RESEARCH PAPER

Assessment of quality of life of patients undergoing single-level instrumented fusion surgery (TLIF & PLIF) at 1-year follow-up visit: a prospective analytic study in a tertiary care hospital in eastern India.

Dr. Sehajpal Singh[1*], Dr. Sanatan Behera[2], Dr. Aditya Prasad Panda[3]

[1*] Post Graduate, Department of Orthopaedics, Kalinga Institute of Medical Sciences, Bhubaneswar-751024 (Corresponding Author). Email: 2387113@kims.ac.in | Mobile: +91-9646466147

[2] Professor, Department of Orthopaedics, Kalinga Institute of Medical Sciences, Bhubaneswar-751024. Email: sanatanspine@gmail.com

[3] Associate Professor, Department of Orthopaedics, Kalinga Institute of Medical Sciences, Bhubaneswar-751024. Email: orthoaditya@gmail.com

Received: 12th Mar, 2026 | **Revised:** 24th Mar, 2026 | **Accepted:** 14th Apr, 2026 | **Available Online:** 30th Apr, 2026

ABSTRACT

Background:

Degenerative lumbar spine disorders serve as the primary source of chronic low back pain, which leads to disability and diminished quality of life. When conservative treatment fails, surgical stabilisation using lumbar interbody fusion is often required. The two techniques of Posterior Lumbar Interbody Fusion (PLIF) and Transforaminal Lumbar Interbody Fusion (TLIF) are standard methods for treating single-level spine problems, but their effectiveness in patients recovering from treatment, their clinical results, and their surgical risks and patient well-being are still under investigation.

Objective:

The objective of this study is to evaluate how TLIF and PLIF methods affect clinical, radiological, surgical, and quality-of-life outcomes for patients with degenerative lumbar conditions who undergo single-level instrumented lumbar fusion.

Methods:

The researchers conducted their prospective observational study at an Eastern Indian tertiary care hospital from February 2024 to February 2026. The research assessed 381 adult patients who received single-level TLIF (n = 206) or PLIF (n = 175) treatment during their one-year follow-up period. The study measured outcomes using surgical outcomes, radiological assessments, pain measurement with the Visual Analog Scale (VAS), functional disability assessment with the Oswestry Disability Index (ODI), and health-related quality of life assessment with EQ-5D-5L and EQ-VAS. The researchers used Student's t-test, Chi-square test, and paired t-test for statistical analysis, considering p-values below 0.05 as significant results.

Results:

The two procedures achieved significant improvements in pain relief and disability reduction, which persisted through the one-year mark ($p < 0.001$). The TLIF procedure provided better results throughout the process because it had faster surgery (132.4 ± 21.6 vs 148.7 ± 24.2 minutes), reduced surgical blood loss (305 ± 85 vs 392 ± 102 mL), and shorter patient hospital stays (5.6 ± 1.4 vs 6.8 ± 1.9 days). The TLIF group had lower postoperative complication rates (8.7%) than the other group (16.0%, $p = 0.03$). The TLIF procedure restored disc lordosis better than traditional methods and resulted in greater improvements in essential quality of life for mobility, usual activities, and pain/discomfort. The TLIF group experienced lower postoperative VAS and ODI scores, indicating better functional improvement.

Conclusion:

The study shows that TLIF and PLIF both provide effective solutions for handling pain and disability and quality of life challenges, which people with single-level degenerative lumbar disease face. The TLIF procedure yields better results than other techniques because it improves operating efficiency, enhances postoperative recovery,

reduces complications, and improves patient-reported outcomes, making it the best method for single-level lumbar fusion.
Keywords: TLIF; PLIF; Degenerative Lumbar Disease; Quality of Life; Oswestry Disability Index; Visual Analogue Scale; Lumbar Fusion; Prospective Study
How to cite this article: Singh S, Behera S, Panda AP. Assessment of quality of life of patients undergoing single-level instrumented fusion surgery (TLIF & PLIF) at 1-year follow-up visit: a prospective analytic study in a tertiary care hospital in eastern India. Int J Drug Deliv Technol. 2026;16(38s): 488-498. DOI: 10.25258/ijddt.16.38s.47
Source of support: Nil.
Conflict of interest: None

Introduction

Low back pain remains one of the most prevalent musculoskeletal conditions worldwide and is a leading cause of disability, work absenteeism, and reduced quality of life across all age groups. Surgical intervention becomes necessary when conservative management fails to provide permanent relief of symptoms because it restores spinal stability, relieves neural compression, and enhances functional outcomes [1–3]. Successful fusion not only addresses the structural pathology but also plays a pivotal role in improving functional capacity and health-related quality of life in affected individuals [4–6].

Interbody fusion techniques have gained widespread acceptance because they facilitate fusion through the anterior column of the spine, which bears the majority of axial load. The posterior approach to lumbar interbody fusion enables doctors to perform both neural decompression and stabilization from one surgical corridor. Among these techniques, Posterior Lumbar Interbody Fusion (PLIF) and Transforaminal Lumbar Interbody Fusion (TLIF) are commonly employed for single-level lumbar pathology. The two techniques achieve circumferential fusion by using posterior instrumentation in combination with interbody cage placement, which improves both biomechanical stability and fusion success rates, according to research studies [7–9].

The surgical procedure of Posterior Lumbar Interbody Fusion requires surgeons to access both sides of the spinal canal, necessitating movement of neural structures and the surgical team to insert interbody grafts or cages through a back midline entry point. The method enables direct observation of neural components while allowing even distribution of interbody implant positioning. The procedure requires extensive neural retraction, resulting in complete bilateral exposure and increasing the risk of soft tissue and potential neural damage. The PLIF procedure remains in practice because it restores disc height, enhances sagittal alignment, and provides strong support to the posterior column [10–12].

Transforaminal Lumbar Interbody Fusion was developed as a modification of PLIF to reduce neural manipulation and disruption of posterior elements. The TLIF procedure uses a transforaminal approach to access the disc space, which requires minimal dura and nerve root retraction for interbody cage installation. The technique enables complete preservation of posterior structures through decompression procedures while maintaining structural stability. The TLIF procedure has become more common because people believe it decreases surgical complications while producing similar fusion results [13–15].

The research investigates how various surgical methods affect patient recovery outcomes, which helps doctors select better treatment options to meet patients' needs during surgery [16-18]. The researchers use established outcome assessment tools, including disability measurements, pain assessment methods, and general quality-of-life assessments, to measure how patients improve after surgery [19]. This study aims to assess and quantify the advantages and disadvantages of single-level instrumented lumbar fusion operations using Transforaminal Lumbar Interbody Fusion and Posterior Lumbar Interbody Fusion methods for treating patients with lumbar conditions.

Materials and Methods

The Department of Orthopaedics at Kalinga Institute of Medical Sciences (KIMS) in Bhubaneswar, Odisha, India, conducted this observational hospital study. The study took place over a two-year period, from February 2024 to February 2026. The study population included adult patients who underwent single-level instrumented lumbar fusion surgeries through TLIF or PLIF methods to treat degenerative lumbar conditions and returned for their first follow-up evaluation one year after their surgery.

The research team used prevalence-based estimation to calculate the necessary sample size. The study required

at least 381 participants because low back pain affects 51% of the Indian population according to [20] with 95% confidence and 5% precision. The study included 381 patients who met the eligibility criteria.

The study included adults who underwent single-level instrumented lumbar fusion (TLIF or PLIF) for degenerative lumbar conditions, including disc herniation, spinal stenosis, and spondylolisthesis, and who provided informed consent to participate.

Those patients who had Spinal disorders due to trauma, tumour, infection, scoliosis, or metabolic causes, associated peripheral neuropathy or systemic conditions affecting spinal pathology, Dural tear or other intraoperative complications altering outcomes or had Surgery performed outside the host institution were excluded from the study.

Data Collection Tools

A predesigned, pretested, and validated questionnaire was used to collect sociodemographic details and clinical information. Outcome assessment focused on pain intensity, functional disability, and health-related quality of life using standardised instruments.

Outcome Measures

1. EuroQol-5D (EQ-5D)

Health-related quality of life was assessed using the EQ-5D-5L instrument, which evaluates five domains: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each domain uses five levels to rate severity, ranging from no problems to extreme problems. The responses generate a health state profile represented by a five-digit code.

In addition, overall perceived health status was measured using the EQ-VAS, a visual scale that extends from 0 to 100, with 0 representing the worst imaginable health state and 100 representing the best imaginable health state.

2. Oswestry Disability Index (ODI)

Functional disability due to low back pain was assessed using the Oswestry Disability Index. The ODI consists of 10 sections that address activities of daily living, each scored from 0 to 5. The total score was expressed as a percentage, with higher scores indicating greater disability. Disability levels were categorised as minimal, moderate, severe, crippled, or bed-bound based on standard thresholds.

3. Visual Analogue Scale (VAS)

Pain intensity was evaluated using the Visual Analogue Scale, ranging from 0 to 10. Higher scores indicated greater pain severity. Scores were interpreted as mild, moderate, or severe interference with functioning based on established cut-offs.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using the Statistical Package for the Social Sciences (SPSS) software version 26.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Comparisons between the TLIF and PLIF groups were performed using unpaired Student's t-test for continuous variables (operative parameters, clinical scores, radiological measures, and quality-of-life indices), Chi-square test for categorical variables (demographics, disease severity, functional outcomes, disability categories, pain severity, and complications) and paired t-test for pre and post dataset comparison of scores of visual analog scores and Oswestry disability index. All statistical tests were conducted at the 95% confidence level, and p-values < 0.05 were considered statistically significant.

Ethical Considerations

Written informed consent was obtained from all participants in a language they understood. Participation was voluntary, and confidentiality of patient data was strictly maintained. The study protocol was reviewed and approved by the Institutional Ethics Committee vide -KIIT/KIMS/IEC/2029/2025 prior to commencement. As the study involved follow-up evaluation without additional intervention, it posed no additional risk to participants.

Results

The study involved 381 individuals. The study participants had an average age of 46.01 years with a standard deviation of 9.54 years. According to Figure 1, 54% of patients received TLIF, while 46% received PLIF. Table 1 shows the initial characteristics and success rates of study participants who received Transforaminal Lumbar Interbody Fusion (TLIF) and Posterior Lumbar Interbody Fusion (PLIF) procedures. The two groups showed similar gender distributions: the TLIF group had 57.3% male members, while the PLIF group had 55.4%, resulting in a non-significant sex difference ($p = 0.716$). The two groups showed identical spondylolisthesis grade distribution patterns, as Grade I occurred more frequently than any other grade (61.2% in TLIF and 57.7% in PLIF), which was followed by Grade II and Grade III. The L4–L5 spinal level was operated on in both groups (64.1% in TLIF vs 65.1% in PLIF), while the remaining operations involved L5–S1, which showed no significant difference between the two groups ($p = 0.83$). The PLIF group experienced more postoperative complications, with an occurrence rate of 16.0%, whereas the TLIF group had an 8.7% rate ($p = 0.03$), indicating that TLIF

is associated with a lower risk of postoperative complications. The Oswestry Disability Index assessment revealed that the TLIF group (64.1%) had more participants with minimal disability than the PLIF group (54.9%), but the difference was not statistically significant (p = 0.31). Pain severity classification showed a greater proportion of patients reporting mild pain following TLIF (74.8%) compared to PLIF (65.1%), but this difference did not reach statistical significance (p = 0.11). Functional outcome evaluation demonstrated that excellent outcomes were more common in the TLIF group (45.6%) than in the PLIF group (36.0%), whereas poor outcomes were relatively infrequent in both groups; however, these differences were also not statistically significant (p = 0.196). Overall, the two groups were largely comparable across baseline characteristics and most outcome measures, except for a significantly higher complication rate observed in the PLIF cohort.

Table 1: Clinical Characteristics of study participants

		TLIF		**PLIF**		**Chi Square**	**P-value**
		Frequency (N=206)	**Percentage (%)**	**Frequency (N=175)**	**Percentage (%)**		
Gender	Male	118	57.3	97	55.4	0.132	0.716
	Female	88	42.7	78	44.6		
Spondylolisthesis Grading	Grade I	126	61.2	101	57.7	0.47	0.79
	Grade II	63	30.6	58	33.1		
	Grade III	17	8.2	16	9.2		
Level of Spinal Operation	L4-L5	132	64.1	114	65.1	0.047	0.83
	L5-S1	74	35.9	61	34.9		
Presence of complications	Present	18	8.7	28	16	4.70	**0.03**
	Absent	188	91.3	147	84		
ODI Disability Category	Minimal	132	64.1	96	54.9	3.55	0.31
	Moderate	58	28.2	60	34.3		
	Severe	14	6.8	16	9.1		
	Crippled	2	1	3	1.7		
Severity of Pain	Mild	154	74.8	114	65.1	4.33	0.111
	Moderate	44	21.4	50	28.6		
	Severe	8	3.8	11	6.3		
Functional Outcome	Excellent	94	45.6	63	36	4.68	0.196
	Good	78	37.9	71	40.6		
	Fair	25	12.1	29	16.6		
	Poor	9	4.4	12	6.8		

Fig. 1: Pie chart depicting the distribution of patients based on the type of fusion procedure

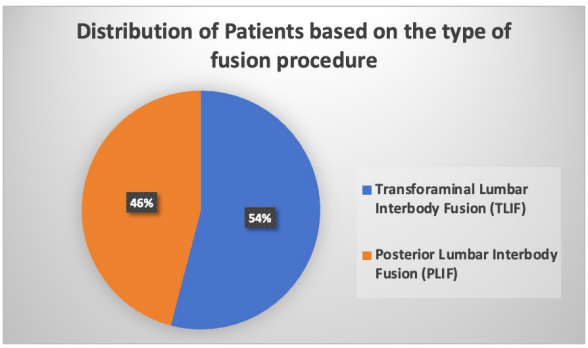


Table 2 compares radiological parameters, operative characteristics, and quality-of-life outcomes between patients undergoing Transforaminal Lumbar Interbody Fusion (TLIF) and Posterior Lumbar Interbody Fusion (PLIF). TLIF resulted in better restoration of local disc lordosis through its 13.4 ± 3.2° measurement which surpassed PLIF's 12.6 ± 3.5° measurement at a

statistically significant level (p = 0.04), however, both groups displayed identical anterior disc height and posterior disc height and overall lumbar lordosis measurements. TLIF proved to be the better choice because it required less time for surgery with TLIF taking 132.4 ± 21.6 minutes compared to 148.7 ± 24.2 minutes of PLIF (p = 0.001) and it resulted in TLIF operating rooms needing 305 ± 85 mL of blood compared to PLIF which needed 392 ± 102 mL (p < 0.001) and TLIF patients spent 5.6 ± 1.4 days in the hospital whereas PLIF patients stayed 6.8 ± 1.9 days (p = 0.002). The assessment of health-related quality of life through EQ-5D-5L dimensions showed TLIF group achieved better results than PLIF group in three areas which included mobility (p = 0.03), usual activities (p = 0.04), and pain/discomfort (p = 0.02), but the two groups showed no statistically significant difference in self-care and anxiety/depression domains. The TLIF group perceived their health status at 82.4 ± 9.6 which showed a significant difference from the PLIF group who reported 78.9 ± 10.4 (p = 0.006), thereby indicating that TLIF leads to better subject recovery experiences and satisfaction ratings. The research findings demonstrate that both procedures create similar radiological corrections for most parameters, yet TLIF delivers important operational advantages together with better perioperative results and functional restoration and patient-centered quality-of-life advancements.

Table 2: Comparison between TLIF and PLIF on the basis of radiological, operative, and quality of Life parameters

		TLIF (Mean ± SD)	**PLIF (Mean ± SD)**	**p-value**
Radiological Parameters	Local Disc Lordosis (In Degrees)	13.4 ± 3.2	12.6 ± 3.5	**0.04**
	Anterior Disc Height (in mm)	11.2 ± 2.1	10.8 ± 2.3	0.09
	Posterior Disc Height (In mm)	7.4 ± 1.6	7.1 ± 1.7	0.18
	Lumbar Lordosis (In Degrees)	46.2 ± 8.5	45.4 ± 9.1	0.52
Operative	Duration of Surgery (In minutes)	132.4 ± 21.6	148.7 ± 24.2	**0.001**
Parameters	Estimated Blood Loss (In mL)	305 ± 85	392 ± 102	**<0.001**
	Duration of Hospital Stay (In days)	5.6 ± 1.4	6.8 ± 1.9	**0.002**
EQ-5D Quality of Life Score	Mobility	1.42 ± 0.55	1.55 ± 0.61	**0.03**
	Self-care	1.28 ± 0.49	1.34 ± 0.52	0.21
	Usual Activities	1.51 ± 0.63	1.66 ± 0.70	**0.04**
	Pain/Discomfort	1.62 ± 0.71	1.78 ± 0.75	**0.02**
	Anxiety/Depression	1.33 ± 0.50	1.39 ± 0.54	0.24
EQ-VAS Quality of Life Score		82.4 ± 9.6	78.9 ± 10.4	**0.006**

Table 3 shows the comparison of clinical results that were recorded before and after surgery between the two groups that underwent Transforaminal Lumbar Interbody Fusion (TLIF) and Posterior Lumbar Interbody Fusion (PLIF) procedures, which are also depicted in Figures 2 and 3. The TLIF group's VAS scores for low back pain decreased from 7.6 ± 1.1 before the operation to 2.1 ± 1.0 after the operation. The TLIF group showed substantial pain relief, as measured by radicular pain scores, which decreased from 7.9 ± 0.9 to 1.8 ± 0.9 (p < 0.001). The ODI score improved from 56.8 ± 8.2 to 18.6 ± 6.4 (p < 0.001), indicating that patients had moved from extreme disability to moderate or minor disability. The PLIF group showed similar results, with their VAS scores for low back pain decreasing from 7.5 ± 1.2 to 2.5 ± 1.2 (p < 0.001) and their radicular pain scores decreasing from 7.8 ± 1.0 to 2.2 ± 1.1 (p < 0.001). The ODI score also improved significantly from 57.3 ± 7.9 preoperatively to 21.3 ± 7.1 postoperatively (p < 0.001). The TLIF group showed better recovery than the PLIF group because it achieved these improvements through both surgical methods, creating important, measurable improvements in pain and disability. Single-level lumbar interbody fusion results in long-lasting pain and disability reduction regardless of which technique is used, according to research

findings. The study found that TLIF produced slightly better results than other techniques used for single-level lumbar interbody fusion.

Table 3: Comparison between TLIF and PLIF on the basis of Visual Analogue score and Oswestry Disability Index before and 1 year after surgery

	TLIF (N=206)			PLIF (N=175)		
	Pre-op (Mean ± SD)	**Post-op (Mean ± SD)**	**p-value**	**Pre-op (Mean ± SD)**	**Post-op (Mean ± SD)**	**p-value**
Low Back Pain Visual Analogue Score	7.6 ± 1.1	2.1 ± 1.0	**P<0.001**	7.5 ± 1.2	2.5 ± 1.2	**P<0.001**
Radicular Pain Visual Analogue Score	7.9 ± 0.9	1.8 ± 0.9	**P<0.001**	7.8 ± 1.0	2.2 ± 1.1	**P<0.001**
Oswestry Disability Index Score	56.8 ± 8.2	18.6 ± 6.4	**P<0.001**	57.3 ± 7.9	21.3 ± 7.1	**P<0.001**

Fig 2: Comparison between TLIF and PLIF Visual Analogue score and Oswestry Disability Index before surgery

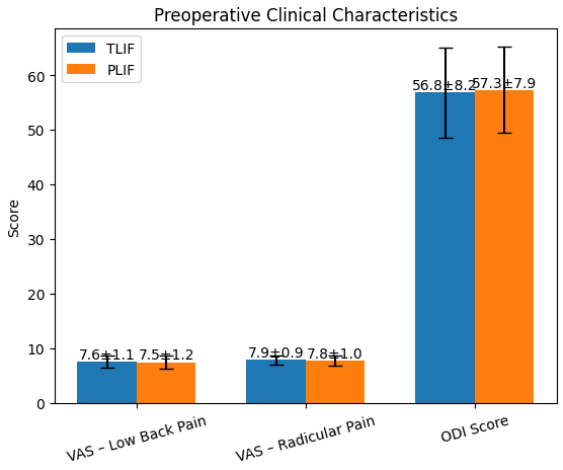
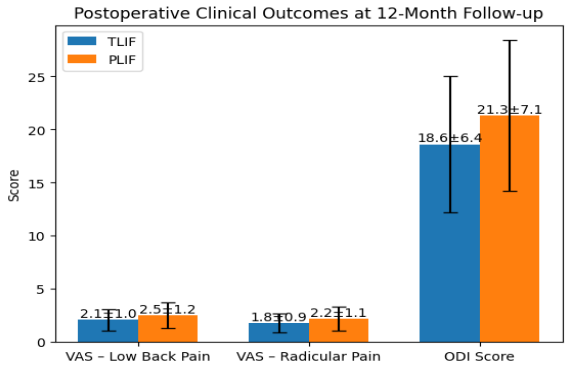


Fig 3: Comparison between TLIF and PLIF Visual Analogue score and Oswestry Disability Index 1 year after surgery



Discussion

The current research assessed and compared multiple aspects, including quality of life, functional recovery, radiological restoration, and perioperative results, of single-level instrumented lumbar fusion using Transforaminal Lumbar Interbody Fusion (TLIF) and Posterior Lumbar Interbody Fusion (PLIF) to treat lumbar degenerative pathology in patients. A total of 381 patients were analysed, allowing a comprehensive comparison of clinical and patient-reported outcomes between the two surgical techniques.

The demographic characteristics of both patient groups showed no significant differences, as their age and gender distributions were identical. The average ages in the TLIF and PLIF groups were nearly identical, and the higher proportion of males in both groups reflects the typical epidemiological profile of degenerative lumbar disorders, which often affect people in their economically active years. The demographic evidence from randomized and observational studies assessing lumbar fusion techniques showed that both research methods maintained equivalent baseline

characteristics, enabling research teams to evaluate study results without bias [21,22]. Garg et al. also noted a similar age range in patients undergoing lumbar interbody fusion, highlighting that degenerative lumbar conditions tend to peak in the fifth and sixth decades of life [23]. The study findings showed that demographic factors did not differ between groups, supporting the researchers' ability to compare the study results.

The groups showed identical patterns of disease severity, with Grade I spondylolisthesis the most frequent condition, followed by Grades II and III. The research results show that low-grade spondylolisthesis is the primary indication for single-level lumbar fusion surgeries, consistent with previous studies. The similarity observed in the present study, therefore, indicates that postoperative differences are likely attributable to surgical technique rather than to baseline pathology.

The operated spinal level showed a predominance of L4–L5 involvement in both groups, followed by L5–S1, with no significant intergroup variation. The current finding supports biomechanical research demonstrating that the L4–L5 segment exhibits higher mobility and increased stress concentration, leading to degeneration and instability. Clinical studies have reported similar outcome distributions for TLIF procedures, with L4–L5 as the most commonly fused level [25]. The groups from the study show identical anatomical distributions, indicating that they have no differences in their characteristics.

The current research demonstrates that TLIF procedures have become more common than PLIF procedures, indicating that surgeons in modern times prefer TLIF. This trend exists because TLIF procedures now allow medical professionals to perform surgery through one side of the body, which decreases the need for neural access while providing better visibility of the spinal disc [21,26]. Surgeons now prefer TLIF because they have gained more experience with the technique and because instrument development for the procedure has advanced.

Study results revealed that TLIF demonstrated better surgical performance metrics than other methods. The surgery took less time, required patients to lose less blood, and kept patients in the hospital for less time than PLIF. El-Ghandour et al. found that TLIF led to better surgical outcomes, decreasing operative complications and shortening hospital stays while producing similar fusion results [26]. The TLIF procedure uses a muscle-sparing unilateral approach, which reduces tissue damage and spinal cord exposure, resulting in better recovery outcomes for patients. Holly et al. demonstrated that surgical methods that cause less disruption to the body provide essential benefits for both rapid recovery and patient satisfaction [27].

The groups demonstrated equal initial VAS scores for back pain and radicular pain, as well as equal ODI disability scores. Researchers established baseline equivalence from which they could assess postoperative improvements in lumbar fusion trials [21]. The observed similarity ensures that postoperative differences reflect treatment effects rather than initial clinical disparities. At 12-month follow-up, both TLIF and PLIF produced substantial improvements in pain and disability; however, TLIF demonstrated significantly lower postoperative VAS and ODI scores. According to these findings, the TLIF group achieved better clinical outcomes. Several randomised trials have shown that TLIF and PLIF produce similar long-term outcomes, but TLIF provides slight benefits because it minimizes nerve root retraction and maintains posterior elements [21].

The TLIF group showed greater clinical improvements because their back pain and radicular pain decreased more than their ODI scores improved. Tippins et al. demonstrated that patients who underwent minimally invasive fusion procedures achieved better clinical results within their first year compared to other surgical methods, which eventually reached identical long-term results [28]. The research conducted by Chen et al. showed that TLIF surgery enabled patients to recover more quickly and achieve better early functional independence, as the procedure caused less damage to their soft tissues [29]. The research results demonstrate that the surgical technique doctors use affects both the surgical risks patients experience and their subsequent recovery.

The radiological examination showed that TLIF slightly outperformed other methods in restoring local disc lordosis, while both groups achieved equal anterior and posterior disc heights and global lumbar lordosis. The process of restoring segmental lordosis plays a critical role in achieving both sagittal balance and long-term spinal biomechanical stability. Hawasli et al. showed that better segmental alignment leads to both improved functional results and higher patient satisfaction after interbody fusion surgery [30]. Garg et al. demonstrated that modern cage designs provide adequate radiological restoration, achieved through any fusion method, resulting in global alignment findings similar to those reported in this research [23].

The assessment of quality of life using EQ-5D dimensions showed that TLIF patients achieved better

results in the mobility and usual activities and pain/discomfort domains, while their psychosocial domains of self-care and anxiety/depression remained unchanged. The study results demonstrate that surgical methods produce more distinct physical recovery outcomes than psychological healing processes. Yee et al. and Caelers et al. reported similar improvements in EQ-5D scores after lumbar fusion, demonstrating that health-related quality of life improved regardless of the fusion technique used [21,22]. The TLIF procedure provides higher functional domain scores because it enables patients to move better and experience less postoperative pain [29].

The functional outcome grading system confirmed these results: TLIF patients achieved better outcomes, with excellent results exceeding those of PLIF patients, and poor results decreased. The study showed that TLIF patients achieve better functional results because effective decompression and stable fusion together provide lasting clinical advantages [31]. The TLIF procedure reduces perioperative morbidity, helping patients achieve better rehabilitation outcomes and functional recovery.

Assessment of disability categories through ODI score evaluation showed that TLIF surgical treatment resulted in more patients reaching minimal disability status during their post-treatment assessment. The research conducted by Schwender and his colleagues showed that the TLIF procedure resulted in permanent disability score improvements which persisted through all follow-up assessments [32]. The study conducted by Goh and his colleagues showed that successful patient selection, combined with optimal pain management, is the primary factor in reducing post-surgical disability after fusion procedures [33].

The 12-month assessment of pain intensity showed that TLIF patients experienced greater-than-mild discomfort compared to other groups, indicating better pain control throughout the study period. Wang and his colleagues established that TLIF treatment leads to sustained pain relief, as measured by decreases in VAS scores, while patients maintained their functional abilities [25].

The study demonstrates that TLIF and PLIF treatments improve pain relief, reduce patient disability, and enhance radiological alignment and patient quality of life during single-level lumbar fusion procedures. TLIF demonstrates higher operational effectiveness than other methods because it enables faster patient recovery while delivering better functional outcomes, higher patient satisfaction, and lower complication rates. The findings of this study support existing evidence, which demonstrates that both surgical techniques will achieve similar long-term outcomes, but TLIF provides patients with essential benefits during operations and the immediate postoperative period, resulting in increased patient satisfaction and improved recovery process [21,22,26,29]

Conclusion

The Transforaminal Lumbar Interbody Fusion (TLIF) and Posterior Lumbar Interbody Fusion (PLIF) surgical methods effectively treat single-level lumbar degenerative disorders by delivering substantial improvements in pain reduction, functional abilities, radiological spinal alignment, and overall health quality. The current research shows that TLIF provides multiple important clinical benefits which exceed those found in PLIF. The advantages include shorter surgery time, lower blood loss during surgery, faster recovery time, improved results on pain and disability assessments, better patient functional outcomes, higher quality-of-life results, and lower rates of complications after surgery. The TLIF procedure is the optimal surgical method for treating single-level lumbar disorders, delivering efficient spinal decompression and stabilization while enhancing patient recovery and satisfaction.

Limitations

1. **Non-randomised Study Design:** The observational nature of the study may introduce potential selection bias despite comparable baseline characteristics.
2. **Single-Centre Study:** Results may not be fully generalizable to all institutions due to variations in surgical expertise and patient populations.

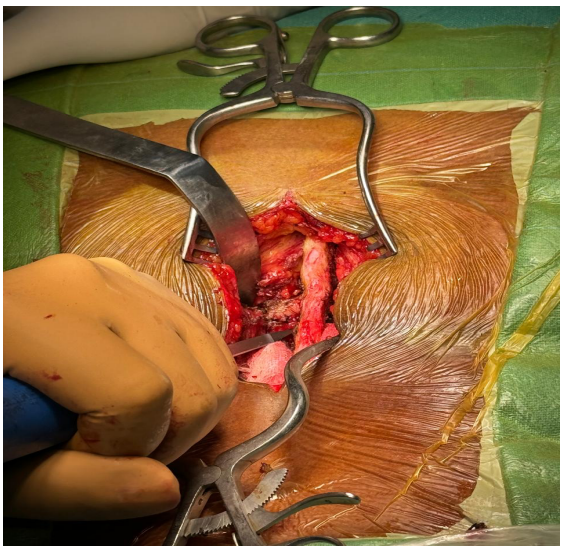
Financial Support and Sponsorship

Nil

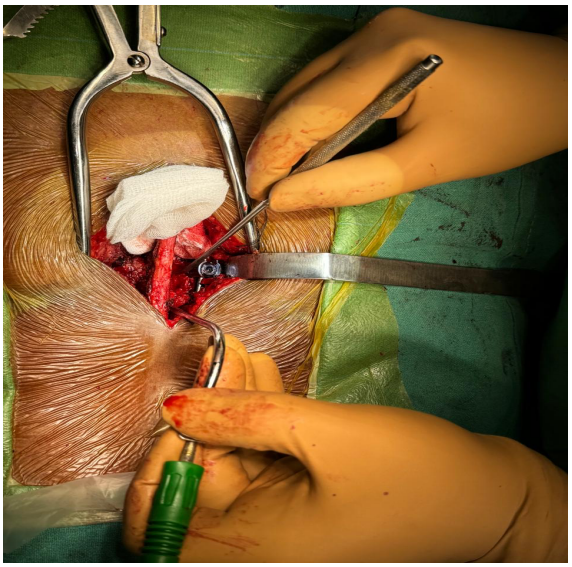
Conflicts of Interest

There are no conflicts of interest

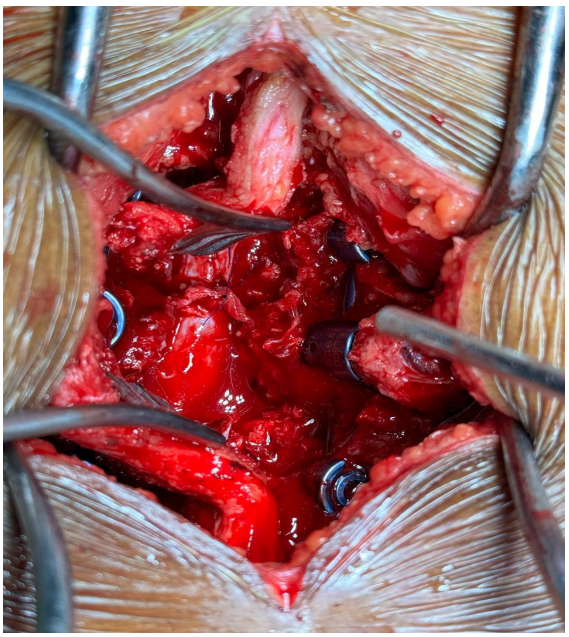
Surgical Procedure photos(supplementary)



Intraoperative TLIF- showing the posterior elements with decompression in progress



Intraoperative TLIF- pedicle screw instrumentation



Intraoperative complication: Dural tear with CSF leak

References

1. Hoy D, March L, Brooks P, Blyth F, Woolf A, Bain C, et al. The global burden of low back pain. Ann Rheum Dis. 2014;73(6):968–974.
2. Andersson GB. Epidemiological features of chronic low-back pain. Lancet. 1999;354(9178):581–585.
3. Hartvigsen J, Hancock MJ, Kongsted A, Louw Q, Ferreira ML, Genevay S, et al. What low back pain is and why we need to pay attention. Lancet. 2018;391(10137):2356–2367.
4. Fischgrund JS, Mackay M, Herkowitz HN, Brower R, Montgomery DM, Kurz LT. Degenerative lumbar spondylolisthesis with spinal stenosis. Spine. 1997;22(24):2807–2812.
5. Resnick DK, Choudhri TF, Dailey AT, Groff MW, Khoo L, Matz PG, et al. Guidelines for the performance of fusion procedures for degenerative disease of the lumbar spine. J Neurosurg Spine. 2005;2(6):686–691.
6. Bridwell KH. Lumbar spinal fusion. Instr Course Lect. 2003;52:541–559.
7. Harms J, Rolinger H. A one-stage procedure in operative treatment of spondylolisthesis. Z Orthop Ihre Grenzgeb. 1982;120(3):343–347.
8. Cloward RB. The treatment of ruptured lumbar intervertebral discs by vertebral body fusion. J Neurosurg. 1953;10(2):154–168.

9. Lowe TG, Tahernia AD. Unilateral transforaminal posterior lumbar interbody fusion. Spine. 2002;27(4):E110–E114.

10. Brantigan JW, Steffee AD. A carbon fiber implant to aid interbody lumbar fusion. Spine. 1993;18(14):2106–2117.

11. McAfee PC. Interbody fusion cages in reconstructive operations on the spine. J Bone Joint Surg Am. 1999;81(6):859–880.

12. Steffee AD, Sitkowski DJ. Posterior lumbar interbody fusion and plates. Clin Orthop Relat Res. 1988;(227):99–102.

13. Humphreys SC, Hodges SD, Patwardhan AG, Eck JC, Murphy RB, Covington LA. Comparison of posterior and transforaminal approaches. Spine. 2001;26(5):567–571.

14. Gertzbein SD, Betz RR, Clements DH, Errico TJ, Hammerberg KW, Robbins SE. Semirigid instrumentation in lumbar spinal fusion. Spine. 1996;21(16):1918–1926.

15. Foley KT, Lefkowitz MA. Advances in minimally invasive spine surgery. Clin Neurosurg. 2002;49:499–517.

16. Sharma SC, Singh R, Sharma AK, Mittal R. Incidence of low back pain in Indian population. J Orthop Surg. 2003;11(1):33–36.

17. Joshi VD, Ingle NA. Disability due to low back pain in India. Indian J Orthop. 2002;36(1):10–13.

18. Patel MS, Gandhi D, Mehta S. Burden of degenerative lumbar spine disease in developing countries. Indian Spine J. 2019;2(2):67–72

19. Deyo RA, Weinstein JN. Low back pain. N Engl J Med. 2001;344(5):363–370

20. Shetty GM, Jain S, Thakur H, Khanna K. Prevalence of low back pain in India: A systematic review and meta-analysis. Work. 2022;73(2):429-452. doi: 10.3233/WOR-205300. PMID: 35964222.

21. Caelers IJ, Droeghaag R, de Kunder SL, Most J, Rijkers K, Bartels RH, Kuijlen JM, Hulsbosch MH, van Hemert WL, de Bie RA, van Santbrink H. Transforaminal versus posterior lumbar interbody fusion for symptomatic single-level spondylolisthesis (LIFT): a multicentre controlled, patient blinded, randomised non-inferiority trial. The Lancet Regional Health–Europe. 2024 Aug 1;43.

22. Yee T, Zammar S, Mummaneni PV. The lumbar interbody fusion trial: TLIF or PLIF for lumbar spondylolisthesis? Lancet Reg Health Eur. 2024 Jul 6;43:101000. doi: 10.1016/j.lanepe.2024.101000. PMID: 39070759; PMCID: PMC11283005.

23. Garg B, Mehta N. Minimally invasive transforaminal lumbar interbody fusion (MI-TLIF): A review of indications, technique, results and complications. J Clin Orthop Trauma. 2019 Oct;10(Suppl 1):S156-S162. doi: 10.1016/j.jcot.2019.01.008. Epub 2019 Jan 14. PMID: 31695275; PMCID: PMC6823784.

24. Modi HN, Shrestha U. Comparison of Clinical Outcome and Radiologic Parameters in Open TLIF Versus MIS-TLIF in Single- or Double-Level Lumbar Surgeries. Int J Spine Surg. 2021 Oct;15(5):962-970.

25. Wang Y, Zhang Y, Chong F, Zhou Y, Huang B. Clinical outcomes of minimally invasive transforaminal lumbar interbody fusion via a novel tubular retractor. J Int Med Res. 2020 May;48(5):300060520920090.doi: 10.1177/0300060520920090. PMID: 32367755; PMCID: PMC7218951.

26. El-Ghandour N, et al. A prospective randomised study: TLIF vs PLIF. Maced J Med Sci. 2021 Aug 03; 9(B):636-645

27. Holly LT, Schwender JD, Rouben DP, Foley KT. Minimally invasive transforaminal lumbar interbody fusion: indications, technique, and complications. Neurosurg Focus. 2006 Mar 15;20(3):E6. doi: 10.3171/foc.2006.20.3.7. PMID: 16599422.

28. Tippins NP, Foreit AM, Kussow NJ, Milne CM, Narayanan AM, Neely MR, Poplarski JH, Reasoner JT, Ricks K, Alentado VJ, Potts EA, Mobasser JP. Examination of clinical and radiographic outcomes after lumbar interbody fusion: a retrospective analysis of TLIF, MidLIF, and MIS-TLIF procedures. J Neurosurg Spine. 2025 May 2;43(1):52-62. doi: 10.3171/2025.1.SPINE241286. PMID: 40315609.

29. Chen M, Cui J, Liu Y, Cai Z, Yang C, Liu H, Chen Y, Yao Z. Comparison of safety and efficacy of posterior lumbar interbody fusion (PLIF) and modified transforaminal lumbar interbody fusion (M-TLIF) in the treatment of single-segment lumbar degenerative diseases. J Orthop Surg Res. 2024 Jan 30;19(1):95. doi: 10.1186/s13018-024-04531-3. PMID: 38287376; PMCID: PMC10826027.

30. Hawasli AH, Khalifeh JM, Chatrath A, Yarbrough CK, Ray WZ. Minimally invasive transforaminal lumbar interbody fusion with expandable versus static interbody devices: radiographic assessment of sagittal segmental and pelvic parameters. Neurosurg Focus. 2017 Aug;43(2):E10. doi: 10.3171/2017.5.FOCUS17197. PMID: 28760032.

31. Tormenti MJ, Maserati MB, Bonfield CM, Gerszten PC, Moossy JJ, Kanter AS, Spiro RM, Okonkwo DO. Perioperative surgical complications of transforaminal lumbar interbody fusion: a single-center experience. J Neurosurg Spine. 2012 Jan;16(1):44-50. doi: 10.3171/2011.9.SPINE11373. Epub 2011 Oct 14. PMID: 21999389.

32. Schwender JD, Holly LT, Rouben DP, Foley KT. Minimally invasive transforaminal lumbar interbody fusion (TLIF): technical feasibility and initial results. J Spinal Disord Tech. 2005 Feb;18 Suppl:S1-6. doi: 10.1097/01.bsd.0000132291.50455.d0. PMID: 15699793.

33. Goh GS, Liow MHL, Yue WM, Tan SB, Chen JL. Are Patient-Reported Outcomes of Minimally Invasive Transforaminal Lumbar Interbody Fusion Influenced by Preoperative Mental Health? Global Spine J. 2021 May;11(4):500-508. doi: 10.1177/2192568220912712. Epub 2020 Mar 13. PMID: 32875869; PMCID: PMC8119908.