



Original Research

## Comparative Analysis of Percutaneous Full Endoscopic Discectomy and Microdiscectomy in the Management of Lumbar Disc Herniation

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### ABSTRACT

**Objective:** Percutaneous Full Endoscopic Discectomy and Microdiscectomy are two of the least invasive surgical procedures used in the management of lumbar disc herniation. This study aimed to evaluate the clinical outcomes of percutaneous full endoscopic discectomy and microdiscectomy in the management of lumbar disc herniation.

**Materials and Methods:** This retrospective study spanned two years. Patients with the diagnosis of lumbar disc herniation confirmed by clinical symptoms and imaging studies undergoing PFED or MD were included. The primary outcome measures included pain relief, assessed using the Visual Analog Scale (VAS), and functional improvement, and measured using the Oswestry Disability Index (ODI). Secondary outcome measures included the occurrence of surgical complications and length of hospital stay.

**Results:** This retrospective analysis included 480 participants in the study, with 247 patients undergoing Percutaneous Full Endoscopic Discectomy (PFED) and 233 patients undergoing Microdiscectomy (MD). In the PFED group, patients experienced an average mean reduction in leg pain score of  $6.97 \pm 1.96$  on the Visual Analog Scale (VAS) as compared to microdiscectomy ( $4.95 \pm 2.45$ ).

**Conclusion:** Our study concluded that both percutaneous full endoscopic discectomy and microdiscectomy are safe and efficient surgical techniques in the management of lumbar disc herniation. However, PELD showed several possible benefits, such as quicker recovery and earlier LBP reductions, improvement in bowel and bladder symptoms along earlier return to work.

**Keywords:** Disc Herniation, Endoscopic Discectomy, Lumbar, Micro Discectomy.

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## INTRODUCTION

Lumbar disc herniation (LDH) is attributed to be one of the most common causes of chronic lower back pain with radiating leg symptoms.<sup>1</sup> LDH places an immense burden on the global economy and healthcare services.<sup>2</sup> Epidemiological studies have shown that between 70% and 85% of people experience back discomfort at some point in their life.<sup>3</sup> The frequency of population with lumbar disc herniation and disc degeneration has been noted to increase as the age advances and typically occurs between the age range of 30 and 50, with a 2:1 male-to-female ratio.<sup>4-5</sup>

Surgical intervention is the treatment of choice in patients whose symptoms have been resistant to conservative therapy for at least six weeks.<sup>6</sup> Removing the herniated lumbar disc is the main objective to relieve pressure on the nerve roots.<sup>7-8</sup> In 1934, Mixter and Barr made the first attempt at a posterior partial laminectomy to remove herniated discs and release compressed nerve roots.<sup>9</sup> Caspar and Yasargil introduced the less invasive microscopic discectomy for the treatment of LDH in the late 1970s as the foundation of their work.<sup>10</sup> Since then, symptomatic LDH has been treated surgically by open lumbar microdiscectomy (OLMD), which is regarded as the gold standard.<sup>11</sup>

Since the late 1990s, comprehensive endoscopic operations utilizing continuous water irrigation, such as transforaminal and interlaminar methods, have been carried out.<sup>8</sup> Since then, the Percutaneous endoscopic lumbar discectomy (PELD), has been most commonly accepted as the preferred surgical procedure over microdiscectomy as it is associated with minimal damage to soft tissue, more bone preservation, decreased rate of complications, and quicker recovery owing to the advancements in endoscopic tools and operative techniques.<sup>10</sup>

This comparative study aimed to evaluate the clinical outcomes of percutaneous full endoscopic

discectomy and microdiscectomy in the management of lumbar disc herniation.

## MATERIALS AND METHODS

This retrospective study was conducted at Farooq Neuroendoscopic Spine Institute, Afridi Medical Complex, Peshawar. The study spanned a period of two years, from 2020 to 2022. The Institutional Review Board at Afridi Medical Complex granted the ethical approval and informed consent was taken from the participants. Patient records from the medical database were retrospectively reviewed to identify individuals who had undergone either PFED or MD for lumbar disc herniation during the study period.

### Patient Selection Criteria

#### Inclusion Criteria

Patients aged between 18 and 75 years with the diagnosis of lumbar disc herniation confirmed by clinical symptoms and imaging studies (MRI or CT) along with the availability of complete medical records of preoperative and postoperative assessments were included in the study.

#### Exclusion Criteria

Patients diagnosed with significant spinal pathologies other than disc herniation, those with a history of previous lumbar surgeries, and patients declining the consent were excluded from our study.

### Data Collection

Patient demographics, clinical history, radiological reports, and surgical records were collected for all included patients. Relevant preoperative information included pain intensity (using a visual Analog Scale), neurological deficits, SLR, and duration of symptoms were noted. Postoperative data recorded were pain relief, functional

improvement, complications, and length of hospital stay.

## Surgical Procedures

Expert neurosurgeons performed both of the surgical interventions. A small incision was made for the Percutaneous Endoscopic Lumbar Discectomy (PELD) procedure to place an endoscope for vision. The herniated disc portion was then excised using specialized instruments to relieve pressure on the nerve. However, in an attempt to reduce pain and nerve compression, a microdiscectomy entailed creating a tiny incision through which the herniated disc fragment was extracted using a microscope.

## Outcome Measures

The primary outcome measures included pain relief, assessed using the Visual Analog Scale (VAS), and functional improvement, and measured using the Oswestry Disability Index (ODI). Secondary outcome measures included the occurrence of surgical complications and length of hospital stay.

## Data Analysis

SPSS software was used for statistical analysis of the data. Descriptive statistics were used to summarize patient characteristics and outcomes for each surgical group. The continuous variables were reported by means alongside their standard

deviations. Frequencies and percentages were used to summarize categorical variables. Comparative analysis between the PFED and MD groups was conducted using the independent sample t-test for continuous variables (mean improvement in back pain, leg pain, ODI, length of hospital stay, duration of surgery, and return to work). Less than 0.05 was the threshold level for statistical significance.

## RESULTS

### Patient Characteristics

This retrospective analysis included 480 participants in the study, with 247 patients undergoing Percutaneous Full Endoscopic Discectomy (PFED) and 233 patients undergoing Microdiscectomy (MD). The gender distribution in the PFED group was 130 males and 117 females, while in the MD group, it constituted 120 males and 113 females. The mean age for patients in the PFED group was 42.5 years, while in the MD group, it was 41.8 years. A diverse range of occupations was represented in both groups, with 288(60 %) patients engaged in a sedentary lifestyle followed by manual labor 120(25%), and office workers 72(15%).

### Level of Disc Herniation

The distribution of disc levels for patients undergoing disc surgery was as follows:

**Table 1:** Demographic and patient characteristics.

Variables	Percutaneous Full Endoscopic Discectomy (PFED)	Micro Discectomy (MD)	Total
Total Patients	247	233	480
<b>Gender Distribution</b>			
- Male	130	120	250
- Female	117	113	230
<b>Age</b>			
- Mean	42.5 years	41.8 years	
Range	25-55 years	27-62 years	

**Table 2:** Occupation distribution:

Occupational Distribution	Frequency (Percentages)
- Sedentary Lifestyle	288(60%)
- Manual Labor	120(25%)
- Office Worker	72(15%)

L5-S1 (180) patients, L4-L5 (40) patients, L3-L4 (15) patients, and L2-L3 (12) patients.

**Table 3:** Disc Herniation Levels:

Disc Level	Number of Patients
L5-S1	350 (73%)
L4-L5	77 (16%)
L3-L4	29 (6%)
L2-L3	24 (5%)

### Clinical Presentation

Clinical presentation varied among the patients. 336(70%) patients presented with radiculopathy, 96(20%) reported back pain, and 48(10%) had combined symptoms, bowel and bladder dysfunction was reported by 67(14%) while myotomal weakness was observed in 34(7%).

### Outcomes of PFED and MD

Outcomes were assessed using various measures. In the PFED group, patients experienced an average mean reduction in leg pain score of 6 on the Visual Analog Scale (VAS) as compared to microdiscectomy (4). Functional improvement

**Table 4:** Clinical Presentation.

Clinical Presentation	Frequency (Percentage)
Radiculopathy	336(70%)
Low back pain	96(20%)
Bowel and bladder symptoms	67(14%)
Myotomal weakness	34(7%)

measured using the Oswestry Disability Index (ODI) showed the mean score to be 3 indicating no disability in PFED compared to 7 in the microdiscectomy group (mild disability). Subjective improvement in bowel and bladder symptoms was reported to be in 39(58%) undergoing PFED as compared to MD 23(34%). No statistically significant difference was observed in ODI score (p 0.052) and bowel and bladder symptoms (0.14) pre and post-operatively, while back pain (0.000), leg pain (0.000), duration of procedure (0.000), average hospital stays (0.000) and return to work (0.004) was significantly associated with the type of procedure as the mean back pain improvement in PFED group was greater compared to microdiscectomy (5.08 vs 2.1). The mean duration of the procedure was also noted to be lower in the PELD group (mean 58.8 minutes) vs MD (mean 122.6 minutes).

### Complications

A subset of patients in both the PFED and MD groups experienced complications. In the PFED

**Table 5:** Outcomes of PFED and MD.

Outcome Measure	PFED Group	MD Group	T-test Value	df	CI Range (95%)	P value
Mean reduction in Leg Pain score (VAS)	6.97±1.96	4.95±2.45	10.001	478	1.62_2.42	<0.001
The mean score of the ODI	3.1±3.54	7.1±5.04	-10.319	478	-4.8_-3.3	0.052
Subjective improvement in bowel and bladder symptoms	39(58%)	23(34%)	12.505	478	2.34_3.59	0.14
The mean reduction in back Pain score	5.08± 3.04	2.1±1.9	12.402	478	2.45-3.38	<0.001
Mean Duration of Procedure (minutes)	58.8±18.56	122.6±6.2	-49.872	478	-66.3_-61.3	<0.001
Average Hospital stay (days)	2.1±1.02	4.0±1.41	-17.341	478	-2.1_-1.7	<0.001
Return to work (weeks)	4.3 ±	9.3±2.5	11.302	478	2.12_3.91	0.003

group, 40(16%) % of patients encountered complications, while 51(22%) of MD patients experienced complications during the study period. The most common complication associated with PFED was transient paresthesia 3(8%) followed by postoperative infection 2(5%), and disc re herniation 2(5%) while for MD the complications were surgical site infection 3(6%), hematoma formation 2(4%) and nerve root injury 1(2%).

**Table 6:** Complications of PFED and MD.

Complication	PFED Group (%)	MD Group (%)
Overall Complications	40(16%)	51(22%)
Transient Paresthesia	3(8%)	-
Post-operative Infection	2(5%)	3(6%)
Disc Reherniation	2(5%)	-
Surgical Site Infection	-	3(6%)
Hematoma Formation	-	2(4%)
Nerve Root Injury	-	1(2%)

## DISCUSSION

Lower back discomfort is primarily caused by nucleus pulposus and annulus fibrous bulging out of the intervertebral disc, especially when they pressure on the nerve roots. It usually spreads to the lower limbs and results in loss of sensation. Open lumbar microdiscectomy was once the gold standard for LDH; nevertheless, the posterior method needs more muscle dissection, the removal of posterior components like the ligament and lamina, facet joint, and spinal nerve root retraction, all of which raises the possibility of spinal instability.<sup>12,13</sup> Owing to the shorter recovery period, quicker mobilization, and lesser need for posterior structure removal, minimally invasive surgery is becoming more and more popular.<sup>14</sup> The ability to apply local anesthetic is the primary benefit of percutaneous full endoscopic lumbar discectomy, as reported by Choi et al.<sup>15</sup>

The results of our study depicted that a statistically significant association was found

between PFED and MD in terms of leg pain relief (p 0.000) and back pain (p 0.000) as those undergoing PFED had a higher mean reduction on the visual analog scale (6.97, 5.08) as compared to MD (4.95, 2.1). Mean ODI score improvement was also higher in the PFED group (3.1) as compared to microdiscectomy (7.1). In contrast to our study, a systematic review and meta-analysis conducted to compare the outcomes of these two procedures also showed that both of the procedures had no statistically significant difference in terms of visual analog scale score of leg pain recorded pre and post-operatively, disability score, and complication rate.<sup>16</sup> Expertise of the operating neurosurgeon in handling the use and correct technique of endoscopic instruments also is a factor that needs to be considered and can lead to different results conducted in different areas of the world. Microdiscectomy carries the risk of resecting the lamina and partial ligamentum flavum, then retracting the nerve roots and dural sac which can lead to primary problems such as dural tears, dysesthesia, and infection.

A statistically significant association was found between average hospital stay (p 0.000) and duration of return to work (p 0.004) between the two groups. Percutaneous full endoscopic lumbar discectomy was associated with decreased hospital stay (mean 2.1 days) and early return to work (mean 4.0 weeks) as compared to microdiscectomy (mean hospital stay 4 days mean time to return to work 9.3 weeks). Also, the amount of blood loss during the surgical procedure was negligible in the PFED group compared with the MD. The use of local anesthesia in PFED also enabled surgeons and the operating team to communicate with the patient.<sup>17</sup> These results also follow a study by Kyung-Chul Choi in 2016.<sup>18</sup> One of the main benefits of PFED over traditional microdiscectomy is that it ablates new vascular nerve formation and granulation surrounding the annular fissure in addition to decompressing the dural sac and lowering intradiscal pressure.<sup>19-21</sup> These differences in outcomes indicate the

superiority of the percutaneous endoscopic lumbar discectomy over microdiscectomy as it facilitates quicker recovery and return to normal activities of daily life.

After PELD, transient dysesthesia is one of the most common complications. According to Choi et al, postoperative dysesthesia can be avoided by keeping the cannula away from the upper nerve root during surgery, as it may compress the leaving root.<sup>22</sup> This occurred in 3(8%) of the PELD group of patients in our study. Another study conducted to determine the outcomes of disc procedures reported that two patients had post-op complications of transient dysesthesia.<sup>23</sup> The difference may be attributed to the overall difference in sample size, operative techniques, and surgical expertise. Overall, our rate of postoperative complications was comparable to the figures reported in the literature. The recurrence rate varies between 5% and 15% in the literature for PFED.

The limitations of our study include the retrospective design as well as the data collection from a single center which restricts the ability of our findings to be generalized to a larger population and retrospective designs predispose to the possibility of selection bias. Future studies of longer duration with a prospective design involving multicenter data collection along with incorporating the cost-effectiveness analysis between the two procedures need to be carried out.

## CONCLUSION

Our study concluded that both, percutaneous full endoscopic discectomy and microdiscectomy are safe and efficient surgical techniques in the management of lumbar disc herniation. However, PELD showed several possible benefits, such as quicker recovery and earlier LBP reductions along with earlier return to work. Thus, we believe that PELD is a significantly less invasive procedure, possibly an alternative to microdiscectomy.

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**Additional Information**

**Disclosures:** Authors report no conflict of interest.

**Ethical Review Board Approval:** The research was a retrospective study.

**Human Subjects:** Consent was obtained by all patients/participants in this study.

**Conflicts of Interest:**

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

**Financial Relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

**Other Relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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**AUTHOR CONTRIBUTIONS**

Sr. No.	Author’s Full Name	Intellectual Contribution to Paper in Terms of
1.	Muhammad Farooq & Abdul Haseeb Sahibzada	1. Study design and methodology.
2.	Muhammad Farooq & Shahid Nawaz	2. Paper writing.
3.	Muhammad Farooq & Mumtaz Ali	3. Data collection and calculations.
4.	Muhammad Farooq, Abdal Wasim Khan & Abdul Haseeb Sahibzada	4. Analysis of data and interpretation of results.
5.	Naeem ul Haq & Muhammad Nawaz	5. Literature review and referencing.
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