

**Comparative Evaluation of Pre- and Postoperative Oswestry Disability Index in Lumbar Canal Stenosis, Instability, and Listhesis Following TLIF**Suman Sekhar Sahu<sup>1</sup>, Aditya Kaushik<sup>2</sup>, Archard Lelsona<sup>3</sup><sup>1</sup>Senior Resident, Department of Orthopaedics, Late Baliram Kashyap Memorial Medical College, Jagdalpur, Chhattisgarh.<sup>2</sup>Assistant Professor, Department of Orthopaedics, Late Baliram Kashyap Memorial Medical College, Jagdalpur, Chhattisgarh.<sup>3</sup>Assistant Professor, Department of Paediatrics, Maharaja Jajati Keshari Medical College and Hospital, Jajpur, Odisha.

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**Abstract:****Background:** Lumbar degenerative pathologies such as canal stenosis, segmental instability, and listhesis are common causes of chronic back pain and disability. Transforaminal Lumbar Interbody Fusion (TLIF) is a well-established surgical intervention for these conditions, offering decompression, stabilization, and alignment restoration. Functional assessment using the Oswestry Disability Index (ODI) is essential to gauge patient-reported outcomes.**Objective:** This study aimed to compare preoperative and postoperative ODI scores among patients with lumbar canal stenosis (LCS), LCS with instability, and listhesis undergoing TLIF using local corticocancellous bone grafts.**Methods:** A retro-prospective observational study was conducted on 100 patients undergoing TLIF at a tertiary center. Based on preoperative diagnosis, patients were categorized into three groups: LCS (n=44), LCS with instability (n=33), and listhesis (n=23). ODI scores were recorded preoperatively, on postoperative day 1, at 3 months, and at 1 year. Statistical analysis was performed using paired t-tests and ANOVA. A p-value < 0.05 was considered significant.**Results:** Baseline ODI was highest in the LCS group ( $61.13 \pm 5.81$ ), followed by LCS with instability ( $60.09 \pm 4.66$ ), and listhesis ( $58.17 \pm 4.77$ ), though the difference was not statistically significant ( $p=0.0921$ ). Postoperative ODI scores showed marked improvement across all groups. Day 1 scores were similar among groups ( $p=0.9092$ ), while significant differences emerged at 3 months ( $p<0.0001$ ) and 1 year ( $p<0.0001$ ). Intragroup analysis revealed substantial reduction in ODI from baseline to 1 year (LCS:  $\downarrow 52.04$ , Instability:  $\downarrow 51.88$ , Listhesis:  $\downarrow 50.56$ ;  $p<0.0001$ ).**Conclusion:** TLIF using corticocancellous bone grafts leads to significant and sustained reduction in disability across lumbar degenerative pathologies. Despite variation in baseline disability, all diagnostic groups experienced comparable postoperative functional gains, reinforcing TLIF's role as a versatile and effective surgical modality.**Keywords:** Lumbar pathology, TLIF, disability index.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Lumbar degenerative diseases, including lumbar canal stenosis (LCS), segmental instability, and spondylolisthesis, are leading causes of chronic lower back pain and neurological dysfunction, especially among the aging population [1]. These conditions often result in radiculopathy, neurogenic claudication, and reduced quality of life, necessitating surgical intervention when conservative treatments fail. Transforaminal Lumbar Interbody Fusion (TLIF), first described by Harms and Jerszenszky, is a widely accepted surgical technique designed to achieve spinal decompression, segmen-

tal stability, and restoration of disc height through a unilateral approach [2]. It allows for neural decompression, disc space reconstruction, and interbody fusion with relatively minimal neural retraction. Functional outcomes post-TLIF are commonly assessed using the Oswestry Disability Index (ODI), a validated patient-reported outcome measure for spinal disorders. The ODI quantifies disability across ten daily living domains and is sensitive to changes in functional status post-intervention [3]. Several clinical trials and case series have demonstrated the efficacy of TLIF in improving ODI

scores, fusion rates, and overall patient satisfaction. However, limited data exist regarding comparative functional outcomes in patients undergoing TLIF for specific pathologies like isolated LCS, LCS with instability, and listhesis [4, 5]. Moreover, many studies overlook the utility of autologous corticocancellous bone grafts harvested during decompression, which offer the dual benefits of avoiding donor site morbidity and reducing cost while ensuring biological fusion potential [6].

Given the clinical and economic implications, it is essential to stratify outcomes based on preoperative diagnoses and assess the trajectory of recovery at standardized postoperative intervals.

**Aim:** To perform a comparative evaluation of pre- and postoperative ODI scores in patients undergoing TLIF for lumbar canal stenosis, instability, and listhesis using local corticocancellous bone grafts.

### Materials and Methods

**Study Design:** Retrospective-prospective observational study.

**Setting:** Department of Orthopedics, Bhagwan Mahaveer Jain Hospital, Bengaluru.

**Study Period:** January 2023 to January 2024 (12 months).

**Sample Size:** 100 patients.

**Study Population:** Patients aged 30–75 years undergoing TLIF for lumbar canal stenosis, instability, or spondylolisthesis.

### Diagnostic Grouping:

- **Group 1 – LCS:** 44 patients
- **Group 2 – LCS with instability:** 33 patients
- **Group 3 – Listhesis:** 23 patients

### Inclusion Criteria:

- Radiologically confirmed diagnosis of LCS, instability, or listhesis
- Underwent single- or multi-level TLIF
- Availability of complete ODI data preoperatively and at follow-up intervals
- Minimum follow-up duration: 12 months

### Exclusion Criteria:

- History of prior lumbar fusion surgery
- Lumbar trauma, infection, or malignancy
- Incomplete clinical or follow-up data

**Surgical Procedure:** All patients underwent TLIF with standard posterior midline approach. Decompression was followed by pedicle screw fixation and insertion of autologous corticocancellous bone chips—harvested during laminectomy—into the interbody space.

**Outcome Measure:** Oswestry Disability Index (ODI) scores collected:

- Preoperatively
- Postoperative day 1
- 3 months postoperatively
- 1 year postoperatively

### Statistical Analysis:

- Software: SPSS version 25.0
- Data: Presented as mean  $\pm$  standard deviation (SD)
- Intragroup comparisons: Paired t-test
- Intergroup comparisons: ANOVA
- Significance: p-value  $<$  0.05

### Results

A total of 100 patients undergoing TLIF were evaluated and categorized into three diagnostic groups: Group 1 (Lumbar Canal Stenosis – LCS, n=44), Group 2 (LCS with instability, n=33), and Group 3 (Listhesis, n=23). The functional outcomes were assessed using the Oswestry Disability Index (ODI) at four timepoints: preoperative, postoperative day 1, 3 months, and 1 year.

**Baseline ODI Comparison:** At baseline, Group 1 (LCS) exhibited the highest mean ODI score ( $61.13 \pm 5.81$ ), followed by Group 2 (LCS with instability) with a mean score of  $60.09 \pm 4.66$ . Group 3 (Listhesis) had the lowest baseline ODI ( $58.17 \pm 4.77$ ). Although Group 1 showed a marginally higher level of preoperative disability, the intergroup difference in baseline ODI scores was not statistically significant ( $p=0.0921$ ) (Table 1).

**Postoperative Day 1 Outcomes:** On postoperative day 1, all groups showed a marked reduction in ODI scores, with Group 1 and Group 2 both averaging  $27.91 (\pm 2.66$  and  $\pm 2.16$ , respectively), and Group 3 slightly lower at  $27.50 \pm 1.92$ . No statistically significant difference was observed among the groups on day 1 ( $p=0.9092$ ), indicating similar immediate postoperative recovery patterns across diagnoses (Table 1).

**ODI at 3 Months:** At the 3-month follow-up, all groups demonstrated further improvement in ODI scores. Group 1 recorded a mean ODI of  $18.50 \pm 2.08$ , Group 2 improved to  $17.42 \pm 1.75$ , and Group 3 showed the best recovery with a score of  $17.00 \pm 2.07$ . The difference among the groups at this timepoint was statistically significant ( $p<0.0001$ ), suggesting differential recovery rates starting to emerge by this stage (Table 1).

**ODI at 1 Year:** One year postoperatively, sustained functional improvement was noted across all groups. Group 1 had a mean ODI of  $9.09 \pm 1.96$ , Group 2 improved further to  $8.21 \pm 1.79$ , and Group 3 demonstrated the lowest disability score of  $7.61 \pm 1.58$ . The intergroup difference at 1 year was also statistically significant ( $p<0.0001$ ), indicating that listhesis patients may achieve marginal-

ly superior long-term functional outcomes (Table 1).

**Intragroup ODI Reduction:** Paired analysis of ODI scores from preoperative to 1-year follow-up within each group showed statistically significant improvement in all groups. Group 1 exhibited a

reduction of 52.04 points ( $p < 0.0001$ ), Group 2 improved by 51.88 points ( $p < 0.0001$ ), and Group 3 showed a reduction of 50.56 points ( $p < 0.0001$ ).

These improvements affirm the effectiveness of TLIF in substantially reducing disability irrespective of preoperative diagnosis.

**Table 1: Mean Oswestry Disability Index (ODI) Scores at Each Time point**

Group	Pre-op ODI	Day 1 Post-op ODI	3-Month ODI	1-Year ODI
LCS	61.13 ± 5.81	27.91 ± 2.66	18.50 ± 2.08	9.09 ± 1.96
LCS + Instability	60.09 ± 4.66	27.91 ± 2.16	17.42 ± 1.75	8.21 ± 1.79
Listhesis	58.17 ± 4.77	27.50 ± 1.92	17.00 ± 2.07	7.61 ± 1.58

**Statistical significance: ANOVA p-values — Pre-op: 0.0921; Day 1: 0.9092; 3-Month: <0.0001; 1-Year: <0.0001**

**Discussion**

The study revealed a consistent trend of significant functional improvement in all diagnostic groups following TLIF, as indicated by substantial reductions in ODI scores over the 1-year postoperative period. The findings confirm the efficacy of TLIF in alleviating disability, irrespective of the underlying lumbar pathology.

At baseline, patients with isolated LCS had slightly higher ODI scores, possibly due to greater neurogenic claudication. However, postoperative improvements were comparable across all groups, suggesting that TLIF effectively addresses both neural compression and mechanical instability.

The uniform ODI values on day 1 suggest that immediate postoperative outcomes are primarily influenced by surgical trauma and recovery rather than preoperative diagnosis. At 3 months and 1 year, patients with listhesis showed marginally better functional gains, potentially attributable to improved sagittal alignment after reduction and fusion.

Our findings align with Patil et al., who reported favorable outcomes using local bone grafts in PLIF procedures, suggesting their biological viability and fusion potential [7]. Similarly, Overley et al. affirmed that local bone grafts perform comparably to synthetic substitutes in lumbar fusion [8].

Moreover, utilizing bone harvested during decompression eliminates the need for iliac crest grafting, thus reducing operative time, morbidity, and cost—points emphasized in cost-effectiveness analyses [9-15].

This study fills a vital gap by stratifying ODI outcomes across different lumbar diagnoses and monitoring recovery at defined intervals. While radiographic fusion assessment was beyond the study’s scope, the robust improvement in ODI supports successful clinical outcomes.

**Limitations:**

- Single-center study limits generalizability.
- Fusion confirmation via CT or MRI was not incorporated.
- Quality-of-life and return-to-work metrics were not assessed.

Future multicentric studies incorporating radiographic fusion and broader functional outcomes are warranted.

**Conclusion**

Transforaminal Lumbar Interbody Fusion utilizing local corticocancellous bone grafts provides significant and sustained functional improvement across diverse lumbar degenerative conditions, including canal stenosis, instability, and listhesis. Despite differing preoperative disability levels, all groups experienced substantial postoperative gains, particularly within the first 3 months. These findings affirm TLIF as an effective, cost-conscious surgical strategy offering durable relief from lumbar disability.

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