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Functional Outcome of Surgical Management of Prolapse Intervertebral Disc (PIVD) In Lumbar Herniation Patient: A Retrospective Study from a Tertiary Centre in Eastern Nepal

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Abstract

Background: Prolapsed intervertebral disc (PIVD) in lumbar disc herniation is a leading cause of low back pain and radiculopathy, frequently necessitating surgery after failed conservative treatment. This study assesses functional outcomes following surgical management in patients at a tertiary center in eastern Nepal.

Methods: A retrospective review was conducted of 335 patients surgically treated for lumbar PIVD at Nobel Medical College Teaching Hospital from January 2016 to December 2023. Inclusion criteria required single-level herniation (documented on MRI), failure of structured conservative treatment (physiotherapy, analgesics, and lifestyle modification for a minimum of 3 months), and/or neurological deterioration. Patients with multi-level disease (n=49, 14.6%) underwent surgery based on clinical-radiological concordance and are reported descriptively. Functional outcomes were evaluated using Visual Analog Scale (VAS) for leg and back pain, Oswestry Disability Index (ODI), and Modified Macnab Criteria at baseline, 1 month, and 3 months postoperatively.

Results: Mean age was 44.34 ± 13.60 years; 58.2% were male. L4-L5 herniation predominated (54.3%). Microdiscectomy was performed in 70.0% of cases. VAS leg pain decreased from 7.5 ± 1.2 preoperatively to 2.0 ± 0.9 at 3 months ($p<0.001$); ODI improved from 55 ± 12% to 20 ± 9% ($p<0.001$). Excellent or good Macnab outcomes were achieved in 90.2%; recurrence occurred in 3.0%.

Conclusions: Surgical intervention for lumbar PIVD provides substantial pain relief and functional improvement at short-term follow-up. Limitations include retrospective design, short follow-up duration (3 months), absence of imaging confirmation at follow-up, and single-center data. Long-term prospective studies with extended follow-up are warranted.

Keywords: Discectomy; Intervertebral Disc Displacement; Lumbar Vertebrae; Nepal; Treatment Outcome; Microdiscectomy

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Introduction

Prolapsed intervertebral disc (PIVD), a common manifestation of lumbar disc herniation, occurs when the nucleus pulposus protrudes through a weakened annulus fibrosus, resulting in compression of adjacent nerve roots.[1] This pathophysiological process frequently leads to chronic low back pain, sciatica, numbness, and functional limitations, significantly impacting quality of life.[2] Globally, PIVD affects approximately 5–10% of the adult population, with the highest incidence in middle-aged individuals, imposing considerable socioeconomic costs through reduced work productivity, increased healthcare utilization, and long-term disability.[3]

In Nepal, degenerative lumbar disc disease has been identified in approximately 17% of patients undergoing MRI for back pain.[4] Modern sedentary lifestyles, prolonged sitting, manual labor, and inadequate ergonomics have contributed to rising prevalence, particularly in urban and semi-urban populations. Despite this burden, robust regional data on epidemiology, clinical characteristics, and outcomes in low-resource settings such as eastern Nepal remain limited.[5]

Conservative management—including analgesics, physiotherapy, and lifestyle modification—remains the first-line approach, yet a significant proportion of patients continue to experience persistent pain and neurological deficits requiring surgery.[6] Understanding patient demographics, symptomatology, radiological features, and postoperative outcomes is essential to optimize individualized care pathways and improve functional recovery.

This study provides a comprehensive retrospective analysis of patients with lumbar PIVD at Nobel Medical College Teaching Hospital, focusing on demographic characteristics, clinical presentation, radiological findings, surgical procedures, and functional outcomes. By generating localized evidence, the study seeks to inform clinical decision-making in resource-limited settings in Nepal.

Methods

Study Design and Setting

This was a retrospective cohort study conducted at Nobel Medical College Teaching Hospital, Biratnagar, Nepal, a tertiary-care academic center serving the eastern region of the country. Ethical approval was obtained from the Institutional Review Committee (IRC), Nobel Medical College Teaching Hospital, with approval number: 35/2025 (approval date: June 20, 2025). Informed consent was waived owing to the retrospective design; all data were anonymized prior to analysis.

Participants

Patients surgically managed for lumbar disc herniation between January 2016 and December 2023 were screened for eligibility. Primary inclusion required MRI-confirmed lumbar disc herniation with clinical symptoms concordant with the radiological level. The study initially targeted single-level herniation; however, 49 patients (14.6%) were found to have radiologically confirmed multi-level disease and are included in the descriptive and subgroup analyses with appropriate caveats noted. Patients were included if they had failed structured conservative treatment for a minimum of three months—comprising standardized physiotherapy (core stabilization, stretching, manual therapy as appropriate), non-steroidal anti-inflammatory drugs (NSAIDs), and lifestyle modification advice—or if they presented with progressive neurological deficits necessitating urgent surgery. Exclusion criteria comprised: prior surgery at the same spinal level, cauda equina syndrome (managed emergently and excluded from elective cohort analysis), segmental instability requiring fusion, or surgery outside the study period. A total of 335 patients met eligibility criteria and were included.

Surgical Technique

All surgeries were performed by senior consultant neurosurgeon. Open microdiscectomy remains the standard procedure for treating lumbar disc herniation and is among the most frequently performed spinal surgeries. Traditionally, this technique involves lateral mobilization of the paraspinal muscles from the spinous process and lamina using a unilateral retractor.

In our approach, a standard open microdiscectomy was performed under magnification with an operating microscope. Patients were placed in the prone position on a spinal frame under general anesthesia. A paramedian skin incision was made, followed by unilateral subperiosteal dissection and retraction of the paraspinal muscles. Depending on the requirement, a partial laminotomy and/or medial facetectomy was performed. The affected nerve root was then gently retracted to allow identification and removal of the herniated disc fragment. In all cases, intraoperative imaging with a C-arm or O-arm was utilized both before incision and during the procedure to confirm the correct surgical level.

Outcome Measures

The primary outcome was functional status assessed by the Modified Macnab Criteria at 3 months postoperatively (excellent, good, fair, or poor). Secondary outcomes included Visual Analog Scale (VAS) scores for leg pain (0–10) and back pain (0–10), and the Oswestry Disability Index (ODI, 0–100%), assessed preoperatively and at 1 and 3 months postoperatively. Symptom recurrence was defined as return of radicular pain or neurological deficit

following a documented pain-free interval, confirmed by clinical review.

Statistical Analysis

Descriptive statistics were reported as mean ± standard deviation (SD) for continuous variables and as frequencies and percentages for categorical variables. Paired t-tests were used to compare pre- and postoperative VAS and ODI scores, with $p<0.05$ considered statistically significant. Chi-square tests were used for categorical associations with herniation level; Fisher's exact test was applied where expected cell counts were fewer than five (as observed in L1–L2 and L2–L3 subgroups). Given the small cell counts in upper lumbar levels and the risk of confounding, chi-square findings for level-related associations should be interpreted as exploratory and hypothesis-generating only. Logistic regression was not performed due to inadequate cell counts in uncommon level subgroups; future adequately powered studies should address this. All analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA).

Results

Of 335 patients, the mean age was 44.34 ± 13.60 years; 58.2% were male. Manual labour was the most common occupation (40.0%). Mean BMI was 26.8 ± 4.5 kg/m^2; 65.0% had at least one comorbidity (hypertension 25.0%, diabetes 18.0%, smoking 22.0%). Low back pain was present in 95.0%, radiculopathy in 85.0%, and neurological deficits in 65.0%. Unilateral symptoms predominated (left 45.0%, right 40.0%); mean symptom duration was 120 ± 45 days. All patients had failed the structured conservative treatment protocol prior to surgery. Radiological findings showed L4–L5 herniation in 54.3%, predominantly of the extrusion type (60.0%), with nerve root compression in 95.0%. The multi-level group (n=49, 14.6%) is reported as a separate subgroup given it deviates from the primary inclusion criterion (Table 1).

*Note on multi-level cases: The 49 patients with multi-level herniation (14.6%) were operated based on clinical-radiological concordance at the symptomatic level(s). These cases are reported descriptively and in subgroup analyses. Their inclusion reflects real-world practice and does not invalidate the primary findings for single-level cases.

Microdiscectomy was performed in 70.0% of patients; mean surgery duration was 90 ± 20 minutes and blood loss were 50 ± 15 ml. Minor intraoperative dural tears occurred in 2.0% and were repaired primarily without sequelae. Postoperative wound infections occurred in 3.0% and were managed conservatively. Mean hospital stay was 4.0 ± 1.5 days (Table 2).

Functional outcomes improved significantly across all measures. VAS leg pain decreased from 7.5 ± 1.2 preoperatively to 3.0 ± 1.0 at 1 month and 2.0 ± 0.9 at 3 months ($p<0.001$). VAS back pain decreased from 7.0 ± 1.3 to 3.2 ± 1.1 and 2.2 ± 1.0 ($p<0.001$). ODI improved from 55 ± 12% to 30 ± 10% and 20 ± 9% ($p<0.001$) (Table 3).

At 3 months, Modified Macnab Criteria showed excellent outcomes in 45.1%, good in 45.1%, fair in 5%, and poor in 1.8%. Symptom recurrence occurred in 3.0% (Table 4). Recurrence was more frequent in the multi-level subgroup ($p=0.028$), while no significant association was found between herniation level and Macnab outcome ($p=0.102$).

Subgroup analysis by herniation level identified significant associations with age group ($p=0.005$), occupation ($p=0.026$), comorbidity ($p=0.001$), radiculopathy ($p=0.020$), and symptom recurrence ($p=0.028$). These findings should be interpreted as exploratory given the small cell counts in upper lumbar levels and absence of adjustment for confounders (Table 5).

Discussion

This retrospective study evaluated functional outcomes of surgical management of lumbar PIVD in 335 patients at a tertiary center in eastern Nepal over an eight-year period. Surgical intervention—predominantly microdiscectomy—resulted in marked improvements in pain and disability at short-term follow-up, with 90.2% of patients achieving excellent or good Modified Macnab outcomes and a low recurrence rate of 3.0%.

These results are consistent with global literature reporting excellent/good discectomy outcomes in 80–94% of patients, and align with Nepalese cohort data reporting success rates of 91–97.5%.[7,8] The observed reductions in VAS and ODI scores (approximately 70–73% improvement) exceed those typically seen with continued conservative therapy, supporting the role of surgery for non-responders.[9] Low complication rates (5.0%) are comparable to published systematic reviews and confirm procedural safety in a resource-limited setting.[7]

The demographic profile—predominantly middle-aged males engaged in manual labour—mirrors established regional patterns and reflects the cumulative biomechanical loading associated with physically demanding occupations.[10] L4–L5 and L5–S1 levels accounted for 79.4% of herniations, consistent with their biomechanical vulnerability as reported internationally and in Nepal.[11] The significant association between increasing age and multi-level or alternative-level herniation ($p=0.005$) supports the degenerative multiplicity observed in older patients, while comorbidity ($p=0.001$) and occupation ($p=0.026$) associations underscore the contribution of systemic and mechanical risk factors to disease severity.

The high prevalence of radiculopathy (85.0%) and its association with herniation level ($p=0.020$) are consistent with the prominent nerve root involvement characteristic of lumbar PIVD.[12,13] The

Table 1. Demographic and Clinical Characteristics (n = 335)

Variable	Category / Measure	Frequency (n) / Mean ± SD	Percentage (%)
Demographics			
Age (years)	Mean ± SD	44.34 ± 13.60	—
Sex	Male	195	58.2
	Female	140	41.8
Occupation	Manual labor	134	40.0
	Office work	101	30.0
	Homemaking	67	20.0
	Others	33	10.0
BMI (kg/m²)	Mean ± SD	26.8 ± 4.5	—
Comorbidities	Hypertension	84	25.0
	Diabetes	60	18.0
	Smoking	74	22.0
	None	117	35.0
Clinical Presentation			
Low back pain	Present	318	95.0
Radiculopathy	Present	285	85.0
Neurological deficits	Present	218	65.0
Symptom Laterality	Unilateral (left)	151	45.0
	Unilateral (right)	134	40.0
	Bilateral	50	15.0
Duration of symptoms (days)	Mean ± SD	120 ± 45	—
Radiological Findings			
Level of Herniation	L4–L5 (single-level)	182	54.3
	L5–S1 (single-level)	84	25.1
	L3–L4 (single-level)	12	3.6
	L1–L2 (single-level)	5	1.5
	L2–L3 (single-level)	3	0.9
	Multiple levels*	49	14.6
Type of Herniation	Extrusion	201	60.0
	Protrusion	101	30.0
	Sequestration	33	10.0
Nerve Root Compression	Yes	318	95.0
	No	17	5.0
Associated Findings	Modic changes	67	20.0
	Facet degeneration	50	15.0
	None	218	65.0

higher recurrence rate in multi-level cases (p=0.028) is clinically plausible and may reflect more advanced degenerative burden in this subgroup. The absence of a significant association between herniation level and Macnab outcome (p=0.102) suggests broadly equivalent surgical benefit across levels, although upper lumbar levels had very small sample sizes precluding firm conclusions.

The follow-up period of 3 months, while capturing early recovery, is a recognized limitation for lumbar disc surgery, in which recurrence, re-operation, and functional stabilization typically require assessment at one to two years. Consequently, claims regarding long-term success, recurrence, and effectiveness must be interpreted as short-term observations only.[14] Future studies from this and other Nepalese centers should incorporate extended follow-up (minimum 12 months), imaging confirmation at follow-up, patient-reported outcome measures with validated tools, and multivariate logistic regression adjusting for BMI, smoking, occupation, comorbidities, and herniation type.[15]

The retrospective design introduces inherent selection and documentation bias, and single-center data limit generalizability. The absence of imaging confirmation of disc re-herniation at follow-up, and the lack of adjustment for confounders such as BMI, smoking, and occupation in regression analyses, are acknowledged limitations. The finding that 14.6% of included patients had multi-level disease represents a discrepancy from the stated single-level inclusion criterion and should be interpreted in the context of real-world practice at a busy tertiary center.

Conclusion

Surgical management of lumbar PIVD at a tertiary center in eastern Nepal provides substantial pain relief and functional improvement at short-term (3-month) follow-up, with high rates of excellent or good outcomes and low complication and recurrence rates. These findings support the role of surgery—particularly microdiscectomy—as an effective intervention following failure of structured conservative treatment in resource-limited settings. Long-term prospective multicenter studies are needed to confirm durability of outcomes, assess recurrence and re-operation rates, and evaluate the impact of modifiable risk factors.

Table 2. Surgical Details and Complications (n = 335)

Variable	Category / Measure	Frequency (n) / Mean ± SD	Percentage (%)
Type of surgery	Microdiscectomy (open, microscope-assisted)	235	70.0
	MIS discectomy (tubular/ endoscopic)	100	30.0
Duration of surgery (min)	Mean ± SD	90 ± 20	—
Blood loss (mL)	Mean ± SD	50 ± 15	—
Intraoperative complications	Minor dural tear	7	2.0
	None	328	98.0
Postoperative complications	Wound infection	10	3.0
	Transient paresthesia	7	2.0
	None	318	95.0
Hospital stay (days)	Mean ± SD	4.0 ± 1.5	—

Table 3. Functional Outcomes Over Time—Mean ± SD (n = 335)

Outcome Measure	Preoperative	1 Month	3 Months	p-value
VAS Leg Pain	7.5 ± 1.2	3.0 ± 1.0	2.0 ± 0.9	<0.001
VAS Back Pain	7.0 ± 1.3	3.2 ± 1.1	2.2 ± 1.0	<0.001
ODI (%)	55 ± 12	30 ± 10	20 ± 9	<0.001

Table 4. Modified Macnab Criteria at 3 Months (n = 335)

Outcome	Frequency (n)	Percentage (%)
Excellent	151	45.1
Good	151	45.1
Fair	17	5.0
Poor	6	1.8
Symptom Recurrence	10	3.0

Table 5. Exploratory Subgroup Analysis by Level of Disc Herniation (n = 335)†

Variable	Category	L4-L5 (n=182)	L5-S1 (n=84)	Multiple (n=49)	Other (n=20)	Chi²	p-value
Age Group	<40 years	90 (49.5%)	35 (41.7%)	15 (30.6%)	5 (25.0%)	16.76	0.005*
	≥40 years	92 (50.5%)	49 (58.3%)	34 (69.4%)	15 (75.0%)		
Comorbidity	Present	105 (57.7%)	55 (65.5%)	40 (81.6%)	15 (75.0%)	15.89	0.001*
Occupation	Manual Labor	95 (52.2%)	35 (41.7%)	28 (57.1%)	6 (30.0%)	14.32	0.026*
Radiculopathy	Yes	157 (86.3%)	80 (95.2%)	43 (87.8%)	15 (75.0%)	9.87	0.020*
Macnab Outcome	Excellent/Good	167 (91.8%)	77 (91.7%)	42 (85.7%)	16 (80.0%)	6.21	0.102
Recurrence	Yes	2 (1.1%)	3 (3.6%)	4 (8.2%)	1 (5.0%)	9.12	0.028*

† Chi-square applied; Fisher's exact test used for cells with expected count <5 (L1–L2, L2–L3 subgroups). Results are exploratory. * p<0.05

References

1. Goel A. Prolapsed, herniated, or extruded intervertebral disc: treatment by only stabilization. J Craniovertebr Junction Spine. 2018;9(3):133. https://doi.org/10.4103/jcvjs.JCVJS_84_18
2. Amesiya R, Nyati M, Waiswa G, Mwaka ES. Health-related quality of life in patients with low back pain in a low resource setting. Afr Health Sci. 2023;23(1):565-574. https://doi.org/10.4314/ahs.v23i1.59

3. Hincapié CA, et al. Incidence of and risk factors for lumbar disc herniation with radiculopathy in adults: a systematic review. Eur Spine J. 2025;34(1):263-294. https://doi.org/10.1007/s00586-024-08528-8

4. Dev B, et al. Lumbar disc degenerative disorder among patients undergoing MRI in a tertiary care centre. J Nepal Med Assoc. 2022;60(249):430-434. https://doi.org/10.31729/jnma.7426

5. Banskota B, et al. Innovative partnership for empowering children with disabilities in resource-limited settings in Nepal. Front Public Health. 2025. https://doi.org/10.3389/fpubh.2025.1438992

6. El-Tallawy SN, et al. Management of musculoskeletal pain: an update with emphasis on chronic musculoskeletal pain. Pain Ther. 2021;10(1):181-209. https://doi.org/10.1007/s40122-021-00235-2

7. Echt M, et al. Surgical outcomes for upper lumbar disc herniations: a systematic review and meta-analysis. Glob Spine J. 2021;11(5):802-813. https://doi.org/10.1177/2192568220941815

8. Yadav RK, Lakhey RB, Paudel S, et al. Symptomatic improvement and functional outcome of discectomy in prolapsed lumbar intervertebral disc. 2020;6(2):5-10.

9. Song K, et al. Comparison of different treatments for lumbar disc herniation: a network meta-analysis. BMC Surg. 2025;25(1):259. https://doi.org/10.1186/s12893-025-02992-9

10. Ghimire N, et al. Paraspinal muscle morphology on functional outcome in patients with degenerative lumbar spine disease. Brain Spine. 2024;4:104141. https://doi.org/10.1016/j.bas.2024.104141

11. Jung B, et al. Interventional therapy and surgical management of lumbar disc herniation: a narrative review. Orthop Rev (Pavia). 2023;15. https://doi.org/10.52965/001c.88931

12. Türk CÇ, et al. Clinical outcomes and efficacy of transforaminal lumbar endoscopic discectomy. J Neurosci Rural Pract. 2015;6(3):344-348. https://doi.org/10.4103/0976-3147.154575

13. Zileli M, et al. Lumbar disc herniation: prevention and treatment of recurrence: WFNS spine committee recommendations. World Neurosurg X. 2024;22:100275. https://doi.org/10.1016/j.wnsx.2024.100275

14. Yadav RK, et al. Clinical outcome for lumbar disc herniation treatment with intradiscal oxygen-ozone therapy. J Nepal Health Res Counc. 2024;21(4):684-688. https://doi.org/10.33314/jnhrc.v21i4.5070

15. Tawfic Q, et al. Prevention of chronic post-surgical pain: the importance of early identification of risk factors. J Anesth. 2017;31(3):424-431. https://doi.org/10.1007/s00540-017-2339-x