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Original Research Article

# Comparative Study of PLIF and TLIF Treatment in Adult Degenerative Spondylolisthesis

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**Abstract**

**Background:** In this study, the therapeutic effects of pedicle screw fixation and posterior lumbar interbody fusion (PLIF) and transforaminal lumbar interbody fusion (TLIF) on the treatment of adult degenerative spondylolisthesis are compared. Transforaminal lumbar interbody fusion (TLIF) and posterior lumbar interbody fusion (PLIF), two frequent surgical techniques for degenerative spondylosis and disc disease, both involve spinal fusion. For the treatment of lumbar spondylolisthesis, a number of surgical methods have been suggested, however there is still debate over the best surgical approach. The indications and contraindications for TLIF and PLIF are the same in both of these treatments. The posterior method of PLIF allows for great vision of anatomical structures, a 360-degree fusion using a single incision, and neural decompression while keeping posterior support systems. The drawback is a higher incidence of nerve root and dural injury.

**Aim:** This study is to compare the therapeutic effect of posterior lumbar interbody fusion (PLIF) and transforaminal lumbar interbody fusion (TLIF) with pedicle screw fixation on treatment in adult degenerative spondylolisthesis.

**Material And Method:** The current study was conducted in the past. The study population included all patients who presented to the orthopedics department's OPD. Patients in a retrospective analysis with adult degenerative spondylolisthesis at the L5-S1 or L4-L5 levels (grades I-II) had PLIF or TLIF. At first, 60 patients met the requirements for the trial, and 10 patients were lost to follow-up. 35 patients who were still eligible for analysis got PLIF with two cages.

**Results:** Between the initial postoperative and the final postoperative follow-up, there were no appreciable changes in the rate of spondylolisthesis and reduction. The two groups had comparable rates of spondylolisthesis, reduction, and loss of reduction. There were no changes between the two groups in terms of disc height or intervertebral foramen height, both of which were superior to preoperative. Both groups saw similar intervertebral foramen and intervertebral space loss.

**Conclusion:** In the treatment of adult degenerative spondylolisthesis, interbody fusion with either a PLIF approach or a TLIF technique yields positive results. The TLIF process is less complicated than the PLIF method and equally safe and efficient. The results of this study show that the TLIF technique provides a good substitute for the more conventional PLIF procedure.

**Keywords:** Spondylolisthesis, Intervertebral Fusion, Internal Fixation, TLIF, PLIF, Degenerative Spondylosis and Disc Disease.



## Introduction

In older patients, lumbar spondylosis with degenerative disc disease and facet disease is a common source of impairment. Mechanical back pain, radiculopathy, and claudication are typical signs of lumbar spondylosis and disc disease, as well as a poor quality of life. In their lifetimes, 60 to 85% of adults will have low back pain, with 90% of them experiencing relief within 6 weeks. Between 15 and 40 percent of people experience chronic low back pain that doesn't go away in three months. Spinal fusion is the go-to procedure for treating spine diseases such lumbar spondylosis and degenerative disc degeneration. The goal of spinal fusion is to achieve a primary solid arthrodesis, which will lessen low back pain and enhance quality of life.[1] The process of spinal fusion, or arthrodesis, has changed over time. A spinal fusion can be performed using an anterior, posterior, lateral, or posterolateral approach.[2]

A therapy option for symptomatic spinal instability, spinal stenosis, spondylolisthesis, and degenerative scoliosis, lumbar spinal fusion was first proposed about 70 years ago. The usage of lumbar fusion surgery has dramatically increased over the past ten years in the United States due to broader applications, including as the treatment of chronic low back pain and recurring radiculopathy.[3-4] When there is evidence of preoperative lumbar spinal deformity or instability that potentially get worse after laminectomy alone, lumbar spinal fusion is frequently done following a posterior decompressive operation.[5]

Techniques for interbody fusion have been developed to fix spinal segments firmly while preserving load-bearing capability and the right disc height.[6] Eighty percent of the compressive, torsion, and shear stresses are transferred through the anterior column, making it crucial to be able to repair it after disc evacuation.[7-9] With direct transperitoneal or retroperitoneal access to the lumbar spine, the anterior technique can be used to reconstruct the anterior column. A 360° or circumferential fusion can be achieved by combining posterior fusion with instrumentation. In comparison to posterolateral fusion, this technique requires two surgical approaches, which increases operating time and raises the possibility of problems with anterior approaches to the lumbar spine. The posterior lumbar interbody fusion is an alternate technique for restoring the anterior column. Several surgeons made modifications to the initial posterior lumbar interbody fusion procedure.[10] It is believed that the drawbacks of the TLIF, such as epidural scarring, can be avoided with Dr. Harms' transforaminal posterior lumbar interbody fusion procedure, which incorporates a transforaminal approach to the anterior interspace.[11]

When lumbar spondylolisthesis occurs, surgical fusion stabilises the spine and helps individuals with chronic low back pain feel less discomfort.[12] The pars interarticularis can be repaired, as well as anterior interbody fusion, posterior interbody fusion, posterolateral fusion, and other surgical fusion methods.[13-14] By using a single posterior approach, PLIF or TLIF can circumferentially stabilise the spine by

inserting pedicle screws and an interbody spacer.[15-16] In terms of fusion or clinical results, there is no solid proof that one technique is better than the other.[17]

To the best of our knowledge, there are just a few papers in the medical literature comparing adult degenerative spondylolisthesis problems and their prognostic characteristics between PLIF and TLIF one-level segment therapy. Our research aimed to compare the two surgical methods, pinpoint issues that were unique to each operation, and uncover preoperative variables that might have predicted complications.

## Material and Methods

The current study was conducted in the past. The study population included all patients who presented to the orthopedic department's OPD. Patients in a retrospective analysis with adult degenerative spondylolisthesis at the L5-S1 or L4-L5 levels (grades I-II) had PLIF or TLIF. At first, 60 patients met the requirements for the trial, and 10 individuals were lost to follow-up. 35 patients who were still eligible for analysis got PLIF with two cages. The institute's Ethics Committee gave the study their blessing. After obtaining participants signed informed consent, the questionnaire was distributed to the chosen individuals. Based on each patient's clinical requirements, the surgeon's preferences, and the patients' demands in accordance with the informed consent and description of alternative surgical techniques, a lumbar fusion technique was selected specifically for them.

### Inclusion criteria:

The age requirement for inclusion was >18 at the time of surgery. The study has covered adult cases of disc herniation, spinal stenosis, spondylolisthesis, and other degenerative diseases. Surgical time, blood loss, complications, pain relief or improvement in handicap are all considered good results in each situation.

### Exclusion criteria:

At the time of operation, the patient had to be under 18 years old. This study excludes patients with other spinal abnormalities brought on by trauma, scoliosis, tumour or infection, and dural rupture. Individuals who have had spinal cord damage are not eligible for this study. Individuals with peripheral neuropathies and metabolic illnesses like diabetes that induce spine abnormalities were not included in this study.

### Surgical procedures:

Single-level fusion was performed on each patient. Two cages filled with autogenous bone grafts were used in the usual PLIF method as described in earlier research.[18] In every instance, posterior segmental spinal pedicle screw instrumentation was employed. One cage was filled with autogenous bone graft using the conventional TLIF method as described in earlier research.[19] In every instance, posterior segmental spinal pedicle screw instrumentation was employed. After surgery, it was advised to wear a brace for 6–8 weeks.

### PLIF

The skin was cut in the middle. The paravertebral muscles were separated from the spine after the fascia was cut. In order to validate the correct vertebral level, radiographs were used. After placing bilateral pedicle screw-rod constructions, a laminectomy was carried out at that level. Bilateral foraminotomy, discectomy, and interbody graft insertion came next.

### TLIF

The skin was cut in the middle. To reveal the lateral aspect of the spinous process, the lamina, and the facet joint, the muscles and soft tissues were drawn back. A unilateral laminectomy and partial facetectomy were

carried out on the side that corresponded with the patient's symptoms based on the clinical presentation. Only when there was clinically considerable compression of both nerve elements, was a bilateral laminectomy performed. Bilateral pedicle screws were inserted as per usual procedure after sufficient decompression of the nerve components.

**Critical of clinical outcomes**

Before surgery and at the 2-year follow-up, pain (VAS) and functional disability (JOA) were quantified. The focus was to evaluate four radiographic characteristics at follow-up:

1. Percentage of slip and percentage of reduction,
2. Height of disk space and intervertebral foramen,
3. Cage position, and fusion rate.

Bone fusion was determined by the method described by Gertzbein.[20] The criteria for fusion were the continuity of the trabecular pattern, and the fusion rate assessed using CT-scan reconstruction.

**Statistical Analysis**

All measurements were performed by a single observer and are expressed as means ± SD. Using the SPSS 11.5 statistics software, classic t-test and chi-square test were performed.

**Result**

**Table 1: Lithe and reduction rate compared between two groups**

| Groups | Spondylolisthesis rate | | |
|---|---|---|---|
| | Pre- | Post | Follow-up |
| PILF | 21.1 ± 5.2 | 5.2 ± 1.1 | 5.1 ± 1.4 |
| TILF | 28.3 ± 6.2 | 6.3 ± 1.5 | 4.1 ± 1.3 |
| | Reduction rate | | |
| | Post | Follow-up | Lost |
| PILF | 65.1 ± 4.2 | 69.3 ± 4.1 | 2.1 ± 1.1 |
| TILF | 68.3 ± 4.1 | 62.2 ± 3.2 | 2.2 ± 1.1 |

Between the initial postoperative and the final postoperative follow-up, there were no appreciable changes in the rate of spondylolisthesis and reduction. The two groups had comparable rates of spondylolisthesis, reduction, and loss of reduction.

**Table 2: The intervertebral space and intervertebral foramen height compared between two groups**

| Groups | Intervertebral space height | | |
|---|---|---|---|
| | Pre- | Post | Follow-up |
| PILF | 3.4 ± 1.2 | 9.3 ± 1.2 | 9.1 ± 1.1 |
| TILF | 4.5 ± 1.5 | 10.3 ± 1.4 | 10.2 ± 1.2 |
| | Intervertebral foramen height | | |
| | Pre | Post | Follow-up |
| PILF | 12.1 ± 1.6 | 15.4 ± 1.4 | 15.1 ± 1.6 |
| TILF | 12.1 ± 1.3 | 14.3 ± 1.5 | 16.1 ± 1.5 |

There were no changes between the two groups in terms of disc height or intervertebral foramen height, both of which were superior to preoperative. Both groups saw similar intervertebral foramen and intervertebral space loss.

With no instances of cage extrusion, all patients successfully fused their spines. Between the initial and final postoperative X-rays, there were three instances of loss of disc space height and foramen height, which is suggestive of cage sinking over time. However, because all patients underwent a bone fusion, there were no infections in the clinical outcomes.

There were three occurrences of radiculitis (one man and two women) and one case of screw loosening, totaling four complications in group 1. (a woman). Two patients with radiculitis showed normal radiologic findings, according to a CT-myelogram, whereas the third had left S1 radiculopathy following L4-L5 fusion and was brought on by left foraminal stenosis at L5-S1. Two incidences of radiculitis (one in a man and one in a woman) and one instance of screw loosening were two of the three problems associated with group 2. Radiculitis patients exhibited normal radiologic findings, according to a CT-myelogram. The loose pedicle screw was removed 18 months after the index surgery and bone fusion.

## Discussion

Back pain and radicular symptoms caused by degenerative spinal illness are initially managed with physiotherapy, oral medicine, and rest. Long-term incapacitating back pain with radiating symptoms is linked to a low quality of life and interferes with the patient's day-to-day activities. Interbody fusion is the ultimate gold standard treatment for degenerative diseases of the lumbar spine like disc degeneration, spondylosis, and spondylolisthesis. Due to instability and compression, spondylolisthesis, whether it be degenerative or isthmic, is frequently accompanied by radicular symptoms and back pain.[21-22] However, surgical treatment of spondylolisthesis requires not only the decompression of neural tissue and stabilisation of the motion segment, but also the reconstruction of disc space height and restoration of sagittal plane translational and rotational alignment.[23]

In their publication on TLIF in symptomatic disc degeneration: 100 patients a retrospective research, Mura et al.[1] and Rezk et al.[2] compared the two procedures for treating single-level lumbar spondylolisthesis. The study by Adogwa et al.[24] on the cost-effectiveness of TLIF for grade 1 degenerative spondylolisthesis revealed that it improves quality of life, mobility, and pain levels.

Humphreys et al.[25] Comparing the posterior and transforaminal approaches to lumbar interbody fusion revealed a greater complication rate because to the increased medial dura retraction required to insert the cage in the PLIF procedure, which raises the risk of dura rupture and nerve root injury. According to a study by Zhang et al.[26], which demonstrated that there are increased odds of durotomy in cases of PLIF, there were more instances of dura damage.

In 1940, Cloward made the first effort at posterior lumbar interbody fusion (PLIF), which was later improved by Lin. The chip PLIF treatment involves less spinal cord retraction and enhances the surface area of bone fusion, but it does not offer the extra mechanical support of an interbody cage. Interbody fusion techniques were created in an effort to maintain the spine's load-bearing capacity, correct the alignment of the sagittal plane, and increase the possibility of fusion by compressively stressing the bone. The initial creation of a postoperative spine that is biomechanically stable by the interbody fusion increases the possibility for arthrodesis.[27-29] This surgery can easily be supplemented with a posterolateral graft to increase stability and likelihood of fusion. The morbidity risks connected to an anterior path to the spine are also avoided by the posterior approach. With indications for

spinal stenosis, instability, degenerative disc disease, spondylolisthesis, spondylolysis, and bilateral disc herniation, the PLIF treatment has grown in popularity.

Humphreys et al.[25] discovered that patients having the PLIF surgery had a higher incidence of side effects, such as radiculitis, which they attributed to the PLIF technique's requirement for more medial thecal sac retraction. The PLIF group 1 in this trial experienced four problems, including three incidences of radiculitis (one man and two women) and one instance of screw loosening (a woman). Two patients with radiculitis showed normal radiologic findings, according to a CT-myelogram, whereas the third had left S1 radiculopathy following L4-L5 fusion and was brought on by left foraminal stenosis at L5-S1. Two incidences of radiculitis (one in a man and one in a woman) and one instance of screw loosening were two of the three problems associated with TLIF group 2. Radiculitis patients exhibited normal radiologic findings, according to a CT-myelogram. The loose pedicle screw was removed 18 months after the index surgery and bone fusion.

According to Patwardhan et al.[30], when the load path stayed close to the rotation centres of the lumbar segments, the compressive load-carrying capacity of the lumbar spine increased. The TLIF approach has the potential to hasten and enhance the patient's rehabilitation by utilising and maintaining the bone attachments of the lumbar spine. The authors of the current study demonstrated appropriate mechanical stability by inserting one interbody cage in the TLIF and two interbody cages in the PLIF. No incidences of cage extrusion occurred, and all patients had fused bones. With no instances of cage extrusion, all patients successfully fused their spines. Between the initial and final postoperative X-rays, there were three instances of loss of disc space height and foramen height, which is suggestive of cage sinking over time. Yet, as all patients underwent a bone fusion, there was no infection in the clinical outcomes.

According to Lars et al.[31], the pre-operative pathology had an impact on the VAS improvement, with the isthmic spondylolisthesis showing greater improvement than the degenerative form. While the isthmic spondylolysis thesis constituted 50% of the TLIF group cases compared to just 41.3% of the PLIF group, this may help to explain the current study's considerable VAS for relief in back pain. Both TLIF and PLIF offer circumferential spinal stabilisation, but TLIF uses a lateral approach to disc space and preserves the interlaminar space on the opposite side, which can be used as a site for further fusion. The use of instrumentation and posterolateral fusion can improve both of these procedures.

## Conclusion

In the treatment of adult degenerative spondylolisthesis, interbody fusion with either a PLIF approach or a TLIF technique yields positive results. The TLIF process is less complicated than the PLIF method and equally safe and efficient. The results of this study show that the TLIF technique provides a good substitute for the more conventional PLIF procedure. Although this study only looked at the immediate effects of the TLIF and PLIF procedures, concerns with the therapeutic efficacy of these treatments must be addressed in long-term clinical outcomes investigations.

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