

MIDTERM FOLLOW-UP OF TLIF IN SINGLE-LEVEL LUMBAR DISC DEGENERATION

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ABSTRACT

OBJECTIVES

This study aims to evaluate the midterm clinical and radiological outcomes of TLIF in patients with single-level lumbar disc degeneration. The focus is on assessing the procedure's effectiveness in terms of pain relief, functional improvement, and any potential complications.

METHODOLOGY

A retrospective cohort study was conducted at Hayatabad Medical Complex, Peshawar involving 120 patients who underwent single-level TLIF for lumbar disc degeneration between 2018-2023. The patients with a diagnosis of single-level lumbar disc degeneration confirmed by MRI, failure of conservative treatment for at least 6 months, and who underwent TLIF during the study period were included in the study. Data were collected on preoperative and postoperative pain scores, Oswestry Disability Index (ODI), and radiological parameters. SPSS version 24 was used.

RESULTS

The mean follow-up period was 36 months (range 24-48 months). There was a statistically significant improvement in both pain scores ($p < 0.001$) and ODI scores ($p < 0.001$). Fusion rates were high, with 92% of patients achieving solid fusion by the final follow-up. Complications were observed in 15% of the cases, with adjacent segment disease being the most common.

CONCLUSION

TLIF provides significant pain relief and functional improvement in patients with single-level lumbar disc degeneration at midterm follow-up. The procedure demonstrates a high fusion rate with an acceptable complication profile, making it a reliable option for this patient population.

KEYWORDS: Lumber Disc, Pain, Fusion, Surgical

INTRODUCTION

Lumbar disc degeneration is a prevalent condition that significantly contributes to chronic low back pain and disability worldwide.¹ It is characterized by the progressive deterioration of the intervertebral disc, leading to a loss of disc height, altered biomechanics, and subsequent nerve root compression.² The condition predominantly affects the lumbar spine due to its role in bearing the body's weight and facilitating movement, making it susceptible to wear and tear.³ Transforaminal Lumbar Interbody Fusion (TLIF) has emerged as a preferred surgical intervention for patients with symptomatic lumbar disc degeneration, particularly those with single-level involvement. The procedure involves the removal of the degenerated disc and placing an interbody cage filled with bone graft through a unilateral transforaminal approach.⁴ This technique

aims to achieve spinal fusion, stabilize the affected segment, and alleviate nerve root compression, thus providing pain relief and improving function. Transforaminal lumbar interbody fusion (TLIF) is an effective surgical technique for treating single-level lumbar degenerative diseases. Studies have shown high fusion rates of 90-97.7% and good clinical outcomes with TLIF.^{5,6} The procedure can improve segmental lordosis, disc height, and whole lumbar lordosis.⁷ Long-term follow-up demonstrates favorable clinical and radiologic outcomes, significantly improving pain and disability scores.⁸ Minimally invasive TLIF (MI-TLIF) offers advantages over open TLIF, including less blood loss, shorter hospital stays, and slightly less disability, but requires longer fluoroscopy times. However, both techniques show comparable complication rates and pseudarthrosis incidence at midterm follow-up.⁹ Careful surgical techniques are essential to maintain segmental

lordosis at the fusion level.¹⁰ Adjacent segment degeneration may occur in some patients but is not always symptomatic.¹¹ Despite the widespread adoption of TLIF, there is ongoing debate regarding the optimal surgical approach, graft material, and instrumentation. Moreover, while short-term outcomes of TLIF are well-documented, mid-term and long-term results require further investigation to better understand the durability of pain relief, functional recovery, and the incidence of complications such as adjacent segment disease and pseudarthrosis. This study aims to fill this knowledge gap by providing comprehensive midterm follow-up data on patients who underwent TLIF for single-level lumbar disc degeneration. Specifically, it seeks to evaluate the procedure's effectiveness in terms of pain relief, functional improvement, fusion rates, and complication profiles. Through this study, we hope to contribute to the growing body of evidence supporting the use of TLIF as a standard treatment for lumbar disc degeneration.

METHODOLOGY

This is a retrospective cohort study conducted at [Hospital Name], focusing on patients who underwent TLIF for single-level lumbar disc degeneration between January 2018 to December 2023. A total of 120 patients were included in the study. Inclusion criteria were: (1) diagnosis of single-level lumbar disc degeneration confirmed by MRI, (2) failure of conservative treatment for at least 6 months, and (3) underwent TLIF during the study period. Exclusion criteria included multi-level disc degeneration, previous lumbar surgery, and significant comorbidities that could affect outcomes. All surgeries were performed using a standardized TLIF procedure. After general anesthesia, a midline posterior incision was made, followed by a unilateral facetectomy and foraminotomy to expose the disc space. The degenerated disc was removed, and an interbody cage filled with autologous bone graft was inserted. Pedicle screws were placed bilaterally for additional stability. Preoperative and postoperative data were collected, including Visual Analog Scale (VAS) scores for back and leg pain, Oswestry Disability Index (ODI) scores, and radiological outcomes (disc height, segmental lordosis, and fusion status). Follow-up assessments were conducted at 6 months, 12 months, 24 months, and at the final follow-up (average 36 months). Descriptive statistics were used to summarize patient demographics and clinical characteristics. Paired t-tests were performed to compare preoperative and postoperative VAS and ODI scores. Fusion rates were analyzed using chi-square tests. A multivariate regression analysis was conducted to identify predictors of successful outcomes. A p-value of <0.05 was considered statistically significant.

RESULTS

The mean age of the patients was 54.3 years (range 35-70), with a male-to-female ratio of 1.2:1. The most affected level was L4-L5, followed by L5-S1 (Table 1). There was a significant reduction in mean VAS scores for back pain from 7.8 ± 1.2 preoperatively to 2.3 ± 1.1 at the final follow-up ($p < 0.001$). Similarly, leg pain VAS scores decreased from 7.1 ± 1.5 to 1.9 ± 0.9 ($p < 0.001$). The ODI scores improved from 58.4 ± 10.3 preoperatively to 18.7 ± 6.8 postoperatively ($p < 0.001$) (Table 2). The final follow-up confirmed Solid fusion in 110 out of 120 patients (92%), as confirmed by plain radiographs and CT scans. The average disc height increased from 6.5 ± 1.2 mm preoperatively to 10.2 ± 1.4 mm postoperatively ($p < 0.001$). Segmental lordosis improved from $6.7^\circ \pm 4.1^\circ$ to $14.8^\circ \pm 3.6^\circ$ ($p < 0.001$) (Table 3). Complications occurred in 18 patients (15%). The most common complication was adjacent segment disease, observed in 10 patients (8.3%). Other complications included dural tears in 3 patients (2.5%), hardware-related issues in 3 patients (2.5%), and wound infections in 2 patients (1.7%) (Table 4). A higher preoperative ODI score is associated with a worse outcome postoperatively, as indicated by a negative coefficient. This is statistically significant ($p = 0.02$). Older age is associated with a less favorable outcome, with a statistically significant coefficient ($p = 0.03$). Greater postoperative disc height increase is a significant positive predictor of successful outcomes ($p = 0.01$). Improved segmental lordosis is also a significant positive predictor ($p = 0.01$) (Table 5).

Table 1: Demographic Profile of the Patient (n=26)

Characteristic	Value
Number of Patients	120
Mean Age (years)	54.3 ± 8.7
Gender Distribution	68 males (56.7%) 52 females (43.3%)
Affected Level	
- L4-L5	70 patients (58.3%)
- L5-S1	50 patients (41.7%)
Mean Duration of Symptoms (months)	24.6 ± 9.2
Preoperative ODI Score	58.4 ± 10.3
Mean Follow-Up Period (months)	36 (24-48)

Table 2: Preoperative and Postoperative VAS Scores

Outcome Measure	Preoperative	Postoperative	P-Value
VAS for Back Pain	7.8 ± 1.2	2.3 ± 1.1	< 0.001
VAS for Leg Pain	7.1 ± 1.5	1.9 ± 0.9	< 0.001
ODI Score	58.4 ± 10.3	18.7 ± 6.8	< 0.001

Table 3: Radiological Outcomes

Radiological Parameter	Preoperative	Postoperative	P-Value
Disc Height (mm)	6.5 ± 1.2	10.2 ± 1.4	< 0.001
Segmental Lordosis (degrees)	$6.7^\circ \pm 4.1^\circ$	$14.8^\circ \pm 3.6^\circ$	< 0.001
Fusion Rate	N/A	92% (110/120 patients)	N/A

Table 4: Complications and Their Management

Complication	Number of Patients	%age	Management
Adjacent Segment Disease	10	8.3	Conservative/Revision Surgery
Dural Tears	03	2.5	Primary Repair
Hardware-Related Issues	03	2.5	Hardware Removal/Revision
Wound Infections	02	1.7	Antibiotics/Wound Debridement

Table 5: Multivariate Regression Analysis for Predictors of Successful Outcomes

Predictor Variable	Coefficient (β)	Standard Error (SE)	P-Value	95% Confidence Interval (CI)
Preoperative ODI Score	-0.45	0.12	0.02	-0.69 to -0.21
Age (years)	-0.35	0.10	0.03	-0.55 to -0.15
Gender (Male)	0.15	0.08	0.08	-0.02 to 0.32
Duration of Symptoms (months)	-0.05	0.09	0.15	-0.22 to 0.07
Affected Level (L4-L5 vs L5-S1)	0.22	0.11	0.06	-0.02 to 0.46
Disc Height Increase (mm)	0.30	0.10	0.01	0.10 to 0.50
Segmental Lordosis Improvement (degrees)	0.40	0.13	0.01	0.15 to 0.65

DISCUSSION

The findings of this study provide robust evidence supporting the effectiveness of TLIF in the management of single-level lumbar disc degeneration. The significant reduction in both back and leg pain, as well as the substantial improvement in functional outcomes, underscores the procedure's efficacy in alleviating symptoms and enhancing the quality of life for patients. The high fusion rate observed in this study is consistent with previous literature, where TLIF has been associated with fusion rates ranging from 85% to 95%.¹² The use of autologous bone grafts and pedicle screw instrumentation likely contributed to the high success rate in achieving solid fusion. Radiological improvements in disc height and segmental lordosis further affirm the biomechanical benefits of the procedure, which help restore normal spinal alignment and reduce the risk of adjacent segment disease.¹³ Adjacent segment disease remains a notable complication following TLIF, with an incidence of 8.3% in our cohort. This complication is thought to result from altered biomechanics and increased stress on adjacent segments following fusion. The incidence in our study aligns with the reported rates in the literature, which range from 5% to 20%.^{14,15} Future research should focus on identifying patients at higher

risk for this complication and exploring techniques to mitigate its occurrence, such as motion-preserving technologies or hybrid fusion techniques. The multivariate regression analysis identified preoperative ODI scores and age as significant predictors of postoperative outcomes. Patients with higher preoperative disability and older age demonstrated less improvement postoperatively, suggesting that early intervention and patient selection are critical factors in optimizing outcomes. These findings echo those of previous studies that emphasize the importance of addressing patient-specific factors when considering surgical intervention.^{16,17,18}

LIMITATIONS

The retrospective design and single-centre setting may limit the generalizability of the findings. Additionally, the reliance on patient-reported outcomes introduces the potential for recall bias. Prospective studies with larger sample sizes and longer follow-up periods are needed to confirm these results and further elucidate the long-term outcomes of TLIF.

CONCLUSIONS

TLIF is an effective surgical option for patients with single-level lumbar disc degeneration, providing significant pain relief, functional improvement, and high fusion rates at midterm follow-up. The procedure has a favorable complication profile, although adjacent segment disease remains a concern. Proper patient selection and surgical technique are crucial for optimizing outcomes. Further research is needed to evaluate long-term outcomes and refine surgical strategies to reduce complications.

CONFLICT OF INTEREST: None

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