ORIGINAL RESEARCH PAPER

Volume-8 | Issue-3 | March-2019 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

PEDICLE SCREW AND ROD FIXATION FOR UNSTABLE THORACOLUMBAR FRACTURES IN ADULTS

Orthopaedics

Dr. T. Karikalan Associate Professor in Orthopaedics Institute of Orthopaedics and Traumatology Coimbatore Medical College and Hospital,Coimbatore, Tamilnadu, India.

ABSTRACT

INTRODUCTION: Spinal injuries are one of the leading causes of morbidity and mortality in young adults. With increase in number of high energy trauma, the incidence of spinal fracture is also high. Depending upon the severity of trauma, around 20% of the thoracolumbar fractures in adults lead to some type of neurological deficit. They are graded according to the ASIA scale from A to E depending upon severity. Our study aims at studying the efficacy of pedicle screw and rod system in achieving stability in thoracolumbar fractures and asses the clinical, neurological and radiological outcome in thoracolumbar fractures in adults.

MATERIALS AND METHODS: 20 cases of unstable thoracolumbar fractures admitted between August 2013 to July 2016, in our institution were included in our study. All the patients had X-ray of DL spine, CT spine and MRI of the whole spine and fractures classified accordingly. Patients underwent pedicle screws and rod fixation through posterior approach. All the patients were followed up at regular intervals upto 1 year.

RESULTS: In Neurological assessment 50% of patient presented with ASIA scale C, 40% patient with scale D and 10% of patient had ASIA scale E. At the end of 1 year follow up 80% patient had a scale of E, 15% patient had recovered in scale D and one patient(5%) had decreased scale from D to C. In radiological assessment average preoperative angle was 22.5 degrees and immediate postop angle was 8 Degrees and at the end of one year the average angle came to 12.5 degrees.

CONCLUSION: Pedicle screw and rod system has control over all three columns of spine and it is effective in correction of deformity and providing better stability which in turn results in better neurological recovery in thoracolumbar fractures.

KEYWORDS

thoracolumbar fractures, pedicle screw, adults, ASIA, denis pain scale.

INTRODUCTION

Spinal injuries are one of the leading causes of morbidity and mortality in young adults. With increase in number of high energy trauma, the incidence of spinal fractures is also high. Thoracolumbar fractures contribute to 65% of spinal trauma. Fractures and dislocations are common at the thoracolumbar junction (from D11 to L2) because the rigid kyphotic thoracic segment is connected to the mobile lordotic lumbar segment here. Transitional zone (D11 to L2) is more prone to biomechanical stresses during trauma leading to fractures.

Depending upon the severity of trauma, around 20% of the thoracolumbar fractures in adults lead to some type of neurological deficit[1]. The neurological deficit ranges from mere root compression to cord compression with complete paraplegia and with bladder and bowel involvement. They are graded according to the ASIA scale from A to E depending upon severity[1,2,3].

AO classification system for thoracolumbar injuries categorises these into three primary types according to the vector force applied to spine. A-compression fractures, B-distraction fractures, C-rotational fractures.

In the past, thoracolumbar fractures were treated conservatively with bed rest resulting in considerable number of complications with poor outcome. Historically, Harrington rod construct was used to stabilise the thoracolumbar spine fractures. The main disadvantage is that it spans 5-6 spinal segments and failure rate was also high[4].

Surgical treatment may be done through anterior, posterior or combined approach[5]. Anterior approach is difficult and it has more morbidity. Recently fixation with pedicle screw and rod system through posterior approach provide short segment fixation with excellent control over all the three columns of the spine with less morbidity[6,7,8,9]. The goals of the surgery is to correct deformity, achieve stability, early mobilisation, expedite post operative recovery and achieve union of fractures. Pedicle screw system helps to achieve all these.

Our study aims at studying the efficacy of pedicle screw and rod system in achieving stability in thoracolumbar fractures and asses the clinical, neurological and radiological outcome in thoracolumbar fractures in adults.

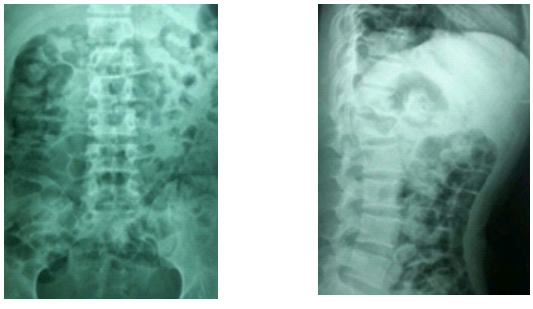
MATERIALS AND METHODS

20 cases of unstable thoracolumbar fractures admitted between August 2013 and July 2016 in our institution were included in our study. After hemodynamically stabilising the patient, spine and neurological statuses were assessed. All the patients had X-ray of DL spine, CT spine and MRI of the whole spine and fractures classified accordingly. Preoperative neurological status was graded on the basis of ASIA scale. It was also used for the post operative recovery and follow up. Detailed sensory, motor and reflex assessment was done after the spinal shock was over to know the extent of neurological injury whether complete or incomplete. Sacral sparing is an important evidence of incomplete neurological injury. The indication for surgery was spinal instability for which instrumentation was needed to restore spinal stability

INCLUSION CRITERIA:

1. Age group 14 to 60 years
2. Traumatic thoracolumbar fracture D11 to L2
3. Unstable fractures with or without neurological deficit
4. Kyphotic angle greater than 30 degrees
5. Vertebralbody height loss greater than 50%
6. Spinal canal compromise more than 50%
7. TLICS score more than 4

Osteoporotic spine fractures in elderly and spine fracture in children were excluded from our study Plain X-ray dorsolumbar spine[10] AP and Lateral view was taken to assess the fracture pattern, instability, mechanism of injury, canal compromise,vertebral body height and deformity(fig 1). MRI was used to assess the spinal cord injury and cord compression by bone and disc material. CT Scan[11] was used to assess the pedicle fractures, retropulsion of bony fragments and canal compromise (fig 2).



A B

Figure 1. Preoperative X-ray AP view(A) and lateral view (B) of dorsolumbar spine showing L1 burst fracture.

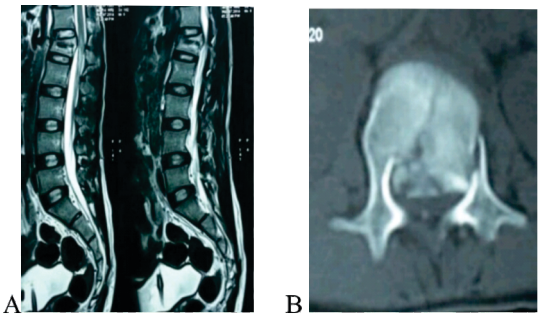


Figure 2. Preoperative MRI(A) and CT scan (B) showing cord compression and canal compromise by bony fragments.

Patient was assessed for surgery. Surgery was done in prone position through posterior approach under C-Arm control. Pedicle screw was inserted one level above and one level below the fractured vertebrae. If the pedicle of the fractured vertebrae is intact, pedicle screw was inserted in that pedicle also. In case of fracture dislocation, pedicle screw was inserted two levels above and two levels below the fractured vertebrae. Pedicle screws were connected with contoured connecting rods on both sides (fig 3).

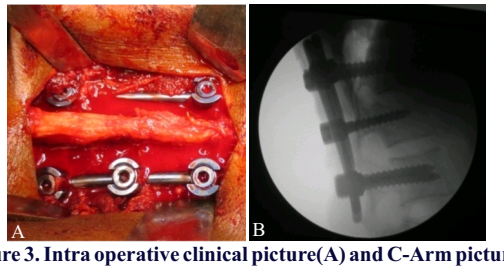


Figure 3. Intra operative clinical picture(A) and C-Arm picture(B) showing pedicle screw fixation.

Prone position of the patient itself reduced the fracture in most cases[12]. Otherwise distraction and rod contouring was used to aid in reduction of the fracture. Very rarely compression of the fracture was done. Manual reduction was done in cases of fracture dislocation.

Laminectomy and decompression was done in case of spinal canal compromise and spinal cord compression. Laminectomy bone was used as bone graft posterolaterally. Postoperative check X-ray and CT scan spine was taken to assess the deformity correction and pedicle screw placement (fig 4 and 5).

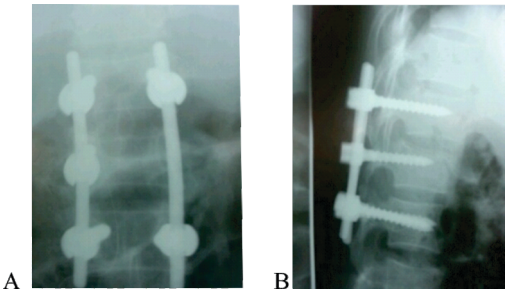


Figure 4: Post Operative Check X-ray Ap View(a) And Lateral View(b) Showing Deformity Correction.

Figure 5: Post Operative Ct Scan Of D12,l1 And L2 Vertebrae Showing Pedicle Screw Position.

Postoperatively patient was mobilised with Taylor's brace from 2nd post operative day onwards and it was continued for 2 months. Post operative neurological status was closely monitored. Physiotherapy and bladder training was given.

All the patients were followed up at regular intervals upto 1 year. During follow up, clinical, radiological and neurological assessment was done. Neurological assessment was done using ASIA scale. Radiological assessment was done to assess the residual kyphotic deformity and anterior vertebral body height (fig 6). Clinical assessment was done using Denis pain scale and Denis work scale(fig 7).

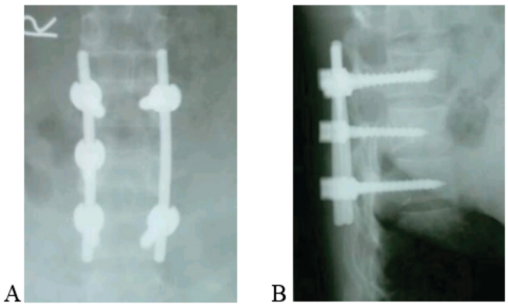


Figure 6. One Year Follow Up X-ray Ap View(a) And Lateral View(b) Showing Fracture Union And Maintenance Of Deformity Correction.

Figure 7. Follow up clinical picture showing good range of spinal movements.

RESULTS:

In this series 16 patients (80%) were male and four patients (20%) were female. Six patients (30%) were below 20 years, nine patients (45%) were 21 to 30 years and five patients (25%) were 30 to 60 years age group. Most patients (75%) sustained fracture due to accidental fall from height and 25% sustained fracture due to RTA. 85% fracture were type A and 10% were type B and 5% type C fracture. L1 fracture was common and it contributed to 60% of fractures and D11 were 10%, D12 were 20% and L2 were 10%. 90% of the patients had TLICS score of 5 and above and only 10% patients had TLICS score of 4. 50% patients were operated within 5 days and other 50% patients were operated within 10 days. The average duration of surgery was 1 hour 40 minutes and the average blood loss was 350 ml.

DISCUSSION:

Neurological assessment was done using ASIA scale. 50% of patients presented with ASIA scale C, 40% patients with scale D and 10% of patients had ASIA scale E. At the end of 1 year follow up 80% patient had a scale of E, 15% patients had recovered in scale D and one patient(5%) had decreased scale from D to C and it was due to implant failure due to loosening of connecting rod. In our study, 85% of the patients had at least one grade improvement in ASIA scale. Nasser M.G et al noted that patient who had neurological deficit showed at least one grade improvement in last follow up assessment[13]. F alvine et al noted that 60% patients had neurological improvement out of which 40% with 1 grade higher and 20% with 2 grade higher level[14]. None of the patient had decrease in ASIA scale.

In radiological assessment average preoperative angle was 22.5 degrees and immediate postoperative angle was 8 degrees and at the

end of one year the average angle came to 12.5 degrees. Nasser M.G et al noted kyphotic angle was 23.6 degree on admission, 7 degree on immediate post operative and 11.5 degree at last follow up[13]. Rick C. Sasso et al noted kyphotic angle 17.6 degree on admission and 3.5 degree on immediate post of X-Ray and 9 degree on last follow-up[9].

Anterior vertebral body height in our study was preoperative 13 mm and immediate postoperative height was 21.5 mm and at one year it was 20.1 mm. A study of Rex AWM showed vertebral body height improvement from 42% preoperatively to 64% at the time of last follow up. Our study showed an improvement from 45% preoperatively to 65% at last follow up.

Clinical assessment by Denis pain scale showed 55% of patients had no pain (P1) at follow up and 30% had occasional mild pain (P2). 10% had P3 and 5% had P4. Around 45% of patient resumed to their previous employment (W1) and 40% had some restriction of activities in their previous employment (W2). 5% W3, 10% W4

Our results are comparable to the results of KIM KS, Chung BS et al of Korean neurosurgical society in 2006 and their results were P1-57.9%, P2-36.8% and W1-52.6%, W2-20.5%[15].

In our study one patient had rod loosening and implant failure(5%). Curtis AD in his meta-analysis of 614 patients showed loss of fixation in 21 patients (3.4%).

In our study one patient had pedicle screw misplacement and upon follow up he did not have any neurological symptoms or pain. So the screw was left as such. Razzak et al noted three cases of misplaced pedicle screw. One patient had dural leak due to piercing of bony fragment and it was repaired with 6-0 Prolene. Two patients had superficial wound infection and was treated with antibiotics.

CONCLUSION

Thoracolumbar fractures are common in third and fourth decades of life with male predominance. Posterior midline approach is simple and consumes less operative time and less blood loss.

Pedicle screw and rod system has control over all three columns of spine and it is effective in correction of deformity and provides better stability which in turn results in better neurological recovery in thoracolumbar fractures.

REFERENCES

1. Campbell's Operative Orthopaedics,12th edition,Vol. 2, 38:1559-1627.
2. Jens R. Chapman Sohail K Mirza H. Rockwood and GreenFractures In Adults. Lippincott Williams and Wilkins, 5th edition; Vol. 2: 1295-1466.
3. Riggins RS. Kraus JF. The risk of neurological damage with fractures of the vertebrae. Journal of Trauma 1977; 126-133.
4. Gestzbeni SD. Mac Michel LD Tile M. Harrington instrumentation as a method of fixation of fractures of the spine - a critical analysis of deficiencies. Journal of Bone and Joint surgery Br. 1982; 64: 526-9. 13.
5. Danisa OA, Shaffrey CI, Jane JA. Surgical approaches for correction of unstable thoracolumbar burst fracture: A retrospective analysis. J Neurosurgery 1995; 83 :977.
6. Mikles MR, Stchur RP, Graziano GP. Posterior instrumentation for thoracolumbar fractures.J Am Acad Orthop Surg. 2004 Nov Dec;12(6):424-
7. P. S Ramani. Applied anatomy of Spine. Chapter 2, Text book of Spine Surgery Ist edn, edt Ramani PS, 1996: 11-27.
8. Han IH, Song GS : Thoracic Pedicle Screw Fixation and Fusion in Unstable Thoracic Spine Fractures. J Korean Neurosurg Soc 32 : 334-340, 2002
9. Sasso RC, Costler HB : Posterior Instrumentation and fusion for unstable fractures and fracture-dislocations of the thoracic and lumbar spine. Spine 18 : 450-460, 1993.
10. Whitesides TE. Traumatic kyphosis of thoracolumbar spine. Clin Orthop 1977; 128: 78-92.
11. McAfee OC, Yuan HA, Fredrickson BE, Lubicky JP : The value of computed tomography in thoracolumbar fractures. J Bone Joint Surg 65 : 461-473, 1983.
12. 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: 179-192.
13. Nasseir M I G and Yemanddea T R.Complications of spine surgery. Neurosurgery 2010;3(4):345-349.
14. Gregory F Alvine, James W Swain, Marc A Asher, Douglas C Burton. Treatment of ThoracoLumbar burst fractures with variable screw placement or Isola instrumentation and arthrodesis: case series and literature review. Journal of Spine Disorders and Techniques;09/2004:17(4):251-64.
15. Kim KS, Oh SH, Huh JS, Noh JS, Chung BS : Dorsal Short-Segment Fixation for Unstable Thoracolumbar Junction Fractures. J Korean Neurosurg Soc 40 : 249-255, 2006.