

A Clinical Study of Dorsolumbar Spinal Fixation in Traumatic ParaplegiaAsman Ali^{1*}, Chintu Patowary²¹Associate Professor, Dept. of Neurosurgery, CN Center, Gauhati Medical College & Hospital²MCh Senior Resident, Dept. of Neurosurgery, CN Center, Gauhati Medical College & Hospital

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Abstract:

Background: Dorsolumbar segment known for having relatively more mobile compared to other segments of spine. Injuries to this area can result in instability and various neurological issues. The goal of treatment approach is to address dorsolumbar spine injuries by decompressing nerves early and stabilizing the affected segment through rigid internal fixation with pedicular screws. This combination of strategies aims to promote healing and restore stability to the spine.

Objective: The primary goal of the study is to prevent complications associated with traumatic paraplegia and stop further deterioration of neurological function by early mobilization to prevent complications and neural decompression to achieve neurological improvement.

Materials & Methods: It is a prospective study which was conducted in the Department of Neurosurgery, CN Center, Gauhati Medical College and Hospital from September 2022 to August 2023. In our study we included 50 patients (M:F=9:1), age group from 11-70 years (mean 41 years), <2 weeks post traumatic instability duration of lower thoracic or lumbar spine. All patients were surgically managed. Postoperatively patients were mobilized post op day 2 with rigid type thoracolumbar spinal brace. Postoperatively spinal support was used in all the cases for 1.5-2 months.

Results: Preoperative and postoperative neurological statuses of the patients were recorded as per Frankel grading. 74% recovery was noted in patients with incomplete neurological injuries of the cases; minimal changes were noted with complete neurological injury patients. All pre and post-operative complications like bed sore, superficial skin infections and intra operative dural tear were managed successfully.

Conclusion: The study showed satisfactory level of improvement of symptoms in selected group of patients, safe and effective with clinical and neurological improvement with acceptable level of cost with early Pedicular Screw and Rod Fixation for traumatic paraplegia for lower dorsal and lumbar spine injury.

Keywords: Dorsolumbar, Paraplegia, Spinal Fixation.

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Introduction

Thoracolumbar spinal injuries are most common because of the unstable zone between the fixed dorsal and mobile lumbar spine.[1] The treatment for thoracolumbar spine injuries with unstable fracture and fracture dislocation has been controversial.[2,3,4,5] With inter pedicular screws and rods fixation from posterior approach for one below and one above vertebra for stabilization was found to be the most effective method.

The treatment of thoraco-lumbar injuries aims to provide stable internal fixation over minimal spinal segments and optimal neural decompression at the injury site through anterior, posterior, or both approaches. Posterior approach is straight forward and less extensive. The pedicle screws are passed through the posterior approach, passing one level above and one level below the fractured vertebra. The study evaluated the use of pedicle screw

fixation for preserving spinal cord function, restoring alignment, achieving pain-free fracture sites, early mobilization, and maximum neurological recovery in paraplegic spinal injury patients.

In unstable spinal injuries pedicle screw and rod fixation provided all 3 column fixation (anterior, middle and posterior column) and reduce the length of fusion of spine.

Material and Methods**Study Setting**

The study was conducted retrospectively at the Department of Neurosurgery, Gauhati Medical College and Hospital, a reputed medical institution equipped with the necessary infrastructure to facilitate extensive research on dorsolumbar fracture.

Duration of the Study

This research encapsulated a span of 2 years, providing a substantial timeframe to gather, analyze, and interpret data pertinent to the clinical presentation and surgical outcomes of dorsolumbar fracture.

Sample Size

A total of 50 cases were selected for this study, ensuring a comprehensive analysis while maintaining a focus on detailed individual case evaluations.

Study Design

A retrospective study design was employed to scrutinize the medical records of patients who underwent pedicle screw and rod fixation for dorsolumbar fracture within the stipulated study period.

Data Collection

Medical Records Review

A meticulous review of medical records was undertaken to collect data on the clinical presentation and surgical outcomes of patients. The data sourced included:

1. **Demographic Information:** Age, gender, and other relevant demographic details of the patients.
2. **Clinical Presentation:** Details pertaining to the symptoms exhibited by patients at the time of presentation physical signs, and other relevant clinical indicators.
3. **Diagnostic Procedures:** Information on the diagnostic procedures employed, including imaging studies such as X ray both AP and lateral view, CT and MRI scans.
4. **Surgical Details:** Records of the surgical procedures, surgical techniques, and any intraoperative complications.

Surgical Outcome Evaluation

A thorough evaluation of surgical outcomes was conducted based on the following parameters:

1. **Post-operative Recovery:** Data on the immediate post-operative recovery of patients, noting any complications or adverse events.
2. **Long-term Outcomes:** Information on the long-term outcomes of the surgeries, including overall patient prognosis.

Data Analysis

Data obtained from the medical records were organized and analyzed using appropriate statistical tools. The analysis included:

1. **Descriptive Statistics:** Utilized to summarize the demographic data and clinical presentation of the patients.
2. **Outcome Analysis:** Employed to evaluate the surgical outcomes

Ethical Considerations

The study was conducted following the ethical guidelines pertaining to retrospective studies, ensuring the confidentiality and privacy of patient data at all stages of the research.

Results

It is a retrospective study which was conducted in the Department of Neurosurgery, CN Center, Gauhati Medical College and Hospital from September 2022 to August 2023. In our study we included 50 patients (M:F=9:1), age group from 15-65 years (mean 41 years), <2weeks post traumatic instability duration of lower thoracic or lumbar spine.

Patients were assessed for trauma mode, neurological status using modified Frankel's grading System, and any spinal deformity at the time of hospitalization. In all patients we assessed instability of spine using plain X-rays, anteroposterior and lateral views using Denis' 3-column concept.

For further evaluation and assessing important relationship, compression and instability of spine we did MRI of spine in all cases. Preoperatively outcome was explained to the patient and family members regarding the outcomes of the surgical treatment. All patients were managed through posterior approach with or without decompression by pedicular screw and rod fixation.

Laminectomy was done at the injured vertebral level. Bone fragments were saved to use as bone graft in some cases. The pedicle screws were inserted through pedicles into vertebral bodies, one level above and one level below the fractured vertebra under the C-Arm.

The wound was closed in layers and suction drain was used in all cases. Post operatively patients were treated with injectable antibiotics and analgesics for 5 days and patients were discharged with oral antibiotics for another 5 days.

All the patients were assessed postoperatively with X-rays on post op day 1. Physiotherapy and position change was done from the day of operation. Postoperatively patients with incomplete neurological deficit were advised to walk with spinal support from 2-3 weeks and patients were advised to withdraw gradually spinal support in 2 months.

Table 1: Demographic Characteristics of the Patients

Parameter	Frequency (n=50)	Percentage (%)
Age Group		
11-20 years	8	16%
21-30 years	14	28%
31-40 years	10	20%
41-50 years	8	16%
51-60 years	6	12%
61-70 years	4	8%
Gender		
Male	45	90%
Female	5	10%

The demographic data revealed that the majority of patients were in the age group of 21-30 years (28%), followed by those aged 31-40 years (20%). In terms of gender distribution, a notable predominance of males was observed, constituting 60% of the study population, as compared to 40% females. This distribution sets groundwork to analyse further data with respect to gender and age-specific trends.

Table 2: Clinical Presentation of Dorsolumbar fracture

Frankel Grading of Patients	Number of Patients	Percentage%
A	13	26%
B	20	40%
C	12	24%
D	5	10%
E	0	0

ASIA impairment scale (modified Frankel's grading System)

- **A**=Complete: No motor or sensory function is preserved in sacral S4-S5.
- **B**=Incomplete: Sensory but not motor function is preserved below the neurological level.
- **C**=Incomplete: Motor function is preserved below the neurological level (power<3).
- **D**=Incomplete: Motor function is preserved below the neurological level (power>3).
- **E**=Normal

Patients were assessed for trauma mode, neurological status using modified Frankel's grading System, and any spinal deformity at the time of hospitalization.

Table 3: Etiologies of Dorsolumbar fracture

	Number of patients	Percentage%
Fall from height	33	66%
Road traffic accident	14	28%
Fall of heavy objects	3	6%

Analyzing the etiologies revealed a variety in causative factors. Fall from height was the predominant cause, observed in 66% of the patients, followed by road traffic accident in 28% and fall of heavy objects in 6% patients.

Table 4: Types of Fracture

Types of Fracture	Number of Patients	Percentage
Wedge compression Fracture	31	62%
Burst Fracture	10	20%
Flexion Distraction injury	7	14%
Fracture dislocation	2	4%

Analyzing the types of fracture revealed wedge compression fracture was the most common type, observed in 62% of the patients, followed by burst fracture in 20%, flexion distraction type in 14% and fracture dislocation in 4% patients.

Surgical Technique:

All patients were operated in prone position with midline posterior approach under general anaesthesia. Intraoperatively injured site was localized with C arm guidance. During the

procedure mammary process of vertebra was considered as anatomical landmark for pedicles localisation and C-arm guidance was used for screw insertion through pedicles into vertebral body, above and below vertebra of the fractured vertebra. The rods were attached to the pedicle screws, thereafter indirect decompression was performed with a spinal distracter, whenever indicated to ensure that the disrupted soft tissue or bone fragments did not compress neural elements during the final reduction.[6] Adequate

decompression was done in all cases, in some cases if it was not possible because of bony fragment protruding into the spinal canal was reduced by horseshoe bone punch or curved periosteum

elevator. Fractured vertebra was stabilized by pedicle screw and rod fixation and to maintain good alignment of the spine.

Table 5: Surgical Details

Surgical Details	Frequency (n=50)	Percentage (%)
Type of Surgery		
Pedicle screw and rod fixation	50	100%
Intraoperative Complications		
CSF leak	2	4%
Superficial infection	5	10%

Surgical details showed a preference for Pedicle screw and rod fixation which was used in 100% of the cases. The standard technique was predominantly used, accounting for 100% of the surgeries. Encouragingly, 86% of the surgeries were accomplished without complications, while 10% experienced minor complications such as superficial infection and a mere 4% encountered major complications such as CSF leak. All of which were treated successfully.

Table 6: Length of Hospital Stay

Parameter	Frequency (n=50)	Percentage (%)	Mean ± SD (Days)
Hospital Stay Length			
1-5 days	9	18%	3 ± 1.2
6-10 days	34	68%	8 ± 1.8
11-15 days	7	14%	13 ± 1.1

The hospital stay duration mostly ranged between 1-10 days, with 68% of patients staying for 6-10 days and 18% for 1-5 days, showcasing a relatively short recovery period post-surgery.

The mean duration, with respective standard deviations, delineated that majority of the patients were discharged within a week's span, facilitating a quicker turnaround time for hospital bed availability.

Postoperative Care:

Postoperatively position change was done 2hourly in all the patients and physiotherapy was started from the same day with proper care of bowel and bladder.

Drain was removed after 48 hours. All stitches were removed on 11th or 12th days. Patients were allowed to sit as well as walk early within three weeks with spinal brace (Rigid type). The spinal brace was worn up to three months postoperatively in all patients and gradually withdrawn.



Figure 1: MRI lateral section burst fracture L1

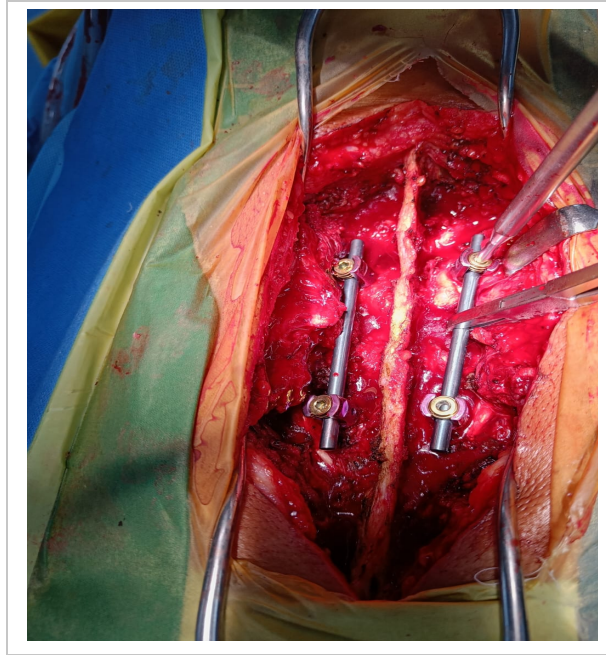


Figure 2: Intraoperative view of pedicle screw and rod fixation



Figure 3: Postoperative X-Ray Lateral view

There were 50 patients who were managed with pedicle screws for thoracolumbar injuries. There were 5 female and 45 male (1:9 ratios).^[78] The aged ranged from 11 to 70 years (mean age of 38 years).^[8] Wedge compression was the commonest in 31 patients (62%) whereas burst fracture was seen in 10 patients (20%). There were 7 flexion distraction injury fractures (14%), 2 fracture dislocation (4%).

The neurological status of the patients was examined and subsequent improvement was analyzed as per Frankel grading system. It was

observed the patients were progressively moving from worse grade to the better grade. 74% patients with incomplete neurological injury had neurological recovery in terms of ASIA impairment scale. However little neurological recovery was seen in 11 patients (22%) with Frankel Grading A (complete neurological injury).

Complications like superficial wound infections were seen in a few cases and preoperative dural tear was seen in one case. All of which were treated successfully. This study indicates that early short segment pedicular screw fixation is a safe and

effective method for treatment of spinal injury paraplegic patients.

Table 7: Surgical Outcomes after 6months

Frankel grading of patients	Follow up after 6 months	Percentage (%)
A	11	22%
B	3	6%
C	9	18%
D	21	42%
E	6	12%

Neurological recovery on ASIA impairment scale Observation

Postoperatively one patient had deep wound infection for which implant was removed and two patients developed bedsores which was treated successfully. One patient became severely depressed and required long term antidepressants. There was no mortality in this series.

The paraplegics having little neurological improvement as per Frankel Grading "A" could be mobilized with crutches and latissimus dorsi rehabilitation independently.

Discussion

The management of fractures in the thoracic and lumbar region has been controversial subject. Disadvantages of conservative treatment include deterioration in neurological status in 17% of the patients, progressive kyphotic deformity in 20%, persistent backache, decubitus ulcer and deep venous thrombosis.[9]

Most of these complications can be avoided by early mobilization and decreased hospital stay by early surgery.[10] The pedicular fixations are a strong point of attachment of the posterior elements to the vertebral body. Pedicle screw instrumentation is good option for traumatic spinal injury surgery.

Pedicle screw fixation is considered superior to other stabilisation constructs or para pedicular screws and is exceptionally rigid.[11,12] It has rapidly become one of the most popular instrumentation and gives good results for spinal injury cases. So pedicle screws fixation is becoming more popular and frequently used procedure for correcting deformity and stabilising the spine. Now-a-days, pedicle screw system is more acceptable and it provides better stability than other implants.[13,14]

Operative stabilisation consists of segmental distraction with pedicle screw fixation one level above and one level below the injured segment. By applying distraction, annulotaxis is exploited to aid in reduction of retro-pulsed bone and disc fragments. Similarly, pedicle screws have been shown to be superior to hooks and Hart shell fixation in spine.[13,14]

Conclusion

Thoraco-lumbar region is the most common affected in road traffic accidents and fall from height. Surgical treatment is a better option for early mobilization, faster and acceptable recovery. Pedicle screw fixation is a useful method, which provides reduction and stability in both anterior and posterior column injuries.

Further, it avoids anterior decompression and it does not immobilize long segment of spine. An early/immediate surgery in the form of pedicle screw fixation with decompression provides good results and better neurological recovery.

This study indicates that early short segment pedicular screw fixation is a safe and effective method for treatment of spinal injury in paraplegic patients.

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