

A Systematic Review on the Comparison between Lumbar Disc Hernia Resection by Endoscopy and Microdiscectomy

Iván Ulises Sámano López, Ernesto Eduardo Galván Hernández, Rafael Avendaño Pradel, José Armando Biebrich Murguía, Emmanuel Cantú Chávez, Thania Karina Gutiérrez Anchondo

Centro Médico ABC, Ciudad de México, México

Email: ivanqx@hotmail.com

How to cite this paper: López, I.U.S., Hernández, E.E.G., Pradel, R.A., Murguía, J.A.B., Chávez, E.C. and Anchondo, T.K.G. (2025) A Systematic Review on the Comparison between Lumbar Disc Hernia Resection by Endoscopy and Microdiscectomy. *Open Journal of Modern Neurosurgery*, 15, 29-36.
<https://doi.org/10.4236/ojmn.2025.151004>

Received: November 5, 2024

Accepted: January 7, 2025

Published: January 10, 2025

Copyright © 2025 by author(s) and Scientific Research Publishing Inc.
This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

Background: Surgical treatment of lumbar disc herniation is a widely debated topic, with several techniques available. Percutaneous endoscopic discectomy (PELD) has gained popularity due to its lower invasiveness compared to conventional techniques such as microdiscectomy/open lumbar microdiscectomy (OLMD)/tubular microdiscectomy (TMD). However, evidence on the effectiveness, recovery time and complications of these techniques is not yet clearly established. This systematic review aims to compare the preoperative and postoperative outcomes of both techniques. **Methods:** A comprehensive search was performed in databases including PubMed and Cochrane, following strict inclusion and exclusion criteria. Comparative studies and narrative reviews on PELD and OLMD/TMD published between 2019 and 2024 were included. Key outcomes considered were pre- and postoperative Visual Analogue Scale (VAS), hospitalization time, time to return to work, and postoperative complications. **Results:** The reviewed studies indicated that PELD is associated with a greater reduction in postoperative pain compared to OLMD/TMD, with a significant decrease in VAS, according to the study by Priola *et al.* (2019). The hospital stay was also shorter for patients undergoing PELD, averaging 2 days compared to OLMD/TMD. Furthermore, PELD favored a faster return to work and had a lower rate of postoperative complications, such as dural tears and reoperations, compared to OLMD/TMD. **Conclusions:** PELD demonstrates clear advantages over OLMD/TMD in terms of pain reduction, shorter hospital stay, faster return to work, and fewer postoperative complications. However, the implementation of this technique requires a significant learning curve, suggesting that its effectiveness may vary depending on the surgeon's experience. PELD should be considered a preferred option in the resection of

lumbar disc herniations, especially in patients seeking a quick and less invasive recovery.

Keywords

Percutaneous Endoscopic Discectomy (PELD), Microdiscectomy/Open Lumbar Microdiscectomy (OLMD)/Tubular Microdiscectomy (TMD), Lumbar Disc Herniation, Minimally Invasive Surgery, Postoperative Recovery, Postoperative Complications

1. Introduction

Lumbar disc herniation (LDH) is a common medical condition with a pathological process that leads to spinal surgery. The annulus fibrosus of an intervertebral disc fracture and allows the soft central portion, the nucleus pulposus, to protrude beyond the damaged annulus fibrosus [1]. Lumbar disc herniation is a major cause of low back pain and sciatica [2]. Advances in surgical techniques have provided minimally invasive approaches for its treatment, including percutaneous endoscopic discectomy (PELD) and microdiscectomy [3]. The most common complications within this procedure are dural tears, epidural hematoma, transient dysesthesia, and incomplete decompression [4]. This article aims to compare clinical outcomes, complications, and recovery between both techniques.

2. Methods

Embase databases until October 2024, using terms such as “percutaneous endoscopic lumbar discectomy”, “lumbar microdiscectomy”, “lumbar disc herniation”, and “minimally invasive spine surgery”. Studies were included that compared both techniques in terms of efficacy, recovery times, complications and hernia recurrence, where discectomy and microdiscectomy were used. A revision of articles published between 2019 and October 2024 was considered. Complete studies accessible in full text were included. Inclusion criteria were patients with symptoms of lumbar radiculopathy or disabling low back pain, patients who underwent percutaneous endoscopic discectomy (PELD) or open microdiscectomy (OLMD), patients with Modic changes 1 - 3 and studies with a minimum follow-up of 6 months. Exclusion criteria were those who received other types of spinal surgeries not related to discectomy or microdiscectomy, as well as those including patients with spinal tumor surgeries, spinal fusion, or severe scoliosis. (**Figure 1**)

3. Results

The systematic review included six studies that compared the postoperative outcomes of lumbar disc herniation resection using percutaneous endoscopic discectomy (PELD) versus microdiscectomy (OLMD) or micro endoscopic tubular resection (TMD). The studies presented outcomes in terms of Visual Analogue Pain

Scale (VAS), hospital stay, time to return to work, and postoperative complications.

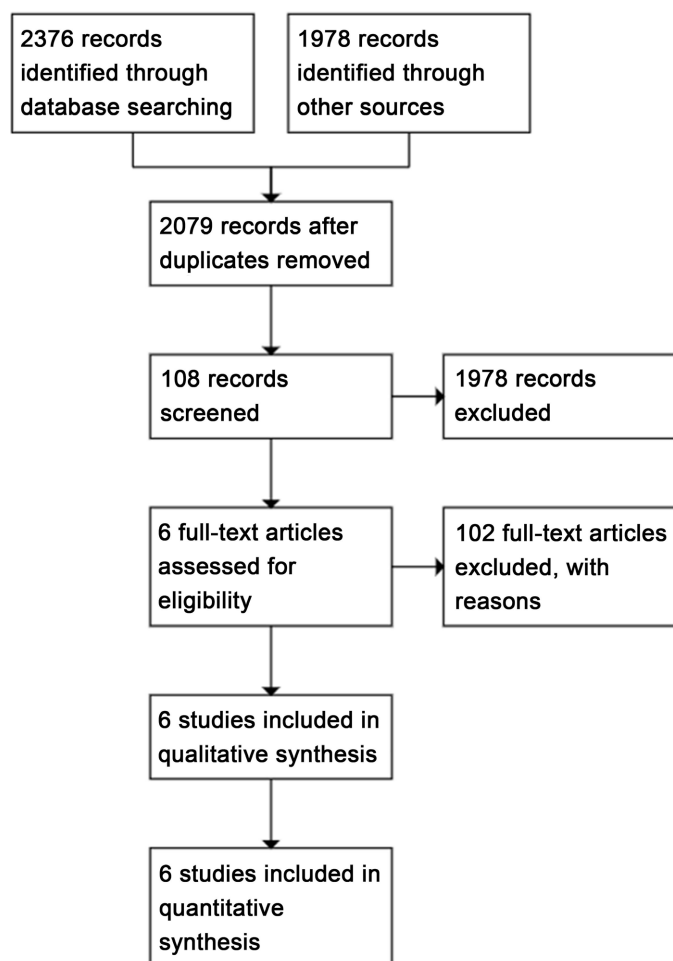


Figure 1. Flow diagram of the search and selection criteria for inclusion.

3.1. Preoperative and Postoperative VAS

The only study that reported specific preoperative VAS values was that of Priola *et al.* [5], in which patients undergoing both percutaneous endoscopic discectomy (PELD) and microdiscectomy (OLMD) presented a value of 8.5 on the pain scale before surgery. This data is relevant since it provides a quantitative reference of the initial state of the patients before undergoing either technique, allowing a more objective comparison regarding the effectiveness of the interventions in reducing pain. Regarding postoperative VAS, studies showed a significant reduction in pain in patients treated with PELD, going from an initial value of 8.5 to 3 years after the intervention. [5]-[8] Other studies also reported that the PELD technique resulted in better results in terms of postoperative pain reduction, although exact values were not provided in those studies. [5]-[8] These findings highlight the superiority of PELD in the long-term improvement of pain compared to microdiscectomy. (Table 1)

Table 1. Systematic review (preoperative and postoperative VAS).

Author	Type of Study	Technique	Preoperative VAS	Postoperative VAS
Teles <i>et al.</i> (2024)	Comparative study	PELD vs. TMD	Not specified.	Not specified, but there are no significant differences between PELD and TMD.
Jung <i>et al.</i> (2023)	Narrative Review	PELD/OLMD	Not specified	Not specified, but high efficacy in both techniques.
Lee & Ahn (2021)	Narrative Review	PELD/OLMD	Not specified	Not specified, but significant improvement in PELD is mentioned.
Bombieri <i>et al.</i> (2022)	Systematic Review	PELD/OLMD	Not reported	Best for PELD
Wei <i>et al.</i> (2021)	Systematic Review (NMA)	PELD/OLMD	Not reported	Significant improvement
Priola <i>et al.</i> (2019)	Pilot study (Cohort)	PELD/OLMD	8.5	0.5 (3 years)

Note: PELD = Percutaneous endoscopic discectomy. OLMD = Microdiscectomy. TMD = Discectomy tubular microendoscopic. VAS = Visual analogue pain scale.

3.2. Hospitalization Time

Discectomy (PELD) was consistently associated with shorter hospital stays compared to microdiscectomy (OLMD) and tubular discectomy (TMD) in all reviewed studies. Similarly, confirmed that PELD significantly reduces hospital stay, standing out as a minimally invasive option that allows for faster recovery and a reduction in hospital resources used. [5]-[8]

3.3. Time to Return to Work

In all reviewed studies, percutaneous endoscopic discectomy (PELD) favored a faster return to work compared to microdiscectomy (OLMD) or tubular discectomy (TMD). It was highlighted that patient undergoing PELD returned to their work activities in a significantly shorter time than those treated with OLMD, underlining the advantage of this minimally invasive technique in functional recovery (**Table 2**). [5]-[8]

Table 2. Systematic review (Hospitalization time and time to return to work).

Author	Type of Study	Technique	Hospitalization time (days)	Return to Work Time (weeks)
Teles <i>et al.</i> (2024)	Comparative study	PELD vs. TMD	Similar between PELD and TMD	Similar between PELD and TMD
Jung <i>et al.</i> (2023)	Narrative Review	PELD/OLMD	Shorter in PELD	PELD favored
Lee & Ahn (2021)	Narrative Review	PELD/OLMD	Shorter in PELD	Faster in PELD
Bombieri <i>et al.</i> (2022)	Systematic Review	PELD/OLMD	Comparable, but better in PELD	PELD: Faster than OLMD
Wei <i>et al.</i> (2021)	Systematic Review (NMA)	PELD/OLMD	PELD: Shorter	PELD: Faster than OLMD
Priola <i>et al.</i> (2019)	Pilot study (Cohort)	PELD/OLMD	2	Not specified

These findings suggest that PELD not only reduces hospital stay time but also allows for an earlier return to work, benefiting both patients and the healthcare system. The studies indicate that patients undergoing PELD had a faster recovery, with shorter hospital stays and an earlier return to work (on average, 4.5 weeks versus 6.6 weeks for microdiscectomy). Regarding complications, percutaneous endoscopic discectomy (PELD) showed a lower incidence of postoperative complications compared to microdiscectomy (OLMD) or tubular discectomy (TMD). Studies reported that PELD had fewer intraoperative and postoperative complications, such as dural tears. Likewise, other authors did not record any complications in patients undergoing PELD, while some studies indicated a lower rate of reoperations in patients treated with this technique. [5]-[8] highlighting its safety profile and the lower invasiveness of the procedure. The reoperation rate was similar in both groups, although PELD showed a greater tendency to minor recurrences related to incomplete resection of disc material in the early learning of surgeons. [5]-[8] (Table 3)

Table 3. Systematic review (complications).

Author	Type of Study	Technique	Complications
Teles <i>et al.</i> (2024)	Comparative study	PELD vs. TMD	Comparable, similar reoperations
Jung <i>et al.</i> (2023)	Narrative Review	PELD/OLMD	Less in PELD, but more studies are needed
Lee & Ahn (2021)	Narrative Review	PELD/OLMD	Except in PELD, significant learning curve
Bombieri <i>et al.</i> (2022)	Systematic Review	PELD/OLMD	Fewer reoperations in PELD
Wei <i>et al.</i> (2021)	Systematic Review (NMA)	PELD/OLMD	Less complications in PELD
Priola <i>et al.</i> (2019)	Pilot study (Cohort)	PELD/OLMD	No complications in PELD

Note: PELD = percutaneous endoscopic discectomy. OLMD = microdiscectomy. TMD = discectomy tubular microendoscopic.

4. Discussion

Both techniques are safe and effective for the treatment of lumbar disc herniation, offering pain relief and improved function. PELD has the advantage of being a minimally invasive technique that allows for faster recovery and lower initial complication rates, but requires a steeper learning curve. On the other hand, microdiscectomy remains the gold standard in terms of complete herniation resolution and a slightly lower reoperation rate. The results of this systematic review suggest that percutaneous endoscopic discectomy (PELD) offers several advantages over open microdiscectomy (OLMD) and microendoscopic tubular discectomy (TMD), particularly in terms of hospitalization time, return to work, and complication rate. Although the reviewed studies did not always present specific data on preoperative and postoperative VAS values, most agree that PELD tends to be more effective in reducing pain, with faster postoperative recovery. Furthermore, the lower incidence of complications in PELD, as observed in several studies, sup-

ports the use of this minimally invasive technique as an effective alternative to OLMD, especially in patients seeking faster recovery and fewer complications. However, studies such as those by Jung *et al.* [8] and Lee & Ahn [9] pointed out the need to consider the learning curve of PELD, which may affect outcomes in less experienced centers. The reviewed studies indicated that while both techniques are effective in reducing pain and improving function, PELD appears to be superior in terms of shorter hospital stay, shorter recovery time and fewer complications. However, further research is required to assess the long-term benefits and reduce variability between studies in terms of the accuracy of results. PELD represents a promising surgical option for patients with lumbar disc herniation, with significant pain reduction, shorter hospital stay and faster return to work compared to OLMD or TMD, and with a favorable complication profile. The results of this review support the use of percutaneous endoscopic discectomy (PELD) as an effective and safe technique for the resection of lumbar disc herniations, with several advantages over microdiscectomy (OLMD) and tubular discectomy (TMD). Reduced postoperative pain, shorter hospital stay, faster return to work, and lower incidence of complications make PELD a superior option for many patients. The PELD learning curve, mentioned by Lee & Ahn [9], is an aspect to consider as it may influence the results, but the potential benefits of this minimally invasive technique are evident. Both techniques are effective, with PELD demonstrating significant clinical advantages in terms of postoperative recovery, suggesting that it could be the preferred option in many clinical settings, especially in centers with experience in endoscopic procedures.

5. Conclusions

Discectomy (PELD) has been shown to be significantly effective in reducing postoperative pain compared to microdiscectomy (OLMD/TMD). In studies such as that of Priola *et al.* [5], a remarkable decrease in long-term pain was observed, confirming its effectiveness in the management of low back pain resulting from disc herniation. These results underline the ability of PELD to provide sustained relief in patients. Regarding hospitalization time, PELD consistently showed a reduction in hospital stay days compared to OLMD and TMD. All the reviewed studies agreed that PELD offers a faster recovery, positively impacting the efficiency of the health system by requiring fewer hospital resources. In addition, patients undergoing PELD also showed a faster return to work, as pointed out by studies such as those by Wei *et al.* [6] and Bombieri *et al.* [7], which reinforces the idea that this technique accelerates the functional recovery of patients. Additionally, PELD was associated with a lower complication rate compared to OLMD/TMD. This includes fewer reoperations and fewer intraoperative complications, suggesting that PELD is a safer and less invasive option. However, PELD presents a considerable learning curve, implying that outcomes may vary depending on the surgical experience available and that specialized training is required to maximize the benefits of the technique. PELD offers multiple advantages over OLMD and TMD, mainly in terms of faster recovery, shorter hospital stay, and fewer complications

[10]. However, its success is highly dependent on surgical experience [11]. Therefore, PELD should be considered a first-line option in lumbar disc herniation resection, especially in patients seeking a less invasive procedure with accelerated recovery [12]-[14].

Acknowledgements

The authors are grateful to the participants and researchers of the primary studies identified for the present review.

Conflicts of Interest

The authors declare that they have no competing interests.

References

- [1] Zhang, B., Liu, S., Liu, J., Yu, B., Guo, W., Li, Y., *et al.* (2018) Transforaminal Endoscopic Discectomy versus Conventional Microdiscectomy for Lumbar Disc herniation: A Systematic Review and Meta-Analysis. *Journal of Orthopaedic Surgery and Research*, **13**, Article No. 169. <https://doi.org/10.1186/s13018-018-0868-0>
- [2] Gadjradj, P.S., Harhangi, B.S., Amelink, J., van Susante, J., Kamper, S., van Tulder, M., *et al.* (2020) Percutaneous Transforaminal Endoscopic Discectomy versus Open Microdiscectomy for Lumbar Disc Herniation. *Spine*, **46**, 538-549. <https://doi.org/10.1097/brs.0000000000003843>
- [3] Gadjradj, P.S., Rubinstein, S.M., Peul, W.C., Depauw, P.R., Vleggeert-Lankamp, C.L., Seiger, A., *et al.* (2022) Full Endoscopic versus Open Discectomy for Sciatica: Randomised Controlled Non-Inferiority Trial. *BMJ*, **376**, e065846. <https://doi.org/10.1136/bmj-2021-065846>
- [4] Ju, C.I. and Lee, S.M. (2023) Complications and Management of Endoscopic Spinal Surgery. *Neurospine*, **20**, 56-77. <https://doi.org/10.14245/ns.2346226.113>
- [5] Priola, S.M., Ganau, M., Raffa, G., Scibilia, A., Farrash, F. and Germanò, A. (2019) A Pilot Study of Percutaneous Interlaminar Endoscopic Lumbar Sequestrectomy: A Modern Strategy to Tackle Medically-Refractory Radiculopathies and Restore Spinal Function. *Neurospine*, **16**, 120-129. <https://doi.org/10.14245/ns.1836210.105>
- [6] Wei, F.L., Zhou, C.P., Zhu, K.L., Du, M.R., Liu, Y., Heng, W., Wang, H., Yan, X.D., Sun, L.L. and Qian, J.X. (2021) Comparison of Different Operative Approaches for Lumbar Disc Herniation: A Network Meta-Analysis and Systematic Review. *Pain Physician*, **24**, E381-E392.
- [7] Bombieri, F.F., Shafafy, R. and Elsayed, S. (2022) Complications Associated with Lumbar Discectomy Surgical Techniques: A Systematic Review. *Journal of Spine Surgery*, **8**, 377-389. <https://doi.org/10.21037/jss-21-59>
- [8] Jung, B., Han, J., Song, J., Ngan, A., Essig, D. and Verma, R. (2023) Interventional Therapy and Surgical Management of Lumbar Disc Herniation in Spine Surgery: A Narrative Review. *Orthopedic Reviews*, **15**. <https://doi.org/10.52965/001c.88931>
- [9] Lee, S.G. and Ahn, Y. (2021) Transforaminal Endoscopic Lumbar Discectomy: Basic Concepts and Technical Keys to Clinical Success. *International Journal of Spine Surgery*, **15**, S38-S46. <https://doi.org/10.14444/8162>
- [10] Hamawandi, S.A., Sulaiman, I.I. and Al-Humairi, A.K. (2020) Open Fenestration Discectomy versus Microscopic Fenestration Discectomy for Lumbar Disc Herniation: A Randomized Controlled Trial. *BMC Musculoskeletal Disorders*, **21**, Article

No. 384. <https://doi.org/10.1186/s12891-020-03396-x>

- [11] Teles, P., Pereira, P., Silva, C., Vaz, R. and Santos Silva, P. (2024) Minimally Invasive Treatment for Lumbar Disc Herniation: A Matched Comparison between Tubular Microdiscectomy and Percutaneous Endoscopic Lumbar Discectomy. *Cureus*, **16**, e57589. <https://doi.org/10.7759/cureus.57589>
- [12] Meyer, G., Da Rocha, I.D., Cristante, A.F., Marcon, R.M., Coutinho, T.P., Torelli, A.G., *et al.* (2020) Percutaneous Endoscopic Lumbar Discectomy versus Microdiscectomy for the Treatment of Lumbar Disc Herniation: Pain, Disability, and Complication Rate—A Randomized Clinical Trial. *International Journal of Spine Surgery*, **14**, 72-78. <https://doi.org/10.14444/7010>
- [13] Liang, Z.Y., Zhuang, Y.D., Chen, C.M. and Wang, R. (2019) Clinical Evaluation of Percutaneous Transforaminal Endoscopic Discectomy (PTED) and Paraspinal Minitubular Microdiscectomy (PMTM) for Lumbar Disc Herniation: Study Protocol for a Randomised Controlled Trial. *BMJ Open*, **9**, e033888. <https://doi.org/10.1136/bmjopen-2019-033888>
- [14] Pahwa, B., Tayal, A., Chowdhury, D., Umana, G.E. and Chaurasia, B. (2023) Endoscopic versus Microscopic Discectomy for Pathologies of Lumbar Spine: A Nationwide Cross-Sectional Study from a Lower-Middle-Income Country. *Journal of Craniovertebral Junction and Spine*, **14**, 373-380. https://doi.org/10.4103/jcvjs.jcvjs_39_23

Abbreviations

LDH: Lumbar disk herniation; MD: Microdiscectomy; MI: Minimally invasive; PRISM: Preferred Reporting Items for Systematic Reviews.