

ORIGINAL ARTICLE

RADIOLOGICAL OUTCOME OF TRANSPEDICULAR SCREWS FIXATION
IN THE MANAGEMENT OF THORACOLUMBAR SPINE INJURYMian Iftikhar ul Haq, Shahbaz Ali Khan*, Ahsan Aurangzeb*, Ehtisham Ahmed*, Sajid
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Background: Traumatic fracture of the spine is a serious neurosurgical condition that has serious impact on the patient's quality of life. Thoracolumbar junction is the most common site of spinal injuries. The aims of management of thoracolumbar spinal fractures are to restore vertebral column stability, and to obtain spinal canal decompression. This ultimately leads to early mobilization of the patients. This study was conducted to compare preoperative and post-operative vertebral height, kyphotic angle and sagittal index in patients treated with pedicle screws and rods in thoracolumbar spine fractures. **Methods:** This cross-sectional study was conducted in the department of Neurosurgery, Hayatabad Medical Complex, Peshawar from 1st. February 2010 to 31st. July 2011. A total 161 patients with unstable thoracolumbar spine fracture were included in this study. In these patients fixation was done through transpedicle screws with rods. Anteroposterior and lateral views X-rays of thoracolumbar spine were done pre and post operatively. **Results:** Out of 161 patients, 109 (67.7%) were males and 52 (32.3%) females. The age of patients ranged from 20 to 70 years (mean 42.2 years) with 71 (44.1%) in the age range of 31–40 years. Preoperative average vertebral height was 9.4194 mm while postoperative average was 19.642 mm. The mean kyphosis was 23.06° preoperatively. Immediately after surgery the average correction of kyphosis was 9.45°. The pre-operative average sagittal index was 19.38°, which was reduced to an average 5.41° post operatively. **Conclusions:** Transpedicular fixation for unstable thoraco-lumbar spinal fractures achieves a stable fracture segment with improvement of vertebral height, kyphotic angle and sagittal index. Hence, preventing the secondary spinal deformities.

Keywords: Radiological outcome, Transpedicular screws fixation, thoracolumbar spine injury

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INTRODUCTION

Traumatic fracture of the spine is a serious medical condition that can have a major impact on the patients quality of life, and thoraco-lumbar junction is the most common site of spinal injuries.^{1,2} Spinal fractures are most common among young healthy population, and most common causes of these fractures are high energy traumas, traffic accidents, or fall from heights.³

The primary aim of management of thoracolumbar spinal fractures is to restore the anatomy and vertebral column stability and in doing so spinal canal decompression is done. Once proper decompression and stability are addressed, patient can be mobilized early.⁴ For the purpose of fusion, either anterior, posterior, or both approaches can be used, but the efficacy of either approach is the same. However posterior approach is less extensive, and most of the spine surgeons advocate posterior fusion as the treatment of choice for unstable thoracolumbar injuries.^{5,6}

In early days fixation was used to be done with the help of hooks and wires, however pedicle screw assisted instrumentation provides more rigid fixation.^{7,8} King⁹ initially reported vertebral body

screw fixation using transfacet approach to the lumbar spine in 1944, Boucher¹⁰ introduced the way to place screws into the vertebral body through the pedicle in 1958. Since then, transpedicular screw fixation has become an increasingly popular procedure in the treatment of not only spinal deformity but also in degenerative spinal diseases, trauma, and tumours.

This study was conducted to evaluate the radiological outcome of transpedicular screw fixation in the management of spinal injury in terms of vertebral height, kyphotic angle, and sagittal index.

MATERIAL AND METHODS

This cross sectional study was conducted at the department of Neurosurgery, Hayatabad Medical Complex Peshawar from 1st. February 2010 to 31st. July 2011. A total 161 patients with unstable thoracolumbar spine fracture of fifteen years and above were included in this study. Patients with spine fracture at other level as well as at thoracolumbar region and pathological fractures were excluded from the study because these cases needed removal of dead, necrotic tissue, bone grafting and anterior approach. In these patients fixations were done through transpedicle screws

with rods under C-arm guidance. Antero-posterior and lateral X-rays views of thoraco-lumbar spine were done pre and post operatively for measuring vertebral body height, Kyphotic angle and Sagittal index. Patients' demographic details and radiological findings were recorded on a *pro forma*. Data was analyzed using SPSS version 16. Pair t-test was applied to compare vertebral height, kyphotic angle and sagittal index before and after surgery and *p*-value ≤ 0.05 was considered significant.

RESULTS

Out of 161 patients, there were 109 (67.7%) males and 52 (32.3%) females. The age of patients ranged from 20 to 70 years, mean being 42.2 years. Majority of patients 71 (44.1%) were in the age range of 31–40 years.

The minimum pre-operative vertebral height was 6 mm and maximum 13 mm with a mean of 9.42 ± 1.89 mm. Postoperative radiographs depicted correction of vertebral height. Minimum vertebral height recorded postoperatively was 18 mm and maximum being 22 mm with mean of 19.64 ± 1.19 mm. The difference between the preoperative and postoperative vertebral height being statistically significant.

The preoperative kyphotic angle was between 16–30 degrees with a mean of 23.06 ± 4.11 degrees. This was seen to be a minimum of 2° and max of 16° with a mean postoperative kyphotic angle of $9.45 \pm 3.99^\circ$ degree. The difference was statistically significant.

Mean preoperative sagittal index was calculated to be 19.38 (range 10–28) and the mean postoperative sagittal index being 5.42 (range -5-13). This difference in sagittal index was also found statistically significant. All these results are tabulated in table-1

Table-1: Pre and post-operative measurement of vertebral height, kyphotic angle and sagittal index

Parameters	Minimum measurement	Maximum measurement	Mean	SD	<i>p</i>
Preoperative vertebral height (mm)	6	13	9.42	1.89	.001
postoperative vertebral height (mm)	18	22	19.64	1.19	
Preoperative kyphotic angle (degree)	16	30	23.06	4.11	.000
postoperative kyphotic angle (degree)	2	16	9.45	3.99	
Preoperative sagittal index	10	28	19.38	4.52	.000
postoperative sagittal index	-5	13	5.42	4.69	

DISCUSSION

Spinal fractures can cause debilitating morbidity to the patients and hence pose serious surgical and socioeconomic problems, especially in cases of permanent neurological damage, and treatment of such patients is long, expensive, and followed by permanent disability of patients. In a series of over 1,000 patients with thoracolumbar spine fractures, 16% of fractures were assigned to T1-T10 segment, 52% were assigned to T11-L1 segment, and 32% were assigned to L1-L5 segment¹¹, and according to study done by Price *et al*¹², that almost half of the spinal fractures are due to road traffic accidents, 20% were due to falls, 13% were due to sport injuries, and 11% of the fractures were due to some form of violence.

Various methods of posterior fixation like hooks and Harrington rods have evolved over the past few decades, however pedicle screw instrumentation has revolutionized spine surgery.¹³ Roy-Camille *et al*¹⁴ suggested that a pedicle screw should be introduced by drilling the path and then applying the screw, however nowadays funnel technique is used widely in which the use of taps of gradually increasing diameter through the isthmus of pedicle into the vertebral body is passed with the help of image intensifier, and this procedure have become standard procedure for safe screw application, resulting in strong fixation.¹⁵

The pedicle provides a strong point of attachment of the posterior elements to the vertebral body, that's why it has rapidly become one of the most popular methods for achieving solid fusion. Operative stabilization in transpedicular fixation consists of segmental distraction with pedicle screw fixation one level above and one level below the injured segment.^{16,17}

Loss of surgical correction has been observed with the different treatment methods used such as conservative treatment, posterior fixation, and posterior fixation with a transpedicular graft and to a lesser extent combined posterior fixation and anterior arthrodesis. Because of these facts different researchers and neurosurgeons conclude that no ideal treatment, able to restore the morphology of the vertebral segment to normal physiological levels, is currently available for thoraco-lumbar spine fractures.^{18,19}

In our study the common age group affected was in the third decade of life, and the mean age was 42.2 years, which closely matches with the results of studies done by Yousafzadeh *et al*²⁰, and Hasler *et al*²¹ who showed the common age group affected are 25–44 years, and mean age 44.5 years respectively.

In our study the correction of kyphosis was 92% which closely matches with the results of Magerl *et al*²² who showed it to be 98%. Helton had observed that the sagittal index of the fractured vertebra improved from 8° to 32° (mean 20°) during the preoperative period to 3°–25° (mean 14°) in the immediate postoperative period²³. In our study the sagittal index of the fractured vertebra ranged from 10° to 28° in the preoperative period (mean: 19.38°), from -5° to 13° in the immediate postoperative period (mean: 5.41°). There was a significant difference between preoperative and immediate postoperative values.

In a study done on 76 preoperative kyphosis was 27° averaged and postoperative was 7° averaged, the sagittal index was 26° averaged and postoperative was 12° averaged.²⁴ In this study the preoperative kyphosis 23° averaged and postoperative kyphosis was 9° averaged and preoperative sagittal index was 19° averaged and postoperative was 5° averaged.

Afzal *et al* has computed post-operative kyphosis improved at an average of 7.5 degrees.²⁵ In the present study the preoperative kyphosis 23° averaged that has been improved to 9° averaged postoperatively.

CONCLUSION

Transpedicular fixation for unstable thoraco-lumbar spinal fractures achieves a stable fracture segment with improvement of vertebral height, kyphotic angle and sagittal index. Hence, preventing the secondary spinal deformities.

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