



A PROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF UNSTABLE DORSO LUMBAR SPINE FRACTURE TREATED BY POSTERIOR STABILIZATION WITH PEDICLE SCREW FIXATION

Orthopaedics

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ABSTRACT

Introduction: Dorso-lumbar spine fractures are among the most common spinal injuries due to high-energy trauma such as falls and road traffic accidents. These injuries often result in significant morbidity and neurological deficits if not managed appropriately. **Aim:** To Study and evaluate the functional outcome of Dorso-lumbar spine fractures treated by posterior stabilization with pedicle screw fixation. **Material and Methods:** This study includes 50 patients attending the emergency department at Pacific Institute of Medical Sciences Udaipur and diagnosed as Dorso lumbar spine fractures. The following data were collected: detailed history of trauma, pre-operative clinical status, intra operative complications, post-operative clinical status, post-operative complications, duration of stay in the hospital, early ambulation of the patient, patient satisfaction, cost effectiveness, loss of work days and post-operative long term follow up. **Results:** The present prospective study evaluated the functional and radiological outcomes of dorso-lumbar spine fractures treated with posterior stabilization using pedicle screw fixation in 50 patients. The mean age of patients was approximately 38 years, with a male predominance (around 64%). The most common mode of injury was fall from height (68%), followed by road traffic accidents (32%). The thoracolumbar junction was most frequently involved, with D12 being the most commonly fractured vertebra, followed by D11. In terms of fracture morphology, Type A fractures were the most common. Neurological assessment using Frankel grading showed that patients with complete neurological deficit (Frankel A) did not demonstrate improvement. However, patients with incomplete deficits showed significant recovery: a majority of Frankel C and D patients improved to higher grades, with many achieving normal neurological status (Frankel E). Importantly, no patient experienced postoperative neurological deterioration. Radiological outcomes demonstrated significant improvement. The mean preoperative Beck's Index improved from 0.607 to 0.72 at one-year follow-up, indicating restoration of vertebral body height. Similarly, the regional kyphotic angle improved from 16.56° preoperatively to 10.44°, with a mean correction of 6.12°, reflecting effective deformity correction. Functional outcomes were favorable. According to the Denis Pain Scale, 44% of patients were pain-free, while 36% experienced only occasional pain without requiring medication. Based on the Oswestry Disability Index, a substantial proportion of patients returned to their previous work, although some required modifications or experienced limitations. Postoperative complications were relatively minimal and manageable. Superficial surgical site infections, bedsores, and urinary tract infections were noted but treated effectively without long-term sequelae. Overall, posterior pedicle screw fixation provided excellent stabilization, significant neurological recovery in incomplete injuries, effective deformity correction, and good functional outcomes, supporting its role as a reliable treatment modality for dorso-lumbar spine fractures. **Conclusion:** Early evaluation of fracture and the neurological status, appropriate planning and adequate fixation at the earliest can benefit the patient in neurological recovery, reducing the fracture pain and mobilizing the patient early thereby preventing complications. Thus, Posterior stabilization with pedicle screw fixation is an excellent option for stabilizing Dorso-lumbar spine fractures.

KEYWORDS

Thoraco-lumbar Spine Fractures, Pedicle Screw Fixation, Posterior Stabilization, Kyphotic Angle, Beck's Index.

INTRODUCTION

Spine fractures are leading problem in today's world, where the life style of the individuals make them prone for the injury. It is one of the common problems encountered in orthopaedic practice. Fractures of the thoracolumbar spine are the major cause of disability in the adult population. Apart from disability it produces to the individual, it also produces socio-economic burden to the country. Spine fractures are common occurrences in polytrauma patients. At least 65 to 80% of spine fractures are seen in thoraco-lumbar region [1]. Common causes of spine fracture include fall from height, motor vehicle accident/collision, direct assault etc. They can range from mild anterior wedge compression to burst fracture, translation or distraction injuries depending on mode of injury and force, bone quality of the patient etc. Roughly 20% of spine fractures will present with neurological deficit. [2] Mortality in paraplegic patients at the end of 1 year is around 4% due to various morbidity related causes. [3] Elderly patients suffer more neurological injury than younger patients and also have a poorer outcome making age a predictive prognostic factor. High energy trauma such as fall from height, road traffic accidents are the most common cause for the fractures. Bimodal distribution is classical of thoracolumbar injuries. It peaks among males less than 30 years of age and in the geriatric population. 1-year mortality rate of patients with paraplegia or other catastrophic spinal cord injuries is 7%, which makes these injuries a serious problem of the country. Spine fractures constitute about 6% of all fractures. Fractures involving thoracolumbar region have a bimodal distribution involving active young individuals (usually males, less than 40 years) due to high energy trauma or older age group years (usually females, above 50 years) due to trivial trauma in osteoporotic bone. [4] However, most of the osteoporotic fractures in elderly are not diagnosed as they cause

compression type of fractures and usually without a neurological deficit. And even after being diagnosed most of such fractures are treated conservatively. Most of the fractures in thoraco-lumbar region involves vertebra D11, D12, L1 and L2 vertebra. This is because the thoracic spine is kyphotic, rigid and stabilized with ribs while the lumbar spine is lordotic and mobile. This transition zone is weak, thus experiencing more biomechanical stress and results in fracture when subjected to trauma. [5] Thoracic spine is stabilized by the rib cage which makes it rigid. On the other hand, lumbar spine is more mobile. These two are connected at this segment. During trauma, biomechanical stress experienced by this segment is higher than the rest of the spinal column. This explains the reason for its high frequency of involvement in fractures. Around 60% of the spinal injuries affect the thoracolumbar segment which is second most common segment in spine fractures after cervical spine. Neurological injury is seen in approximately 15 to 20% of these patients. The following anatomical reasons make the thoracolumbar transition susceptible to injury. The transition is from a rigid thoracic kyphosis to a mobile lumbar lordosis, which occurs at the level of T11 to L2. Patients with mild degree of compression fractures without much deformity or displacement and no neurological deficit can be treated conservatively. Whereas, patients with neurological deficit and unstable fracture morphology may need surgical treatment. The treatment options for thoracic and lumbar spine injuries have long been controversial. Non-operative treatment was advised by most authors, but later reports emphasized the advantage of Open reduction and internal fixation. Although neurological improvement is independent of treatment modality, surgical decompression and stabilization has shown advantage of improving neurological deficits. Concert is evolving for stabilization of unstable spine, with fusion and

instrumentation. Internal fixation and stabilization has the advantage of early mobilization of all the patients, protects the neurological structures from further injury and enhance their recovery. In pedicle screw system, the screw is passed through the force nucleus of the vertebra which provides a stronger fixation. Posterior decompression and stabilization with pedicle screw fixation are done in such cases. This increases the chances of improving the neurological status of the patient. Surgical stabilization of the spine also helps to mobilize the patient early with better nursing care and thereby reducing the morbidity and mortality associated with prolonged bed ridden patients. 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.

MATERIALS AND METHODS

This prospective quasi-experimental study was conducted in the Department of Orthopaedics at Pacific Institute of Medical Sciences (PIMS), Udaipur, over a period of 18 months from April 2024 to October 2025, after obtaining institutional ethical clearance. A total of 50 patients with dorso-lumbar spine fractures were included in the study. Patients aged between 18 and 50 years with unstable thoracolumbar fractures, with or without neurological deficit, and a Thoracolumbar Injury Classification and Severity Score (TLICS) ≥ 4 were included. Patients with pathological fractures, pre-existing spinal deformities, injuries at other spinal levels, or those unfit or unwilling for surgery were excluded. All patients underwent detailed clinical and neurological evaluation using the ASIA Impairment Scale and Frankel grading. Radiological assessment included X-rays (AP and lateral views), CT scan for fracture morphology, and MRI to assess spinal cord and ligamentous injuries. Preoperative parameters such as regional kyphotic angle and Beck's Index were calculated. After initial stabilization, patients received intravenous methylprednisolone as per NASCIS III guidelines when indicated. All patients underwent posterior stabilization with pedicle screw and rod fixation under general anesthesia in the prone position. Pedicle screws were inserted into the vertebrae above and below the fracture, with or without inclusion of the fractured vertebra, under fluoroscopic guidance. Rods were contoured and fixed to achieve stabilization and deformity correction. Postoperatively, patients received antibiotics, early mobilization, and physiotherapy. Neurological status was reassessed periodically. Patients were followed up at regular intervals up to one year. Functional outcomes were evaluated using the Denis Pain Scale and Oswestry Disability Index (ODI), while radiological outcomes included assessment of kyphotic angle correction and Beck's Index. Postoperative complications were also recorded and managed accordingly.

RESULTS

In this prospective interventional study done at the department of Orthopaedics in Pacific Institute of Medical Sciences Udaipur, between April 2024and October 2025. The following observations were made.

Table no. 1: Age of the patients

AGE (In Years)	NUMBER OF PATIENTS	PERCENTAGE
<=20	4	8%
21-30	22	44%
31-40	11	22%
41-50	9	18%
51-60	3	6%
61-70	1	2%
Total	50	100 %

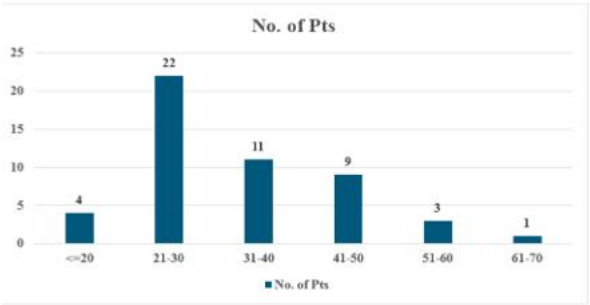


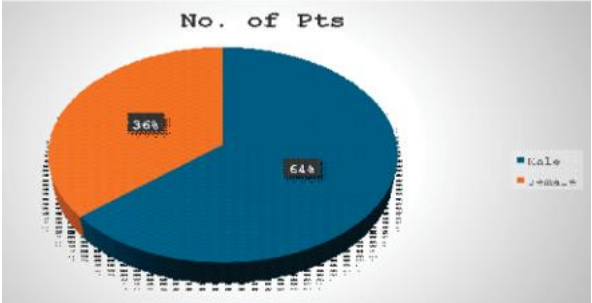
Chart 1 Age of the patients

In our study the most common age group involved was between 21 – 30 years which included 22 patients (44%). The youngest patient was 17 years and the oldest was 62 years of age. The mean age was 38.4 years. The table below shows the age wise distribution of patients.

Table No. 2: Gender wise distribution

Gender	NUMBER OF PATIENTS	PERCENTAGE
Male	32	64%
Female	18	36%
Total	50	100%

Chart 2: Gender wise distribution

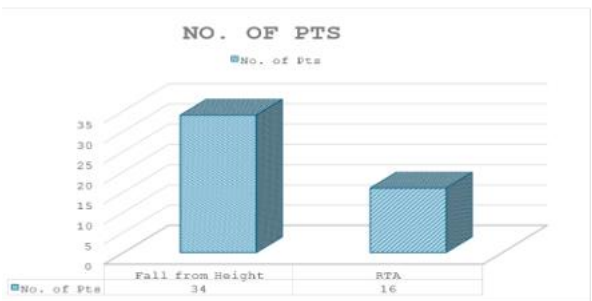


In our study, 32 patients were male (64%) and 18 (36%) patients were female.

Table No. 3: Mode of Injury:

MODE OF INJURY	NUMBER OF PATIENTS	PERCENTAGE
Fall from Height	34	68%
Road Traffic Accident	16	32%
Total	50	100%

Chart 3: Mode of Injury:

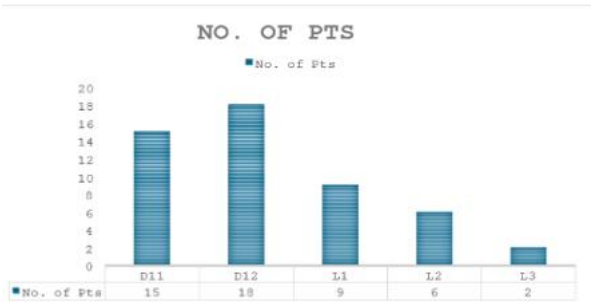


The most frequent mode of injury was fall from height in 34 patients (68%) followed by RTA (road traffic accidents) in 16 patients (32%).

Table no.4: Level of injury

VERTEBRAL BODY LEVEL	NUMBER OF CASES	PERCENTAGE
D11	15	30%
D12	18	36%
L1	9	18%
L2	6	12%
L3	2	4%
Total	50	100%

Chart 4: Level of injury

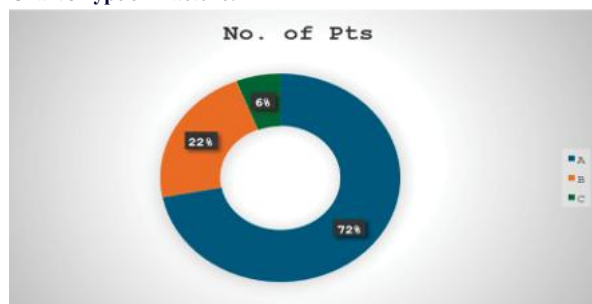


The most commonly fractured vertebra was D12 and number of patients were 18(36%) followed by D11 and number of patients were 15(30%). The least commonly fractured vertebra in this study was L3 and number of patients were 2(4%).

Table no.5: Type of Fracture:

TYPE OF FRACTURE	NUMBER OF CASES	PERCENTAGE
A	36	72%
B	11	22%
C	3	6%
Total	50	100%

Chart 5 Type of Fracture:

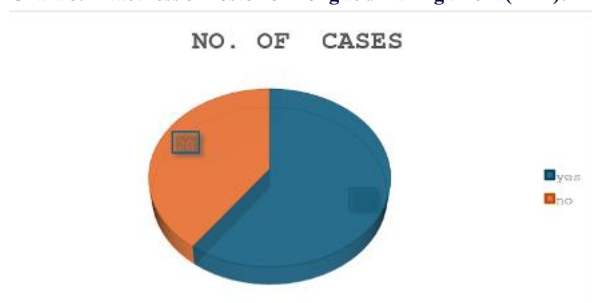


Majority of the cases has Type-A fracture of vertebra seen in 36 cases (72%) followed by Type-B fracture in 11 cases (22%). Only 3 case in our study had Type C fracture (6%).

Table no.6: Intactness of Posterior Longitudinal Ligament (PLL):

PLL STATUS	NUMBER OF CASES	PERCENTAGE
PLL intact	30	60%
PLL not intact	20	40%
Total	50	100%

Chart 6: Intactness of Posterior Longitudinal Ligament (PLL):



Posterior longitudinal ligament (PLL) was intact in 30 (60%) patients and was destroyed in 20 (40%) patients.

Table no.7: Neurological status: Pre-operative and Postoperative and neurological status of patients

Frenkel Grading	Preoperative	3 months Post operative	6 months post operative	1-year Post operative
E	24	30	36	40
D	11	6	2	1
C	9	8	6	3
B	0	0	0	0
A	6	6	6	6
Total	50	50	50	50



Chart 7: Neurological status:

The pre-operative and post-operative neurological status of all the patients were analysed with ASIA scale and Frankel Grading. The following table shows the preoperative, 12 weeks post-operative and 1-year post-operative neurological status of all cases operated.

Table no.8: Beck's Index/ Sagittal Index:

Pre-operative	0.607
12 Weeks - post operative	0.73
1-year post-operative	0.72

The mean pre-operative Beck's index was 0.607, which improved to 0.73 at 12 weeks post-operatively and to 0.72 at 1 year post-operatively. Comparison of Beck's index pre- and post-operatively

Table no.9: Regional Kyphotic Angle:

Pre-operative	16.56°
12 Weeks - post operative	10.28°
1-year post-operative	10.44°

The mean pre-operative regional kyphotic angle was 16.56° which reduced to 10.28° at 12 weeks post-op and to 10.44° at 1 year post-operatively.

Comparison of Regional Kyphotic angle pre- and post-operatively.

Table no.10: Functional outcome based on Oswestry Disability Index Scale (ODI)

Oswestry Disability Index Scale (ODI)	No. Of Patients	PERCENTAGE
0-4	21	42%
5-14	17	34%
15-24	3	6%
25-34	3	6%
35-50	6	12%
Total	50	100%

According to Oswestry Disability Index Scale (ODI), 21 patients (42%) returned to their previous work/ heavy work, 17 patients (34%) were able to return to previous sedentary work or heavy work with restrictions, 3 patients (6%) were unable to return to previous work but were able to return to new sedentary work, 3 patients (6%) were unable to return to full time work and 6 patients (12%) were completely disabled and could not return to any work.

Chart 8: Functional outcome based on Oswestry Disability Index Scale (ODI)

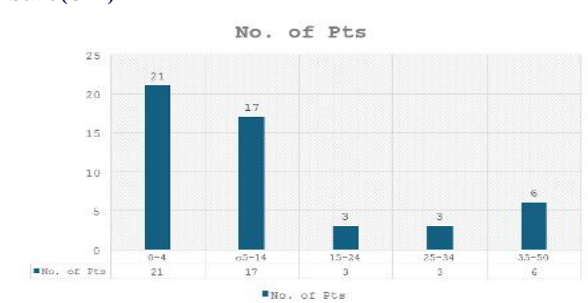


Table no.11: Post-operative Complications:

Complications	NUMBER OF CASES	PERCENTAGE
Nil	35	70%
Pressure sore	6	12%
Superficial infection	5	10%
Urinary Tract Infection	4	8%

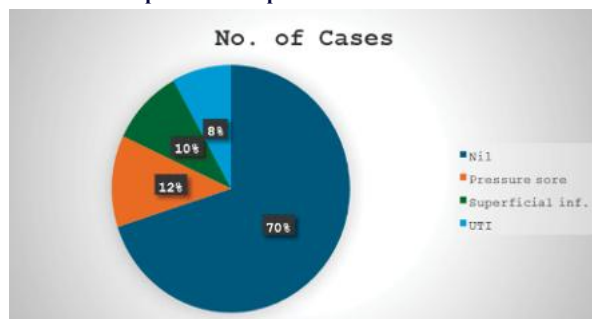
During the post-operative period, 5 patients developed superficial surgical site infection. They had mild discharge from wound site along with oedema and pain. For both these patients, IV antibiotics were started and regular dressing was done. Pus culture and sensitivity was sent from wound site and were managed accordingly.

Six patients developed bedsore that was identified early and treated by air-bed and frequent position change educating the patient's relatives and care givers.

Four Patients developed urinary tract infection who were on complete

bladder drainage with Foley's catheter as they had poor bladder control. Bladder wash was given and catheter was changed. Appropriate antibiotics were given based on the urine culture and sensitivity and responded well to treatment.

Chart 9: Post-operative Complications:



Associated injuries:

Since most spine fractures occur due to fall from height, multiple fractures are a common occurrence. Fracture of calcaneum is very commonly associated with spine fractures.

In our study, 3 patients had unilateral fracture of calcaneum and 5 patients had bilateral fracture of calcaneum. of these 8 cases, 5 were managed conservatively with below knee slab and 3 patients was operated and calcaneum was fixed.

Three patients had superior and inferior pubic rami fracture which was also conservatively managed. 3 patients had fracture of both bones of leg, which was operated and ILN tibia was done.

Associated Injuries	No. of Cases
Unilateral Calcaneum fracture	3
Bilateral Calcaneum fracture	5
Superior and inferior Pubic rami fracture	3
Both bones fracture leg	3

DISCUSSION

Injury to the spine have been known to mankind since ancient times. Various treatment options have evolved in treating a fractured spine by non-operative and operative methods. The incidence has increased in recent times due to industrialization, high speed motor-vehicles and work place associated injuries. About 5 to 10% of polytrauma patients attending emergency department suffer a spinal fracture. Out of this 65% to 80% occur at the Dorso-lumbar junction. D12 to L2 are the most commonly involved vertebral levels. Approximately 20% of these patients may develop some form of neurological deficit. Hence, treating a Dorso- lumbar spine fracture by appropriate means is essential to help in preventing neurological deficit or to rehabilitate the patient.

The main goals of treatment should be

- (1) Restoring the anatomy and decompressing the spinal cord,
- (2) To prevent new onset or worsening of neurological deficit,
- (3) To help improve the neurological status of the patient,
- (4) Mobilize the patient at the earliest so that complications (like bedsores, DVT, Pulmonary infections etc.) associated with prolonged bed rest can be avoided,
- (5) Rehabilitate the patients to near pre-injury levels as much as possible.

Simple fractures without much compression over the spinal cord, neurological deficit and without instability can be treated conservatively. On the other hand, fractures that have caused a neurological deficit, unstable and displaced fractures often require fixation.

The most common fixation technique currently being followed for a Dorso-lumbar spine fracture is posterior stabilization with pedicle screw fixation.

In our study, the decision to operate a spine fracture was based on Thoraco- lumbar injury classification and severity score (TLICS). In our study all patients included were operated and posterior stabilization with pedicle screw fixation was done. Pedicle screw fixation will stabilize the fractured segment, will indirectly decompress the spine and also maintains the sagittal alignment of

spine. If needed, in very unstable fractures, we used a screw at the fractured vertebrae in the intact pedicle.

The average age of patients included in the study was 38.4 years. When comparing with other studies, the average age of fracture and fixation was 38 years in Ahmed M Salam et al, 2019 [27], 36.8 years in AWY Yung et al, 2013 [28], 41 years in Himanshu Rohela et al, 2020[29]. We can see that the average age of incidence is comparable to other studies and is common in middle-age population.

In our study, males were more affected than females. Out of 50 cases, 32 (64%) were males and 18 (36%) were females. Comparing the age-wise distribution with other studies are given in the table below.

Comparing the age-wise distribution in various studies.

Study	Males (%)	Females (%)
Our study	64%	36%
Quan M. Zhao et al, 2015 [28]	65.6%	34.4%
Ambrose W Y Yung, 2011[17]	78%	22%
Mohammed Mustafa Adawi et al, 2019 [20]	72%	28%
Shailendra Khare, 2013 [19]	76%	24%

The most common mode of injury in current study was fall from height in 34 patients (68%) and Road traffic accident in the remaining 16 patients (32%). Comparing with other studies, most common mode of injury was fall from height seen in 60% cases in Shailendra Khare et al, 2013 [19], 62.5% in Mohammed Mustafa Adawi et al, 2019[20], 65% in Himanshu Rohela et al, 2020[18] and 69% in Razak et al [21].

The most common level of injury in our study was D12 in 36% of the cases, followed by D11 in 30 %. Comparing with other studies the most common levels to be involved in fracture of Dorso-lumbar spine is D12 and L1 followed by L2 vertebra. Comparison showing the level of injury with other studies is shown in the table below.

Comparing the level of injury with other studies

Study	D11	D12	L1	L2	Others
Our study	30%	36%	18%	12%	4%
Ahmed M Sallam et al, 2019 [16]		23%	37.7%	29.6%	10.1%
Marco Cimatti et al, 2013 [22]	6.25%	18.75%	50%	12.5%	12.5%
Ambrose W Y Yung, 2011[17]	5.3%	10.5%	26.3%	36.8%	21.1%
Farrokhi et al, [23]		34.2%	57.9%	7.9%	

The fracture classifying according to AO classification, type A was most common in 72% in our study, followed by type B in 22% and type C in 6% of the cases. The table below shows the comparison of fracture type between various studies, which also shows type A as most common type.

Comparison of type of fracture

Study	AO- Type A	AO- Type B	AO- Type C
Our study	72%	22%	6%
Mohammed Mustafa Adawi et al, 2019[20]	72.3%	16.6%	11.1%
Marco Cimatti et al, 2013 [22]	87.5%	12.5%	

The average kyphotic angle pre-operatively was 16.56° pre-operatively which improved to 10.28° at 12 weeks post-operative and to 10.44° at 1-year follow up.

The mean correction from pre-operative status to one-year post-operative was 6.12°. Comparing with other studies we can see the average correction of kyphotic angle was around 6° to 7°.

Comparison Regional Kyphotic angle and mean correction with other studies.

Study	Pre-op	Post-op	Follow up	Mean correction
Our study	16.56	10.28	10.44	6.12
Ambrose W Y Yung, 2011[17]	10.9	3.20	3.68	7.22

Alvine et al [25]	12	1	6	6
Huang & Luo et al [26]	9.63	2.51	2.51	7.12
Sasso et al [27]	17.6	3.5	11.6	6

The mean Beck's index, which is ratio of anterior vertebral body height to posterior vertebral body height is 0.607 pre-operatively which improved to 0.73 post-op and 0.72 at 1-year follow-up. The post-operative Beck's index is comparable with the studies shown below.

Comparison of Beck's index with other studies.

Study	Pre-op	Post-op	Follow up
Our study	0.607	0.73	0.72
Ambrose W Y Yung, 2011[17]	0.68	0.79	0.79
Mohammed Mustafa Adawi et al, 2019 [20]	0.70	0.80	0.78

According to Oswestry Disability Index Scale (ODI) 21 patients (42%) returned to their previous work/ heavy work, 17 patients (34%) were able to return to previous sedentary work or heavy work with restrictions, 3 patients (6%) were unable to return to previous work but were able to return to new sedentary work, 3 patients (6%) were unable to return to full time work and 6 patients (12%) were completely disabled and could not return to any work.

No patient experienced complications like implant failure, screw pull-out, worsening of neurological deficit or new onset neurological deficit.

CONCLUSION

Injury to the spine have been known to mankind since ancient times. Various treatment options have evolved in treating a fractured spine by non-operative and operative methods. The incidence has increased in recent times due to industrialization, high speed motor-vehicles and work place associated injuries. About 5 to 10% of polytrauma patients attending emergency department suffer a spinal fracture. Out of this 65% to 80% occur at the Dorso-lumbar junction. D12 to L2 are the most commonly involved vertebral levels. Approximately 20% of these patients may develop some form of neurological deficit. Hence, treating a Dorso- lumbar spine fracture by appropriate means is essential to help in preventing neurological deficit or to rehabilitate the patient.

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Mohammed Mustafa Adawi et al, 2019 [20]	0.70	0.80	0.78
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According to Oswestry Disability Index Scale (ODI) 21 patients (42%) returned to their previous work/ heavy work, 17 patients (34%) were able to return to previous sedentary work or heavy work with restrictions, 3 patients (6%) were unable to return to previous work but were able to return to new sedentary work, 3 patients (6%) were unable to return to full time work and 6 patients (12%) were completely disabled and could not return to any work.

No patient experienced complications like implant failure, screw pull-out, worsening of neurological deficit or new onset neurological deficit.

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