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Functional Outcomes After Lumbar Microdiscectomy for Lumbar Disc Herniation: A Single-Center Experience

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ABSTRACT

Background: A herniated disc in the lower back is one of the most common sources of pain and radiculopathy, and can seriously limit a patient's function and quality of life. For patients with chronic pain who do not respond to conservative pain relief, the most common surgical procedure is lumbar microdiscectomy. This study aimed to assess the functional outcome after lumbar microdiscectomy for lumbar disc herniation.

Objective: To evaluate functional outcomes after lumbar microdiscectomy and to determine factors associated with better recovery.

Methods: A retrospective study was conducted on 100 patients who underwent lumbar microdiscectomy for symptomatic lumbar disc herniation between January 2023 and December 2024. The demographic, clinical, radiological, and operative information was retrieved from the medical records. Functional outcome was assessed using the Oswestry Disability Index (ODI) and the Visual Analog Scale (VAS) preoperatively and at 6 months after surgery. The data were analyzed using SPSS version 27. The continuous variables were presented as mean ± standard deviation, and categorical variables were represented by frequency and percentages. A p-value <0.05 was considered statistically significant.

Results: The study included 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 ($p < 0.001$). Good-to-excellent functional recovery was achieved in 87% of patients. Younger age (<50 years) ($p = 0.028$) and symptom duration <6 months ($p = 0.015$) were significantly associated with better outcomes. Overall complication rate was 6%, with no procedure-related mortality.

Conclusion: Lumbar microdiscectomy is an effective and safe surgery with a high degree of pain relief and function improvement for patients with lumbar disc herniation. Postoperative recovery was better for those who underwent early surgery and those who were younger.

KEYWORDS: Lumbar microdiscectomy; Lumbar disc herniation; Functional outcomes; Oswestry Disability Index..

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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, causing radiating leg pain, 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 Microdiscectomy has emerged as the "gold standard" surgical approach to the treatment of symptomatic, conservative-refractory lumbar disc herniation. Microdiscectomy is now widely used in place of traditional open discectomy due to its exceptional visualization and low soft-tissue damage. With the use of an operating microscope and microsurgical technique, the removal of the herniated disc fragments can be achieved with a shorter incision and limited muscle dissection for accurate removal. Thus, patients have less pain after surgery, a shorter hospital stay, are mobilized earlier, and return to a normal lifestyle sooner [4,5]. Lumbar microdiscectomy has been proven to provide fast relief of radicular pain and significant improvement in neurological function in several studies. Quality of postoperative recovery is often expressed using patient-reported outcome measures, including a pain Visual Analog Scale (VAS) and the Oswestry Disability Index (ODI). The majority of 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 microdiscectomy is over 80% for the right patient, some complications can hurt 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 microdiscectomy has been studied in many studies worldwide, outcome data from a single center in a developing country are relatively limited. There may be variations in healthcare facilities, patient age, availability of surgical intervention, and rehabilitation, resulting in variations in postoperative recovery. Thus, it is important to assess the outcomes of the institutions for benchmarking of surgical performance and enhancing clinical practice [9]. A retrospective analysis was done in the present study to evaluate the functional results of lumbar microdiscectomy in patients with a symptomatic lumbar disc herniation treated in a tertiary care hospital. The functional improvement was assessed with validated clinical outcome scales, and demographic and clinical variables related to the recovery after surgery were also analyzed. Results of this study are anticipated to yield valuable knowledge about the efficacy and safety of lumbar microdiscectomy in the actual clinical setting and help optimize patient selection and post-operative care [10].

Study Objectives

To assess improvement in functional outcomes following lumbar microdiscectomy for lumbar disc herniation and identify demographic and clinical variables that are associated with this improvement in pain, disability, neurological status, and functional status.

MATERIALS AND METHODS

Study Design and Setting.

This was a retrospective study conducted in the Department of Neurosurgery at Ayub Teaching Hospital, MTI, Abbottabad, from January 2023 to December 2024, following ethical clearance from the institute.

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 microdiscectomy. Data were collected 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 microdiscectomy for the first time.
- At least 6 months of follow-up.

Exclusion Criteria

- A history of surgery in the lower back.
- Multilevel Lumbosacral 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

The diagnosis was confirmed by clinical examination and magnetic resonance imaging. Conservative treatment was initially given to all patients, 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 were reported as frequencies and percentages. Where appropriate, paired t-tests and Chi-square tests were used. A p-value < 0.05 (two-tailed) was considered statistically significant.

RESULTS

A total of 100 patients underwent lumbar microdiscectomy during the study period. There were 62 (62%) males and 38 (38%) females, with a mean age of 44.8 ± 11.2 years. The majority of patients belonged to 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 below six months experienced better recovery compared with those having prolonged symptoms (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 ± SD	**44.8 ± 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

Functional outcomes were assessed using the Visual Analog Scale (VAS) and Oswestry Disability Index (ODI). Statistical significance was set at $p<0.05$.

Table 3. Factors Associated with Good Functional Recovery After Lumbar Microdiscectomy

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)	

Good functional recovery was defined 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 operative complications: The ligation rate was 6%. Most complications were managed successfully without permanent neurological deficits.

DISCUSSION

A single-center retrospective analysis was performed of the functional outcomes of lumbar microdiscectomy in 100 patients with symptomatic lumbar disc herniation. The results showed a substantial reduction in pain intensity and functional disability, with 87% of patients achieving a good-to-excellent postoperative outcome. In addition, patient age was inversely correlated with good functional recovery, while sex was not. The duration of symptoms was also significantly correlated with the surgical outcome. The results confirm the efficacy and safety of lumbar microdiscectomy for the right candidates [11,12]. The demographic data from our study were similar to those recently reported in the literature. The mean age of 44.8 ± 11.2 years and the majority of patients being male (62%) were similar to the findings of studies conducted in the last five years, which reported that the mean age of patients with lumbar disc herniation was 45 to 46 years. The majority of patients were male [13,14]. As in previous studies, the L4–L5 level was the most frequently affected disc level, whereas the L5–S1 level is most subject to biomechanical stress [15]. Perhaps the most important result of this study was the large reduction in postoperative pain and disability scores. After 6 months of follow-up, the mean VAS score decreased from 8.2 to 2.1, and the mean Oswestry Disability Index (ODI) increased 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 microdiscectomy. This is consistent with the results of large multicenter studies, which have shown that over 80% of patients have clinically significant improvements in pain and function at 1 year after surgery [16,17]. The success rate in our series was 87%, similar to that reported in recent studies after lumbar microdiscectomy [16–18]. These consistently high success rates are due to the ongoing improvements in microsurgical techniques, patient selection, and perioperative care, as well as the setup of rehabilitation protocols that can be followed. Our study found a relatively low complication rate (6%), consistent with recent systematic reviews reporting rates below 10%, with superficial wound infections, incidental dural tears, and recurrent disc herniation as the most common adverse events [18,19]. One of the key findings of this study was that younger patients had significantly greater functional recovery than older patients. This is corroborated by recent studies indicating that younger patients have reduced degenerative spinal processes, greater postoperative rehabilitation potential, 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 reported similar findings, highlighting the benefits of early surgical intervention following failure of conservative treatment [20-21]. In this study, a correlation between patient gender and postoperative recovery was not significant. This result is consistent with a few recent studies showing that patients of both sexes benefit similarly from lumbar microdiscectomy when performed according to accepted surgical indications [22]. From these observations, it would seem that demographic factors should not really be considered in surgical management decisions. There are a few limitations to this study's results. Because of the study's retrospective design and single-center setting, there is a possibility of selection bias and incomplete documentation. The number of patients in the study was small, and functional outcomes were evaluated only at 6 months post-surgery. Furthermore, other factors that could affect long-term outcomes, such as smoking status, occupation requirements, psychological status, and body mass index, were not assessed. The results of these studies need to be confirmed with longer follow-up periods and larger sample sizes in multicenter prospective studies to establish additional predictors of postoperative success [23]. In general, the present study shows that lumbar microdiscectomy is an excellent pain-relief procedure that leads to significant improvements in functional parameters and has a low complication rate in patients with lumbar disc herniation. The results are consistent with current knowledge and add to the body of evidence indicating that lumbar microdiscectomy is the preferred surgical procedure for a well-selected patient population that has not responded to conservative management.

LIMITATIONS

The limitations of this study are that it is retrospective, was conducted in a single center, and the sample size is relatively small; 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 microdiscectomy is a safe and effective surgical procedure for lumbar disc herniation that relieves pain, improves function, and has a low incidence of complications. Better postoperative outcomes were related to earlier surgical intervention and younger age. This Study confirms the use of lumbar microdiscectomy in the proper patients.

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Authors Contributions

Concept & Design of Study: Baynazir Khan
Drafting: Attiya Nasir
Data Collection & Data Analysis:faiz alam, saad sultan
Critical Review: Baynazir Khan
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