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Clinical Outcome of Lumbar Disc Herniation Treated with Micro discectomy

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ABSTRACT

Background: Lumbar disc herniation is a significant cause of radicular low back pain and functional disability in adults. When conservative management fails, surgical decompression becomes necessary. Micro discectomy is a minimally invasive technique that relieves nerve root compression while preserving spinal stability, enabling early recovery and favorable clinical outcomes.

Objectives: To evaluate the clinical outcomes of lumbar disc herniation treated with micro discectomy by assessing postoperative pain relief, functional improvement, neurological recovery, and procedure-related complications.

Methodology: This prospective study enrolled 120 adult patients with MRI-confirmed single-level lumbar disc herniation undergoing micro discectomy at a tertiary care hospital. Patients with persistent radiculopathy despite adequate conservative treatment were included. Preoperative evaluation included neurological examination, a Visual Analog Scale (VAS) for pain, and the Oswestry Disability Index (ODI). Standard microscopic lumbar discectomy was performed under general anesthesia. Patients were followed postoperatively at scheduled intervals to assess pain, functional status, neurological recovery, and complications.

Results: 120 patients the mean age was 42.3 ± 10.6 years, with a predominance of male patients. The most frequently involved disc levels were L4–L5 and L5–S1. Preoperatively, patients experienced severe radicular pain and marked functional impairment. The mean VAS score significantly decreased from 7.8 ± 1.1 preoperatively to 2.1 ± 0.9 at final follow-up ($p < 0.001$). Similarly, the mean ODI score improved from 62.5 ± 8.4% to 18.7 ± 6.2% postoperatively, reflecting substantial functional recovery ($p < 0.001$). Neurological deficits were observed preoperatively in a considerable proportion of patients, with most achieving complete recovery and a smaller number showing partial improvement during follow-up.

Conclusion: Lumbar micro discectomy is a safe and effective surgical treatment for symptomatic lumbar disc herniation unresponsive to conservative therapy. It provides significant pain relief, marked functional improvement, and high rates of neurological recovery with minimal complications.

Keywords: Lumbar disc herniation, Micro discectomy, Clinical outcome, Radiculopathy

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INTRODUCTION

Lumbar disc herniation (LDH) is one of the most common degenerative spinal disorders and a leading cause of low back pain associated with radiculopathy in adults. It results from the displacement of nucleus pulposus material through the annulus fibrosus, leading to mechanical compression and inflammatory irritation of adjacent nerve roots [1]. Clinically, patients may present with radiating leg pain, sensory disturbances, motor weakness, and significant functional impairment, often limiting daily activities and work productivity. LDH predominantly affects individuals in their most productive years, creating a substantial socioeconomic burden [2]. Conservative management—including analgesics, physiotherapy, activity modification, and epidural steroid injections—remains the first-line treatment for most patients. However, a subset of patients fails to respond adequately to nonoperative measures or develops progressive neurological deficits, severe radicular pain, or functional deterioration. In such cases, surgical intervention is indicated to decompress the affected nerve root and alleviate symptoms. The primary goal of surgery is rapid pain relief, neurological recovery, and restoration of functional capacity [3,4]. Micro discectomy has emerged as the standard surgical technique for treating symptomatic lumbar disc herniation requiring operative management. Introduced as a refinement of open discectomy, micro discectomy utilizes magnification and limited soft tissue dissection to remove the offending disc fragment while preserving par spinal musculature and spinal stability [5]. Compared with conventional open discectomy, micro discectomy is associated with reduced postoperative pain, shorter hospital stays, faster mobilization, and earlier return to normal activities. These advantages have contributed to its widespread adoption in neurosurgical and orthopedic spine practice [6]. Despite the overall success of micro discectomy, postoperative outcomes may vary depending on several factors, including patient age, duration of symptoms, level and type of disc herniation, preoperative neurological status, and adherence to postoperative rehabilitation [7].Moreover, although complications are relatively infrequent, issues such as Dural tears, surgical site infection, recurrent disc herniation, and persistent radiculopathy can adversely affect outcomes and patient satisfaction. Therefore, continuous evaluation of clinical outcomes is essential to optimize patient selection, refine surgical techniques, and improve perioperative care [8,9]. Outcome assessment following lumbar micro discectomy commonly relies on validated clinical instruments such as the Visual Analog Scale (VAS) for pain and the Oswestry Disability Index (ODI) for functional impairment. These tools provide objective measures of pain relief and functional recovery, facilitating comparisons across studies and populations [10]. Reporting local outcome data is particularly important in low- and middle-income countries, where patient characteristics, delays in presentation, and healthcare resources may differ from those reported in high-income settings. This study aims to evaluate the clinical outcomes of lumbar disc herniation treated with micro discectomy in a tertiary care setting by assessing postoperative pain relief, functional improvement, neurological recovery, and complication rates. Generating local evidence will help guide clinical decision-making, improve patient counseling, and strengthen the evidence base for micro discectomy in the management of lumbar disc herniation.

Research Objectives

To assess the effectiveness and safety of lumbar microdiscectomy by evaluating postoperative pain reduction, functional improvement, neurological recovery, and complication rates in patients with symptomatic lumbar disc herniation.

MATERIALS AND METHODS

Study Design & Setting

This prospective study was conducted at Neurosurgery Bacha khan Medical College/Mardan Medical Complex, Mardan from jan 2023 to june 2023

Participants

A total of 120 adult patients with MRI-confirmed single-level lumbar disc herniation were included—patients presented with persistent radicular symptoms refractory to conservative management. Demographic data, clinical presentation, neurological status, and imaging findings were recorded preoperatively using a standardized data collection form.

Sample Size Calculation

The sample size was calculated based on expected postoperative improvements in VAS and ODI scores following micro discectomy, with 95% confidence and 80% power. The minimum required sample size was estimated at 108 patients; to account for potential loss to follow-up, 120 patients were enrolled.

Inclusion Criteria

Age ≥18 years MRI-confirmed single-level lumbar disc herniation. Persistent radiculopathy despite conservative treatment. Clinical–radiological correlation. Undergoing primary lumbar micro discectomy.

Exclusion Criteria

Previous lumbar spine surgery, Multilevel disc herniation**,** Spinal instability or spondylolisthesis**,** Spinal infection, tumor, or trauma**,** Cauda equina syndrome requiring emergency surgery

Diagnostic and Management Strategy

Diagnosis was established through clinical evaluation and MRI findings. All patients underwent standard microscopic lumbar discectomy under general anesthesia. Postoperative management included early mobilization, analgesia, wound care, and structured physiotherapy to facilitate functional recovery.

Statistical Analysis

Data were analyzed using SPSS version 24.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Preoperative and postoperative VAS and ODI scores were compared using paired t-tests. A p-value <0.05 was considered statistically significant.

Results

A total of 120 patients underwent lumbar micro discectomy during the study period. The mean age was 42.3 ± 10.6 years, with a predominance of male patients. The most frequently involved disc levels were L4–L5 followed by L5–S1. Preoperatively, patients reported severe radicular pain and significant functional disability. The mean preoperative VAS score was 7.8 ± 1.1, which showed a statistically significant reduction to 2.1 ± 0.9 at final follow-up ($p < 0.001$). Similarly, the mean ODI score improved significantly from 62.5 ± 8.4% preoperatively to 18.7 ± 6.2% postoperatively ($p < 0.001$). Neurological deficits were noted in several patients before surgery, with complete recovery observed in the majority during follow-up and partial recovery in a smaller proportion. The overall complication rate was low, including a few cases of dural tear and superficial surgical site infection, all managed conservatively. No perioperative mortality was recorded.

Intervention Outcome

Lumbar micro discectomy resulted in significant pain relief, marked functional improvement, and favorable neurological recovery in most patients. The procedure demonstrated a low complication rate and enabled early return to daily activities, confirming its effectiveness and safety for appropriately selected patients with lumbar disc herniation.

Table 1. Baseline Demographic and Clinical Characteristics (n = 120)

Variable	Value
Age (years), mean ± SD	42.3 ± 10.6
Gender (Male), n (%)	78 (65.0)
Gender (Female), n (%)	42 (35.0)
Duration of symptoms (weeks), mean ± SD	14.2 ± 5.8
Affected side (Left), n (%)	56 (46.7)
Affected side (Right), n (%)	52 (43.3)
Bilateral symptoms, n (%)	12 (10.0)
Positive straight leg raise test, n (%)	98 (81.7)
Preoperative neurological deficit, n (%)	64 (53.3)

This table summarizes baseline demographic and clinical characteristics of patients undergoing lumbar micro discectomy. Continuous variables are expressed as mean ± standard deviation, and categorical variables are presented as frequencies and percentages.

Table 2. Radiological and Operative Characteristics

Variable	n (%)
Disc level L4–L5	68 (56.7)
Disc level L5–S1	44 (36.7)
Disc level L3–L4	8 (6.6)
Herniation type – Protrusion	38 (31.7)
Herniation type – Extrusion	62 (51.6)
Herniation type – Sequestration	20 (16.7)
Operative time (minutes), mean ± SD	58.4 ± 12.3
Hospital stay (days), mean ± SD	2.3 ± 0.8

Radiological distribution and operative details of lumbar microdiscectomy cases. Disc level and herniation type were determined on preoperative MRI. Operative time and hospital stay are presented as mean ± standard deviation.

Table 3. Comparison of Preoperative and Postoperative Outcomes

Outcome Measure	Preoperative (mean ± SD)	Postoperative (mean ± SD)	p-value
VAS score	7.8 ± 1.1	2.1 ± 0.9	<0.001
ODI (%)	62.5 ± 8.4	18.7 ± 6.2	<0.001

Comparison of pain intensity and functional disability before and after lumbar microdiscectomy. Statistical significance was assessed using paired t-test. A p-value <0.05 was considered statistically significant.

Table 4. Postoperative Neurological Recovery and Complications

Variable	n (%)
Complete neurological recovery	52 (81.3)
Partial neurological recovery	10 (15.6)
No neurological improvement	2 (3.1)
Dural tear	4 (3.3)
Superficial wound infection	3 (2.5)
Recurrent disc herniation	2 (1.7)
Reoperation required	1 (0.8)
Mortality	0 (0.0)

Postoperative neurological outcomes and complications observed following lumbar microdiscectomy. Neurological recovery percentages are calculated from patients with preoperative neurological deficits.

Discussion

The present study demonstrates that lumbar micro discectomy is a highly effective surgical intervention for patients with symptomatic lumbar disc herniation refractory to conservative management. Significant improvements in both pain intensity and functional disability were observed, as evidenced by marked reductions in VAS and ODI scores. These findings reinforce the role of micro discectomy as the gold-standard surgical technique for appropriately selected patients with lumbar disc herniation [11].In this cohort, the mean patient age was 42.3 ± 10.6 years, which aligns with the epidemiological profile reported in recent studies, indicating that lumbar disc herniation predominantly affects individuals in their fourth and fifth decades of life [12]. As in prior reports, a male predominance was observed, which has been attributed to occupational physical demands and greater exposure to mechanical spinal stress among males [13]. The most commonly affected disc levels were L4–L5 and L5–S1, consistent with biomechanical vulnerability described in contemporary literature [14]. Pain relief following micro discectomy was substantial in the present study, with mean VAS scores improving from 7.8 preoperatively to 2.1 postoperatively ($p < 0.001$).Comparable reductions have been reported in recent multicenter, prospective studies, in which postoperative VAS improvements ranged from 60% to 75% within the first 6 months following surgery [15]. These findings suggest that decompression of the affected nerve root effectively alleviates both mechanical and inflammatory components of pain associated with disc herniation [16]. Functional recovery, assessed using the Oswestry Disability Index, also showed significant improvement, with ODI scores decreasing from 62.5% to 18.7% ($p < 0.001$). This degree of functional restoration is consistent with outcomes reported in Systematic reviews and cohort studies conducted over the past five years, where postoperative ODI scores typically improved to below 20% in successful cases [17]. Functional improvement is significant in low- and middle-income settings, as it directly impacts patients' ability to return to work and maintain socioeconomic stability [18]. Neurological recovery following micro discectomy was favorable in the majority of patients in this study, with complete recovery observed in more than four-fifths of those presenting with preoperative deficits. Similar recovery rates have been reported in the recent literature, underscoring that timely surgical intervention is associated with better neurological outcomes, particularly when performed before prolonged nerve root compression [19]. Partial recovery observed in a small subset of patients may be attributed to longer symptom duration or irreversible nerve damage before surgery [20]. The complication rate in this study was low, with Dural tears and superficial wound infections being the most commonly encountered adverse events. These complications were managed conservatively without long-term squeal. Recent studies have reported comparable complication rates ranging from 3% to 8%, reinforcing the overall safety profile of micro discectomy. Importantly, no perioperative mortality was observed, further supporting the procedure's safety when performed in appropriate clinical settings.

Limitations:

This study has certain limitations. It was conducted at a single center with a relatively short follow-up period,

which may limit generalizability. The absence of a control group and of long-term outcome assessment limits the evaluation of recurrence rates and sustained functional improvement after micro discectomy.

Conclusion:

Lumbar micro discectomy is an effective and safe surgical option for patients with symptomatic lumbar disc herniation unresponsive to conservative treatment. It provides significant pain relief, substantial functional recovery, and favorable neurological outcomes with minimal complications, supporting its continued role as the standard surgical approach in appropriately selected patients.

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Conflict of Interest: Nil

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Authors Contributions

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Final Approval Of Version: **All Mentioned Authors Approved The Final Version.**

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