# Evaluation of percutaneous endoscopic lumbar discectomy: a prospective case series

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**Introduction**
Lumbar discectomy is one of the most common operations performed worldwide for lumbar-related symptoms. During the latter half of the 19th century, more techniques were developed to remove the herniated disc with minimal invasiveness. The first herniated disc excision using a microscope (microdiscectomy) was performed by Yasargil in 1977. In 1993, Mayer and Brock and then, in 1997, Smith and Foley described endoscopic discectomy techniques. With these minimally invasive techniques, the authors demonstrated decreased soft tissue manipulation, operative time, blood loss, and hospital stay, allowing early recovery.

**Objective**
The objective of this study was to evaluate clinical, functional, and surgical outcomes of percutaneous endoscopic lumbar discectomy (PELD) in patients with lumbar disc herniation (LDH).

**Patients and methods**
This study is a clinical prospective case series conducted from December 2016 to May 2018; 15 patients who presented with single-level, posterolateral, L4-5 or L5-S1 LDHs underwent PELD within a mean follow-up period of 10.6 months. The procedure was evaluated by the duration of the procedure, blood loss, time of hospital stay, preoperative and postoperative visual analog score (VAS) of low back pain (LBP) and radicular pain (RP) and patient satisfaction according to modified MacNab's criteria.

**Results**
There were 10 male patients and five female patients with the mean age of 35.9 years. The mean amount of intraoperative bleeding was 98.67 ml. The mean operative time was 124 min. The mean postoperative hospital stay was 33.6 h. The mean preoperative VAS of LBP was 6.13 and that of RP was 6.73. Postoperatively, the mean VAS of LBP became 1.6 and that of RP was 1.6. Patient satisfaction score according to modified MacNab's criteria was excellent in 80% and good in 20%.

**Conclusion**
PELD appears to be an effective intervention for LDH, as it has a small amount of intraoperative blood loss, short postoperative hospital stay, and good clinical and functional outcomes. It needs more training, as it has a long learning curve.

**Keywords:**
endoscopic lumbar discectomy, lumbar disc herniation, minimally invasive discectomy

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## Introduction

Low back and sciatic pain has been one of the most common and disabling spinal disorders recorded in medical history [1]. Conservative management is effective in more than half of the affected patients [2,3]. On failure of conservative management of sciatica due to lumbar disc herniation (LDH) for at least 6 months, surgical intervention becomes an essential solution. The primary goal of surgery is decompression of the nerve root by removing the compressing disc materials [4]. The first reported lumbar disc surgery was carried out in 1934 by Mixter and Barr [5] who performed a laminectomy with transdural disc removal; since then, various less invasive techniques have been developed. With the introduction of the microscope, the original laminectomy was refined into the open microdiscectomy by Yasargil [6] and Caspar [7]. This technique has become the most common procedure worldwide. In 1997, the transmuscular approach of microendoscopic discectomy was introduced by Foley [8] with advanced optics' and instruments' application in laparoscopic surgery. Later, the original endoscopic procedure was modified with the operative microscope, which has led to the development of the microscopic endoscopic tubular retractor system. Traditional open discectomy is performed with a standard surgical incision and generally involves a laminectomy or hemilaminotomy. The microdiscectomy involves a smaller incision with visualization through an operating microscope, whereas minimally invasive techniques, such as endoscopic discectomy, involve even smaller incisions with the aid of endoscopic visualization and illumination [9]. With endoscopic discectomy, patients are expected to have less back pain, shorter hospitalization, and quicker resumption of daily activities [10]. There are two major approaches of endoscopic discectomy for the lumbar spine, either transforaminal or interlaminar. The former can be performed by posterolateral or lateral approaches, while the later can be performed by endoscopy-assisted or fully endoscopic techniques [11].

## Aim of the work

The aim of this study was to evaluate percutaneous endoscopic lumbar discectomy (PELD), as a new experience in our department in Assiut University Hospitals, with regard to surgical, clinical, and functional outcomes.

## Patients and methods

This study is a clinical prospective case series. It was conducted at the Neurosurgery Department, Assiut University Hospitals, during the period spanning from December 2016 to May 2018. It included 15 patients suffering from de-novo posterolateral single-level (L4-5 or L5-S1) LDH not responding to conservative treatment for 12 weeks. For every patient, a full history taking, general and neurological examination, basal laboratory investigations including complete blood count, international normalized ratio and renal functions, radiological investigations including plain radiography and MRI of the lumbosacral spine were performed. The site and degree of herniation were evaluated with the exclusion of any case with extraforaminal, recurrent disc prolapses or spondylolisthesis.

### Ethical consideration

The data that were obtained from participants are confidential. The study participants will not be identified by name in any report or publication concerning this study. Before the participants were admitted in this study, the purpose and nature of the study, as well as the risk–benefit assessment was explained to them. An informed consent was obtained.

### Surgical technique

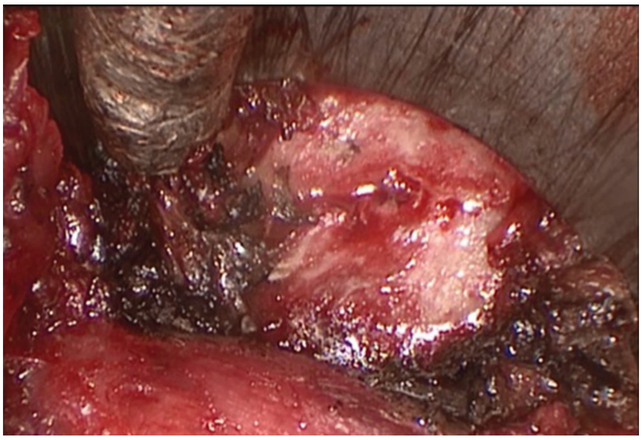
All surgeries were performed under general anesthesia and in knee chest position. After preparation of the surgical site, insertion of a Stienmann pin into the paraspinal musculature was carried out at about 2.5 cm off the midline toward the junction between the facet and the lamina. The site was confirmed using lateral fluoroscopy; thereafter, a 2.5 cm longitudinal skin incision was made with the pin in its center; the subcutaneous tissue and lumbar fascia were incised. Microscopic endoscopic tubular retractor system of soft tissue dilators and tubular retractor of EasyGo system (Karl Storz, Hamburg, Germany) were used. The smallest soft tissue dilator was inserted over the Stienmann pin, directed toward the inferior edge of the superior lamina, and then the pin was removed. The next series of dilators were sequentially placed over each other; thereafter, the optimum tubular retractor was placed over the sequential dilators and seated firmly on the bony anatomy; the retractor was then attached to the table by arm assembly (Fig. 1). After exposure was achieved, a small curved curette was used to define the edge of the superior lamina and the facet joint. The muscle fibers that obscure the trajectory were coagulated by bipolar diathermy and removed (Fig. 2). Bone removal with an electric drill or Kerrison rongeur began on the inferolateral portion of the superior lamina and may proceed to the superolateral portion of the inferior lamina; moreover, partial medial facetectomy may be needed (Fig. 3). This continued until the superior border of the ligamentum flavum (LF) started to appear. After safe dissection from the dura by the dissector, the LF was opened by a dissector and scalpel, and then kerrison rongeur was used to excise LF until the nerve root was exposed. The root was explored and could be retracted medially either by using a dissector or suction probe; annulotomy was carried out using scalpel blade 11. Free fragments or contained disc

**Figure 1**

Intraoperative view of soft tissue dilators and tubular retractors.

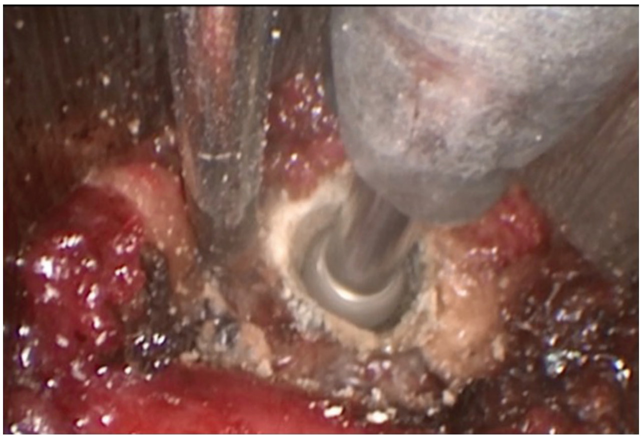
herniations were identified and removed in a piecemeal way using disc rongeurs (Fig. 4). Afterwards, the nerve root and dural sac were finally checked for complete decompression, especially in the subligamentous area. Epidural bleeding was controlled with gelfoam. The fascia was then closed by simple interrupted sutures followed by subcutaneous inverted sutures and, finally, the skin was closed with simple or subcuticular sutures. The wound was wiped with betadine and dressed with sterile dressing. Postoperatively, patients were transferred to the recovery room until full recovery from anesthesia; they were then transferred to the ward and counseled with regard to restart of oral intake and way of mobilization from bed. All patients received intravenous antibiotic and analgesic for 48 h. Patients were discharged as long as there were no complications.

**Figure 2**



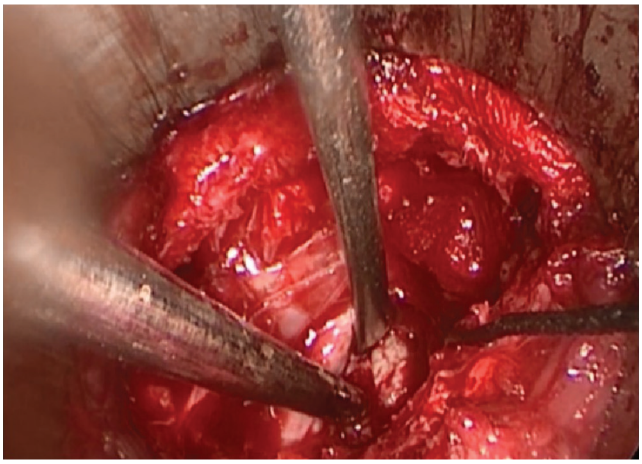
Intraoperative view taken by the camera of the endoscope showing opening of a small window in lamina by an electric drill.

**Figure 3**



Intraoperative view taken by the camera of the endoscope after tubular retractor application showing lamina and cauterized muscle.

**Figure 4**



Intraoperative view taken by the camera of the endoscope showing dura and nerve root, after completion of bone and ligaments removal, with the disc material appearing beneath the nerve root.

### Outcome assessment

All patients were evaluated immediately postoperatively and after discharge at the outpatient clinic regularly within a mean follow-up period of 10.6 months. They were evaluated clinically using visual analog score (VAS) for both low back pain (LBP) and radicular pain (RP) and functionally using modified MacNab's criteria for patient satisfaction. Surgically, they were evaluated for operative duration, wound size, intraoperative blood loss, intraoperative complications, postoperative hospital stay, and postoperative complications such as wound infection and cerebrospinal fluid leakage.

### Statistical analysis

Analysis of results was carried out by calculating means and SDs.

## Results

There were 10 male patients and five female patients, and their ages ranged between 26 and 43 years, with a mean of 35.9 years. The disc level was L4-5 in nine (60%) cases and L5-S1 in six (40%) cases, as shown in Table 1. The affected side was the right side in 10 (66.66%) cases and the left side in the remaining five (33.33%) cases, as shown in Table 2. The mean amount of intraoperative bleeding was 98.67 ml, SD = 51.67. The mean surgical wound length was 2.63 cm, SD = 0.091.

**Table 1 Disc-level distribution among patients**

| Disc level | *n* (%) |
|---|---|
| L4-5 | 9 (60) |
| L5-S1 | 6 (40) |
| Total | 15 (100) |

**Table 2 Affected side distribution among patients**

| Surgery side | *n* (%) |
|---|---|
| Left | 5 (33.33) |
| Right | 10 (66.66) |
| Total | 15 (100) |

The mean operative time was 124 min, SD = 35.62, as shown in Table 3. Intraoperative complications, in the form of small dural tear, occurred in two (13.33%) cases. The mean duration of postoperative hospital stay was 33.6 h, SD = 12.17. The mean follow-up period was 10.6 months, SD = 6.85 and was eventless, as shown in Table 4. The mean preoperative VAS of LBP was 6.13, SD = 0.916, and became 1.6, SD = 0.63 postoperatively, as shown in Table 5. The mean preoperative VAS of RP was 7.3, SD = 0.704, and became 1.6, SD = 0.63 postoperatively, as shown in Table 6. Patient satisfaction score according to modified MacNab's criteria was excellent in 80% of cases and good in the other 20%, as shown in Table 7.

**Table 3 Intraoperative surgical outcomes**

| Surgical outcomes | Patients | Mean | SD |
|---|---|---|---|
| Operative time | 15 | 124 min | 35.62 |
| Wound length | 15 | 2.63 cm | 0.091 |
| Operative bleeding | 15 | 98.67 ml | 51.67 |

**Table 4 Postoperative hospital stay and follow-up period**

| Postoperative | Patients | Mean | SD |
|---|---|---|---|
| Hospital stay | 15 | 33.6 h | 12.17 |
| Follow-up period | 15 | 10.6 m | 6.85 |

**Table 5 Preoperative and postoperative visual analog score of low back pain**

| Status | Patients | Mean | SD |
|---|---|---|---|
| Preoperative | 15 | 6.13 | 0.916 |
| Postoperative | 15 | 1.6 | 0.632 |

**Table 6 Preoperative and postoperative visual analog score of radicular pain**

| Groups | Patients | Mean | SD |
|---|---|---|---|
| Preoperative | 15 | 6.73 | 0.704 |
| Postoperative | 15 | 1.6 | 0.632 |

**Table 7 Patients' distribution according to modified MacNab's criteria**

| MacNab's criteria | *n* (%) |
|---|---|
| Excellent | 12 (80) |
| Good | 3 (20) |
| Fair | 0 (0) |
| Poor | 0 (0) |
| Total | 15 (100) |

## Discussion

In our study, the age of the patients ranged from 26 years to 43 years, with the mean age being 35.9 years. This agreed with Huang *et al.* [12] and Schick *et al.* [13], in whose studies the mean age was 39.7 and 39.5 years, respectively. It was noticed that the age range was around 40 years. It could be explained by the increasing disc degeneration through the age group from 20 to 40, which are the years of most muscular activity.

As regards sex distribution; despite the small-sized sample in our study, male predominance was found, wherein male patients were 10 in number (60%) and female patients were five (40%). We agreed with Hermantin *et al.* [14] who in their study published in 1999 had 39 (65%) male patients and 21 (35%) female patients. We think that male individuals are more vulnerable to lumbar disc prolapse than female individuals due to their involvement in more hard activities.

Our study showed the mean value of operative time was 124 min, which is longer than other series like Dasenbrock *et al.* [15], wherein operative time was 49 min; however, Huang *et al.* [12] reported 109 min. This can be explained by the long learning curve in endoscopic discectomy, as this method was new at our department.

With regard to the intraoperative bleeding in our study, it was comparable with other studies such as those carried out by Nakagawa *et al.* [16] and Huang *et al.* [12], wherein the mean intraoperative bleeding was about 92.9 and 87.5 ml, respectively. This could be explained by smaller wound length and less muscle dissection.

With regard to intraoperative complications, apart from small dural tear that occurred in two (13.33%) patients who were managed conservatively with the use of fibrin glue and/or gelfoam, no further complications occurred either intraoperatively or postoperatively.

Our mean value for length of hospital stay was short (33.6 h) due to lack of complications and tolerable or no wound pain. The hospital stay in the study by Huang *et al.* [12] was about 3.5 days. It is a longer postoperative hospital stay but may be due to variable sample size.

In our study, the mean value of preoperative VAS of LBP was 6.1 and became 1.6 postoperatively after a mean follow-up period of 10.6 months. Arts *et al.* [17] reported that LBP VAS after 1 year was 2.25. There was not much difference between the two studies.

The mean value of preoperative VAS of RP was 6.7 and became 1.6 postoperatively. This was the same in other studies such as those carried out by Dasenbrock *et al.* [15] and Liu *et al.* [18].

As regards postoperative satisfaction using modified MacNab's criteria, our results were excellent in 80% of cases and good in the other 20%. There was no significant statistical difference between our study and that of Li *et al*. [19]. Hence, this method is effective in improving clinical manifestation, thus allowing early return to normal work and activities.

## Conclusion

On the basis of our findings, PELD seems to be a promising technique in treating LDH. It gives good results for patients with regard to clinical improvement, either in LBP or RP. It has some advantages such as smaller wound, less intraoperative bleeding, and shortened hospital stay due to tolerable or no wound pain. In contrast, PELD takes more time for surgeons to gain experience, as it has a longer learning curve; hence, neurosurgeons should spend more time in practicing PELD to gain further experience and overcome its long learning curve.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

## References

1 Saal JS, Franson RC, Dobrow R, Saal JA, White AH, Goldthwaite N. High levels of inflammatory phospholipase A2 activity in lumbar disc herniations. Spine 1990; 15:674–678.
2 Nachemson AL. The lumbar spine an orthopaedic challenge. Spine 1976; 1:59–71.
3 Rothoerl RD, Woertgen C, Brawanski A. When should conservative treatment for lumbar disc herniation be ceased and surgery considered? Neurosurg Rev 2002; 25:162–165.
4 Arts MP, Peul WC, Brand R, Koes BW, Thomeer RTWM. Cost-effectiveness of microendoscopic discectomy versus conventional open discectomy in the treatment of lumbar disc herniation: a prospective randomised controlled trial [ISRCTN51857546]. BMC Musculoskelet Disord 2006; 7:42.
5 Mixter WJ, Barr JS. Rupture of the intervertebral disc with involvement of the spinal canal. New England Journal of Medicine 1934; 211:210-215.
6 Yasargil MG. Microsurgical operation of herniated lumbar disc. In: Lumbar Disc Adult Hydrocephalus. Berlin: Springer, Berlin, Heidelberg; 1977. p. 81.
7 Caspar W. A new surgical procedure for lumbar disc herniation causing less tissue damage through a microsurgical approach. In: Lumbar Disc Adult Hydrocephalus. Berlin: Springer, Berlin, Heidelberg; 1977. p. 74-80.
8 Foley KT. Microendoscopic discectomy. Techniq Neurosurg 1997; 3:301–307.
9 Phan K, Xu J, Schultz K, Alvi MA, Lu VM, Kerezoudis P, *et al.* Full-endoscopic versus micro-endoscopic and open discectomy: a systematic review and meta-analysis of outcomes and complications. Clin Neurol Neurosurg 2017; 154:1–12.
10 Gadjradj PS, van Tulder MW, Dirven CM, Peul WC, Harhangi BS. Clinical outcomes after percutaneous transforaminal endoscopic discectomy for lumbar disc herniation: a prospective case series. Neurosurg Focus 2016; 40:E3.
11 Yorukoglu AG, Goker B, Tahta A, Akcakaya MO, Aydoseli A, Sabanci PA, *et al.* Fully endoscopic interlaminar and transforaminal lumbar discectomy: analysis of 47 complications encountered in a series of 835 patients. Neurocirugia (Asturi) 2017; 28:235–241.
12 Huang TJ, Hsu RW, Li YY, Cheng CC. Less systemic cytokine response in patients following microendoscopic versus open lumbar discectomy. J Orthop Res 2005; 23:406–411.
13 Schick U, Dohnert J, Richter A, Konig A, Vitzthum HE. Microendoscopic lumbar discectomy versus open surgery: an intraoperative EMG study. Eur Spine J 2002; 11:20–26.
14 Hermantin FU, Peters T, Quartararo L, Kambin P. A prospective, randomized study comparing the results of open discectomy with those of video-assisted arthroscopic microdiscectomy. JBJS 1999; 81:958–965.
15 Dasenbrock HH, Juraschek SP, Schultz LR, Witham TF, Sciubba DM, Wolinsky JP, *et al.* The efficacy of minimally invasive discectomy compared with open discectomy: a meta-analysis of prospective randomized controlled trials. J Neurosurg Spine 2012; 16:452–462.
16 Nakagawa H, Kamimura M, Uchiyama S, Takahara K, Itsubo T, Miyasaka T. Microendoscopic discectomy (MED) for lumbar disc prolapse. J Clin Neurosci 2003; 10:231–235.
17 Arts MP, Brand R, van den Akker ME, Koes BW, Bartels RH, Tan WF, *et al.* Tubular diskectomy vs conventional microdiskectomy for the treatment of lumbar disk herniation: 2-year results of a double-blind randomized controlled trial. Neurosurgery 2011; 69:135–144; discussion 44.
18 Liu W-G, Wu X-T, Min J, Guo J-H, Zhuang S-Y, Chen X-H, *et al.* Long-term outcomes of percutaneous lumbar discectomy and microendoscopic discectomy for lumbar disc herniation. Zhonghua Yi Xue Za Zhi 2009; 89:750–753.
19 Li SH, Li HZ, Zhao JR. Clinical comparison between micro-endoscopic discectomy (MED) and open discectomy for treatment of lumbar disc herniation. Zhongguo Gu Shang 2008; 21:349–351.