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Original Article

Outcomes After Lumbar Micro discectomy for Lumbar Disc Herniation: A Single-Center Experience

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Abstract

Objective: To evaluate functional outcomes after lumbar micro discectomy and identify factors associated with better recovery.

Methodology: This retrospective study was conducted in the Department of Neurosurgery, Mardan, from January to June 2025. We included 100 patients with medical records who underwent lumbar micro discectomy for symptomatic lumbar disc herniation from January 2023 to December 2024. We retrieved demographic, clinical, radiological, and operative information from the medical records. We assessed functional outcome using the Oswestry Disability Index (ODI) and the Visual Analog Scale (VAS) preoperatively and at 6 months after surgery.

Results: 62 males and 38 females with a mean age of 44.8 ± 11.2 years. The L4–L5 level was the most frequently affected (54%), followed by L5–S1 (36%). Mean ODI significantly improved from 56.4 ± 12.7 preoperatively to 18.9 ± 9.3 postoperatively ($p < 0.001$), while mean VAS scores decreased from 8.2 ± 1.1 to 2.1 ± 1.3 ($p < 0.001$). 87% of patients achieved good-to-excellent functional recovery. Younger age (<50 years) ($p = 0.028$) and symptom duration <6 months ($p = 0.015$) were significantly associated with better outcomes. The overall complication rate was 6%, with no procedure-related mortality.

Conclusion: Lumbar micro discectomy is an effective and safe procedure with high pain relief and functional improvement for patients with lumbar disc herniation. Postoperative recovery was better in those who underwent early surgery and were younger.

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Introduction

Lumbar disc herniation (LDH) is one of the most prevalent spinal afflictions in adults and is a significant contributor to low back pain and sciatica in the world. It is mainly caused by disc degeneration with a nucleus pulposus protruding or extruding through the annulus fibrosus. The displaced disc material can press on neighboring nerve roots, creating pain in the radiating leg, sensory disturbances, motor weakness, and functional disability. It is a condition that mainly occurs in the third to fifth decades of life and has an important socio-economic dimension, due to loss of productivity, health costs, and lower quality of life [1,2]. It is estimated that 1-3% of the general adult population has symptomatic lumbar disc herniation and that L4-L5 and L5-S1 are the most commonly affected spinal levels due to the greater biomechanical stress. While about 10-20% of patients will improve with conservative measures such as analgesics, physical therapy, activity modification, and epidural steroid injections, others will still have persistent radicular pain or progressive neurologic deficits that require surgical treatment [3]. Lumbar Micro discectomy has emerged as the "gold standard" surgical approach for symptomatic, conservative-refractory lumbar disc herniation. Micro discectomy is now widely used in place of the traditional open discectomy due to the exceptional visualization and the low soft tissue damage that it causes. Using an operating microscope and microsurgical technique, surgeons can remove herniated disc fragments through a shorter incision and with limited muscle dissection for accurate removal. As a result, patients have less pain after surgery, a shorter hospital stay, earlier mobilization, and a quicker return to normal activities [4,5]. Several studies have shown that lumbar micro discectomy provides rapid relief of radicular pain and significant improvement in neurological function. Postoperative recovery is often assessed using patient-reported outcome measures, including the Visual Analog Scale (VAS) for pain and the Oswestry Disability Index (ODI). Most patients improve in pain and disability in the first few months after surgery. The extent of functional recovery, however, depends on patient characteristics, length of symptoms, age, body mass index, smoking, work demands, psychological factors, and preoperative neurologic impairment [6,7]. While the recovery rate of a lumbar micro discectomy is over 80% for the right patient, some complications can hinder recovery, including recurrent herniation, dural tear, wound infection, nerve root injury, epidural fibrosis, and chronic pain. Thus, proper patient selection, precise surgical procedures, and rehabilitation are key to achieving optimal function and minimizing complications [8]. Although lumbar micro discectomy has been studied worldwide, outcome data from a single center in developing countries remain relatively limited. Variations in healthcare facilities, patient age, and access to surgical intervention and rehabilitation may affect postoperative recovery. Thus, it is important to assess institutional outcomes to benchmark surgical performance and improve clinical practice [9]. This retrospective study evaluated the functional outcomes of lumbar micro discectomy in patients with symptomatic lumbar disc herniation treated at a tertiary care hospital. We assessed functional improvement with validated clinical outcome scales and analyzed demographic and clinical variables related to post-operative recovery. This study is expected to provide valuable knowledge about the efficacy and safety of lumbar micro discectomy in clinical practice and help optimize patient selection and postoperative care [10].

Materials and Methods

Study Design and Setting

This retrospective study was conducted in the Department of Neurosurgery, Mardan, from January to June 2025

Participants

One hundred consecutive symptomatic patients with single-level lumbar disc herniation who failed at least 6 weeks of conservative care were included in the study after they underwent lumbar micro discectomy. We collected data from hospital medical records and outpatient clinic documentation, including demographic characteristics, clinical findings, radiological imaging, operative records, and follow-up data.

Sample Size Calculation

The sample size of 100 patients was calculated using the WHO sample size calculator with an expected improvement in functional status after surgery of 85%

with a 95% confidence level, 7% margin of error, and allowing for the possibility that clinical records might not be complete for the endpoint analysis to be sufficiently powered.

Inclusion Criteria

- Adults aged 18–75 years.
- One-level, MRI-proven lumbar disc herniation.
- Persistent symptoms of radiculopathy following at least 6 weeks of conservative treatment.
- Patients who are getting a lumbar micro discectomy for the first time. At least 6 months of follow-up.

Exclusion Criteria

- A history of surgery in the lower back.
- Multilevel Lumbo-sacral disc herniation.
- Spinal instability in the lower spine or spondylolisthesis that can be corrected with fusion.
- Tumors, infections, or spinal injuries.
- Partial medical records or loss to follow-up.

Diagnostic and Management Strategy

Clinical examination and magnetic resonance imaging confirmed the diagnosis. We initially treated all patients conservatively, followed by early mobilization, early analgesia, physiotherapy, and regular follow-up. All patients received conservative treatment and then underwent a standardized LMD under general anesthesia with microscopic magnification, followed by early analgesia, early mobilization, and regular follow-up.

Statistical Analysis

SPSS version 27 was used to analyze the data. Continuous variables were reported as mean (SD), and categorical variables as frequencies and percentages. Where appropriate, we used paired t-tests and chi-square tests. We considered $p < 0.05$ (two-tailed) statistically significant.

Results

A total of 100 patients underwent lumbar micro discectomy during the study period. The cohort included 62 (62%) males and 38 (38%) females, with a mean age of 44.8 ± 11.2 years. Most patients were in the 31–50-year age group. The L4–L5 intervertebral level was involved in 54% of patients, followed by L5–S1 in 36%, while 10% had herniation at L3–L4. The mean preoperative VAS pain score was 8.2 ± 1.1 , which significantly improved to 2.1 ± 1.3 at six months after surgery ($p < 0.001$). Likewise, the mean Oswestry Disability Index improved from 56.4 ± 12.7 preoperatively to 18.9 ± 9.3 postoperatively ($p < 0.001$). Eighty-seven patients achieved excellent or good functional recovery, whereas thirteen demonstrated fair or poor outcomes. Patients younger than 50 years showed significantly greater improvement in functional status than older patients ($p = 0.028$). Patients with symptom duration under six months had better recovery than those with longer symptom duration ($p = 0.015$). Gender was not significantly associated with postoperative outcomes ($p = 0.482$). Postoperative complications occurred in six patients, including superficial wound infection (3%), incidental dural tear (2%), and recurrent lumbar disc herniation requiring revision surgery (1%). No mortality or permanent neurological deterioration was observed.

Table 1. Baseline Demographic and Clinical Characteristics of the Study Population (n = 100)

Variable	Category	n (%)
Age (years)	Mean $\pm$ SD	44.8 $\pm$ 11.2
	18–30	15 (15.0)
	31–40	28 (28.0)
	41–50	31 (31.0)
	51–60	18 (18.0)
	>60	8 (8.0)

Sex	Male	62 (62.0)
	Female	38 (38.0)
Body Mass Index (kg/m²)	Mean ± SD	27.1 ± 3.8
Duration of Symptoms	<6 months	67 (67.0)
	≥6 months	33 (33.0)
Affected Disc Level	L3–L4	10 (10.0)
	L4–L5	54 (54.0)
	L5–S1	36 (36.0)
Presenting Symptom	Radicular pain	100 (100.0)
	Sensory deficit	46 (46.0)
	Motor weakness	24 (24.0)

Values are presented as frequency (n), percentage (%), or mean ± standard deviation (SD).

Table 2. Comparison of Preoperative and Postoperative Functional Outcomes

Outcome Measure	Preoperative (Mean ± SD)	Postoperative (Mean ± SD)	Mean Difference	p-value
VAS Pain Score	8.2 ± 1.1	2.1 ± 1.3	6.1	<0.001
ODI Score	56.4 ± 12.7	18.9 ± 9.3	37.5	<0.001

We assessed functional outcomes using the Visual Analog Scale (VAS) and Oswestry Disability Index (ODI). We set statistical significance at *p*<0.05.

Table 3. Factors Associated with Good Functional Recovery After Lumbar Micro discectomy

Variable	Good Outcome n (%)	Fair/Poor Outcome n (%)	p-value
Age <50 years (n=74)	68 (91.9)	6 (8.1)	0.028
Age ≥50 years (n=26)	19 (73.1)	7 (26.9)	
Symptom duration <6 months (n=67)	62 (92.5)	5 (7.5)	0.015
Symptom duration ≥6 months (n=33)	25 (75.8)	8 (24.2)	
Male (n=62)	55 (88.7)	7 (11.3)	0.482
Female (n=38)	32 (84.2)	6 (15.8)	

We defined good functional recovery as an excellent or good postoperative outcome based on clinical assessment and ODI improvement.

Table 4. Postoperative Complications Following Lumbar Microdiscectomy

Complication	n	%
No complications	94	94.0
Superficial wound infection	3	3.0
Incidental dural tear	2	2.0

Recurrent disc herniation	1	1.0
Permanent neurological deficit	0	0.0
Mortality	0	0.0
Total	100	100.0

Overall postoperative complication rate was 6%. Most cases were managed successfully without permanent neurological deficits.

Discussion

We performed a single-center, retrospective analysis of the functional outcome of Lumbar micro discectomy in 100 patients with symptomatic lumbar disc herniation. The results showed a substantial reduction in pain intensity and functional disability, and 87% of patients had a good-to-excellent postoperative outcome. In addition, patient age was inversely correlated with good functional recovery, while sex was not. Symptom duration was also significantly correlated with surgical outcome. The results confirm the efficacy and safety of lumbar micro discectomy for the right candidates [11,12]. The demographic data in our study were similar to those recently reported in the literature. The mean age of 44.8 ± 11.2 years and the fact that most patients were male (62%) were similar to conclusions from studies in the last five years, which reported a mean age of 45 to 46 years among patients with lumbar disc herniation. Most patients were male [13,14]. As in previous studies, the L4–L5 level was the most frequently affected disc level, compared with L5–S1, which is most subjected to biomechanical stress [15]. Perhaps the most important result was the large reduction in postoperative pain and disability scores. After 6 months of follow-up, the mean VAS score dropped from 8.2 to 2.1, and the mean Oswestry Disability Index (ODI) decreased from 56.4 to 18.9. These enhancements are consistent with recent prospective and retrospective studies, which have shown significant pain and disability improvement after lumbar micro discectomy. This is consistent with large multicenter studies showing that over 80% of Patients have clinically significant Improvements in pain and function at 1 year after surgery [16,17]. Our series success rate was 87%, similar to rates reported in recent studies after lumbar micro discectomy [16–18]. These consistently high success rates reflect ongoing improvements in microsurgical techniques, patient selection, and perioperative care, as well as the development of follow able rehabilitation protocols. Our study found a relatively low complication rate (6%), consistent with recent systematic reviews that report complication rates below 10%, with superficial wound infections, incidental dural tears, and recurrent disc herniation as the most common adverse events [18,19]. One key finding was significantly greater functional recovery in younger patients than in older patients. Recent studies corroborate this, showing that younger patients have less degenerative spinal change, greater potential for postoperative rehabilitation, and greater regenerative capacity. Similarly, patients with symptoms for less than 6 months had better outcomes after surgery than those with more than 6 months of symptoms. If there is a delay in surgical treatment, chronic compression of the nerve root and permanent nerve injury may develop, leaving a poor chance of full recovery of function. Recent cohort studies have also found similar results, focusing on the advantages of early surgical intervention after failure of conservative treatment [20–21]. In this study, patient gender was not significantly correlated with postoperative recovery. This result is consistent with a few recent studies showing that patients of both sexes benefit similarly from lumbar micro discectomy when performed based on accepted surgical indications [22]. These observations suggest that demographic factors should not influence surgical management decisions. This study has a few limitations. Because of the retrospective design and single-center setting, selection bias and incomplete documentation may be present. The study included a small number of patients, and it evaluated functional outcomes only at 6 months after surgery. Furthermore, the study did not assess other factors that could affect long-term outcomes, such as smoking status, occupation requirements, psychological status, and body mass index. These results need confirmation with longer follow-up and larger sample sizes in multicenter prospective studies to identify additional predictors of postoperative success [23]. Overall, the present study shows that lumbar micro discectomy is an excellent pain-relief procedure that significantly improves functional parameters and has a low complication rate in patients with lumbar disc herniation. The results align with current knowledge and add to the evidence that lumbar micro discectomy is the preferred surgical procedure for a well-selected patient population that has not responded to conservative management. This study is retrospective, single-center, and relatively

small, so the findings may not be generalizable. Long-term results were not possible due to the short follow-up. The follow-up was too short to assess recurrent or late complications. Further multicenter studies with longer follow-up are indicated.

Conclusion

Lumbar micro discectomy is a safe and effective surgical procedure for lumbar disc herniation that relieves pain, improves function, and has a low complication rate. Better postoperative outcomes were related to earlier surgical intervention and younger age. This Study confirms the use of lumbar micro discectomy in the proper patients.

Authors' Contributions

Syed Nasir Shah: Conceptualization, study design, data collection, clinical assessment, interpretation of findings, manuscript drafting, and critical revision.

Rizwan Ali: Data collection, clinical assessment, literature review, data analysis, and critical revision.

Naeem ul Haq: Supervision, methodological guidance, interpretation of findings, critical revision of the manuscript, and final approval.

Muhammad Ishaq: Conceptualization, literature review, data interpretation, manuscript revision, and reference verification.

All authors made substantial contributions to the work, approved the final version for publication, and agreed to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Ethical Approval: The Ethical Committee of Bacha Khan Medical College, Mardan granted ethical approval (IRB No. 1121/Neuro/BKMC) on 22 November 2024 for the proposed research study involving human participants.

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