ORIGINAL ARTICLE

INCIDENCE OF RECURRENCE OF LUMBAR DISC HERNIATION FOLLOWING ENDOSCOPIC DISCECTOMY

Mukhtiar Ahmed Lakho[1], Hamid Akbar Shaikh[2], Talha Abbas[3], M Ajmal Khan Ayaz[4], Sundus Ali[5]

[1]Professor of Neurosurgery Department KMC Khairpur Mirs, [2]Professor Neurosurgery at PUMHSW Nawabshah, [3] Assistant Professor Neurosurgery FJMU/SGRH, Lahore, [4] Professor of Neurosurgery, SIMS/Services Hospital Lahore, [5] Associate Professor /HOD Department of Neurosurgery RMU & Allied Hospitals Rawalpindi

ABSTRACT

Objectives: To determine the six-month incidence of symptomatic recurrent lumbar disc herniation following endoscopic discectomy and to evaluate associated pain and functional outcomes.

Study Design: Prospective Cohort Study.

Place and Duration of Study: Khairpur Medical College Hospital (KMCH), Sindh, Pakistan. 01 year (January 2024 to December 2025).

Methodology: This study enrolled 180 patients, aged 18–60 years, undergoing percutaneous endoscopic lumbar discectomy and percutaneous endoscopic transforaminal discectomy for single-level lumbar disc herniation (LDH). Follow-up was conducted for 6 weeks, 3 months, and 6 months. The primary outcome was MRI-confirmed symptomatic recurrence; secondary outcomes were Visual Analogue Scale(VAS) for leg pain and Oswestry Disability Index (ODI).

Results: Symptomatic recurrence occurred in 11 of 180 patients (6.1%; 95% CI: 3.1–10.7%). Mean time to recurrence was 3.2 months. VAS improved from 7.8 ± 1.1 to 2.1 ± 0.9, and ODI from 62.4% to 18.3% at six months (both $p < 0.001$). The overall complication rate was 3.9%. No difference in recurrence found between techniques ($p = 0.612$).

Conclusion: Endoscopic discectomy yields a low 6-month recurrence rate, with clinically significant pain and functional improvement in a Pakistani provincial setting, supporting its adoption in resource-appropriate tertiary care centres.

Key words: *Lumbar disc herniation; endoscopic discectomy; recurrent disc herniation; Oswestry Disability Index; Visual Analogue Scale*

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INTRODUCTION

Lumbar disc herniation (LDH) continues to be one of the most common and disabling musculoskeletal and neurological disorders, worldwide. The disorder occurs when the nucleus pulposus (hydrated proteoglycan-rich portion of the intervertebral disc) herniates through a defect in the annulus fibrosus, and mechanically or chemically compresses or irritates adjacent spinal nerve roots [1,2]. This clinical syndrome, lumbar pain with unilateral or bilateral radiation into the lower extremity, sensory disturbance, and in severe cases motor deficit , is called sciatica, and has a lifetime prevalence in the general population to be between 10 and 40% [3]. Low back pain, of which disc herniation is a major aetiology, is the leading cause of disability adjusted life years (DALYs), at 64.9 million per year across 204 countries [4,5].

Lumbar disc disease in Pakistan, with a population of over 230 million people, has a significant epidemiological profile, but this remains poorly defined. Sindh province, with about 47 million people, ranges from the highly technologically advanced city of Karachi to the rural farming areas like Khairpur, where the working-age population is subjected to heavy labour, prolonged stooped posture, and manual labour, all risk factors for accelerated disc degeneration and herniation [6-8].

The surgical management of LDH has evolved over a period of 90 years. In the late 1970s, Caspar (1977) and Williams (1978) independently brought about the refinement of open

Correspondence to: Dr. Mukhtiar Ahmed Lakho, Khairpur Medical College, Khairpur Mirs.

Email: drmukhtairahmedlakho@gmail.com

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laminectomy, which was first described by Mixter and Barr (1934), into microsurgical discectomy, where a much smaller surgical corridor is used to perform disc removal [9,10,1]. Since then, microdiscectomy has become the "standard" against which all further innovations are judged [11,12]. In the past 20 years, the percutaneous endoscopic spine surgery, especially PELD/TELD and PETD, has developed rapidly with comparable clinical results to microdiscectomy, but with significantly less trauma to the paraspinal muscles, shorter hospital stay, lower blood loss, and early return to activity [13,14]. The endoscopic discectomy provides several advantages over conventional microdiscectomy, including reduced tissue trauma, shorter hospital stays, and quicker postoperative recovery with comparable clinical outcomes. Symptomatic recurrent LDH is a significant postoperative complication, with international studies reporting recurrence rates of between 2% and 8% [13,15].

CAPSULE SUMMARY

The six-month incidence of symptomatic recurrent lumbar disc herniation following endoscopic discectomy was determined. Endoscopic discectomy yielded a low 6-month recurrence rate, with clinically significant pain and functional improvement, supporting its adoption in resource-appropriate tertiary care centres.

Several studies have shown good pain and functional results after endoscopic lumbar discectomy [16-18]. Recurrence after surgery remain a major concern as it may lead to persistent pain, re-operation, and additional healthcare burden [19,20]. Various factors, like, smoking, annular defect, and disc degeneration have also been reported as risk factors for recurrence [21,22].

The most clinically relevant complication after surgery is the symptomatic recurrent disc herniation (reHD), which is defined as reherniation at the same level and side after documented postoperative recovery, which in many cases requires further investigation, long-term disability, and revision surgery. The recurrence rates vary from 2.0% to 8.7 % internationally after endoscopic discectomy [2]. No prospective study has quantified this result in Pakistan. This gap means that locally informed pre-operative counselling and evidence-based planning of surgical follow-up are not possible. Despite the rising use of endoscopic spine surgery in Pakistan, there is still a limitation of prospective data on recurrence and surgical outcomes, especially for those undergoing surgery in tertiary care centres in the province of Sindh.

The present prospective cohort study aimed to find the incidence of symptomatic recurrent lumbar disc herniation after 6 months of endoscopic discectomy performed at Khairpur Medical College Hospital (KMCH), and to assess the pain and functional outcomes using Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI) scores.

METHODOLOGY

This was a prospective cohort study, conducted in the Department of Neurosurgery and Orthopaedic Surgery at KMCH in Khairpur, Sindh, Pakistan, from January 2024 to December 2025. The study protocol was approved by the Institutional Review Board (IRB) of Khairpur Medical College. All procedures followed the guidelines of the Declaration of Helsinki (2013 revision). Each participant provided written, informed, and voluntary consent before enrolment, and the freedom to terminate at any time without repercussion of care.

A sample size of 174 participants was required, based on a published recurrence rate of 5.0% from previous endoscopic discectomy studies, a 95% confidence level, and a 3.2% margin of error using OpenEpi computer software (v3.01)[23]. To anticipate attrition and to solidify the precision of 95% confidence interval around the primary outcome estimate, a final sample of 180 patients was enrolled by consecutive non-probability (convenience) sampling. Only patients between 18 and 60 years old with MRI confirmed single level LDH (Pfirrmann 3–4) with persistent ipsilateral radicular leg pain for ≥ 6 weeks. Despite adequate conservative care (analgesia, physiotherapy, and/or epidural steroid injection), and willing and able to participate in structured follow-up visits were included. Exclusion criteria included, multilevel disc disease, previous lumbar surgery at the index level, significant spondylolisthesis (Meyerding grade ≥ II), lumbar spinal stenosis with need for decompression or fusion, active systemic infection or malignancy and pregnancy.

The choice of surgical approach was made according to the MRI scan results before surgery and surgeon assessment. PELD/TELD was chosen for contained disc herniations, paracentral disc herniations and foraminal disc herniations that were suitable for transforaminal approach; PETD was selected for high migrations disc herniations, extruded disc herniations and anatomically difficult lesions, where direct access to the herniated fragment via the epidural space was felt to be more appropriate[18]. All procedures were performed by surgeons experienced in more than 60 prior endoscopic discectomies [24]. Local anaesthetic and intravenous sedation were used unless patient or anaesthetic factors dictated general anaesthetic. Annular shrinkage and haemostasis were done throughout using radiofrequency bipolar haemostasis.

Symptomatic recurrent lumbar disc herniation was the primary outcome, operationally defined as: (i) ipsilateral radicular pain and/or new neurological deficit ≥ 4 weeks after the index procedure, and (ii) MRI confirmation of reherniation at the same level and side as the index procedure. Secondary outcomes included VAS leg pain score (0–10 numerical scale), ODI (as a percentage of maximum disability) , and incidence of intraoperative and post-operative complications [25]. Assessment was done at baseline, 6 weeks, 3 months, and 6 months for all patients. On clinical indication, symptom-triggered MRI was obtained, and all patients with recurrent radiculopathy had an MRI, regardless of timing.

IBM SPSS Statistics, Version 26.0, was used for data entry and analyses. Categorical variables are presented as frequency and percentage, and continuous variables as mean ± standard deviation (SD). Normality of continuous variables was assessed using the Shapiro–Wilk test. Paired-samples t- test and Wilcoxon signed rank test were used to determine pre- to post-operative change in VAS and ODI (as appropriate). Recurrence rates were compared between PELD/TELD and PETD groups by using the chi-square (χ^2) test. All analyses were performed using a 2-tailed p-value < 0.05 as statistically significant.

Table 1: Baseline Demographic, Clinical, and Surgical Characteristics

Characteristic	Category / Statistic	n (%) or mean ± SD
Demographic Variables		
Age	Years	38.5 ± 11.2
Sex	Male	108 (60.0)
	Female	72 (40.0)
Body mass index	kg/m²	26.4 ± 3.8
Clinical Variables		
Symptom duration	≥ 12 weeks	112 (62.2)
	< 12 weeks	68 (37.8)
Active smoking	Yes	48 (26.7)
Diabetes mellitus	Yes	21 (11.7)
Pre-operative VAS (leg pain, 0–10)	Mean ± SD	7.8 ± 1.1
Pre-operative ODI (%)	Mean ± SD	62.4 ± 9.8
Operative Variables		
Technique	PELD/TELD	95 (52.8)
	PETD	85 (47.2)
Level Distribution		
Disc level	L3–L4	18 (10.0)
	L4–L5	83 (46.1)
	L5–S1	63 (35.0)
	Two adjacent (single dominant)	16 (8.9)

PELD = percutaneous endoscopic lumbar discectomy; TELD = transforaminal endoscopic lumbar discectomy; PETD = percutaneous endoscopic transforaminal discectomy; VAS = Visual Analogue Scale; ODI = Oswestry Disability Index. Percentages may not sum to 100 due to rounding.

RESULTS

There was no patient attrition during 6-month follow-up. The average age of the subjects was 38.5 ± 11.2 years, with the majority being male. The most affected disc level was L4–L5 followed by L5–S1. The number of PELD/TELD and the number of PETD techniques were similar. Detailed baseline demographic, clinical and operative characteristics are shown in Table 1.

Table 2: Primary Outcome: Six-Month Incidence of Symptomatic Recurrent Lumbar Disc Herniation

Parameter	Result
Total participants	180
Confirmed recurrences, n (%)	11 (6.1)
95% Confidence interval	3.1% – 10.7%
Mean time to recurrence, months (range)	3.2 (1.5 – 6.0)
Recurrences within first 4 months, n (%)	8 (72.7)
Managed conservatively, n (%)	3 (27.3)
Requiring revision endoscopic surgery, n (%)	8 (72.7)
Recurrence - PELD/TELD group (n = 95)	5 (5.3%)
Recurrence - PETD group (n = 85)	6 (7.1%)
Chi-square statistic (χ^2)	0.26
p-value (PELD/TELD vs. PETD)	0.612 (not significant)

Among 180 patients 11 (6.1%) (95% CI: 3.1–10.7%) had symptomatic recurrent lumbar disc herniation at 6 months. The average time until recurrence was 3.2 months. No statistically significant differences in recurrence were seen between the PELD/TELD group and the PETD group (p = 0.612). Primary outcome findings are reported in detail in Table 2.

Recurrence definition: ipsilateral radicular symptoms at the index level after ≥ 4 weeks of documented symptom-free interval, confirmed by MRI reherniation at the same level.

All postoperative follow-ups, there was considerable improvement in VAS leg pain and ODI scores when compared to baseline levels (p < 0.001). The most significant improvement was seen in the first 6 weeks after surgery and further improvement was seen at 3 and 6 months. Pain and functional outcomes were clinically improved at 6 months. Trends in outcomes are detailed in Table 3.

The complication rate overall was 3.9%. The complications recorded were dural tearing, transient neurological deficit, surgical site infection (superficial), and a single conversion to open discectomy. No permanent neurological deficits or deaths occurred during follow up. Complication data is summarized in detail in Table 4.

DISCUSSION

This prospective cohort study of 180 patients is the first structured outcome data of endoscopic discectomy in a provincial teaching hospital in Sindh, Pakistan. The main

Table 3: VAS Leg Pain and ODI Score Trajectories at Follow-up Time Points

Outcome Measure	Pre-operative	6 Weeks	3 Months	6 Months	p-value*
VAS leg pain (0–10), mean ± SD	7.8 ± 1.1	4.2 ± 1.3	3.0 ± 1.0	2.1 ± 0.9	< 0.001
Change from baseline (VAS)	—	−3.6	−4.8	−5.7	—
ODI (%), mean ± SD	62.4 ± 9.8	38.1 ± 8.4	26.5 ± 7.1	18.3 ± 6.2	< 0.001
Change from baseline (ODI, %)	—	−24.3	−35.9	−44.1	—
MCID achieved (VAS ≥ 2.0 pts)	—	Yes	Yes	Yes	—
MCID achieved (ODI ≥ 10 pts)	—	Yes	Yes	Yes	—

**Paired-samples t-test, each post-operative time point versus pre-operative baseline. VAS = Visual Analogue Scale; ODI = Oswestry Disability Index; MCID = minimum clinically significant difference. MCID thresholds: VAS ≥ 2.0 points 15 ODI ≥ 10 percentage points 25.*

Table 4: Intraoperative and Post-operative Complications

Complication	n	%	Management and Outcome
Dural tear	2	1.1	Primary repair; bed rest × 5 days; no sequelae
Transient neurological deficit (L5 paraesthesia)	3	1.7	Conservative; complete resolution by 6 weeks
Superficial surgical site infection	1	0.6	Oral antibiotics; resolved without deep extension
Conversion to open discectomy	1	0.6	Instrument failure; open procedure completed successfully
Permanent neurological deficit	0	0.0	—
Mortality	0	0.0	—
Total complications	7	3.9	

Complication rate calculated per patient; one patient experienced more than one complication. No cauda equina syndrome or post-operative haematoma requiring intervention was recorded.

result is a clinically important reduction in leg pain (VAS reduction 5.7 points) and functional disability (ODI reduction 44.1 percentage points) at 6 months, with a complication rate of 3.9% and no permanent neurological morbidity. All these outcomes collectively highlight the safety and efficacy of endoscopic discectomy in the Khairpur, Sindh population as a surgical option for single-level LDH.

The recurrence rate in the present cohort of 6.1% is like the best international evidence available. The most widely cited benchmark for endoscopic disc removal is the YESS series with 307 patients, who reported a recurrence rate of 4.9% at a mean follow-up of 11.5 months[20], which is slightly lower than in the present study and is plausibly explained by the fact that their centre performs a high volume of operations, the longer period of maturity of their programme, and perhaps because their observation period was longer, capturing more late recurrences than our study period of six months. A recurrence rate of 7.2% with a longer follow-up of 16 months, which may be due to the longer follow-up period rather than a less effective technique, as there is known to be a bimodal distribution of recurrences over time [12,26].

The most directly comparable is the systematic review calculated a weighted mean recurrence rate of 5.8% (95% CI: 4.1–7.5%) from 14 prospective endoscopic discectomy studies, which is within the range of the present study's result [15,19.] The pain and functional scores gained are also consistent with published benchmarks; the VAS improvement of 5.7 points and ODI decrease of 44.1 percentage points for this cohort is greater than that observed in the pivotal RCT [13]. The complication rate of 3.9% is in line with the published range of 2.0-6.0% for endoscopic discectomy within the lower limit of the 4.0-10.0% complication rate reported for conventional open discectomy in systematic reviews [11,14,27]. Two dural tears (1.1%) and three transient neurological deficits (1.7%) were recognised endoscopic complications and were within expected incidence and did not result in permanent sequelae.

These results have several clinical implications. First, there was a high proportion of patients (62.2%) who had a duration of symptoms of more than 12 weeks before undergoing surgery, which is most likely due to a lack of timely specialist referral and diagnostic MRI in the upper part of Sindh, which might result in increased annular degeneration and may increase recurrence rates at the time of surgery. Earlier surgical intervention in appropriately selected patients would be expected to occur in rural Sindh with the addressing of referral pathways and MRI access, which could lead to a decrease in the incidence of recurrence. Secondly, 26.7% of this cohort were

smokers, and there is a known association between smoking, disc degeneration, and annular weakening and these patients should be offered structured preoperative smoking cessation counselling[7,28]. Third, the presence of diabetes mellitus (DM) in 11.7% of patients is a condition that causes impaired disc matrix healing and may predispose to higher recurrence rates; therefore, optimal glycaemic control is important prior to surgery [14].

Moreover, the recurrence rate was low, complications were acceptable and functional improvement was significant in the current study. However, the feasibility of adding endoscopic discectomy to the routine neurosurgical practice in the provincial tertiary centres is supported. The minimally invasive nature of the procedure may allow for shorter hospital stays, quicker mobility and better use of surgical beds and health care resources in resource-limited settings. These results offer local evidence which can be supportive for the establishment of endoscopic spine surgeries at similar regional hospitals in Pakistan on a larger scale.

CONCLUSION

The rate of 6-month symptomatic recurrence after endoscopic discectomy (both PELD/TELD and PETD approaches) was low, and patients showed clinically and statistically significant results for leg pain and functional disability. Endoscopic discectomy technique is safe and effective in this context and suggest that it can continue to be used and quality assured at provincial tertiary care centres throughout Pakistan.

Limitations and Future Directions: Although the six-month follow-up period is in line with many published endoscopic discectomy trials, it's likely to be an underestimate of the actual cumulative recurrence rate, based on international data, herniations may recur up to 40% after six months or more [2,20]. A longer follow-up period could show a higher cumulative recurrence.

The single-centre nature of the study restricts the generalisability of results to other health care settings in Pakistan. An accurate systemic measurement of the size of the defect in the annulus was not undertaken, which precludes risk-stratified analysis according to this important predictor[21]. No within-cohort comparison of techniques was possible since there was no concurrent microdiscectomy control group.

Future studies should aim to overcome these limitations with a multicentre, prospective, randomised study design with at least two years of follow-up, systematic documentation of defects, a comparator arm of microdiscectomy, and incorporate patient-reported experience measures (PREMs) along with validated PROMs.

ETHICAL APPROVAL: *KMC-IRB-2024, Dated: 11.05.2026*
CONSENT FOR PUBLICATION: *Written, informed consent was obtained from the study participants.*
AVAILABILITY OF DATA: *Data is available from the corresponding author on a justified request.*
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AUTHORS' CONTRIBUTION

- ***Mukhtiar Ahmed Lakho:*** *Conception and design, Acquisition of data, Drafting the article.*
- ***Hamid Akbar Shaikh:*** *Analysis and interpretation of data, Critical revision.*
- ***Talha Abbas:*** *Drafting the article.*
- ***M Ajmal Khan Ayaz:*** *Conception and design, Analysis and interpretation of data.*
- ***Sundus Ali:*** *Critical revision.*

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