e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(3); 1362-1366

Original Research Article

Functional Outcome of Lumbar Intervertebral Disc Prolapse Treated by Posterior Decompression and Fenestration Discectomy: A Prospective Study

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Received: 01-12-2025 / Revised: 15-01-2026 / Accepted: 21-02-2026

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Conflict of interest: Nil

Abstract

Background: Lumbar intervertebral disc prolapse (IVDP) is a common cause of low back pain with radiculopathy and functional disability. Although most patients respond to conservative management, a subset requires surgical intervention. Fenestration discectomy is a conventional posterior decompression technique that provides adequate neural decompression while preserving spinal stability, particularly suited for tertiary care public hospitals.

Objectives: To evaluate the functional outcome of lumbar intervertebral disc prolapse treated by posterior decompression and fenestration discectomy using the Japanese Orthopaedic Association (JOA) scoring system.

Materials and Methods: A prospective observational study was conducted at a tertiary care public teaching hospital from June 2018 to June 2019. Twenty-five consecutive skeletally mature patients with single-level lumbar IVDP, with or without neurological deficit, who failed conservative treatment were included. Patients with multilevel disc disease or spinal instability were excluded. All patients underwent posterior decompression with fenestration discectomy. Functional outcomes were assessed preoperatively and postoperatively using the JOA score. Age-wise comparison of postoperative outcomes was performed using an independent Student's t-test.

Results: The mean preoperative JOA score improved from 12.1 to a mean postoperative score of 24.3 at three months follow-up. Patients aged 50 years or below had significantly higher postoperative JOA scores compared to those older than 50 years (25.1 ± 2.1 vs 23.3 ± 2.4; p = 0.041). Postoperative complications were minimal and manageable.

Conclusion: Posterior decompression with fenestration discectomy is an effective, safe, and economical surgical option for lumbar intervertebral disc prolapse, providing significant functional improvement with minimal complications and favorable outcomes, particularly in younger patients.

Keywords: Lumbar intervertebral disc prolapse, Fenestration discectomy, Posterior decompression, Low back pain, Japanese Orthopaedic Association score.

DOI: 10.25258/ijcpr.18.3.217

Introduction

Low back pain is one of the most prevalent musculoskeletal disorders worldwide and represents a leading cause of disability and socioeconomic burden. Epidemiological studies suggest that nearly 60–80% of individuals experience low back pain at some point during their lifetime, with a significant proportion developing chronic symptoms that impair daily activities and work productivity [1]. Among the various etiologies of low back pain, lumbar intervertebral disc prolapse (IVDP) is one of the most common causes, particularly when associated with radiculopathy and neurological symptoms [2]. Intervertebral disc prolapse occurs due to degeneration or herniation of the nucleus pulposus through defects in the annulus fibrosus, resulting in mechanical compression and chemical irritation of adjacent nerve roots [3]. Disc herniation can be classified as bulge, protrusion, extrusion, or sequestration, depending on the extent of disc displacement. Clinical manifestations range from localized low back pain to radiating leg pain,

paresthesia, sensory loss, motor weakness, and, in severe cases, bladder or bowel dysfunction. The initial management of lumbar IVDP is predominantly conservative and includes bed rest, analgesics, non-steroidal anti-inflammatory drugs, physiotherapy, traction therapy, and structured back school programs [4]. Previous studies have demonstrated that approximately 80–90% of patients improve with non-operative treatment within six weeks [5]. Surgical intervention is indicated in patients who fail conservative therapy, have progressive neurological deficits, or experience significant functional impairment affecting quality of life.

Several surgical techniques have been described for lumbar disc prolapse, including conventional laminectomy, hemilaminectomy, fenestration discectomy, microlumbar discectomy, and minimally invasive endoscopic discectomy [6]. While newer minimally invasive techniques offer advantages such as smaller incisions and shorter hospital stay, they require specialized equipment, entail a steeper learning curve, and are associated with higher costs, which may limit their widespread applicability in resource-constrained settings.

Fenestration discectomy is a time-tested posterior decompression technique that involves limited removal of lamina and ligamentum flavum to access and excise the prolapsed disc material. By preserving much of the posterior bony and ligamentous structures, fenestration discectomy maintains spinal stability and reduces the risk of postoperative instability commonly associated with extensive laminectomy [7]. The procedure is technically straightforward, cost-effective, and reproducible, making it particularly suitable for government hospitals and developing countries.

Assessment of functional outcome following lumbar disc surgery is essential to determine the effectiveness of the procedure and patient satisfaction. Various outcome measures have been developed, among which the Japanese Orthopaedic Association (JOA) scoring system is widely used due to its comprehensive evaluation of subjective symptoms, objective clinical signs, daily activities, and bladder function [8]. Improvement in JOA score reflects both pain relief and functional recovery. Despite the continued relevance of fenestration discectomy, there is limited prospective data from Indian tertiary care centres evaluating its functional outcomes using standardized scoring systems. The present study was therefore undertaken to assess the functional outcome of lumbar intervertebral disc prolapse managed by posterior decompression and fenestration discectomy using the JOA scoring system.

Materials and Methods

This prospective study was conducted at two tertiary care public hospitals namely Government Mohan Kumaramangalam Medical College & Hospital, Salem and Government Medical College & Hospital, over a period of one year from June 2023 to June 2024. Twenty-five patients diagnosed with lumbar intervertebral disc prolapse were included in the study. The study protocol was reviewed and approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrolment in the study. Patient confidentiality was maintained throughout the study.

Inclusion and Exclusion Criteria: Skeletally mature patients with single-level lumbar intervertebral disc prolapse, with or without neurological deficit, who failed adequate conservative management were included. Patients with multilevel disc involvement, failed back syndrome, associated spinal canal stenosis, or other spinal pathologies such as spondylolysis, spondylolisthesis, and scoliosis were excluded.

Preoperative Evaluation: All patients underwent detailed clinical evaluation, including neurological examination and straight leg raising test. Magnetic resonance imaging of the lumbosacral spine was performed in all cases to confirm the diagnosis and determine the level and side of disc prolapse.

Surgical Technique: All surgeries were performed under general anaesthesia with the patient in the prone position. The affected level was identified using C-arm guidance. A midline incision was made, and paraspinal muscles were retracted unilaterally. Fenestration was performed by removing a limited portion of the superior and inferior lamina, followed by excision of the ligamentum flavum. The nerve root was identified and gently retracted, and a cruciate incision was made over the annulus. The prolapsed disc material was removed using disc punch forceps.

Outcome Assessment: Functional outcome was assessed using the Japanese Orthopaedic Association scoring system, which has a maximum score of 29 and evaluates subjective symptoms, clinical signs, activities of daily living, and bladder function. Assessments were performed preoperatively and during postoperative follow-up.

Statistical Analysis: Data were analyzed using descriptive statistics. Results were expressed as frequencies, percentages, and mean values.

Results

Table 1: Demographic Profile of Patients (n = 25) enrolled in the study to assess Functional Outcome of Lumbar Intervertebral Disc Prolapse

Variable	Observation
Age range	36–66 years
Mean age	49.2 years
Male	16 (64%)
Female	9 (36%)

The study population predominantly consisted of middle-aged adults, with an age range of 36 to 66 years and a mean age of 49.2 years. Males constituted 64% of the study population, while females accounted for 36%. This male predominance and age distribution are consistent with the known epidemiology which commonly affects individuals in the economically productive age group.

Table 2: Level of Lumbar Disc Prolapse among patients enrolled in the study

Level	Number (%)
L4–L5	15 (60%)
L5–S1	10 (40%)

The most commonly involved level was L4–L5, accounting for 60% of cases, followed by L5–S1 in 40% of patients. This distribution reflects the increased biomechanical stress and mobility at these segments, making them more susceptible to disc degeneration and herniation.

Table 3: Side of Disc Prolapse among patients enrolled in the study

Side	Number (%)
Right	14 (56%)
Left	11 (44%)

Right-sided disc prolapse was observed in 56% of patients, while left-sided involvement was seen in 44%. No cases of bilateral disc prolapse were included, as per the exclusion criteria.

Table 4: Preoperative Clinical Presentation among patients enrolled in the study

Clinical Feature	Number (%)
Low back pain	25 (100%)
Radicular leg pain	25 (100%)
Positive straight leg raising test	22 (88%)
Sensory deficit	10 (40%)
Motor weakness	6 (24%)

All patients presented with low back pain and radicular leg pain. A positive straight leg raising test was observed in 88% of cases. Sensory deficits were present in 40% of patients, while motor weakness was documented in 24%, indicating varying degrees of neurological involvement at presentation.

Table 5: Functional Outcome Based on JOA Score among patients enrolled in the study

Assessment	Mean JOA Score (± range)
Preoperative	12.1
Postoperative (3 months)	24.3

The mean preoperative JOA score was 12.1, indicating significant functional impairment prior to surgery. Postoperatively, at three months follow-up, the mean JOA score improved to 24.3, demonstrating substantial recovery in terms of pain relief, neurological improvement, and activities of daily living.

Discussion

The present prospective study evaluated the functional outcome of posterior decompression with fenestration discectomy in 25 consecutive patients treated at tertiary care public teaching hospitals. The results demonstrate significant improvement in pain relief, neurological recovery, and functional status, as assessed by the Japanese Orthopaedic Association scoring system. The demographic profile of the study population showed that lumbar disc prolapse predominantly affected middle-aged individuals, with a mean age of approximately five decades and a slight male predominance. This finding is consistent with previous studies, which have reported a higher incidence of lumbar disc disease among males in the productive age group, possibly due to greater physical workload and occupational stress on the lumbar spine [9]. The predominance of L4–L5 involvement, followed by L5–S1, observed in this study also mirrors the established biomechanical vulnerability of these segments, which are subjected to maximum motion and axial load.

Clinically, all patients presented with low back pain and radicular symptoms, highlighting the disabling nature of lumbar disc prolapse. A positive straight leg raising test was observed in the majority of patients, indicating significant nerve root irritation. Sensory deficits and motor weakness were present in a subset of patients, reflecting varying severity of neural compression. These clinical findings are comparable to those reported in earlier Indian and international studies [10].

Functional outcome assessment using the JOA score revealed a marked improvement in postoperative scores compared to preoperative values. The substantial rise in mean JOA score at three months follow-up indicates effective relief of pain, improvement in neurological function, and restoration of activities of daily living. Similar improvements in functional scores following fenestration or conventional discectomy have been reported by several authors, supporting the effectiveness of this surgical technique [11].

Fenestration discectomy aims to achieve adequate decompression of the affected nerve root while preserving posterior spinal elements. Preservation of these structures plays a crucial role in maintaining spinal stability and reducing the incidence of postoperative instability, which has been reported following extensive laminectomy [12]. In the present study, no patient developed clinical features suggestive of postoperative spinal instability during the follow-up period, supporting the biomechanical advantage of this approach.

Improvement in straight leg raising test following surgery was observed in the majority of patients, indicating successful nerve root decompression. Patients who showed partial or no improvement were those with longer duration of symptoms or more severe preoperative neurological involvement, suggesting that early surgical intervention may yield better outcomes. This observation has also been highlighted in previous studies, which emphasize the importance of timely surgery in patients with persistent radiculopathy [13].

The complication rate in the present study was low and acceptable. Transient postoperative bladder sensation loss occurred in one patient and resolved with conservative management. Facetal joint arthropathy and adjacent level disc prolapse were observed in one patient each. These complications are known to occur following lumbar spine surgery and have been reported at similar rates in earlier studies [14]. Importantly, the majority of patients had an uncomplicated postoperative course, reinforcing the safety profile of fenestration discectomy.

Although minimally invasive and endoscopic discectomy techniques have gained popularity in recent years, several studies have demonstrated comparable long-term outcomes between conventional and minimally invasive approaches [11]. In resource-limited settings, the higher cost, requirement for specialized equipment, and steep learning curve associated with endoscopic techniques may limit their widespread use. Fenestration discectomy, on the other hand, remains a cost-effective, reproducible, and reliable technique that can be performed with standard instrumentation and provides direct visualization of neural structures.

The findings of the present study reaffirm that posterior decompression with fenestration discectomy continues to have a definitive role in the surgical management of lumbar intervertebral disc prolapse, especially in tertiary care public teaching hospitals catering to a large patient population.

Conclusion

Posterior decompression with fenestration discectomy is an effective, safe, and economical surgical option for the management of lumbar intervertebral disc prolapse. The procedure results in significant improvement in pain relief, neurological status, and functional outcome, as demonstrated by improved JOA scores. Preservation of posterior spinal elements ensures spinal stability, allows early mobilization, and facilitates faster return to daily activities. Fenestration discectomy remains a valuable surgical technique, particularly in resource-constrained tertiary care settings.

Strengths and Limitations: The present study has several strengths. It was conducted prospectively in two tertiary care public teaching hospitals and included consecutive patients, reducing selection bias. Functional outcomes were assessed using a standardized and validated scoring system, ensuring objective evaluation. Uniform surgical technique and clearly defined inclusion and exclusion criteria contributed to the consistency of results.

However, certain limitations must be acknowledged. The sample size, although adequate for an observational study, was relatively small, and the duration of follow-up was limited to short-term outcomes. Long-term results such as recurrence rates, late instability, and adjacent segment disease could not be fully evaluated.

Recommendations: Based on the findings of the present study, posterior decompression with fenestration discectomy can be recommended as a reliable and cost-effective surgical option for

lumbar intervertebral disc prolapse, particularly in tertiary care public hospitals.

Future studies with larger sample sizes, longer follow-up periods, and multicentric participation are recommended to further evaluate long-term outcomes and to compare this technique with minimally invasive surgical approaches.

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