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A prospective study of the outcome of traumatic Dorsolumbar fractures treated with posterior stabilization by pedicle screw fixation

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Abstract

Introduction and Aim: Spine fractures are common in today's world due to high frequency of motor vehicle accidents and work place injuries. These are a major cause of disability in the adult population. The mortality rate following spinal injuries is 7%. Thoracolumbar junction is the most mobile segment which makes it more prone to injury. Management of these injuries are still under debate. Internal fixation provides early mobilization of the patients and protects the neurological structures. Conventional short segment stabilization is associated with high failure rates especially if anterior column injury is severe. In these cases, short segment stabilization with intermediate screws provides better stability and avoids future anterior surgery. In this study we aim to study the outcome of Traumatic Dorsolumbar Fractures treated with Posterior stabilization by pedicle screw fixation.

Materials and Methods: This is a prospective interventional study done at the Department of Orthopaedics Government Medical College at Jammu between August 2021 and August 2022. Twenty patients with dorso-lumbar spine fractures who were willing to take part in the study were included in this study. All the patients were treated by posterior stabilization with poly-axial pedicle screw fixation. All the patients were followed up for a minimum of 12 months. All 25 patients were available for follow-up till 12 months.

Observation and Results: The mean age of the study group was 38.4 years, males being most common (68%). The most common mode of injury was fall from height (68%) followed by road-traffic accidents (32%). The most frequently fractured vertebra was D11 followed by L1 in our study. The most common type of fracture was type A (80%). The preoperative regional kyphotic angle was 16.56° which improved to 10.44° at 1-year follow-up with a mean correction of 6.12°. Our study also shows improvement of vertebral height from a preoperative value of 13.5 mm to a value of 20.4 mm during the last follow up, i.e., an improvement from 45% to 68% of vertebral height. In our series, out of 25 patients, 16(55%) were having denis pain scale of P1, 06(30%) were having scale of P2, 2 (10%) patients were having scale of P3 and 1(5%) patient was having a scale of P4. In our series, out of 25 patients, 12 were having denis work scale W1, 11 were having work scale of W2, 01 patient was having W3 & 1 patient was having work scale W4. In our study, 21 patients had no complications. 1(5%) patient had rod displacement, 1(5%) patient had screw misplacement and 1(5%) patient had dural puncture and 1(5%) patient had superficial wound infection.

Conclusion: From our study we conclude that posterior stabilization with pedicle screw and rod system is an excellent option for dorso-lumbar spine fractures. It resulted in good improvement in post-operative regional kyphotic angle and anterior vertebral height. Also, the post-operative neurological status has improved in a significant number of patients and the over-all functional outcome of patients according to the Denis pain and Denis work scale has shown improvement.

Keywords: Thoraco-lumbar spine fracture, Dennis pain and Dennis work, pedicle screw, kyphotic angle

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.

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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. Thoracolumbar junction comprises of T 11 to L2 vertebra. Being the most mobile segment, it is more prone to injury. 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. The eleventh and twelfth ribs are floating ribs. They neither are or not connected to sternum. So they provide lesser stability to the thoracolumbar junction when compared to the rostral thoracic region. The orientation of facet joints in thoracic region is in the coronal (frontal) plane. This factor limits flexion and extension while providing substantial resistance to antero-posterior translation. The facet joints are oriented in a more sagittal alignment in the lumbosacral region. Due to this orientation the degree of flexion and extension are increased. But this happens at the expenses of limiting rotation and lateral bending. 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. The five anatomical structures in the posterior aspect- the superior facet, the inferior facet, the pedicle, the lamina, and the transverse process, channel all posterior forces through this post and transmit to the body.

Materials and Methods

This study included the patients treated in government medical college Jammu for dorsolumbar spine fracture with neurological deficit. These patients were managed with posterior stabilization, decompression and the functional outcome was evaluated.

Period of study: August 2021 to August 2022

Inclusion criteria

- Age group 18 to 70 years of either sexes.
- Fractures duration less than 14 days after hemodynamic stabilization.

- Dorsolumbar spine fracture-Confirmed by clinical examination, x rays and if required CT scan.
- Patients who give informed consent and willing for follow up.

Exclusion criteria

- Patients less than 18 years of age.
- Patients unfit for surgery.
- Pregnancy.
- Associated comorbid conditions history of suffering from Myocardial Infarction (MI) less than 1year, psychiatric illness, head injury.
- Associated major visceral injury.

Patient evaluation

Patients admitted in emergency department were thoroughly examined regarding patient details, detailed history of mode of injury, any associated comorbid conditions, previous history of any surgery and also ruled out associate head injury, chest injury and abdominal injury.

After detailed general examination, patients who fulfilled the inclusion criteria were evaluated for neurological status and radiological examination.

Neurological Examination

By using Glasgow coma scale level of conscious was evaluated. Motor power, sensory examination, reflexes were elicited and ASIA impairment scale was used for this neurological examination.

Radiological examination

Plain x-ray was taken initially in patients with suspected spinal injury. These includes anteroposterior and lateral view of spine.

Anteroposterior view

Interpedicular distance widening, Coronal plane irregularities. Lateral view: Compression of vertebral body, Interspinous distance, Degree of kyphosis by using cobb's method, Posterior vertebral angle, Retropulsion of bony fragments Subluxation.

Computed Tomography

CT scan was taken for all patients before surgery to identify the comminution of fracture, intactness of pedicles etc.

Magnetic Resonance Imaging

In our study MRI was taken for all the patients. It is useful to assess the cord edema, cord compression, disc herniation, ligament injury etc. It is a useful tool to assess the integrity of posterior ligamentous complex and assessing the spinal stability.

Timing of surgery

All patients were taken up for surgery between 3rd and 15 days following trauma. The average delay following surgery is 9 days. The average duration of surgery is 120 minutes.

Surgical technique positioning

General anesthesia
Prone position in hall's frame in radiolucent table

Operative technique

Midline skin incision made, dorso-lumbar fascia incised in line with skin incision. Spinous process identified

paravertebral muscles raised sub-periosteally. Pedicle awl inserted and probe passed and its position checked under image intensifier in both antero-posterior and lateral projection. Pedicle sound was inserted to check intactness of wall then tapping done and appropriate size pedicle screw inserted. Pedicle screws were connected to connecting rods on either side and fixed with inner screws. Then decompression was done to decompress neural elements. Wound closed in layers with a negative suction drain after attaining perfect haemostasis.



Fig 1: Preop X-ray of patient

Postoperative protocol

Patients were turned sideways periodically in the immediate post-operative period. Drain tube was removed at 2nd post-operative day. Suture removal was done on 12th post-operative day. Active assisted and passive exercises were taught to keep the joints supple. Patients were made to sit wearing Taylor's brace for 10 minutes every 2 hourly once after suture removal.



Fig 1: Post of X-ray of patient

Follow up

All the patients were advised to continue the Taylor's brace for the first 3 months after the surgery. They were followed up every month till 6 months and then every 2 months. The minimum follow up in our study is 6 months and the maximum follow up is 12 months.

During the follow up period, functional outcome were assessed using Denis pain and work assessment scale. In patients with neurological deficit, neurological status were assessed using ASIA score and also evaluated radiologically for fracture and implant status.

Results

Age and sex distribution

In this series 20 (80%) patients were male and 5 (20%) were female patients. 6 (24%) patient was below 20 years, 8 (32%) were in the 21-30 age group and 11 (44%) were in the 30 and above age group.

Type of fracture

In this series there were 20 (80%) of type A fractures, 04 (16%) of type B fractures, and 01 (4%) of type C fractures.

Mode of injury

In this series we had 20 (80%) patients had accidental fall as most common mode of injury and 05 (20%) were having road traffic accident as mode of injury.

Level of injury

In this series we had 14 (56%) patient had fracture at D11 level, 2 (8%) patients had fracture at D12 level, 7 (28%) patients had fracture at L1 level and 02(8%) patients had fracture at L2 level.

Associated injuries

In our study, 5(25%) patients had associated head injury, 1(5%) patient had fracture radial head with elbow dislocation, 1(5%) patient had calcaneus fracture and 1(5%) patient had fracture of fibula. 17(60%) patients had no other injury.

Duration of injury to surgery

In our study, 13 patients underwent surgery within 10 days of admission and 12 patients had surgery within 20 days of surgery.

Tlics score

In this series, 2 patients had TLICS score of 4, and 23 patients had a score of 5 and above

Duration of surgery

The average duration of the surgical procedure was 1 hour and 41 minutes.

Blood loss

The average blood loss during surgery was 328 ml.

Duration of surgery

The average duration of the surgical procedure was 1 hour and 41 minutes.

Radiological assessment

Regional angle

In our series, average regional angle of 25 patients is 16.56 degree, where as post operative angle was 10.44 degree and average angle at the last visit was 6.12

Anterior vertebral height

In our series, average anterior vertebral height among 25 patients is 13.5mm whereas height in post-operative height was 21.3mm and in last visit was 20.4 mm.

Clinical assessment

In our series, out of 25 patients, 16 (55%) were having denis pain scale of P1, 6 (30%) were having scale of P2, 2 (10%) patients were having scale of P3 and 1 (5%) patient was having a scale of P4. In our series, out of 25 patients, 12 were having denis work scale W1, 11 were having work scale of W2, 01 patient was having W3 & 1 patients were having work scale W4.

Complications

In our study, 21 patients had no complications. 1 (5%) patient had rod displacement, 1 (5%) patient had screw misplacement and 1 (5%) patient had dural puncture and 1 (5%) patient had superficial wound infection.

Discussion

In our study we had 20 (80%) males and 5 (20%) female patients. The average age was 38.4 years and more common in the third and fourth decade. Gregory F. Alvine *et al.* in their study found that average age was 31 years, with a male predominance. Rick C. Sasso *et al.*, in their study had 77% males and 23% females with a mean age of 34 years. Razak M, *et al.* in their study found that average was 30 with a male predominance.

In our study we noted fall from a height in 20 (80%) patients as the most common mode of injury and was mainly the result of work injury. Road traffic accident was the second commonest cause 5 (20%) of patients. Nasser M.G, *et al.* in his study noted that the main cause of injury was fall from a height and road traffic accident was the second commonest. Gregory F. Alvine, *et al* noted that in 52% of patients injuries resulted from fall from a height, in 39% patients due to road traffic accidents and 9% due to fall of heavy objective. Razak M, *et al* in his study noted that 69% of injuries were caused from fall from height, 31% due to road traffic accident. In our series we found 20 of patients with AO Type-A fractures, 4 with AO Type-B fractures and 1 with AO Type-C fractures. Nasser M.G. *et al.*, in their study noted 76% of patients with Type-A, 8% with Type-B and 16% with Type-C. Rick C.Sasso *et al.*, noted that 62.5% had AO Type-B and 37.5% had AO Type-A fractures. Gregory F.Alvine *et al* noted that Type-B fractures were seen in 57.5% of patients Type-A in 22.5% and 20% with Type-C. The most common vertebrae involved in this series were between T11 – L2 to the extent up to 100%. While Alvine noted to the extent of 70%, Sasso *et al* noted up to 80% and Razak *et al* noted to the extent of 92% of the fractures were at the level of T11- L2. In our series the mean Regional angle by Cobb's method was 16.56 on admission, 10.44° post operatively and 6.56 at latest follow up. Nasser M.G *et al.*, noted the kyphotic angle was 23.6° on admission, 7° post-operatively and 11.5° at latest followup. Rick C.Sasso *et al.*, noted that the kyphotic angle was 17.6° pre operatively, 3.5° post operatively and 11.6° at latest follow up. Razak M. *et al.*, noted that the average kyphotic angle was 20° pre operatively, 7° post operatively and 9° at latest follow up. A Study of Rex AWM involving vertebral body height improved from a mean of 42% preoperatively to 64% at the time of the latest follow-up. In a study by Yaser MB involving 70 patients with thoracolumbar fractures treated with pedicle screw instrumentation with

mean follow up of 10 months, there was a significant improvement in anterior vertebral body height. Our study also shows improvement of vertebral height from a preoperative value of 13.5 mm to a value of 20.4 mm during the last follow up, i.e., an improvement from 45% to 68% of vertebral height. In our study, 55% of patients had no pain (P1) at follow up and 30% patients had occasional mild pain (P2). Around 45% patients returned to their previous employment with heavy labour (W1) and 40% of patients returned to their previous heavy labour with lifting restrictions (W2). These results are comparable to a study conducted by Tae-Sob Shin *et al* of the Korean neurosurgical society in 2007, and the results were P1-57.9%, P2-36.8% and W1-52.6%, W2-20.5%. Curtis AD in their metaanalysis of surgical treatment alternatives for fixation of unstable fractures of thoracic and lumbar spine, they analysed 15 articles including 614 patients and noted loss of fixation by disconnection of rod in 21 patients (3.4%). Screw rod interface loosening and disconnection of rod with failure of construct was seen in 1 patient (3.1%). Razak M *et al.*, noted 2 instances of hardware loosening and 3 misplaced pedicle screw in their study. Our study of 20 patients had 1 (5%) patient with rod displacement from the pedicle screw, which is comparable to the above study. The patient developed kyphotic deformity and paraparesis. Since she was on 5 months amenorrhoea she was kept on regular follow up. She is planned for resurvey after delivery. The cause of rod pullout may be due to improper inner screw placement. In highly unstable fractures or in fractures where both pedicles are disrupted, stabilization should be done two segments above and two segments below the fractured vertebra. If one pedicle is intact, then one pedicle screw can be inserted in the intact pedicle [1]. (5%) patient had pedicle screw misplacement. On follow up, he did not have any neurological symptoms or pain. So, the screw was left as such. Razak M *et al.*, noted 3 cases of misplaced pedicle screw in their study which is comparable to our study [1]. (5%) patient had superficial wound infection, which was treated with higher antibiotics. Khan. I *et al.*, in their study noted that there was 1 patient with superficial wound infection. 1 (5%) patient had dural puncture per operatively which was repaired with 6-0 proline

Conclusion

We conclude that posterior stabilization in the form of posterior fixation for thoraco-lumbar spine fractures has given encouraging results on short term follow-up. Posterior stabilization with restoration of anterior column height is most important in determining the outcome which needs to be confirmed on long term follow up.

Conflict of Interest

Not available

Financial Support

Not available

References

1. Alanay A, Acaroglu F, Yazici M. Short-segment pedicle instrumentation of the thoracolumbar burst fractures: does transpedicular intracorporeal grafting prevent early failures? *Spine*. 2001;26(2):213-7.
2. Alvine GF, Swain JM, Asher MA, Burton DC. Treatment of thoracolumbar burst fractures with variable screw placement or Isola instrumentation and arthrodesis: case series and literature review. *J Spinal Disord Tech*. 2004

- Aug;17(4):251-64.
3. Benson DR, Keenen TL. Evaluation and treatment of trauma to the vertebral column. *J Bone Joint Surg.* 1990;39:577-88.
 4. Chapman JR, Mirza SK. *Rockwood and Green's Fractures in Adults.* 5th ed. Vol. 2. Philadelphia: Lippincott Williams & Wilkins; c2001. p. 1295-1466.
 5. Chun SW, Hwang JH, Sung JK, Hwang SK, Hamm IS, Park YM, *et al.* Pedicle screw fixation and posterolateral fusion for thoracolumbar spine fracture. *J Korean Neurosurg Soc.* 1999;28:644-8.
 6. Denis F. The three column spine and its significance in the classification of acute thoracolumbar spinal injuries. *Spine (Phila Pa 1976).* 1983 Nov-Dec;8(8):817-31.
 7. Frankel HL, Hancock DO, Hyslop G. The value of postural reduction in the initial management of closed injuries of the spine with paraplegia and tetraplegia. Part I. Paraplegia. 1969;78:179-92.
 8. Hyun SJ, Lim YB, Hong HJ, Kwon JT, Suk JS, Min BK. Predictable risk factors for adjacent segment degeneration after lumbar fusion. *J Korean Neurosurg Soc.* 2007;41:88-94.
 9. Leventhal MR. Fracture, dislocations, and fracture dislocations of the spine. In: Canale ST, editor. *Fractures and Dislocations of the Spine.* 10th ed. Missouri: Mosby; c2003. p. 1597-690.
 10. Marco RA, Kushwaha VP. Unstable burst fractures treated with balloon-assisted calcium phosphate reconstruction. *J Bone Joint Surg Am.* 2009;91(1):26-32.
 11. Mermelstein LE, McLain RF, Yerby SA. Reinforcement of thoracolumbar burst fractures with calcium phosphate cement. *Spine.* 2000;25(15):2024-31.
 12. Nasser R, Yadla S, Maltenfort MG, Harrop JS, Anderson DG, Vaccaro AR, *et al.* Complications in spine surgery. *J Neurosurg Spine.* 2010;13:144-57.
 13. Patel N. Surgical disorders of the thoracic and lumbar spine: a guide for neurologists. *Br Med J.* 2002;73:142-8.
 14. Razak M, Mahmud MM, Hyzan SA, Omar A. Short segment posterior instrumentation, reduction and fusion of unstable thoracolumbar burst fractures: a review of 26 cases. *Med J Malaysia.* 2000 Sep;55 Suppl:22-9.
 15. Riggins RS, Kraus JF. The risk of neurological damage with fractures of the vertebrae. *J Trauma.* 1977;17:126-33.
 16. Sasso RC, Cotler HB, Reuben JD. Posterior fixation of thoracic and lumbar spine fractures using DC plates and pedicle screws. *Spine (Phila Pa 1976).* 1991 Mar;16(3 Suppl):S134-9.
 17. Tran NT, Watson NA, Tencer AF, Ching RP, Anderson PA. Mechanism of burst fracture in the thoracolumbar spine: the effect of loading rate. *Spine.* 1995;20(13):1438-40.

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