

Original Article (SPINE)

## Results of Lumbar Transpedicular Fixation for Spondylolisthesis, in Terms of Back Pain Relief

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### ABSTRACT

**Objective:** The goal of this study was to see how transpedicular fixation for degenerative spondylolisthesis affected lumbago.

**Methodology:** A retrospective observational study was conducted at the Department of Neurosurgery in Hayatabad Medical Complex, Peshawar between May 2018 and February 2020. Degenerative spondylolisthesis was diagnosed using static and dynamic spinal X-rays. The research excluded the patients with grade 5 spondylolisthesis, congenital anomalies, or prior spinal surgery. The visual rating scale was used to assess pain alleviation (GRS). Dynamic or static lumbosacral X-rays and 3D CT scans were used to assess union.

**Results:** In total 70 patients, 38 (54.3%) were male and 32 (45.7%) were female. L5–S1 was impacted in most of the cases (68%). 40% of patients were having Meyerding grade II. All patients had pedicle screw fixation. Following surgery, 44 (63%) patients reported no pain, and 12 (17%) patients reported mild discomfort. 8 (11%) patients reported moderate pain and 6(9%) patients experienced severe pain. There existed a significant difference between pre/postoperative moderate-severe GRS scores (p-value: 0.000336). After surgery, we were able to negotiate surgical unions with 91.4% of the patients.

**Conclusion:** For individuals with spondylolisthesis who need pain relief, transpedicular fixation is a safe, straightforward, and effective treatment. It also aids with the surgical union and the improvement of the neurological condition.

**Keywords:** Spondylolisthesis, Meyerding grading, Transpedicular fixation.

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### INTRODUCTION

Spondylolisthesis is the forward slippage of the upper vertebra relative to the lower one, and it is characterized as dysplastic, ischemic, degenerative, traumatic, pathologic, and iatrogenic by Wiltse and Rothman.<sup>1</sup> Short-segment instrumentation is the treatment of choice.<sup>2</sup> Boucher in 1958, established the means to anchor the vertebral bodies by using screws

through the pedicles, after first reporting vertebral body screw fixation by the trans facet approach to the lumbar spine in 1944.<sup>3</sup> Conservative treatment is often suggested in patients with no neurologic deficit, tolerable pain or of short duration, improvement with an activity program or brace treatment, and a high level of patient comorbidity. When therapy fails, regardless of the spondylolisthesis grade, disc height, or mobility, operational treatment is superior.<sup>4</sup>

Pedicle screws have been frequently employed in the treatment of lumbar spine problems since they were first reported by Roy Camille and colleagues in 1963. The best way to treat thoracolumbar fractures is still a point of contention.<sup>5-6</sup> The transpedicular short-segment successfully restores the anterior column without needing plate fixation of the anterior strut. It, therefore, avoids motion segment arthrodesis.<sup>7</sup> Research proved the advantage of using pedicle screws that substantiate pedicle function better than wires or hooks.<sup>8</sup> This approach has yielded several unsatisfactory findings to date. Those who advocated for temporizing therapies claimed that only postures and long-term relaxations could produce good outcomes.<sup>8-9-10</sup> Others, on the other hand, say that by utilizing decompression and fixation, patients may anticipate becoming mobile sooner, undertake rehabilitative treatments to overcome anatomic fractures, and improve, in most cases, neurological functioning.<sup>11</sup> There were several reports of degraded neurological functioning, worsening spinal stenosis, increasing pressure on the vertebral body, increasing kyphosis and generating radiculopathy, and discomfort after temporizing therapies.<sup>12</sup>

A literature review reveals several studies done on transpedicular fixation and its outcome. But limited work on how much this procedure relieves back pain. This study determined the effectiveness of transpedicular fixation in terms of relieving back pain. The result of this study will be

shared with our Neurosurgery colleagues to draw some recommendations regarding surgical intervention.

## **MATERIAL AND METHODS**

### **Study Design & Setting**

A retrospective observational study was commenced after approval from the Institutional review board and agreement from patients between May 2018 and February 2020, with a six-month to five-year follow-up period. The research was carried out at Peshawar's Hayatabad Medical Complex's Department of Neurosurgery.

### **Inclusion Criteria**

A total of 70 people who needed surgery were included in the research. Both genders with a single degree of spondylolisthesis between the ages of 20 and 80 were included in the research. Those with modest disc changes were also included, as were those with intact disc heights. Patients with severe lower back pain or radiculopathy who agreed to surgery after conservative treatment failed were also included.

### **Exclusion Criteria**

Participants who were considered unfit, recalcitrant, or on conservative therapy were not permitted to take part. Patients under the age of 20, those with local tissue abnormalities requiring immediate treatment, those with spondylolisthesis without symptoms, and those with mild backaches lasting less than three months were all excluded from the research. Those who could not be contacted after six months were likewise removed.

### **Surgical Management**

The procedures were carried out by a group of neurosurgical departments from Peshawar's Hayatabad Medical Complex. Every patient had

been given a proforma to fill, and for the digital records, the Microsoft Access database was customized. A prospective analysis of all lumbar spine fractures treated with surgery was conducted to assess different clinical factors. In tiny segmentation, patients had transpedicular fixation. For a minimum of six months, charts, operating notes, pre, and post-surgical radiography, and visit records were analyzed. General anesthesia was used on the patients, and they were operated on in prone positions. An image intensifier was used to level and place all pedicle screws, which were inserted utilizing anatomical landmarks. Pain relief, post-surgical union, and neurological conditions were documented.

## Data Analysis

Before and after surgery, patients' pain was measured using the graphic rating scale (GRS). Union was determined by clinical tests, static/dynamic X-rays, and thin slice 3-D CT scans. The data were analyzed using SPSS, Version 25, for frequencies and descriptive statistics. To determine whether there was a significant difference between preoperative and postoperative GRS values/levels, a Chi-square test was used. Chi-square was not applicable for the zero-cell value. A p-value of less than 0.050 was regarded as significant.

## RESULTS

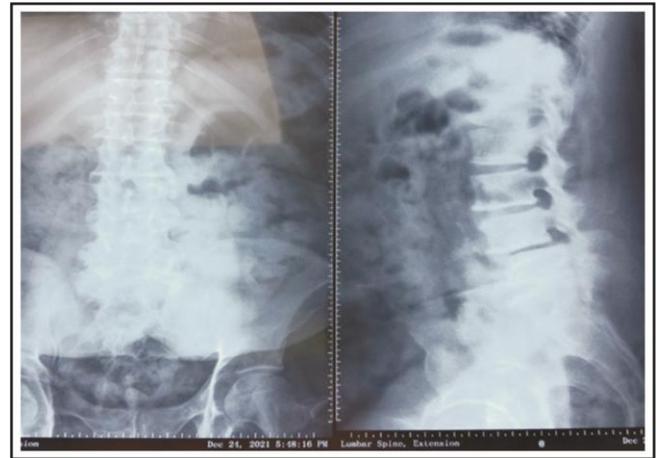
### Age & Gender Distributions

In total 70 cases, 38 (54.3%) were male and 32 (45.7%) were female patients, Majority of the patients, were between 30 – 40 years of age.

### Imaging

**Figure 1** shows a grade 1 spondylolisthesis. **Figure 2** shows a post-operative lumbar spine X-ray with transpedicular fixation at the L4, L5, and

S1 vertebral bodies. **Figure 3** depicts a disc prolapse causing significant radiculopathy.



**Figure 1:** Flexion extension radiographs of lumbar vertebrae. (image used with patient's permission)



**Figure 2:** After screw fixation, and correction of listhesis. (image used with patient's permission)

### Grades of Spondylolisthesis and Impacted Lumbar Vertebrae

Most of the patients reported pain from the surgery. L5–S1 in 48(68%) cases, L4–L5 in 16(23%), L3–L4 in 4(6%), and L2–L3 were involved in 2(3%)

**(Table 1).**

22 (31%) patients had grade I spondylolisthesis, 28 (40%) were having Meyerding grade II, 16 (23%) had grade III, and 4 (6%) had degree IV spondylolisthesis. All patients had pedicle screw fixation **(Table 1).**

On the first day after surgery, they were gradually ambulated considering their neurological condition. Patients were followed up

Spondylolisthesis Grades	Frequency	Percentages
I	22	31%
II	28	40%
III	16	23%
IV	4	06%
<b>Levels of Impacted Lumbar Vertebrae</b>		
L5–S1	48	68%
L4–L5	16	23%
L3–L4	4	6%
L2–L3	2	3%

for an average of two years and five months (ranging from six months to five years).

**Pre and Post Operatively Pain**

Pain relief was measured using a visual/graphical rating scale (GRS). Following surgery, 44 (63%) patients reported no pain, and 12 (17%) patients reported mild discomfort. 8 (11%) patients reported moderate pain and 6 (9%) patients experienced severe pain **(Table 2).**

There existed a significant difference between pre/ post-operative moderate-severe GRS scores (p value: 0.000336) **(Table 2).**

After surgery, we were able to negotiate surgical unions with 64 (91.4%) of the patients. Dynamic or static lumbosacral x-rays and 3D CT scans were used to assess union. After surgery, the patient's neurological condition did not deteriorate. We had one patient who experienced implant failure and another who had a wound infection after surgery.

Pain (GRS)	Pre-operatively	Post-operatively	Chi Square
No Pain	0	44	(between moderate & severe)
Mild	0	12	Chi-Sq: 12.85
Moderate	8	8	P-value: 0.000336
Severe	52	6	Significant result
Excruciating	10	0	

**DISCUSSION**

Through the current study, we found that there was a significant improvement in pain after surgery in patients with severe or excruciating pain at the time of presentation. The patient's neurological status did not worsen following surgery. Transpedicular fixation is a safe, simple, and effective therapy for those with spondylolisthesis who seek pain alleviation. It also helps with the surgical union and neurological improvement in patients.

Significant discomfort, neurological deficits, or deformity are common in symptomatic patients. A non-union of the pars interarticularis fatigue fracture is the lesion in spondylolysis.<sup>13-14</sup> Early transpedicular instrumentation allows patients to get back on their feet sooner, reducing nerve damage by stabilizing the spine, which is a significant advantage of thorough internal mending over brief medicines<sup>14-19</sup> It has been stated that stance-based treatments will suffice and that it is possible to make patients mobile after regaining their stability through long-term

restoration.<sup>20</sup> Another treatment option for low-grade slippage is dynamic stabilization, which involves the use of interspinous and pedicle screw-based devices.

Reduction of high-grade spondylolisthesis can damage exiting nerve roots and fusion can be done without reduction of the listhesis. A cancellous screw can be passed across the pedicle of the lower adjacent vertebra to the body of the upper slipped vertebra.<sup>21</sup> High-grade spondylolisthesis patients must endure a difficult and disputed surgical surgery. The main drawbacks of this surgery are the steep learning curve and radiation exposure for both doctors and nurses, which may be decreased as much as possible by adopting the new 3D CT screw insertion technology. It is a good option for treating unstable thoracolumbar fractures with no neurological deficit. Brief-term surgery, little blood loss, and nearly no muscle injury result in less postoperative discomfort than typical open operations, as well as short hospitalization, early mobility, a faster return to work, and a reduced risk of complications.<sup>22</sup>

For the unstable spine, the use of Transpedicular fixation devices has been considered rewarding though there are currently being developed. These techniques may achieve stiff fixation in the vertebra that lacks posterior parts, firm sacral fixation, and connecting vertebra, while maintaining lordosis, preventing distraction, and fusing short spinal segments. They also offer preservation of motion segments. Even when performing drastic decompressions and spinal resections, stable, short segment structures can be established.<sup>23</sup>

In prospective research, 133 patients with crippling low back pain were treated with temporary external transpedicular fixation of the lumbosacral spine. 67% had a history of previous surgery on their spine. 55 of 133 patients were chosen for spinal fusion based on temporary external transpedicular fixation, while the remaining 78 patients were managed

conservatively.<sup>23</sup> Patients with prolonged low back discomfort following TDR (total disc replacement) who do not have device failure or neighboring segment diseases may benefit from lumbar transpedicular fixation without removing the disc prosthesis. Despite the small number of patients in a study by Cinibulak et al. (2021),<sup>25</sup> it was demonstrated that fusion is preferable to TDR in some cases. Patients who do not get adequate low back pain alleviation following TDR despite presumably well-placed disc prosthesis and no evidence of neighboring segment disease may benefit from salvage surgery with posterior transpedicular fixation without anterior disc replacement. The danger of adverse effects is decreased with this method. However, further comparison research and long-term outcomes evaluations are needed to corroborate these findings.<sup>26</sup> The goal of the study was to see how effective minimally invasive polyetheretherketone (PEEK) rod devices are for treating lumbar spine degenerative disorders. In 83.4 percent of instances, the PEEK rod fixation delivers satisfactory to outstanding clinical outcomes. Within a year, the low volume of movements on the operated segment had remained, with no evidence of nearby intervertebral disc degeneration.<sup>26</sup>

Lower back pain is a major worldwide health problem that affects individuals and has a negative influence on productivity. The use of invasive surgery as a kind of intervention jeopardizes the patient's integrity and frequently has severe consequences. Traditional open surgical approaches frequently result in a long healing period, including a gradual remission of the symptoms that surgery is intended to alleviate. Given this environment, the development of endoscopic and microscopic surgical procedures has significantly driven to search for innovative medicinal and surgical therapy solutions.<sup>27</sup>

## CONCLUSION

For patients with spondylolisthesis, transpedicular instrumentation is a safe, easy, and effective technique to reduce back pain. Patients develop synostosis and recover satisfactorily. Pain relief, as well as neurological improvements, are noticeable, with no noteworthy problems.

Transpedicular screw fixation gives excellent fusion for the delineated spine and should be considered for the relief of painful symptoms when conservative treatments have failed. It should be done by a qualified surgeon for the best results.

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## Additional Information

**Disclosures:** Authors report no conflict of interest.

**Ethical Review Board Approval:** The study was a retrospective study. The study conformed to the ethical requirements.

### Conflicts of Interest:

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

**Financial Relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

**Other Relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

## AUTHOR CONTRIBUTIONS

Sr. No.	Author's Full Name	Intellectual Contribution to Paper in Terms of
1.	Sohail Amir	Study Design, Methodology, and Paper Writing.
2.	Mushtaq	Data Calculation and Data Analysis.
3.	Shahid Ayub	Interpretation of Results.

4.	Tabraiz Wali Shah	Literature Review.
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