

## COMPARISON OF TRANSFORAMINAL LUMBAR INTERBODY FUSION AND POSTERIOR LUMBAR INTERBODY FUSION IN THE MANAGEMENT OF SINGLE-LEVEL LUMBAR SPONDYLOLISTHESIS

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**Abstract:** *This study aimed to compare the outcomes of transforaminal lumbar interbody fusion and posterior lumbar interbody fusion in managing single-level lumbar spondylolisthesis. A Randomized Controlled trial was conducted at the Department of Neurosurgery, Gomal Medical College, DI Khan, Pakistan, from December 2022 to May 2023 on 50 patients presenting with adult lumbar spondylolisthesis. In group A, 25 patients underwent posterior lumbar interbody fusion (PLIF) utilizing two cages and pedicle fixation, while 25 patients received transforaminal lumbar interbody fusion (TLIF) employing a single cage and pedicle fixation, representing group B. Outcomes such as mean operative times, blood loss, back and leg pain score on VAS, and complications were assessed between both groups. The mean postoperative time, blood loss, and back pain on the VAS scale were significantly lower in the TLIF group than in the PLIF group. The TLIF group showed a lower number of complications as compared to the PLIF group. TLIF outperforms PLIF regarding functional outcomes and the rate of complications for grade I/II single-level lumbar spondylolisthesis.*

**Keywords:** Lumbar spondylolisthesis, Posterior lumbar interbody fusion (PLIF), Transforaminal lumbar interbody fusion (TLIF), Randomized Controlled Trail

### Introduction

Lumbar spondylolisthesis is a common spinal condition characterized by the displacement of one vertebra over an adjacent one in the lumbar region. It often leads to debilitating lower back pain, neurological deficits, and a reduced quality of life for affected individuals (Sun et al., 2016). While conservative treatments like physical therapy and medications can be effective for mild cases, surgical intervention may be necessary for more severe forms of spondylolisthesis. Two widely employed surgical techniques for managing single-level lumbar spondylolisthesis are transforaminal lumbar interbody fusion (TLIF) and posterior lumbar interbody fusion (PLIF). This paper aims to comprehensively compare these two surgical approaches, examining their indications, surgical procedures, advantages, disadvantages, and outcomes (Chan et al., 2019; Matz et al., 2016).

Transforaminal Lumbar Interbody Fusion (TLIF) is a minimally invasive surgical technique developed as an alternative to traditional PLIF. It involves accessing the affected spinal segment through a unilateral posterolateral approach, typically from the affected or symptomatic side of the patient (de Kunder et al., 2017). The surgeon removes the intervertebral disc and prepares the endplates of the adjacent vertebrae. A bone graft or interbody cage is inserted into the disc space to restore disc height and facilitate fusion. TLIF allows for indirect decompression of neural elements by restoring the intervertebral height, and it

is known for its ability to maintain segmental stability (Fan et al., 2021; Lan et al., 2018).

Posterior Lumbar Interbody Fusion (PLIF), on the other hand, is a more conventional surgical approach that involves a midline incision and the removal of the posterior portion of the vertebral lamina (Qureshi et al., 2017). The intervertebral disc is removed, and the adjacent vertebral bodies are prepared for fusion. Unlike TLIF, PLIF allows for direct visualization of neural elements and decompression, making it suitable for cases with more severe neural compression. A bone graft or interbody cage is inserted into the disc space, similar to TLIF, to promote fusion and segmental stability (Caelers et al., 2021; Li et al., 2020; Liu et al., 2016).

The choice between TLIF and PLIF often depends on the specific characteristics of the patient's condition. TLIF is typically preferred for mild to moderate neural compression cases, as it provides a less invasive approach and preserves more posterior spinal elements. PLIF, on the other hand, is favored when there is severe neural compression or when direct decompression of the nerve roots is necessary. Proper patient selection is crucial for achieving successful outcomes and minimizing complications (Glassman et al., 2016; Li et al., 2016).

Managing single-level lumbar spondylolisthesis is a complex decision that requires careful consideration of the patient's condition and the surgical technique. This paper will probe into the nuances of TLIF and PLIF, comparing

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their indications, surgical procedures, advantages, disadvantages, and clinical outcomes to help clinicians and patients make informed decisions regarding the most appropriate surgical approach for this challenging spinal condition.

**Methodology**

During the period spanning from December 2022 to May 2023, a total of 50 patients diagnosed with adult lumbar spondylolisthesis were subjected to lumbar interbody fusion and pedicle screw fixation treatment at the Department of Neurosurgery, Gomal Medical College, DI Khan, Pakistan. Within the cohort of patients under study, 25 individuals underwent posterior lumbar interbody fusion (PLIF) utilizing two cages and pedicle fixation, constituting group A. Conversely, 25 patients received transforaminal lumbar interbody fusion (TLIF) employing a single cage and pedicle fixation, representing group B. The criteria for inclusion in the study were as follows: participants must have had a single-level spondylolisthesis with a low-grade classification according to the Meyerding grading system (grades I or II), regardless of whether it was of isthmic or degenerative origin. Additionally, participants must have reported suffering substantial discomfort in the back and legs that did not show improvement with conservative treatment methods. The exclusion criteria consisted of spondylolisthesis grades III and IV, instrumentation spanning more than two levels, a previous history of lumbar spine fusion surgery, the coexistence of spine deformities such as scoliosis, tumors, or trauma, and the diagnosis of osteoporosis determined by radiography and bone mineral density examination (T-score ≤ 2.5). Before the surgical procedure, the body mass index (BMI) was computed for all participants, and those with a BMI equal to or exceeding 40, which signifies morbid obesity, were excluded from the research investigation. All the surgeries were performed by a single consultant neurosurgeon with more than 5 years of

experience. All participants provided informed consent, and the selection of the particular lumbar fusion technique was based on individual considerations, including the patient's clinical requirements, the surgeon's preferences, and the patient's informed consent following a comprehensive explanation of the different surgical procedures. Mean operative times, blood loss, back and leg pain score on VAS, and complications were assessed between both groups. Data was analyzed using SPSS 24. Numerical figures were evaluated using mean and standard deviation, while categorical data was analyzed using frequency and percentages. Independent Samples T-test was applied to compare numerical figures between both groups, keeping the P value significant at < 0.05.

**Results**

We conducted this study on 50 patients divided into two groups equally. The mean age of the patients was 35.14±7.76 years. Regarding gender distribution, there were 56% male and 44% female patients. Group A patients had PLIF, while group B patients had TLIF. Regarding the outcomes between both groups, we observed that the mean operative time in group A was 126.44±12.03 mins, while in group B, it was significantly shorter, 113.32±8.48 mins (P < 0.05). The mean blood loss in group A was 440±76.33 cm<sup>3</sup>, while in group B it was significantly lower, 371.40±39.2 cm<sup>3</sup> (P < 0.05). There was no difference between both groups regarding postoperative VAS leg pain (P > 0.05), while the postoperative back pain on VAS was significantly lower in group B as compared to group A (P < 0.05). In group A, 3 patients had a Dural tear, while 1 patient in group B had a Dural tear. In group A, 2 patients suffered from a neurologic deficit, while no patient in group B had a neurologic deficit. A wound infection was seen in 1 patient in group A, while no one in group B had a wound infection.

**Table 1: Comparison of outcomes between both groups**

Outcomes	Groups	N	Mean	Std. Deviation	P value
Operative time (Mins)	Group A	25	126.44	12.03	0.0001
	Group B	25	113.32	8.48	
Blood loss (cm <sup>3</sup> )	Group A	25	440	76.33	0.0001
	Group B	25	371.40	39.2	
Postoperative VAS leg pain	Group A	25	2.16	1.02	0.112
	Group B	25	1.72	.891	
Postoperative VAS back pain	Group A	25	3.16	.898	0.001
	Group B	25	2.32	.802	

**Table 2: Complications between both groups**

Complication		Group A		Group B	
		n	%	n	%
Dural tear	Yes	3	12.0%	1	4.0%
	No	22	88.0%	24	96.0%
Neurologic deficit	Yes	2	8.0%	0	0.0%
	No	23	92.0%	25	100.0%
Wound infection	Yes	1	4.0%	0	0.0%
	No	24	96.0%	25	100.0%

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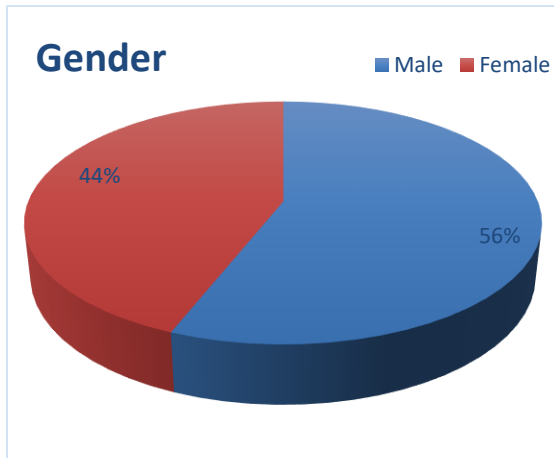


Figure 1: Distribution of Gender in study population

### Discussion

The prevalence of degenerative lumbar illness, characterized by lower back discomfort and potential limb nerve complications, has increased in recent years, primarily attributed to the aging demographic. This ailment poses significant challenges for affected persons. Lumbar decompression and fusion surgery is a well-established therapeutic approach to treating degenerative spine disorders such as disc degeneration, spondylosis, and spondylolisthesis. The efficacy of this treatment has demonstrated notable enhancements during its development, primarily attributed to the progressions in surgical methodologies, particularly interbody fusion techniques (Agabegi and Fischgrund, 2010).

Two frequently used lumbar fusion methods include TLIF and PLIF. Historically, PLIF has been regarded as the favored choice (Wu et al., 2008). Nevertheless, the substantial decompression in this surgical technique may diminish the viable surface area for achieving successful bone fusion, potentially constraining its efficacy. The utilization of interbody procedures, which aim to enhance the area available for fusion, has resulted in TLIF surpassing posterior lumbar fusion (PLF) as the prevailing method for treating lumbar spondylolisthesis (Spruit et al., 2002). The prevalence of degenerative spondylolisthesis patients who underwent TLIF treatment witnessed a notable rise from 13.6% in 1999 to 32% in 2011. The reported increase in fusion rates with TLIF compared to PLF, reaching up to 90% in certain experiments, contributed significantly to this transition. Utilizing an interbody spacer offers many advantages, including biomechanical assistance for the anterior column, load distribution, indirect compression alleviation, and fortification of the posterior pedicle screw and rod configuration (Videbaek et al., 2006).

Regardless of whether it is degenerative or isthmic in etiology, spondylolisthesis frequently manifests with symptoms such as nerve-related complications and back discomfort, attributable to instability and compression (Kwon et al., 2005). Nevertheless, the surgical intervention for spondylolisthesis encompasses not only the alleviation of pressure on neural tissue and the stabilization of the impacted spinal segment but also emphasizes the restoration of disc space height and the realignment of the spine in terms of both sagittal plane translation and rotation (STONECIPHER and WRIGHT, 1989).

Our study observed that the mean operative time and blood loss in the TLIF group were significantly lower than in the PLIF group ( $P < 0.05$ ). A similar observation has been reported by a study which showed that the mean operative time and blood loss in TLIF were significantly lower than PLIF ( $P < 0.05$ ) (Rezk et al., 2019).

We observed a significant reduction in back pain score on VAS in the TLIF group as compared to PLIF groups ( $P < 0.05$ ), but we did not see a significant difference between leg pain score on VAS between both groups ( $P > 0.05$ ), similar observation has been reported by the aforementioned study as well.<sup>19</sup> We noted that the postop complications were lower in the TLIF group.

### Conclusion

The present research has the potential to demonstrate that TLIF outperforms PLIF in terms of functional outcomes and the rate of complications for grade I/II single-level lumbar spondylolisthesis.

### Declarations

#### Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

#### Ethics approval and consent to participate

Approved by the department Concerned.

#### Consent for publication

Approved

#### Funding

Not applicable

### Conflict of interest

The authors declared absence of conflict of interest.

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