ISSN: 2474-9206

Research Article

Journal of Anesthesia & Pain Medicine

Percutaneous Transforaminal Endoscopic Discectomy Under Low-Dose Analgesic Spinal Anesthesia: Clinical and Functional Outcomes of a Single-Center Case Series

Francesco Saturno[1]*, Giulia Monaco[1], Angela Salerno[2], Antonio Cianciola[3], Nicole Cianciola[3] and Emidio Cianciola[1]

[1]UOC Anestesia, Rianimazione e Terapia del Dolore, P.O. Sapri, ASL Salerno, Italy

[2]UdR-Servizio Trasfusionele, P.O. Sapri, ASL Salerno, Italy

[3]Saint Camillus International University of Health and Medical Sciences (UniCamillus), Rome, Italy

***Corresponding Author**
Francesco Saturno, UOC Anestesia, Rianimazione e Terapia del Dolore, P.O. Sapri, ASL Salerno, Italy.

Submitted: 2026, Jun 18 **Accepted:** 2026, Jul 20; **Published:** 2026, Jul 28

Citation: Saturno, F., Monaco, G., Salerno, A., Cianciola, A., Cianciola, N., et al. (2026). Percutaneous Transforaminal Endoscopic Discectomy Under Low-Dose Analgesic Spinal Anesthesia: Clinical and Functional Outcomes of a Single-Center Case Series. *J Anesth Pain Med, 11*(2), 01-05.

Abstract

Background: *Percutaneous Transforaminal Endoscopic Discectomy (PTED) has become an established minimally invasive procedure for the treatment of lumbar disc herniation. The possibility of performing the procedure under low-dose analgesic spinal anesthesia while preserving patient cooperation may further improve procedural safety through continuous neurological monitoring.*

Objective: *To evaluate the feasibility, safety, and medium-term clinical outcomes of PTED performed under low-dose spinal analgesia in a consecutive single-center series.*

Methods: *A retrospective observational study was conducted on 60 consecutive patients treated between January 2022 and December 2024. Demographic characteristics, operative variables, complications, recurrence rate, pain intensity (VAS), functional disability (ODI), modified MacNab classification, and patient satisfaction were assessed over a 24-month follow-up.*

Results: *The mean age was 45 ± 11 years, 70% of patients were male, and the mean BMI was 28 ± 3.4 kg/m². Mean operative time was 59 ± 14 minutes, while average hospital stay was 3.1 ± 0.8 days. Mean VAS improved from 8.2 ± 0.9 preoperatively to 2.1 ± 1.2 at 24 months ($p < 0.001$). Mean ODI decreased from 56 ± 11% to 21 ± 8% ($p < 0.001$). According to the modified MacNab criteria, 86.7% of patients achieved excellent or good outcomes. Minor complications occurred in 11.7% of patients and resolved with conservative treatment. Three patients (5%) developed recurrent disc herniation requiring revision surgery.*

Conclusions: *PTED performed under low-dose analgesic spinal anesthesia appears to be a safe and reproducible minimally invasive procedure, providing durable pain relief, functional recovery, and preservation of intraoperative neurological monitoring.*

Keywords: Percutaneous Endoscopic Lumbar Discectomy, PTED, Lumbar Disc Herniation, Awake Spine Surgery, Spinal Analgesia

1. Introduction

Lumbar disc herniation is among the most common causes of chronic radicular pain and disability in adults. Although conservative treatment remains the first therapeutic option, surgery is indicated in patients with persistent radiculopathy, neurological deficits, or disabling pain refractory to medical therapy and rehabilitation. Percutaneous Transforaminal Endoscopic Discectomy (PTED) has progressively evolved into a well-established minimally invasive alternative to conventional microdiscectomy. By accessing the disc through Kambin's triangle, PTED minimizes paraspinal muscle trauma, preserves posterior spinal structures, reduces postoperative pain, and facilitates early mobilization. Most published reports describe PTED under general anesthesia or conscious sedation. However, performing the procedure under low-dose spinal analgesia offers the potential advantage of maintaining patient cooperation throughout surgery, thereby allowing continuous neurological monitoring during nerve root manipulation. The present study describes our institutional experience with PTED performed under selective low-dose spinal anesthesia and evaluates its clinical outcomes, perioperative safety, and medium-term follow-up.

2. Materials and Methods

2.1. Study Design

This retrospective observational study included consecutive patients undergoing PTED at the Pain Medicine and Minimally Invasive Spine Unit of Sapri Hospital between January 2022 and December 2024.

2.2. Patient Population

Sixty consecutive patients met the inclusion criteria.

The mean age was 45 ± 11 years, and 42 patients (70%) were male.

The mean BMI was 28 ± 3.4 kg/m².

Affected levels included:

- L3–L4: 6 patients (10%)
- L4–L5: 37 patients (62%)
- L5–S1: 17 patients (28%)

All patients had symptomatic single-level lumbar disc herniation with persistent radicular pain despite at least 12 weeks of conservative treatment.

2.3. Surgical Technique

Patients were positioned prone on thoraco-pelvic supports. Selective spinal analgesia was obtained using 6 mg of 0.2% ropivacaine, providing adequate analgesia while preserving voluntary motor function and partial sensory feedback. Following fluoroscopic localization, an 18G spinal needle was advanced through Kambin's triangle. Progressive foraminoplasty was performed using sequential drills until an 8–9 mm working channel was obtained. A working cannula and endoscope were introduced, allowing direct visualization and selective removal of the herniated disc fragment (Figure 1). The study was performed using the RiwoSpine surgical instrumentation and the EndoSmart sterile procedural kits.

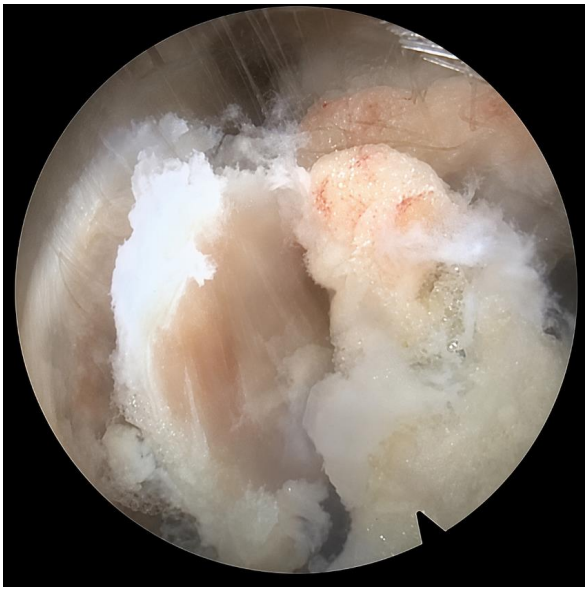

Figure 1: Endoscopic intradiscal view following percutaneous mechanical discectomy, demonstrating the decompressed intradiscal cavity after removal of degenerated nucleus pulposus the mean operative time was **59 ± 14 minutes**

2.4. Outcome Measures

Clinical evaluation was performed preoperatively and at:

- 30 days
- 3 months
- 6 months
- 12 months
- 24 months

Primary outcomes included pain intensity measured using the Visual Analog Scale (VAS) and functional disability assessed

with the Oswestry Disability Index (ODI). Secondary outcomes included modified MacNab classification, operative time, hospital stay, postoperative complications, recurrence rate, patient satisfaction, and return to normal daily activities.

3. Results

All sixty procedures were completed successfully without conversion to open surgery or general anesthesia. Mean operative time was **59 ± 14 minutes**, while mean hospital stay was **3.1 ± 0.8 days**.

3.1. Pain Outcomes

Mean VAS leg pain significantly improved from **8.2 ± 0.9** before surgery to:

- **2.9 ± 1.3** at 30 days
- **2.3 ± 1.2** at 6 months
- **2.2 ± 1.1** at 12 months
- **2.1 ± 1.2** at 24 months

The improvement remained stable throughout follow-up (**$p < 0.001$**).

3.2. Functional Outcomes

Mean ODI improved from **56 ± 11%** preoperatively to:

- **30 ± 11**% at 3 months
- **24 ± 9%** at 12 months
- **21 ± 8%** at 24 months

representing a statistically significant functional recovery (**$p < 0.001$**).

3.3. Clinical Outcome

According to the modified MacNab classification:

- Excellent: 37 patients (61.7%)
- Good: 15 patients (25.0%)
- Fair: 5 patients (8.3%)
- Poor: 3 patients (5.0%)

Overall, **86.7%** of patients achieved an excellent or good outcome. Patients returned to normal daily activities after a mean of **24 ± 8 days**. Overall satisfaction was high, with **91%** of patients reporting they would choose the same procedure again.

3.4. Complications

No permanent neurological deficits, deep surgical site infections, symptomatic epidural hematomas, vascular injuries, or cauda equina syndrome were observed.

Minor complications included:

- transient postoperative radiculitis in 4 patients (6.7%);
- transient lower-limb dysesthesia in 2 patients (3.3%);
- post-dural puncture headache in 1 patient (1.7%).

All resolved following conservative management. Three patients (5%) developed recurrent lumbar disc herniation during the 24-month follow-up and underwent successful revision surgery.

Outcome	Value
Study population	60 patients
Mean age (years)	45 ± 11
Male sex	42 (70%)
Mean BMI (kg/m²)	28 ± 3.4
Primary treated level	L4–L5 (62%)
Mean operative time (min)	59 ± 14
Mean hospital stay (days)	3.1 ± 0.8
Conversion to open surgery	None
Conversion to general Anesthesia	None
Baseline VAS	8.2 ± 0.9
VAS at 24 months	2.1 ± 1.2
Baseline ODI (%)	56 ± 11
ODI at 24 months (%)	21 ± 8
Excellent/Good MacNab outcome	52/60 (86.7%)
Return to daily activities (days)	24 ± 8
Overall patient satisfaction	91%
Minor complications	7/60 (11.7%)
Permanent neurological deficit	None
Deep surgical site infection	None
Symptomatic epidural hematoma	None
Vascular injury	None
Cauda equina syndrome	None

Recurrent lumbar disc herniation	3/60 (5%)
Revision surgery	3 patients

Table 1: Summary of demographic characteristics, perioperative variables, clinical outcomes, complications, and medium-term follow-up of patients undergoing percutaneous transforaminal endoscopic discectomy under low-dose analgesic spinal anesthesia

4. Discussion

This single-center experience suggests that PTED performed under low-dose analgesic spinal anesthesia is technically feasible, safe, and associated with favorable medium-term clinical outcomes. The principal innovation of our protocol lies in the anesthetic strategy. Administration of 6 mg of 0.2% ropivacaine produced selective spinal analgesia while preserving voluntary lower-limb movement and continuous communication with the patient. This allowed immediate neurological feedback during decompression and may represent an additional safety advantage compared with procedures performed under general anesthesia. Clinical improvement was substantial and remained stable throughout the 24-month follow-up, with significant reductions in pain and disability accompanied by a high rate of favorable MacNab outcomes.

The recurrence rate of 5% and the low incidence of transient neurological complications are comparable with those reported in contemporary PTED literature, supporting the reproducibility of the technique when performed by an experienced multidisciplinary team.

The absence of major neurological complications and the rapid return to normal daily activities further reinforce the minimally invasive nature of the procedure. The present study has several limitations, including its retrospective design, single-center setting, relatively small sample size, and lack of a comparative control group. Larger prospective multicenter studies comparing awake PTED with conventional anesthetic techniques are warranted to determine whether selective spinal analgesia translates into superior neurological safety, patient satisfaction, and healthcare efficiency.

5. Conclusions

PTED performed under low-dose analgesic spinal anesthesia represents a promising minimally invasive option for the treatment of selected patients with lumbar disc herniation. In this illustrative example, the procedure was associated with significant improvements in pain and functional disability, rapid postoperative recovery, high patient satisfaction, and a low incidence of complications and recurrence. Future prospective randomized studies should further investigate the role of awake spinal anesthesia in endoscopic lumbar spine surgery and clarify its potential advantages over conventional anesthetic approaches [1-25] .

Conflict of Interest

The authors declare no conflicts of interest.

Funding

No external funding was received.

Ethics Statement

Ethics approval and informed consent should be obtained according to local regulations before conducting observational clinical studies.

References

1. Ruetten, S., Komp, M., Merk, H., & Godolias, G. (2008). Full-endoscopic interlaminar and transforaminal lumbar discectomy versus conventional microsurgical technique: A prospective, randomized, controlled study. *Spine, 33*(9), 931–939.
2. Hoogland, T., Schubert, M., Miklitz, B., & Ramirez, A. (2006). Transforaminal posterolateral endoscopic discectomy with or without the combination of a low-dose chymopapain: A prospective randomized study. *Spine, 31*(24), E890–E897.
3. Ahn, Y. (2020). Percutaneous endoscopic lumbar discectomy: Surgical technique and outcomes. *Neurosurgical Clinics of North America, 31*(1), 19–27.
4. Choi, G., Lee, S. H., Bhanot, A., Raiturker, P. P., & Chae, Y. S. (2007). Percutaneous endoscopic discectomy for extraforaminal lumbar disc herniations. *Spine, 32*(2), E93–E99.
5. Yeung, A. T., & Tsou, P. M. (2002). Posterolateral endoscopic excision for lumbar disc herniation: Surgical technique, outcome, and complications in 307 consecutive cases. *Spine, 27*(7), 722–731.
6. Kambin, P., & Gellman, H. (1983). Percutaneous lateral discectomy of the lumbar spine: A preliminary report. *Clinical Orthopaedics and Related Research, 174*, 127–132.
7. Barber, S. M., Nakhla, J., Konakondla, S., et al. (2022). Awake minimally invasive spine surgery: Current evidence and future directions. *Journal of Neurosurgery: Spine, 36*(1), 1–10.
8. Wang, M. Y., & Grossman, J. (2016). Endoscopic minimally invasive transforaminal interbody fusion without general anesthesia: Initial clinical experience. *Neurosurgical Focus, 40*(2), E13.
9. Sivaganesan, A., Hirsch, B. P., Phillips, F. M., & McGirt, M. J. (2018). Spine surgery in ambulatory surgery centers: A systematic review. *Spine, 43*(7), E129–E137.
10. Phan, K., Xu, J., Schultz, K., et al. (2017). Full-endoscopic versus microdiscectomy for lumbar disc herniation: Systematic review and meta-analysis. *World Neurosurgery, 100*, 624–631.
11. Li, X. C., Zhong, C. F., Deng, G. B., Liang, R. W., & Huang, C. M. (2016). Full-endoscopic procedures versus traditional discectomy surgery for lumbar disc herniation: A meta-analysis. *European Spine Journal, 25*(5), 1377–1387.
12. Rasouli, M. R., Rahimi-Movaghar, V., Shokraneh, F., et al. (2014). Minimally invasive discectomy versus microdiscectomy/open discectomy for symptomatic lumbar

disc herniation. *Cochrane Database of Systematic Reviews*, (9), CD010328.
13. Arts, M. P., Brand, R., van den Akker, M. E., et al. (2009). Tubular diskectomy vs conventional microdiskectomy for the treatment of lumbar disk herniation: Two-year results of a double-blind randomized controlled trial. *JAMA, 302*(2), 149–158.
14. Gibson, J. N. A., & Waddell, G. (2007). Surgical interventions for lumbar disc prolapse. *Cochrane Database of Systematic Reviews*, (2), CD001350.
15. Kreiner, D. S., Hwang, S. W., Easa, J. E., et al. (2014). An evidence-based clinical guideline for the diagnosis and treatment of lumbar disc herniation with radiculopathy. *The Spine Journal, 14*(1), 180–191.
16. North American Spine Society. (2022). Evidence-based clinical guidelines for multidisciplinary spine care: Diagnosis and treatment of lumbar disc herniation with radiculopathy.
17. Chou, R., Loeser, J. D., Owens, D. K., et al. (2009). Interventional therapies, surgery, and interdisciplinary rehabilitation for low back pain: An evidence-based clinical practice guideline. *Spine, 34*(10), 1066–1077.
18. Wu, X., Fan, G., Gu, X., et al. (2018). Percutaneous endoscopic lumbar discectomy for lumbar disc herniation: A systematic review and meta-analysis. *Pain Physician, 21*(5), E507–E517.
19. Birkenmaier, C., Komp, M., Leu, H. F., et al. (2020). The current status of endoscopic disc surgery. *Orthopedic Clinics of North America, 51*(3), 399–409.
20. Wu, P. H., Kim, H. S., & Jang, I. T. (2020). Intervertebral disc diseases part 2: Minimally invasive and endoscopic treatment. *International Journal of Molecular Sciences, 21*(6), 2133.
21. Kim, H. S., Wu, P. H., & Jang, I. T. (2020). Lumbar endoscopic spine surgery: Where are we now? *Pain and Therapy, 9*(2), 305–317.
22. Hsu, H. T., Chang, S. J., Yang, S. S., & Chai, C. L. (2013). Learning curve of full-endoscopic lumbar discectomy. *Spine, 38*(25), 225–231.
23. Mayer, H. M., & Brock, M. (1993). Percutaneous endoscopic lumbar discectomy: Surgical technique and preliminary results. *Neurosurgery, 33*(4), 596–600.
24. Knight, M., Goswami, A., Patko, J., & Buxton, N. (1999). Endoscopic foraminoplasty and discectomy. *Spine, 24*(21), 2305–2310.
25. Deyo, R. A., Mirza, S. K., & Martin, B. I. (2006). Back pain prevalence and management. *New England Journal of Medicine, 354*(26), 279–281.