

Original Research Article

The radiological outcomes of pedicle screw fixation in unstable dorsolumbar fractures by measuring the correction in various parameters namely Regional angle, Anterior wedge angle and vertebral body height ratio

Dr. Gaurav Jain¹ (Asst. Prof.), Dr. Tushaar Ghodawat² (Asst. Prof.) & Dr. Ravindra Kumar Gupta³ (Assoc. Prof.),

Dept. of Orthopaedics, LNCT Medical College, Indore, M.P.^{1,2&3}
Corresponding Author: Dr. Tushaar Ghodawat

Abstract:

Background & Method: The aim of the study is to study the radiological outcomes of pedicle screw fixation in unstable dorsolumbar fractures by measuring the correction in various parameters namely Regional angle. Obtain images of the spine to confirm the degree of spinal reduction and determine the limits of the incision. Prepare and drape the thoracolumbar spine to be instrumented and the iliac crest. Make an incision from one spinous process above the area to be instrumented to one spinous process below the area to be instrumented.

Result: In this study sex ratio among the patients was 1.5:1(M:F) 36 patients out of 60 were male and rest females. In this series most commonly fractured vertebra was found to be L1 followed by D12. There was a statistically significant improvement in mean anterior wedge angles with a p value off less than 0.001. Most of the patients at 6 months follow up only have a occasional minimal pain with no need of medications.

Conclusion: In long term the radiological parameters namely anterior wedge angle, regional angle and vertebral body height ratio, which are the measure of deformity are well restored showing the efficacy of pedicle screw fixation in deformity correction and its maintenance. There is a very high statistically significant restoration of these parameters.

Keywords: radiological screw fixation, anterior & vertebral.

Study Designed: Observational Study.

1. INTRODUCTION

Vertebral column injuries are reported to occur in approximately 6% of trauma patients. Fractures of thoracolumbar spine are commonly due to fall from a height, road traffic accidents, and sports injuries. Thoracolumbar injuries classically peak among males less than 40 years of age[1]. Many of these patients sustain spinal cord or nerve root level neurologic injury. Thoracolumbar segment is second most commonly involved segment in the spinal cord following spinal injuries followed by cervical segment. It constitutes 60 to 60% of all spinal injuries. The trauma of thoracolumbar segment is high in thoracolumbar junction to the extent up to 60% between T12 to L2.

The use of pedicle screw instrumentation in the spine has evolved over the last two decades. The initial use of pedicle screws began in the lumbar spine, the use of pedicle instrumentation has evolved to include their use in the thoracolumbar and thoracic spine[2]. The impetus behind their increased use is a result of the many advantages that pedicle screw anchorage offers over traditional hook and rod constructs. Improved deformity correction and overall construct rigidity are two important advantages of pedicle screw instrumentation due its three-column control over the spinal elements. First, pedicle screw instrumentation obviates the need to place instrumentation within the spinal canal with its inherent risk of neurologic injury[3]. The narrow and inconsistent shape of the thoracic pedicles, especially in spinal deformity, makes their placement technically challenging. As a result, surgeons have employed a number of techniques to ensure the safe and efficacious placement of thoracic pedicle screws[4]. Detailed anatomic landmarks used to determine pedicle location, intraoperative imaging including navigation, and neurophysiologic monitoring are some of the techniques currently used by surgeons. The implementation of these techniques and a thorough understanding of the complex three-dimensional anatomy have allowed surgeons to successfully place thoracic and thoracolumbar pedicle screws[5].

2. MATERIAL & METHOD

This study is a prospective clinical study of unstable thoracolumbar spinal injuries treated by posterior instrumentation (pedicular screw and rod fixation) carried out at Department of Orthopaedics, LNCT Medical College, Indore, M.P. In all, a total of 60 cases were.

The Inclusion criteria of the study were:

1. D11,D12,L1,L2 unstable fractures with or without neurologic deficit
2. Adult patients 17-60 years of age.

The Exclusion criteria were:

1. Pathological fractures
2. Polytrauma patients with expected delay in primary and immediate fixation.
3. Uncontrolled diabetes, morbid obesity with BMI> 40, Immunocompromised patients, patients on chronic steroid therapy and debilitated patients.

Pedicle Screw Segmental Spinal Instrumentation:

Position the patient prone on a padded spinal operating table.

- Obtain images of the spine to confirm the degree of spinal reduction and determine the limits of the incision. Prepare and drape the thoracolumbar spine to be instrumented and the iliac crest.
- Make an incision from one spinous process above the area to be instrumented to one spinous process below the area to be instrumented.
- Infiltrate the subcutaneous tissue and muscle with epinephrine 1 : 500,000.
- Continue the dissection with electrocautery to the fascia. Delineate the fascia for later closure. Continue the dissection through the fascia.
- Dissect the perispinal muscles from the spinous processes with Cobb elevators and electrocautery.
- Use electrocautery to tease the muscle from the bone carefully at the level of the fracture. Watch for evidence of a spinal fluid leak or the presence of free nerve roots.
- Continue to widen the dissection to the tips of the transverse processes in the thoracic and lumbar spine.

3. RESULTS

Table 1: Sex wise distribution

Sex	No. of Patients
Female	24
Male	36

In this study sex ratio among the patients was 1.5:1(M:F) 36 patients out of 60 were male and rest females.

Table 2: Fracture level

	No. of Patients
D11	06
D12	16
L1	22
L2	16

In this series most commonly fractured vertebra was found to be L1 followed by D12.

Table 3: Mean anterior wedge angles

	No. of Patients
Preoperatively	19.433
Postoperatively	9.833
At 3 months post operatively	11.433
At 6 months post operatively	11.333

There was a statistically significant improvement in mean anterior wedge angles with a p value off less than 0.001

Table 4: Denis Pain Scale at 6 months post operatively

Denis Pain Scale	No. of Patients
P1	22
P2	26
P3	06
P4	06

Most of the patients at 6 months follow up only have a occasional minimal pain with no need of medications

4. DISCUSSION

In our study the most commonly fractured vertebra is L1, 36% followed by D12 and L2 which account to be 27%, in their study noted that the commonest vertebra to be fractured was L1 comparable to our study. 72.5% of cases the injury was at level of T11-L2[6].

The mean regional angles and anterior wedge angles in our study preoperatively were 18.267 degrees and 19.433 degrees respectively which improved to 9.967 and 11.433 degrees on last follow up of 6 months[7].

In a study (n=183) these values were 18.8 and 9.9 degrees preoperatively which improved to 5.9 and 0.3 degrees on last follow up.

In a study involving 70 patients with thoracolumbar fractures treated with pedicle screw instrumentation with mean follow up of 10 months, there was a significant improvement in regional kyphotic from 34degrees preoperatively to 4 degrees postoperatively[8&9].

In their study of thoracolumbar fractures treated with pedicle screw instrumentation involving 52 patients reported a measurable loss of reduction of more than 5 degree of kyphotic angle in 10 patients out of which 8 had more than 10 degree. They concluded that primary cause for progressive deformity was failure of fixation construct due to bending or breakage of screws, loosening or pull out of screws or translation of vertebra that had been included in the instrumentation[10]. However, in our study, there was only a small insignificant loss of reduction

5. Conclusion

Pedicle screw fixation is meant for primary fixation and provides facility for indirect or direct decompression at the fracture site and to stabilise the spinal column till fracture union. Thus it helps to prevent the secondary progression of deformity which usually forms in these cases in due course. Whether it helps in primary neurologic improvement or not is not well proven but by the method of indirect decompression it is known to cause neurological improvement plus correction of deformity and its maintenance provides appropriate environment for neural tissues to recover and also halts further progression of neurological injury.

In long term the radiological parameters namely anterior wedge angle, regional angle and vertebral body height ratio, which are the measure of deformity are well restored showing the efficacy of pedicle screw fixation in deformity correction and its maintenance. There is a very high statistically significant restoration of these parameters.

6. References

1. Crutcher JP Jr, Anderson PA, King HA, Montesano PX. Indirect spinal canal decompression in patients with thoracolumbar burst fractures treated by posterior distraction rods. *J Spinal Disord.* 1991 Mar;4(1):39-48.
2. Leferint VJM, Zimmer KW, Veldhuis EFM, Ten Vergert EM, Ten Duis HJ, 2001.
3. Sang Moon, Won-Tae Choi, Doo-Hoon Sun, Jong-Woo Chae, Jong-Seon Ryu, Han Chang, Jin-Fu Lin *Indian Journal of Orthopaedics*, Year 2007.
4. Correction of post-traumatic kyphosis using intermediate facet joints as fulcrum in dorso-lumbar spine injuries Amit Agrawal, M Shantharam Shetty, JP Shetty, Srikrishna U, Swapnil S Nagvenkar KS Hegde Medical Academy, Mangalore *Indian Journal Of Orthopaedics* July 2006 Volume 40 : Number 3 : P. 164-167.
5. Mikles MR, Stchur RP, Graziano GP. Posterior instrumentation for thoracolumbar fractures. *J Am Acad Orthop Surg.* 2004 Nov-Dec; 12(6):424-35.
6. Denis F. The three column spine and its significance in the classification of acute thoracolumbar spinal injuries. *Spine.* 1983;8(8):817-831.
7. Alpentaki K, Bano A, Pasku D, et al. Thoracolumbar burst fractures: a systematic review of management. *Orthopedics.* 2010;33(6):422-429.
8. McLain RF, Sparling E, Benson DR. Early failure of short-segment pedicle instrumentation for thoracolumbar fractures. A preliminary report. *J Bone Joint Surg Am.* 1993;75(2):162-167.

9. Schmid R, Krappinger D, Blauth M, Kathrein A. Mid-term results of PLIF/TLIF in trauma. *Eur Spine J.* 2011;20(3):395–402.
10. Wang L, Li J, Wang H, et al. Posterior short segment pedicle screw fixation and TLIF for the treatment of unstable thoracolumbar/lumbar fracture. *BMC Musculoskelet Disord.* 2014;15:40.