (43.2%)	17 (38.6%)	8 (18.2%)	44 (100.0%)		

Pre ASIA	Post ASIA6					
	A	B	C	D	E	Total
A	3	4	4	1	0	12
B	0	0	0	1	0	1
C	0	0	0	2	2	4
D	0	0	0	3	10	13
E	0	0	0	0	13	13
<b>Total</b>	3	4	4	7	25	43

**Table 5.** showing comparison of preoperative ASIA score (pre ASIA) to postoperative ASIA score at 6 months (post ASIA6).

None of the operated patients had deterioration in ASIA score at 6month follow up. Of the total of 12 patients operated with preASIA grade A, only 3 patients remained at grade A, whereas 4 patients each had improved to ASIA grade B and C (table 5) on post-operative follow up at 6months.

Preoperative ASIA impairment score showed significant relation to fracture type, with patients suffering from translational /distraction injury having a poorer grade (mean ASIA score of 2.14 = grade B to C) whereas anterior wedge compression fracture having better grades (mean ASIA score of 4.27= grade D to E). Post operatively ASIA impairment scale at 6 months showed significant relations to fracture type, with patients having anterior wedge compression fracture (mean ASIA score of 4.73= grade D to E) having better scores than patient with translational injury (mean ASIA score of 3.15= grade C to D) (table.4e).

Considering canal compromise, patients with severe canal compromise were having poor ASIA score both preoperatively and postoperatively when compared with patients having mild / moderate canal compromise (table.4c).

Regarding the level of involvement, patient with D7-D9 involvement were having lowest preoperative ASIA score (mean ASIA score was 1.67= A to B), but these finding didn't have and statistical significance (table. 4d). Interval between injury and surgery failed to find any statistically significant relation in terms of outcome.

When compared to preoperative KPS there was

significant improvement in mean postoperative KPS score at 1month and 6 months as 25 and 39.8 respectively. (table.6a). Though preoperatively KPS failed to show any significant relation to fracture type, post operatively KPS at 6 months showed significant relation to fracture type, with patients having anterior wedge compression fracture (KPS=90.9) having better scores than patient with translational injury (KPS= 66.2) (table.6b).

Considering canal compromise, patients with severe canal compromise were having poor KPS score both pre-operatively (mean=30.8) as well as post operatively (mean=63.3) when compared with patients having mild (mean preKPS =46.3, mean post KPS6 =92.5)/ moderate (mean preKPS =42.6, mean post KPS6 = 83.9) canal compromise (table.6c). KPS score didn't have any significant relation with the level of injury.

Considering the VAS pain scale, there was again significant decrease VAS pain scale in post-operative period (Immediately, at 1month and at 6 month scores being 1.65, 4.88 and 6.7 respectively-table.7). However, VAS pain scale didn't show any significant relations to fracture type, canal compromise or the level of injury.

Parameter	Mean	N	Std. Deviation	Difference (Decrease in pain)	t	p value
PreVAS	7.70	44	.851	-1.65	7.975	.000
PostVAS I*	6.05	44	1.613			
PreVAS	7.70	44	.851	-4.88	26.899	.000
PostVAS1*	2.82	44	.995			
PreVAS	7.70	43	.860	-6.7	36.423	.000
PostVAS6*	1.00	43	1.024			

**Table 7.** showing preoperative and postoperative VAS pain score. (I\*-immediate post operative, 1\*-post operative at 1month, 6\*- post operative at 6 months).

Of the 44 patients operated, 25 patients (56.8%) were able to return to job. 8 patients (18.2%) were able to return to their old job (table.8a). Among the 13 patient operated with paraplegia only 1 patient (7.7%) was able to return to work with job

modification and none of them were able to return to old job. But among 15 patients with paraparesis 12 (80%) were able to return to job (1 patient returned to the same job, rest 11 had to modify their job) (table. 8b).

Bowel was involved in only 12 patients, of which 4 patients improved after surgery (33.3%) and in the rest 8 patients symptom remained same. Bladder was involved in 14 patients of which 4 patients improved (28.6%) and rest 10 patients remained symptomatically same. There was no worsening of bowel or bladder symptom following surgery (Table 9).

Symptom	Outcome after surgery			
	Not involved	worsen	Same	Improved
Bowel	32	0	8	4
Bladder	30	0	10	4

**Table 9.** showing outcome of bowel and bladder symptom following surgery.

No significant relationship was found out between associated injuries or comorbidities to post-operative outcome.

Intraoperative complication like pedicle breakage was seen in 3 patients. Other intraoperative complications like nerve root injuries were not observed. Postoperative complications like surgical site infection was seen in only 2 patients, discitis/ abscess and DVT was observed in 1 patient each. Other postoperative complications like implant failure were not observed. Post-operative complaint most commonly observed was stiffness in back at the operative site and was present in 25 patients (56.8%).

## DISCUSSION

This retrospective study was done during the study period from 1<sup>st</sup> January 2019 to 31<sup>st</sup> December 2020, including 44 patients admitted for thoracic and lumbar spine fracture who had underwent posterior spine decompression and fixation. The study had 39 male patients (88.6%), with male to female ratio 7.8:1. The mean age of presentation was 44.30+/-11.87yrs and most common age group of presentation was 30-50 yrs (59% patients) this again point to the fact that traumatic fractures mainly affects physically active age group and population (males). In a similar study done by Hariri O R et al between 2005 to 2015 among 46 patients, 93%

patients were male and mean age of presentation was 36.8 years<sup>9</sup>. Another comparative study done by Petr V et al in thoraco-lumbar spine fractures among 35 patients, again had 28 male patients and mean age of presentation as 42.4years<sup>10</sup>.

As the study included only patients undergoing surgery for thoracic and lumbar fractures most common fracture type included in the study was burst fracture 43% (even though posterior element fracture and anterior compression fractures are far more common, as they are commonly managed conservatively, they are lesser in number in this study).

In the study population thoraco-lumbar junction (D10-L2) was the most commonly involved fracture level (56.8%), probably due to the relative instability of transition zone. In the study of 66 patients by Roop Singh et al from 2007 to 2011 had reported similar results with about 57.6% (38 patients) thoracolumbar fracture occurring at D12, L1 levels<sup>11</sup>. Petr Vet al again had reported 80% of thoracolumbar fractures from D12, L1 levels<sup>10</sup>.

Regarding the postoperative outcome the study showed improvement in ASIA impairment scale of 0.74 grade at 6 months postoperatively when compared with preoperative status. Among 43 patients followed up at 6 months (1patient lost in follow-up at 6month) no patients had deterioration in ASIA score. On post-operative follow up of 12 patients operated with preoperative ASIA grade A at 6 months only 3 patients remained at grade A , 4 patients each had improved to ASIA grade B and C, 1 patient to grade D and non to grade E (table.5). Among patients with paraparesis and paraplegic mean preoperative ASIA were 3.6 (ASIA grade C to D) and 1 (ASIA grade A). Their post-operative grade improved to 4.67 (ASIA grade D to E) and 2.25 (ASIA grade ~B) (table.4b). Although there was post-operative improvement in paraplegic patients, it was not up to functional levels. So, we can infer from the study that both paraplegic and paraparesis patient can have significant improvement in ASIA scale, but chance of paraplegic patients able to walk after surgery is rare. The study by Roop Singh et al among 66 patients also had similar observations with an improvement of average 1.03 grades in neurological status as per ASIA Impairment scale from the preoperative to final follow-up at one year<sup>11</sup>. Among 34 patients having preASIA grade A, 14 patients improved to grade B , 2 patients to grade D and non

to grade E. The study also showed that the patients having incomplete lesions of the spinal cord showed more neurological improvement (mean, 1.5 grade) than the complete lesion of the spinal cord (mean, 0.53 grade). Similar observations were reported in another study by Butt *et al*<sup>12</sup>.

When ASIA score was assessed in terms of fracture type, as expected patients with anterior wedge compression fracture had better preASIA score (mean preASIA=4.27, ASIA D to E) compared to patient with translational /distraction injury (mean preASIA=2.14, ASIA B to C). This may be due to severe canal compromise / spinal cord injury associated with translation/ distraction injury. But postoperatively there was significant improvement in ASIA score at 6months for translation/distraction injury (post ASIA6=3.15, ASIA C to D) (mean improvement=1.01 grade) and burst fracture (post ASIA6= 4.37, ASIA D to E) (mean improvement = 0.84 grade). So we can expect a significant neurological improvement even in patients with translational / distraction injury on doing decompression + fixation.

Patients with severe canal compromise were having preASIA score 1.62 (ASIA A to B) and with no/mild canal compromise were having preASIA score 4.38 (ASIA D to E). Here also post operatively patients with severe canal compromise were having significant improvement at 6month (post ASIA6= 3.00, ASIA C) (Mean improvement =1.38 grade). Similar improvement was seen in moderate canal compromise patients. So, we can expect a significant neurological improvement in patients with moderate to severe canal compromise, on doing decompression + fixation.

There was no significant relation between level of injury and ASIA score but patients with D7-D9 level injury tend to have preASIA score very low (mean pre-ASIA =1.67, ASIA A to B) and 6month post-surgery there was significant improvement (mean post ASIA6= 3.17, ASIA C to D). Alessandro L *et al* in their study have reported poor ASIA score common for thoracic level vertebra fracture<sup>13</sup>.

In our study, most of the patients underwent surgery within 4weeks of injury, (30 patients, 68.2%). For 14 patient surgery was done between 1-3 months duration (table.3d). Surprisingly there was no significant difference in improvement between early surgery group and late surgery group in terms of ASIA impairment scale. This is primarily because even in early surgery group most of the surgery were

done after 1 week (partly because of lack of facilities for emergency stabilization of the spine and due to patient reporting late because of ignorance on the part of the patient or due to late referral from other centers). But study done on 27 patients between 2004 to 2006 by Sahika L C *et al* have reported surgical decompression and stabilization within 8 hours of spinal cord injury had better outcome than when operated between 3 and 15 days<sup>14</sup>. In the study by Roop Singh *et al* the patients of early surgery group showed slightly better improvement in mean ASIA score (1.2 grade) than the patients who had underwent surgery late (0.95 grade), which was not a statistically significant difference<sup>11</sup>. Chadha *et al* and Butt *et al.* had also reported a fair neurological recovery in cases where surgery was done late<sup>12,15</sup>.

Compared to preoperative KPS score (mean PreKPS=39.8) there was significant improvement in mean post-operative KPS score at 1month (mean PostKPS1=64.8) and 6 months (mean post KPS6= 79.8) as 25 and 40 respectively. So, at 6months follow up on an average the patient in the study were able to carry out normal activity with signs and symptoms of disease (KPS=80). Similar results were seen in a study done by Mohsen K *et al* who compared the outcome after surgery and conservative management among 25 patients. In this study JOABPEQ (JOA Back Pain Evaluation Questionnaire) was used to assess the functionality in five domains including walking ability, lumbar function, low back pain, social life function and mental health at admission and at the interval of 3, 6, 12 months after treatment. In both surgery and conservatively managed patients there was improvement in outcome, but faster and better recovery was among post-surgery group<sup>16</sup>.

In our study fracture type and KPS score didn't have significant relation in preoperative period. Postoperatively at 6months KPS showed significant relation to fracture type with patients with anterior compression fracture having mean KPS score as 90.9, and those with translation / distraction injury having mean KPS as 66.2. So, even though there was improvement in KPS score in all types of fractures, anterior wedge compression fracture followed by burst fracture tend to have best improvement in terms of KPS score after 6months of surgery. In terms of canal compromise, pre-operative KPS for no/mild, moderate and severe were 46.3, 42.6 and 30.8 respectively which improved to 92.5, 83.9 and

63.3 at 6month post operatively. So, improvement in KPS score in no/ mild, moderate, severe canal compromise were 46.2, 41.3 and 32.5 respectively. So, there was better improvement in KPS score in mild and moderate canal compromise patients compared to severe canal compromise patients. These findings may be partly due to absolute bed rest advised for all patients prior to surgery, hence irrespective of fracture type and canal compromise preoperative KPS will be low for all, whereas postoperatively patients with less severe injury have far better improvement in KPS score.

Compared to preoperative status, postoperatively there was significant decrease in VAS pain scale - immediately post op, at 1month post op and at 6-month post op as 1.65, 4.88 and 6.7 respectively (table.4). VAS pain scale didn't find any significant relation in terms of fracture type, canal compromise both preoperatively as well as post operatively. Study by Rajdeep S B et al on 30 patients conservatively managed had mean VAS score of  $9.77 \pm 0.43$ , which decreased to  $2.03 \pm 0.90$  at the end of 2 years<sup>17</sup>. Study by Roop singh et al had quantified pain using Denis pain scale and found out 48.48% patient had mild to no pain, and 42.42% patient had moderate pain at 1 year follow up<sup>11</sup>.

Regarding outcome in terms of job, postoperatively at 6months follow up 19 patients (43.2%) were not having job, of which 12 were paraplegic initially itself.

Among 13 patient having paraplegia initially, only 1 returned to job (7.7%) with job modification, none of them were able to returned to same job. Whereas, of the 15 patients having paraparesis 12 (80%) of them returned to job, but 11 of them had to modify their job. In patients having no weakness, 11 patients (73.3%) were able to return to job, of which 7 patients (46.7%) were able to return to old job itself. So, paraplegia in initial presentation implies a very poor outcome in terms of job. Patients with no weakness or paraparesis in initial presentation tend to return to same job or to a modified job.

Study by Roop singh et al had reported 63.4% patients not returning to job (most of them were initially paraplegic) and 36.6% patients returning to work (half of them with job modification)<sup>11</sup>. Leferink et al. had reported, 50% of patients changed the intensity of their work or the kind of work they did, after thoracolumbar spine injury and treatment<sup>18</sup>.

Study by Briem D et al also had reported a low work capacity after thoracolumbar spine fractures<sup>19</sup>.

was involved in only 12 patients, of which 4 improved after surgery (33.3%) and rest 8 symptom remained same. Bladder was involved in 14 patients, of which 4 patients improved (28.6%) and for rest 10, symptoms remained same. There was no worsening of bowel or bladder symptom following surgery (table.7). So, there is around one third chance of improvement by surgical decompression when bowel and bladder is involved in thoracolumbar spine fracture. In literature review a study by Ping-Yeh Chiu et al among 8 patients from 2005 to 2012 with pure conus medullaris syndrome with thoracolumbar burst fracture, 5 patients regained self-voiding function<sup>20</sup>.

In our study no significant relationship was found out between associated injury or comorbidity to post-operative outcome.

Complications observed in the study were intraoperative pedicle breakage in 3 patients, postoperative surgical site infection in 2 patients, discitis/ abscess and DVT was observed in 1 patient each. Other complications like nerve root injury and implant failure were not seen. Though there was no implant failure reported in 6-month follow up (which may be an advantage of fixation of 2 levels above and below the spine fracture), most of the patients (56.8%) complaint of stiffness in back at operative site. In transpedicular screw fixation it is recommended to include two spinal levels above the fracture level and one or two levels caudal to the fracture level<sup>21</sup>. Such long segment spinal fixation might result in significant loss of mobility and increased risk for adjacent level morbidity. In an attempt to lessen the problem arising due to decreased mobility, short segment instrumentation has been introduced, fusing only two motion segments. But it also has come up with mixed results and complications<sup>22,23</sup>. On literature review the study by Butt MF et al.says more than 50% of patients had one or more complications, including 18 cases of hardware failures, involving 20 pedicle screws<sup>12</sup>. Complications reported in study by Roop Singh et al were single level above and below the fracture site was fused had only one implant failure such as nut loosening (asymptomatic), 4misplaced screws (in 3 patients -asymptomatic)<sup>11</sup>. Chadha et al had reported misplacement of the screw in 3 cases, one case of screw loosening and one screw pullout<sup>15</sup>.

## CONCLUSION

From this retrospective study, we can conclude that laminectomy and decompression of the spinal cord and posterior spine fixation 2 levels above and below, using polyaxial screws and rods is safe, reliable and effective method in the management of thoraco-lumbar fractures. There was significant improvement in ASIA impairment scale (mean improvement at 6months=0.74 grade) , KPS score (mean improvement at 6months= 40) and VAS pain scale (mean improvement at 6months= 6.7) at 6 months follow up after surgery.

Study was able to find out that the improvement in ASIA impairment scale was more in patient with severe canal compromise (mean improvement at 6months=1.62 grade), patients with translational/distractoin injuries (mean improvement at 6months= 1.01grade) and patients with paraparesis /paraplegia (mean improvement at 6months= 1.06/1.25 grade respectively).

Only one third patients with bowel and bladder involvement improved after decompressive surgery. Around 56.8% patients were able to return to job (either same job or with some modification) at 6 months follow up. Patients who were paraplegic at initial presentation, were mostly not able to return to job.

Most common reported complication in the study was intraoperative pedicle breakage.

## ABBREVIATIONS

ASIA - American Spine Injury Association Scale  
KPS - Karnofsky Performance Status Scale  
VAS - Visual Analog Scale  
MRI - Magnetic Resonance Imaging  
CT - Computed Tomography

## DECLARATIONS

Funding: self  
Conflict of interest: none declared  
Ethical approval: Obtained (IRB No.-61/2021)

## ACKNOWLEDGEMENTS

Dr. Shaju Mathew, Associate Professor, Department of Neurosurgery  
Dr. Vinu V. Gopal, Associate Professor, Department of Neurosurgery  
Dr. Philip Issac, Assistant Professor, Department of Neurosurgery  
Dr. Ajax John, Senior Resident, Department of Neurosurgery  
Dr. Tom Jose, Senior Resident, Department of Neurosurgery

Dr. Ahammed Shameel P, Senior Resident, Department of Neurosurgery

Dr. Amritha Subramonian, Senior Resident, Department of Neurosurgery.

## REFERENCES

1. Yue JJ, Sossan A, Selgrath C, et al. The treatment of unstable thoracic spine fractures with transpedicular screw instrumentation: a 3-year consecutive series. *Spine (Phila Pa 1976)* 2002; 27:2782-7.
2. Modi HN, Chung KJ, Seo IW, et al. Two levels above and one level below pedicle screw fixation for the treatment of unstable thoracolumbar fracture with partial or intact neurology. *J Orthop Surg Res* 2009; 4:28.
3. Alexandra C, William S, Dean C, Murat P, Vedat D, Sigurd B. Pathologic fractures. In: Frank P, Isador L, David P, editors. *Minimally invasive spine surgery: surgical techniques and disease management*. New York, NY: Springer; 2014: 377-393.
4. Shin TS, Kim HW, Park KS, Kim JM, Jung CK. Short segment pedicle instrumentation of thoracolumbar burst-compression fractures: short term follow-up results. *J Korean Neurosurg Soc* 2007; 42:265-70.
5. Kothe R, Panjabi MM, Liu W. Multidirectional instability of the thoracic spine due to iatrogenic pedicle injuries during transpedicular fixation. A biomechanical investigation. *Spine (Phila Pa 1976)* 1997; 22:1836-42.
6. Korovessis P, Baikousis A, Koureas G, et al. Correlative analysis of the results of surgical treatment of thoracolumbar injuries with long Texas Scottish Rite Hospital construct: is the use of pedicle screws versus hooks advantageous in the lumbar spine? *J Spinal Disord Tech*. 2004;17(3):195-205.
7. ASIA and ISCoS International Standards Committee. The 2019 revision of the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI)-What's new? *Spinal Cord*. 2019 Oct;57(10):815-817.
8. Schag CC, Heinrich RL, Ganz PA. Karnofsky performance status revisited: Reliability, validity, and guidelines. *J Clin Oncology*. 1984; 2:187-193.
9. Hariri O R, Kashyap S, Takayanagi A, et al. (March 09, 2018) Posterior-only Stabilization for Traumatic Thoracolumbar Burst Fractures. *Cureus* 10(3): e2296. DOI 10.7759/cureus.2296
10. Petr Vanek, Ondrej Bradac, Renata Konopkova, Patricia de Lacy, Jiri Lacman, Vladimir Benes. Treatment of thoracolumbar trauma by short-segment percutaneous transpedicular screw instrumentation: prospective comparative study with a minimum 2-year follow-up. *J Neurosurg: Spine / Volume 20 / February 2014* (pg 150-156).
11. Roop S , Rajesh KR , Kulbushan K , Narender KM , Kiranpreet K. Outcome of Pedicle Screw Fixation and Monosegmental Fusion in Patients with Fresh

- Thoracolumbar Fractures. *Asian Spine J* 2014;8(3):298-308.
12. Butt MF, Farooq M, Mir B, Dhar AS, Hussain A, Mumtaz M. Management of unstable thoracolumbar spinal injuries by posterior short segment spinal fixation. *Int Orthop* 2007; 31:259-64.
  13. Alessandro Landi, Nicola Marotta, Angela Ambrosone, Emiliano Prizio, Cristina Mancarella, Fabrizio Gregori, Giuseppe La Torre, Antonio Santoro, Roberto Delfini. Correlation Between Timing of Surgery and Outcome in ThoracoLumbar Fractures: Does Early Surgery Influence Neurological Recovery and Functional Restoration? A Multivariate Analysis of Results in Our Experience. *Trends in Reconstructive Neurosurgery* pp 231-238.
  14. Sahika Liva Cengiz , Erdal Kalkan, Aysegul Bayir, Kemal Ilik, Alper Basefer. Timing of thoracolumbar spine stabilization in trauma patients; impact on neurological outcome and clinical course. A real prospective (rct) randomized controlled study. *Arch Orthop Trauma Surg.* 2008 Sep;128(9):959-66.
  15. Chadha M, Bahadur R. Steffee variable screw placement system in the management of unstable thoracolumbar fractures: a Third World experience. *Injury* 1998; 29:737-42.
  16. Mohsen Koosha, Hossein Nayeb Aghaei, Hamid Reza Khayat Kashani, Sepideh Paybast. Functional Outcome of Surgical versus Conservative Therapy in Patients with Traumatic Thoracolumbar Fractures and Thoracolumbar Injury Classification and Severity Score of 4. A Nonrandomized Clinical Trial, *Bull Emerg Trauma* 2020;8(2):89-97.
  17. Rajdeep Singh Bagga, Arvind B Goregaonkar, Aditya Anand Dahapute, Saurabh R Muni, Sandeep Gokhale, Jitesh Manghwani. Functional and radiological outcomes of thoracolumbar traumatic spine fractures managed conservatively according to Thoracolumbar Injury Severity Score. *J Craniovertebr Junction Spine.* 2017 Oct-Dec; 8(4): 369-373
  18. Leferink VJ, Keizer HJ, Oosterhuis JK, van der Sluis CK, ten Duis HJ. Functional outcome in patients with thoracolumbar burst fractures treated with dorsal instrumentation and transpedicular cancellous bone grafting. *Eur Spine J* 2003; 12:261-7.
  19. Briem D, Behechtnejad A, Ouchmaev A, et al. Pain regulation and health-related quality of life after thoracolumbar fractures of the spine. *Eur Spine J* 2007; 16:1925-33.
  20. Ping-Yeh Chiu, Jen-Chung Liao. Surgical outcomes in thoracolumbar fractures with pure conus medullaris syndrome. *Biomed J.* 2019 Aug; 42(4): 277-284
  21. Cengiz SL, Kalkan E, Bayir A, et al. Timing of thoracolumbar spine stabilization in trauma patients; impact on neurological outcome and clinical course. A real prospective randomized controlled study. *Arch Orthop Trauma Surg.* 2008;128(9):959-966.
  22. Mahar A, Kim C, Wedemeyer M, et al. Short-segment fixation of lumbar burst fractures using pedicle fixation at the level of the fracture. *Spine.* 2007;32(14):1503-1507.
  23. McLain RF, Sparling E, Benson DR. Early failure of short-segment pedicle instrumentation for thoracolumbar fractures. A preliminary report. *J Bone Joint Surg Am.* 1993;75(2):162-167.