



RADIOLOGICAL FUSION AND FUNCTIONAL RECOVERY AFTER TRANSFORAMINAL LUMBAR INTERBODY FUSION IN DEGENERATIVE LUMBAR CANAL STENOSIS

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Abstract

Background:

Degenerative lumbar canal stenosis is a frequent source of pain and neurological compromise in adults. In patients who do not respond to conservative treatment, surgical intervention combining decompression and stabilization may be necessary.

Objective:

To assess radiological fusion and neurological outcomes following transforaminal lumbar interbody fusion (TLIF) in patients with degenerative lumbar canal stenosis.

Methods:

This observational study included 40 adult patients with symptomatic degenerative lumbar canal stenosis who underwent TLIF at a tertiary care institution. Preoperative neurological status was documented using the American Spinal Injury Association (ASIA) impairment scale. Radiological assessment focused on ligamentum flavum hypertrophy, facet joint degeneration, and fusion status at follow-up using the Bridwell grading system. Outcomes were analysed using descriptive statistical methods.

Results:

Most patients were middle-aged or elderly, with a slight male predominance. Preoperatively, the majority had preserved neurological function (ASIA grades D and E). Radiological evaluation demonstrated ligamentum flavum hypertrophy in 70% of patients and facet joint arthropathy in 67.5%. At follow-up, solid interbody fusion (Bridwell grade I) was observed in 80% of cases, while the remaining patients achieved grade II fusion. No implant-related complications or evidence of pseudoarthrosis were noted.

Conclusion:

TLIF results in dependable radiological fusion while maintaining neurological function in patients with degenerative lumbar canal stenosis. The procedure represents a reliable surgical option when decompression alone may not provide adequate spinal stability.

Keywords: Lumbar canal stenosis; Transforaminal lumbar interbody fusion; Spinal stabilization; Degenerative spine

Introduction

Degenerative lumbar canal stenosis is among the most common spinal disorders affecting adults, particularly in the later decades of life. The condition develops as a consequence of progressive degenerative changes involving intervertebral disc collapse, hypertrophy of facet joints, and thickening of the ligamentum flavum, all of which contribute to narrowing of the spinal canal and compression of neural elements.^{1–3}

Initial management is typically non-operative; however, a subset of patients experience persistent symptoms despite adequate conservative therapy.⁴ Surgical decompression may alleviate neural compression, but when extensive bony and ligamentous resection is required, postoperative instability can occur.⁵ This has led to the increasing use of fusion techniques in selected patients.

Transforaminal lumbar interbody fusion was introduced to achieve circumferential fusion through a unilateral posterior approach, thereby reducing neural manipulation and preserving posterior structures.⁶ Restoration of disc height and segmental alignment through TLIF enhances spinal stability and may contribute to indirect neural decompression.⁷

The present study evaluates radiological fusion outcomes and neurological status following TLIF in patients treated for degenerative lumbar canal stenosis.

Materials and Methods

Study Design

This was an observational clinical study conducted at a tertiary care teaching hospital. Patients treated both retrospectively and prospectively were included to reflect routine clinical practice.

Patient Selection

Forty adult patients with imaging-confirmed degenerative lumbar canal stenosis who underwent TLIF were included.

Inclusion criteria:

- Age 18 years or older
- Symptomatic degenerative lumbar canal stenosis
- Failure of conservative management

Exclusion criteria:

- Spinal infection or malignancy
- Structural spinal deformity
- Previous fusion at the index level
- Severe systemic illness contraindicating surgery

Clinical Evaluation

Neurological status was recorded preoperatively using the ASIA impairment scale.

Radiological Evaluation

Preoperative MRI and radiographs were reviewed to assess ligamentum flavum hypertrophy and facet joint degeneration. Fusion status was evaluated at follow-up using the Bridwell fusion grading system.⁸

Surgical Technique

All procedures were performed through a posterior midline approach. Bilateral pedicle screw fixation was followed by unilateral facetectomy and transforaminal discectomy. After careful endplate preparation, an interbody cage filled with bone graft was inserted, and final stabilization was completed.

Statistical Analysis

Data were analysed using descriptive statistics. Results are expressed as frequencies and percentages.

Results

Demographic Characteristics

The study cohort included 23 males and 17 females. Most patients were 60 years of age or younger.

Table 1. Demographic profile of the study population

Age group (years)	Male	Female	Total
≤60	13	15	28
>60	10	2	12
Total	23	17	40

Neurological Status

Preoperative neurological assessment revealed that 75% of patients had preserved motor function (ASIA grades D and E).

Table 2. Preoperative neurological status (ASIA scale)

ASIA grade	Number	Percentage
C	10	25
D	20	50
E	10	25

Radiological Findings

Ligamentum flavum hypertrophy was identified in 28 patients (70%), while facet joint arthropathy was present in 27 patients (67.5%).

Table 3. Ligamentum flavum hypertrophy

Status	Number	Percentage
Present	28	70
Absent	12	30

Table 4. Facet joint arthropathy

Status	Number	Percentage
Present	27	67.5
Absent	13	32.5

Fusion Outcomes

At follow-up, 32 patients (80%) demonstrated Bridwell grade I fusion, while 8 patients (20%) achieved grade II fusion. No cases of non-union or hardware failure were observed.

Table 5. Fusion status at follow-up
Bridwell grade Number Percentage

Grade I	32	80
Grade II	8	20

Discussion

This study demonstrates that TLIF provides consistent radiological fusion with preservation of neurological function in patients with degenerative lumbar canal stenosis. The fusion rates observed are comparable to those reported in earlier clinical series evaluating TLIF outcomes.^{6–9}

Degenerative hypertrophy of the ligamentum flavum and facet joints was frequently encountered, highlighting their role in canal narrowing. By restoring disc height and stabilizing the motion segment, TLIF likely contributes to symptom relief through both mechanical stabilization and indirect decompression.

The absence of implant-related complications or pseudoarthrosis in this series supports the procedural reliability of TLIF when performed with meticulous surgical technique.

Study Limitations

Limitations include the single-center design, limited sample size, and lack of a comparison group. Additionally, patient-reported outcome measures such as pain or disability scores were not assessed.

Conclusion

Transforaminal lumbar interbody fusion results in dependable radiological fusion and preservation of neurological function in patients with degenerative lumbar canal stenosis. TLIF should be considered a reliable surgical option when spinal stability is a concern following decompression.

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