

## Functional Outcome of Dorsolumbar Fractures Treated with Short Segment Stabilization Including Fractured Vertebra: A Prospective Observational Study

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### Abstract:

Spinal fractures are the major cause of disability in adult population. They are common due to high frequency of motor vehicle accidents and occupational injuries. The mortality rate following spinal injuries is 7%. The aim of the study is to assess the functional and radiological outcome of fractures of dorsolumbar spine treated with short segment posterior stabilization with fractured body pedicle screw fixation.

**Methods:** Dorsolumbar fractures with intact pedicle on the fractured segment with Load sharing classification score of equal or less than 5, Loss of vertebral height less than 50%, khyposis angle more than 20 degrees and neurological involvement are included in the study. Patient with multiple level fractures and pathological fractures are excluded from the study. AO classification and Denis classification were used. Load sharing score is used in Decision Making For Fracture Body Screw Fixation.

**Results:** L1 is the most common fracture involved followed by D12. AO distraction types and Denis burst types are the most common types. Among the 30 patients, 5 patient had complete neurological deficit, 15 patients had incomplete deficit and 10 patients without neurological deficit. None of the patient developed loss of correction in the follow up period. Outcome using Ronald Morris questionnaire was excellent in 65.2% cases good in 24.3% cases and poor in 10.5% cases.

**Conclusion:** To conclude short segment posterior stabilization with fractured body screw fixation provides better biomechanical stability when compared with conventional short segment stabilization.

**Keywords:** Dorsolumbar Fractures, Short Segment Stabilization, Fracture Body Screw Fixation.

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### Introduction

Spinal injuries constitute 7% of all fractures of which 90% of them occur in the dorsolumbar spine. With increase in number of motorized vehicles and increase in high energy violence due to road traffic accidents and occupational injuries the occurrence of spinal fractures and dislocations has increased drastically. These injuries occur most frequently in males with younger age group between 15 and 30 and usually present with neurological deficit. Fractures of spine can occur when the force acting on the spinal column exceeds its strength and stability. Common mechanism of injuries are road traffic accidents, fall from height and penetrating injuries. 90% of all fractures occur in the dorsolumbar spines mainly between D11 and L2. Neurological injuries are seen in almost

50% of these fractures. The recovery is dependent on the initial primary trauma and the early intervention. Clinical instability usually follows major disruption of vertebral bodies, discs, posterior ligamentous complex and facets. Radiographic signs of axial instability include vertebral body collapse and retropulsion more than one third of canal diameter combined with widened pedicles and laminar fracture. Translational instability is evidenced by more than 2.5mm transverse displacements between vertebral bodies. Angular instability is identified by abnormal spinous process widening combined with more than 50% anterior or lateral body collapse. A neurological deficit implies clinical instability because it usually results from major retropulsion or acute deformity in

the dorsolumbar spine. With recent advances in spine surgery there is a growing consensus that patient with clinical instability in any plane are best treated with surgical stabilization of the spine. Patients typically experience less pain and fewer complications and obtain better alignment than those treated by conservative means.

#### **Aim**

The objective of the study is to evaluate the functional and radiological outcome of short segment stabilization including the fractured vertebra in dorsolumbar spine fractures with or without neurological deficit.

#### **Methods**

This prospective study was conducted in Department of Orthopedics, Govt Theni Medical College, Theni from April 2021 to March 2023 for a period of 24 months.

#### **Inclusion Criteria**

Patients between ages 20 to 50 were included, patients with unstable dorsolumbar fractures between D11 and L2, Intact pedicle at least one side of fractured vertebra, more than 50% loss of vertebral body height, more than 50% canal involvement and kyphosis progressing to 20% and more.

#### **Exclusion Criteria**

Patients above 50yrs, osteoporotic patients, patients with fracture dislocations, and patients with broken pedicles on both sides of fractured body. All patients underwent preoperative X rays, computed

tomography (CT) and magnetic resonance imaging (MRI) to evaluate dorsolumbar fractures and the associated injuries. The load sharing score was calculated based on the scoring system described by Mc Cormack et al. The neurological assessment was done based on American spinal injury association (ASIA) classification criteria.

#### **Surgical Technique**

A standard posterior midline approach was performed (Fig 2); pedicle screws were inserted into the vertebra cephalad and caudal to the fracture. The length and width of the screw was determined according to the size of the vertebra. The intermediate screw was inserted in the fractured vertebra with intact side of pedicle. Fractures with neurological deficits or more than 50% of canal compromise, decompressive laminectomy was performed. Anterior surgery was not performed in any of our patients. Patients without neurological deficits were treated with indirect decompression alone.

#### **After Surgery**

Sutures were removed after 10 to 12 days. Dorsolumbar braces were given or 3weeks. All patients were periodically followed up with clinical and radiological evaluations (Fig 3). Radiographs were taken at 3,6,9,12 and 24 months.

Ronald Morris questionnaire was used to evaluate the outcome of the treatment.



**Figure 1: L1 Vertebral Fracture**



Figure 2: Intraoperative image

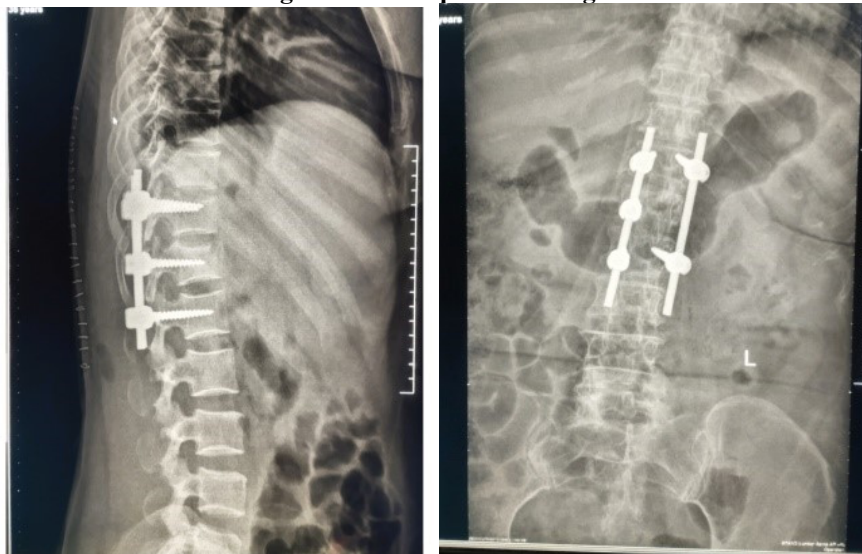


Figure 3: Post operative x ray

**Results**

**Table 1: Sex Distribution**

Sex	Number of patients	Percentage
Male	23	76%
Female	7	24%

**Table 2: Age group distribution**

Age Group	Number of patients	Percentage
21-30	8	27%
31-40	13	43%
41-50	9	30%

**Table 3: ASIA classification**

ASIA classification	Number of patients	Percentage
ASIA A	5	17%
ASIA B	12	40%
ASIA C	2	7%
ASIA D	1	3%
ASIA E	10	33%

**Table 4: Vertebra involved**

Vertebral level	Number of patients	Percentage
D10	2	7%
D11	6	20%
D12	10	33%
L1	12	40%

**Table 5: Parameters corrected**

Parameter	Preoperative (Mean± SD)	Correction (Mean ± SD)	Loss after follow up (Mean)
Kyphotic angle	23 ± 7°	8± 5°	2.3°
Wedge angle	20±5°	9 ± 5°	1.2°
Anteriorvertebral height	15±4 mm	25±3mm	1mm
Posterior vertebral height	23±3 mm	25± 3mm	0mm

**Table 6: Outcome**

Ronald Morris questionnaire	Percentage
Excellent	65.2%
Good	24.3%
Poor	10.5%

In our study 30 patients were included with age ranged from 20 to 50 years. The mean age was 35 years. (Table 2). The male: female ratio was 3:1. (Table 1). The mean follow-up time was 21 months ranging from 18 to 24 months. All patients underwent surgery within a week, the mean duration for surgery was 48 to 72 hrs from the time of admission.

Posterior stabilization without laminectomy was performed in 12 patients (all ASIA –B) (Table 3) and posterior decompressive laminectomy was performed in 18 patients with neurological deficits. The mean operating time was 90 minutes. The mean blood loss was 250 to 300 ml. The mean duration of hospitalization was 7 to 10 days.

Among the dorsolumbar fractures L1 was the most common affected vertebra(n-12) followed by D12 (n-10), D11 (n-6) and D10 (n-2)(Table 4).10 patients had normal neurology (ASIA-E),15 had incomplete deficits(ASIA –B,C and D) and 5 had complete deficits.

Patient with complete neurological deficit did not show any recovery, 4 ASIA –B patient improved to ASIA –C. 6 ASIA –C patients improved to ASIA-E. The remaining ASIA-C patients improved to ASIA-D.

One patient had postoperative superficial wound infection and responded to antibiotics. One patient had postoperative implant failure observed at the 12<sup>th</sup> month follow up which was removed later. The mean preoperative kyphotic angle was 23 ± 7° which improved significantly to 8± 5° in the postoperative period. A mean loss of 2.3° was observed on the final follow-up. The mean preoperative wedge angle was 20±5° which was corrected to 9 ± 5° during the post operative period. A loss of mean 1.2° occurred during the follow-up period. The mean anterior vertebral height was 15±4 mm whereas the value was 25±3mm in the adjacent vertebra. The parameter improved to 23±3 mm during the immediate follow-up period. The mean posterior vertebral height was 23±3 mm, whereas the value was 26±3mm in the normal adjacent vertebra. After surgery the mean height improved to 25± 3mm, the height restored until the final follow-up.(Table 5).

Outcome using Ronald Morris questionnaire was excellent in 65.2% cases, good in 24.3% cases and poor in 10.5% cases (Table 6).

### Discussion

Short segment stabilization has become the most common method of treating unstable dorso lumbar

fractures, i.e., fixing pedicle screws one level above and one level below the fractured vertebra.

This technique is advantageous because of its decreased involvement of motion segments compared to long segment stabilization. Since the approach is simple, familiar the complications are less when compared to anterior surgeries. However, this technique has been criticized because of the risk of implant failure and progression to kyphosis. The outcome has been attributed to defective anterior weight bearing column of spine.

Similar studies conducted by various authors, i.e. inclusion of intermediate screws at the fracture level in both short segment and long segment stabilization has proven that fracture level fixation has lowered the risk of implant failure and kyphosis correction and increased the stability of the construct and protected the fractured body from anterior load.

The use of intermediate screws provided the effect of three-point fixation of the fractured segment and better pull out strength because of additional fixation point provided. The procedure also provides anatomic continuity which is usually preserved between the pedicles and the articular process or pars interarticularis. Therefore, the screws holding the pedicles are not floating, and can transmit load to the adjacent vertebra through the posterior elements.

Before the development of load sharing classification various classifications had been used. The LSC was developed by Mc Cormack et al. [14] to identify fractures that required additional anterior reconstruction. The authors observed that anterior reconstruction is essential in patients with LSC scores of 7 or more to prevent implant failure. In our study 80% of patients had LSC values of 7 and underwent short segment stabilization including intermediate screws in fractured vertebra and had good results. One patient had implant failure after 12 months.

In our study we have observed that short segment stabilization combined with fracture body screw fixation provided better intra operative correction and maintenance than short segment stabilization without fracture level screws.

### Conclusion

Posterior stabilization with pedicle screw fixation is an effective method for restoring the near normal anatomy of the injured spinal column. The conventional short segment stabilization i.e. fixing one level above and one level below the fracture body had high failure rates. Short segment stabilization with additional screw in the fractured vertebra provides better biomechanical stability. This

technique restored the collapsed vertebral body height, prevents future kyphosis, provides additional stability, prevents further anterior procedure in patients with severe anterior column injury and also reduced the number of motion segments fused thereby provides a better functional outcome. The radiological correction achieved is maintained even at the end of 2 years which reflected a good functional outcome without additional complications. Hence, we recommend the insertion of screw into the fracture vertebra of dorsolumbar vertebra when planning for short segment stabilization.

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