

## Evaluation of Neurological Recovery in Cases of Thoracolumbar Fracture with Paraparesis after Fixation and Decompression

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### Abstract

**Background:** The recent advances in management of Spinal Cord Injury (SCI) are born on evolving understanding of spinal mechanics, injury mechanics, improved instrumentation, better imaging modalities and better rehabilitative care. However management of thoracolumbar fractures remains controversial for many reasons. The purpose of this study was to assess the neurological recovery of patients with traumatic incomplete thoracolumbar spinal cord injury, who were treated by reduction, posterior stabilization and decompression at our centre.

**Material & Methods:** 36 patients with incomplete spinal cord injury treated with posterior pedicle screw fixation and decompression were included in the study. These patients were evaluated with American Spinal Injury Association (ASIA) Impairment Scale before and at 1, 2 and 6 months follow up after surgery.

**Results:** Out of total 36 patients, 22 were male and 14 were female. The mean age was 33.7 years. Neurological improvement in our series was more than one ASIA Impairment Scale (AIS) grade in 24 cases with 3 cases showing improvement of two ASIA grades.

**Conclusion:** Posterior decompression and pedicle screw fixation is an effective procedure to achieve early mobilisation and rehabilitation and the evidence indicates that it leads to improvement in neurological recovery in cases of incomplete SCI.

**Keywords:** Spinal Cord Injury, Thoracolumbar Fracture, Posterior Decompression, Pedicle Screw Fixation, ASIA Impairment Scale.

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### How to cite this article:

Khare A, Mishra PK, Uikey S, Maravi DS. Evaluation of Neurological Recovery in cases of Thoracolumbar Fracture with Paraparesis after Fixation and Decompression. *Ortho J MPC*. 2019;25(2):63-66.  
Available from:  
<https://ojmpc.com/index.php/ojmpc/article/view/85>



### Introduction

The recent advances in management of Spinal cord Injury (SCI) are based on evolving understanding of spinal mechanics, injury mechanics, improved instrumentation, better imaging modalities and better rehabilitative care. However management of thoracolumbar fractures remains controversial for many reasons. Firstly, to determine which injuries require operative treatment and which require non-operative treatment is difficult; secondly, to determine which is the best approach to be considered for the SCI when treated

operatively; and lastly, to determine whether surgical management should have a direct decompression or if indirect decompression is sufficient [1].

Similarly there has never been a clear consensus regarding the effectiveness of decompression and fixation in spinal cord injury. Several authors like Roy Camille (1986), Cotler et al (1986), Transfeldt et al (1990), Anderson et al (1993) and Rahimi-Movaghar et al (2005) have opined that operative intervention has benefits like early mobilisation and rehabilitation thereby

enhancing neurologic recovery [2-6]. Whereas several authors like Bohlman and Eismont (1981), Clark (1981) and Wood et al (2003) have opined that doing surgery has its own harmful effects on patients which outweigh the advantages [7-9].

Currently, the treatment of fractures of thoracolumbar spine is determined mainly by three factors which include, the morphology of the fracture, the neurology of a patient as it is an indicator of functional integrity of spinal cord, and which specific structures are injured [10]. Further till date, the role of decompression in patients with incomplete SCI is supported only by level III and limited level II evidence and there is no definite evidence to support the role of decompression in complete SCI [11].

Hence, in this study we attempt to look for the neurological recovery of patients with paraparesis due to traumatic incomplete thoracolumbar spinal cord injury treated by reduction, posterior stabilization and decompression.

## Material and Methods

A total of 36 cases of incomplete spinal cord injury presented to our casualty department during the two years 2017 to 2018 were included in the study. Institutional ethical clearance and proper informed and written consent from all the patients was taken before the study.

All patients between age group 18 to 70 years with traumatic fracture involving thoracolumbar spine with incomplete neuro-deficit (American Spinal Injury Association (ASIA) Impairment grades B, C and D) were included in the study. Patients with complete neuro-deficit (ASIA grade A), or pathological fracture were excluded from the study.

In all patients a detailed history and thorough examination was done evaluating pain, tenderness, motor examination, sensory and autonomic examination including assessment of bladder and bowel, etc. Initial ASIA grade was calculated according to American Spinal Injury Association (ASIA) Impairment and recorded and was revised daily.

After routine investigation and fitness, all patients were operated under general anaesthesia in prone position over bolsters, using posterior midline approach to spine. After insertion of pedicle screws posterior decompression was performed using laminectomy and finally fixation and distraction with rods was done to achieve correction of deformity (fig. 1).

Rehabilitation was started pre-operatively unless contraindicated by other injuries. Patients were given appropriate nursing care, active and passive physiotherapy, DVT prevention centripetal massage, bowel care (using biological bulk forming agents like isabgol / psyllium husk, laxatives were given if required), skin care, air/water mattresses (in patients with sensory loss), chest physiotherapy and psychological support. Regular bladder irrigation was done with mild antiseptic solution when self-retaining catheter was there for unavoidable reasons. Regular follow ups were done and at each follow up ASIA grade was analysed and recorded. Patients completing follow up of minimum 6 months were only included in the study.

Statistical analysis was done using Statistical Package of Social Science (SPSS Version 22; Chicago Inc., USA). Chi-square test was used to determine significant differences. Significance level was fixed at 95% confidence interval ( $P < 0.05$ ).

## Results

A total 36 patients with incomplete spinal cord injury with mean age 33.7 years (range 18 to 60) were included in study, out of which 22 were males and 14 were females. The most common mode of injury was fall from height found in 58% cases followed by motor vehicle accidents found in 36% cases. The mean injury to surgery interval was 14 days (range 5 to 40 days). Initial neuro-deficit as per ASIA score was D in 18 cases (50%), 8 cases (22%) had grade B and 10 cases (28%) had grade C.

After a follow up of 6 months the neurological status of 24 cases (67%) improved by more than at least one grade and 3 cases had improvement by two grades with p value 0.001 (table 1). Complications were found in 9

patients (25%), which included bed sore (14%), urinary tract infection (5%), deep infection (3%) and chronic backache (3%). All the complications were treated symptomatically.

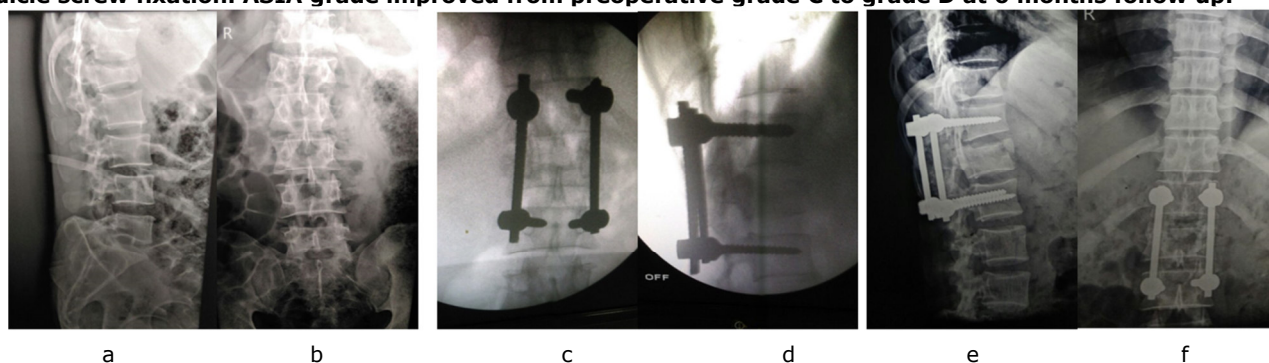
## Discussion

Spinal trauma presenting with neuro-deficit can lead to gross morbidity and disability. In spite of best treatment by decompression and fixation, the results of neurological recovery are inconsistent and unpredictable [12-13]. Jun et al (2011) showed 92 % improvement of at least one Frankel grade with an average of 1.7 grade improvement in thoracic and lumbar fractures treated using posterior decompression and fusion, whereas Lee et al reported only 53.6 % improvement [14,15]. Spiess et al (2009) reported 43.5% spontaneous improvement of more than one

ASIA grade in cases with incomplete spinal cord injury over a follow up period of one year without surgical intervention [16]. Thus it can be seen that historically different studies have observed variable percentage of improvement in cases of spinal cord injury.

In this study, we assessed the neural recovery in 36 patients of incomplete neuro-deficit following spinal trauma, treated by posterior decompression and pedicle screw fixation. Overall 66.7% of our patients had neurological improvement of at least one grade. 3 cases (8.3%) had improvement of two grades which was statistically significant ( $p = 0.001$ ). Thus our results were better than conservative treatment, but not as good as other surgical treatment studies groups. The probably reason for this difference could be late presentation of patients in our study.

**Fig 1. Pre-operative lateral (a) and AP (b) x rays, intraoperative fluoroscopic AP (c) and lateral (d) view and 6 months post op lateral (e) and AP (f) x rays for 45 years patient with fracture L1 treated by decompression and pedicle screw fixation. ASIA grade improved from preoperative grade C to grade D at 6 months follow up.**



**Table 1. Neurological improvement in the studied group as per ASIA grade**

ASIA grade		Post-operative					Total
		A	B	C	D	E	
Pre-operative	A	-	-	-	-	-	-
	B	-	3	4	1	-	8
	C	-	-	4	4	2	10
	D	-	-	-	5	13	18
Total		-	3	8	10	15	36

Transfeldt showed neurological improvement in 46.5% cases after delayed anterior decompression in spinal cord and cauda equina injuries of the thoraco-lumbar spine [4]. Anderson showed 92% recovery of incomplete paraplegia due to thoracic spinal injury when treated early with 14 days with surgical intervention [5]. In our series, we could operate these patients with mean delay of 14 days (range 5-40 days), which even after this delay showed 66% neural

improvement. This delay is attributable to a number of factors e.g. our patients were from rural background, had poor socioeconomic status, and were referred to our tertiary centre. Further, at our institute level there was delay in obtaining fitness from physician and anaesthesiologist along with late availability of implants. Studies by Anderson et al (1993) and Lee et al (2018) have operated patients within 24 and 8 hours respectively, whereas they have considered patients operated after 24 hours as late group [5,15]. It was not feasible for us to operate patients in such short duration due to various restrictions as mentioned above. In our series also, the patients who were operated early i.e. within a week had better recovery. This confirmed that the early surgical intervention definitely helps in neural recovery.

Our study as compared to larger studies in literature, may project erroneous results because our study is limited by late presentation and small number of patients. However, it still provides an insight into the prevailing situation of the disease process and its recovery pattern in general government hospital with average facilities.

### Conclusion

Our study indicates that operative intervention by decompression and pedicle screw fixation

done in cases of incomplete spinal cord injury has better chances of neurological recovery, although the definite answer to this question remains uncertain because of the lack of well-designed well executed randomized, controlled trials. But decompression and stabilization of spinal column fractures have several potential advantages: they allow early mobilization to prevent systemic complications of prolonged immobilization such as pulmonary infections, decubitus ulcers, thrombophlebitis etc, reduce the length of hospital stay, and improve rehabilitation.

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