

# Traumatic Thoracolumbar Spine Fractures: Radiographic Outcome after Transpedicular Screw Fixation

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## ABSTRACT

**Objective:** To determine the radiographic outcome of transpedicle screw fixation in patients who had sustained traumatic thoracolumbar spine fractures,

**Study Design:** Quasi-experimental study,

**Place and Duration of study:** This study was conducted at the Department of Neurosurgery, Ayub Teaching hospital, Abbottabad from January, 2017 to August, 2017,

**Materials and Methods:** All patients of both genders who had suffered from traumatic thoracolumbar spine fractures and were between the ages of 20 to 60 years were included in the study. All patients underwent detailed history and clinical examination. Spinal fractures were fixed with transpedicular screw fixation using C-arm guidance and under general anesthesia by an experienced neurosurgeon. Pre- and post-operative spinal radiographs of the affected region were taken in both lateral and anteroposterior views to calculate the height of vertebral body, kyphotic angle and sagittal index.

**Results:** Out of sixty patients who were included in this study, mean age of study participants was  $39.24 \pm 7.24$  years. There were 46 male patients and 14 female patients with male to female ratio of 3.28:1. The mean vertebral body height, kyphotic angle and sagittal index were 52.42 mm, 9.77 degrees and 21.9 degrees before surgery respectively while they were 9.30 mm, 3.59 degrees and 5.52 degrees after the surgery respectively. Paired t-test showed that the differences were statistically significant ( $p$ -value  $< 0.001$ ).

**Conclusion:** Transpedicle screw fixation is an effective and reliable way of managing thoracolumbar spine fractures. It not only helps in early restoration of spinal anatomy but also improves functional outcome in these patients. Radiological parameters are helpful in determining the outcome in immediate postoperative period. But, other parameters like clinical and functional must also be taken into account to predict the long term outcome in these patients.

**Key Words:** Transpedicular, spinal fracture, thoracolumbar, screw

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## INTRODUCTION

Spinal trauma is the leading cause of morbidity and mortality even in modern era. The causes of these injuries include road traffic accidents, fall and sports activities.<sup>1-4</sup> Spinal trauma can either affect spine alone or it can also involve spinal cord.<sup>2</sup> Among trauma patients, incidence of spinal fractures is believed to be around 6% whereas in 2.6% of these cases, spinal cord is also involved.<sup>5</sup>

Injury to spinal cord leads to longstanding debility which has grave consequences based on psychological, physical and socioeconomic reasons.<sup>2</sup> Furthermore, these injuries are associated with an enormous economic burden on a health system. In USA alone, the cost of treating spinal cord injuries is valued to be around \$9.7 billion per annum.<sup>6</sup>

After cervical spine, thoracolumbar spine is the second most common spinal area affected by traumatic spine injuries. This region is involved in about 30 to 60% of all cases of spinal trauma. Out of these injuries to thoracolumbar area, 15 to 20% are associated with neurological impairment.<sup>5,7,8</sup> Thoracolumbar injuries follow a bimodal pattern with peaks in those who are less than thirty years of age and in geriatric people.<sup>5</sup> Main aim of treating these fractures surgically is to restore vertebral column stability and to attain spinal cord decompression which in turn leads to early mobilization of the patient.<sup>9</sup> Transpedicular screw fixation of thoracolumbar spinal fractures is a widely

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accepted surgical technique for this purpose.<sup>10, 11</sup> We have conducted this study to determine the radiological outcome in patients who had sustained traumatic thoracolumbar fractures and were treated with transpedicular screw fixation technique.

**MATERIALS AND METHODS**

This was a quasi-experimental study which was conducted at the Department of Neurosurgery, Ayub Teaching hospital, Abbottabad, from January, 2017 to August, 2017. Sampling approach used was a non-probability consecutive sampling. Study was approved by hospital ethics committee and informed consent was taken. Patients who had suffered traumatic thoracolumbar spine fracture, between the ages of 20 to 60 years and of both genders were included in the study. Whereas patients with spinal fracture secondary to malignancy or pathological spine fractures or multiple spinal injuries or patients with severe spinal cord or neurological injury were excluded from the study. A pre-structured proforma was used to record the demographic data of the study participants. All patients underwent detailed history and clinical examination. Spinal fractures were fixed with transpedicular screw fixation using C-arm guidance and under general anesthesia by an experienced neurosurgeon. Pre- and post-operative spinal radiographs of the affected region were taken in both lateral and antero-posterior views to calculate the height of vertebral body, kyphotic angle and sagittal index, (SI).

SPSS (version 22) was used to manage and analyze data. Data were expressed as percentages, frequencies and mean ± standard deviation as required. Significance between pre- and post-operative variables was determined using paired t-test with p-value < 0.05 was taken as significant.

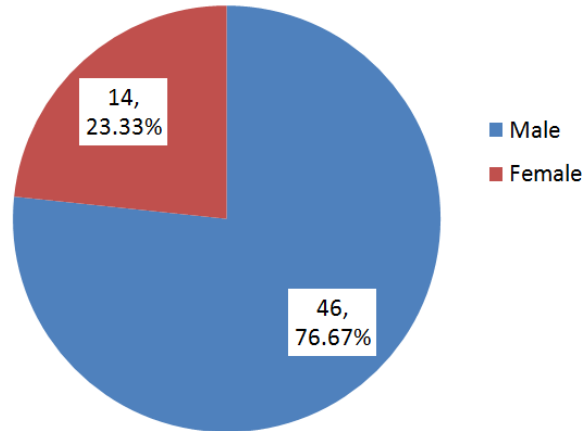
**RESULTS**

**Table No.1. Pre-operative and post-operative values of radiological parameters, (n=60)**

| Variable                | Preoperative Measurements |               | Postoperative Measurements |              | P value |
|-------------------------|---------------------------|---------------|----------------------------|--------------|---------|
|                         | Mean± SD                  | Range         | Mean± SD                   | Range        |         |
| Vertebral height (mm)   | 52.42± 4.45               | 44.75 – 59.90 | 9.30± 0.58                 | 8.40 – 10.36 | .001    |
| Kyphotic angle (degree) | 9.77± 1.86                | 6.88 – 13.25  | 3.59± 1.37                 | 1.16 – 5.88  | .000    |
| Sagittal index (degree) | 21.90± 5.23               | 13.54 – 31.99 | 5.52± 2.26                 | 2.25 – 9.76  | .000    |

Out of sixty patients who were included in this study, mean age of study participants was 39.24±7.24 years, (range = 28 – 53 years). There were 46 male patients and 14 female patients with male to female ratio of 3.28:1 showing higher predilection for male gender, as shown in Figure 1..

Pre- and post-operative measurements are given in Table 1. The mean vertebral body height, kyphotic angle and sagittal index (SI) were 52.42 mm, 9.77 degrees and 21.9 degrees before surgery respectively while they were 9.30 mm, 3.59 degrees and 5.52 degrees after the surgery respectively.



**Figure No.1: Gender distribution of study population, (n=60)**

**DISCUSSION**

For many decades, transpedicle screw fixation is used to stabilize thoracolumbar spine and it is one of the robust posterior fixation technique which is used for steadying the thoracolumbar spine, especially in cases of traumatic spinal fractures.<sup>12</sup> It has global acceptance as well as it is found to be more advantageous when compared with other procedures of spinal instrumentation.<sup>13,14</sup> This might be due to the reason that this procedure leads to remarkably higher pedicle screw placement accuracies. A meta-analysis conducted by Tian NF and Xu HZ reported accuracies of up to 89.22% among 7533 transpedicle screws which were placed.<sup>15</sup> Furthermore, it leads to improved mechanical spinal stability as well as neurological functional improvement which in turn leads to early mobilization, timely recovery and reduced inpatient stay.<sup>1, 8</sup>

In this study, average age of study participants was 39 years and there were 76.67% male patients and 23.33% female patients. Davis and Dunn, who had conducted their study in south Africa, found that the mean age of their study patients was 36 years and there were 76.92% male patients and 23.08% female patients<sup>16</sup> Similarly, Butt et al reported, from Srinagar, India, that the mean age of their patients was 33.6 years and 70% of them were males.<sup>1</sup> Likewise, in a Qatari study conducted by

Faramaway et al, mean age of patients was found to be 33.2 years and majority of them, 90%, were males.<sup>2</sup>

There was a significant improvement in radiological parameters in immediate postoperative period in our study, ( $p < 0.001$ ). Singh et al have also reported a highly significant improvement in SI in postoperative period from the preoperative values. SI was improved by  $10.3^\circ$  in their study.<sup>17</sup> Likewise, Kim et al have also described significant radiographic improvement in mean kyphotic angle and vertebral height in their Korean patients with thoracolumbar spine fractures.<sup>18</sup> Similarly, according to Butt et al, there was a substantial improvement in the radiological parameters in patients with thoracolumbar spine injuries and who were managed with transpedicle screw fixation using posterior approach.<sup>1</sup> Milenković et al have also described transpedicle screw fixation to be a successful approach to manage thoracolumbar spine fractures in their study. It not only lead to mechanically stable fracture fixation but also marked clinical improvement in their patients postoperatively.<sup>19</sup>

There are complex number of factors which predict the neurological outcome in patients who had sustained thoracolumbar spinal injury and therefore, no single factor can predict the outcome in such patients accurately.<sup>17</sup> Hence, other parameters e.g. clinical and functional must be taken into account along with radiological parameters to accurately gauge the final outcome in such patients.<sup>20</sup>

## CONCLUSION

Transpedicle screw fixation is an effective and reliable way of managing thoracolumbar spine fractures. It not only helps in early restoration of spinal anatomy but also improves functional outcome in these patients. Radiological parameters are helpful in determining the outcome in immediate postoperative period. But, other parameters like clinical and functional must also be taken into account to predict the long term outcome in these patients.

### Author's Contribution:

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| Revisiting Critically:     | Syed Irfan Raza Arif,<br>Muhammad Sajjad,<br>Mohammad Mushtaq |
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**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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