

Comparison of anesthesia techniques in laser hemorrhoid surgery: pudendal nerve block vs. spinal anesthesia

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ABSTRACT

Aims: Laser hemorrhoidoplasty (LHP) is a minimally invasive surgical procedure gaining popularity due to its low complication rate and rapid recovery. However, issues such as postoperative pain and urinary retention continue to adversely affect patient comfort. This study aimed to evaluate the effects of ultrasound-guided pudendal nerve block (PNB) under propofol sedation, compared to spinal anesthesia (SA), on postoperative pain control, analgesic requirement, urinary retention incidence, and patient satisfaction.

Methods: A prospective, randomized, controlled trial was conducted at Amasya University Sabuncuoğlu Şerefeddin Training and Research Hospital. Ninety-six patients diagnosed with grade 2–3 hemorrhoidal disease and scheduled for elective LHP were enrolled. Patients were divided into two groups: the PNB group (n=48) received PNB under propofol sedation, and the SA group (n=48) received SA. Postoperative pain intensity was assessed using the Visual Analog Scale (VAS) at 2, 4, 8, 16, 48, and 72 hours. Secondary outcomes included total analgesic consumption, urinary retention incidence, and patient satisfaction.

Results: At all time points, VAS scores were significantly lower in the PNB group compared to the SA group ($p<0.001$). Total analgesic consumption during the first 72 hours was markedly reduced in the PNB group ($p<0.001$). The incidence of urinary retention was 4.2% in the PNB group versus 22.9% in the SA group, demonstrating a significant difference ($p<0.001$). Patient satisfaction was significantly higher in the PNB group ($p<0.001$).

Conclusion: Ultrasound-guided PNB combined with propofol sedation provides superior postoperative pain control, reduces analgesic requirements, and lowers complication rates compared to SA in laser hemorrhoid surgery. This technique represents an effective and safe alternative that enhances patient satisfaction.

Keywords: Laser hemorrhoidoplasty, pudendal nerve block, spinal anesthesia, postoperative pain, patient satisfaction

INTRODUCTION

Hemorrhoidal disease is common and substantially impairs quality of life by affecting the rectum and anal canal.¹ In the adult population, hemorrhoidal symptoms are reported in approximately 4.4% of individuals, and the condition tends to progress in a considerable proportion of patients over time.² Advanced-stage cases frequently require surgical treatment; however, severe postoperative pain prolongs recovery and adversely affects patient satisfaction.³ Conventional excisional hemorrhoidectomy techniques (Milligan–Morgan, Ferguson) are effective in eliminating rectal bleeding and prolapse, but they are associated with marked postoperative pain, delayed mobilization, and prolonged healing.^{4,5} To mitigate these drawbacks, minimally invasive techniques such as laser hemorrhoidoplasty (LHP) have gained popularity due to advantages including less postoperative pain, earlier return to daily activities, and shorter hospital stay.^{6,7}

While the minimally invasive nature of the procedure improves patient comfort, the choice of anesthesia is also critical for maintaining intraoperative hemodynamic stability and minimizing postoperative pain.⁸ The use of regional anesthesia techniques in hemorrhoid surgery has increased in recent years.⁹ Spinal anesthesia (SA), depending on the level of injection, typically blocks lower thoracic, lumbar, and sacral nerve roots, affecting the lower extremities, lower abdomen, and perineal region; however, it may cause adverse effects such as hypotension, urinary retention, and delayed mobilization.¹⁰ As an alternative, the pudendal nerve block (PNB) provides targeted innervation of the anal canal and perineal region through a more localized block and has drawn attention for its clinical effectiveness in recent years.¹¹

The beneficial effects of PNB on postoperative pain have been demonstrated in several studies, and the PROSPECT

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(PROCEDURE SPECIFIC postoperative pain management) group lists it among the recommended techniques for hemorrhoid surgery.¹² In a comparative study by Tepetes et al.,¹³ PNB was reported to be superior to local anesthesia with respect to postoperative pain and analgesic consumption. Moreover, because it does not produce sympathetic blockade, PNB has been associated with lower rates of complications such as postoperative hypotension and urinary retention compared with SA.¹⁴

Nevertheless, randomized controlled trials directly comparing PNB and SA specifically in patients undergoing LHP are scarce. Given this gap, high-quality studies evaluating how anesthesia protocols affect patient comfort are needed. Accordingly, we designed a prospective, randomized, controlled clinical study at Amasya University Sabuncuoğlu Şerefeddin Training and Research Hospital to compare SA with ultrasound-guided PNB administered under propofol sedation in patients with grade II–III hemorrhoidal disease undergoing LHP. The study evaluates the effects of these two techniques on postoperative pain control, postoperative analgesic requirements, incidence of urinary retention, and patient satisfaction.

METHODS

This study was conducted between March and July 2025 at Amasya University Sabuncuoğlu Şerefeddin Training and Research Hospital. Approval was obtained from the Amasya University Non-interventional Clinical Researches Ethics Committee (Date: 24.02.2025, Decision No: E-30640013-050.04-246920). All procedures were planned in accordance with the Declaration of Helsinki and Good Clinical Practice guidelines; written informed consent was obtained from all participants. A total of 96 patients were enrolled: adults aged 18–75 years with American Society of Anesthesiologists (ASA) physical status I–II, diagnosed with grade II–III hemorrhoidal disease, and scheduled for elective LHP. Exclusion criteria were: age <18 years; history of allergy to local anesthetics; pelvic floor dysfunction (rectocele, rectal prolapse, fecal incontinence); previous proctologic surgery (e.g., anal stenosis); major neurological disorders (e.g., paraplegia, neurogenic bladder); inflammatory bowel disease; anorectal malignancy; unavailable or incomplete postoperative follow-up data; cutaneous infection at the intended injection site; and refusal of regional anesthesia techniques. All patients were instructed and trained to use the Visual Analog Scale (VAS; 0=no pain, 10=worst imaginable pain) for postoperative pain assessment.

Group 1 (PNB+propofol sedation; n=48): Bilateral, ultrasound-guided PNB was performed and sedation was provided with propofol. Group 2 (SA; n=48): SA was administered via the L3–L4 interspace. The same surgical procedure was applied in both groups. Hemodynamic parameters were tracked and respiratory function was monitored throughout the intervention. Postoperative evaluations were performed by general surgery and anesthesia specialists at prespecified time points.

Postoperative outcomes assessed: Pain: VAS scores at 2, 4, 8, 16, 48, and 72 hours. Analgesic consumption: total use at 0–24 hours and 24–72 hours. Urinary retention: incidence within

the first 24 hours. Patient satisfaction: visual scale scored 1 (very poor) to 5 (excellent) prior to discharge. Adverse events/complications: hypotension, nausea–vomiting, and respiratory depression were documented.

Statistical Analysis

The data analyses were performed using IBM SPSS Statistics for Windows, version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean±standard deviation (SD) and compared between groups using the independent-samples t test or the Mann–Whitney U test, according to distributional characteristics. Categorical variables were expressed as counts (n) and percentages (%) and compared using the Chi-square test or, when appropriate, Fisher's exact test. A two-sided p value <0.05 was considered statistically significant.

Anesthesia Methods

All patients were evaluated preoperatively in the anesthesia clinic, and risk stratification was performed according to the ASA classification. A 6-hour preoperative fasting period was observed before transfer to the operating room. A peripheral intravenous line was established with a 20-G cannula, and a Ringer's lactate infusion was initiated at 100 ml/h. For premedication, 2 mg intravenous midazolam was administered. Throughout the procedure, patients were continuously monitored using non-invasive blood pressure measurement, electrocardiography (ECG), peripheral oxygen saturation (SpO₂), and respiratory rate.

Group 1—Pudendal nerve block (PNB) with sedation: Patients in group 1 underwent bilateral, ultrasound-guided PNB in the lithotomy position. Using a low-frequency (2–5 MHz) curved transducer placed along the line between the greater trochanter and the posterior superior iliac spine, the internal pudendal artery and pudendal nerve bundle were identified proximal to Alcock's canal. An in-plane approach with a 22-G needle was used to reach the target. Bupivacaine 0.5% was injected 10 ml per side (total 20 ml). Block efficacy was confirmed by reduced sensation and pain in the anal/perineal region. For sedation, continuous infusions of propofol 2–3 mg/kg/h and remifentanyl 4–6 µg/kg/h were administered and titrated to deep sedation prior to incision; the level of sedation was monitored clinically using the Ramsay Sedation Scale.

Group 2—Spinal anesthesia (SA): Under sterile conditions, SA was performed at the L3–L4 interspace with the patient in the sitting position. A 25-G spinal needle was advanced into the subarachnoid space, and 2 ml of 0.5% hyperbaric bupivacaine was administered. The target sensory block level was the T12 dermatome. Following injection, patients were positioned in lithotomy, and the block level was verified prior to incision. In both groups, patients were then placed in the standard surgical position for LHP.

Intraoperative Monitoring and Intervention Protocol

Hemodynamic stability was maintained and respiratory function was continuously monitored in both groups throughout surgery. Respiratory depression was defined

as a respiratory rate <8 breaths/min or SpO₂ <94%; when detected, the propofol infusion was reduced, airway patency was optimized with positional maneuvers, and laryngeal mask ventilation was provided if necessary. Hypotension was defined as a >20% decrease from baseline systolic blood pressure or an absolute SBP <90 mmHg and was treated with 6 mg IV ephedrine. All intraoperative parameters were recorded and included in postoperative analyses. Surgical procedures in both groups were performed by the same team using a standardized LHP technique.

Surgical Procedure

All operations were performed using a minimally invasive technique; no additional excisional hemorrhoidectomy was undertaken. LHP involved inserting a dedicated laser fiber into each hemorrhoidal cushion and delivering controlled laser energy to achieve tissue ablation and volume reduction. Owing to the minimal need for incision and reduced intraoperative bleeding, this approach is considered a safe surgical option. All procedures were carried out by the same surgical team using a standardized protocol. A 1470-nm diode laser was used with a power setting of 8–12 W. Controlled doses of energy were applied at the base of each hemorrhoidal cushion to accomplish ablation with concomitant vessel coagulation and tissue retraction, thereby minimizing the risk of postoperative bleeding. This protocol was implemented to promote low postoperative pain, early mobilization, and rapid recovery, and its surgical effectiveness and patient safety were evaluated in detail.

Postoperative Assessment

Patients were instructed to assess pain using the VAS (VAS; 0=no pain, 10=worst pain). The following parameters were systematically recorded during clinical follow-up: Primary outcome: Postoperative pain: VAS scores at 2, 4, 8, 16, 48, and 72 hours after surgery. Secondary outcomes: Urinary retention: incidence within the first 24 hours. Analgesic consumption: total use at 0–24 hours and 24–72 hours. Pain at first defecation: VAS during the first bowel movement. Hemodynamic and respiratory events: hypotension (SBP <90 mmHg or >20% below baseline) and respiratory depression (respiratory rate <8/min or SpO₂ <94%). Postoperative adverse effects: nausea and vomiting within the first 48 hours. Time to mobilization: time to first unaided ambulation to the toilet. Patient satisfaction: visual satisfaction scale scored from 1 (very poor) to 5 (excellent) prior to discharge.

RESULTS

In this study, we compared SA with PNB plus sedation in patients undergoing laser hemorrhoid surgery, focusing on postoperative pain, complication rates, patient satisfaction, and time to mobilization. Demographic and clinical variables, pain scores, analgesic consumption, and postoperative complications were analyzed in detail for two clinically homogeneous groups. At baseline, the groups were comparable with respect to sex, body weight, ASA class, and hemorrhoid grade ($p>0.05$). In contrast, there were significant between-group differences in age, height, and operative time ($p<0.05$) (Table 1, Figure 1, 2).

Table 1. Demographic and clinical characteristics of the patients (PNB vs SA groups)

Variable	SA group (n=48)	PNB group (n=48)	p-value
Sex (female/male)	22/26	20/28	0.419
Age, years (mean±SD)	41.46±3.92	43.77±4.76	0.011
Weight, kg (mean±SD)	72.65±7.41	72.58±6.88	0.966
Height, cm (mean±SD)	167.52±3.56	164.58±5.44	0.002
ASA I/II, n	29/19	31/17	0.417
Hemorrhoid grade II/III, n	31/17	33/15	0.414
Operative time, min (mean±SD)	17.56±3.09	19.02±3.03	0.022

PNB: Pudendal nerve block, SA: Spinal anesthesia, SD: Standard deviation, ASA: American Society of Anesthesiologists

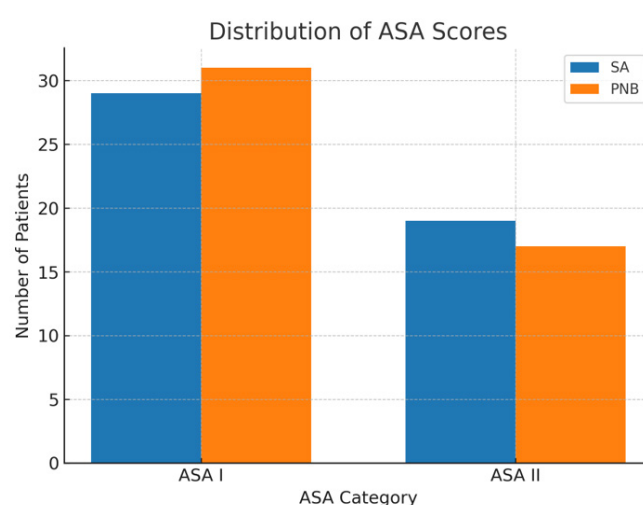


Figure 1. Distribution of ASA physical status (I–II) in the spinal anesthesia (SA) and pudendal nerve block (PNB) groups
ASA: American Society of Anesthesiologists

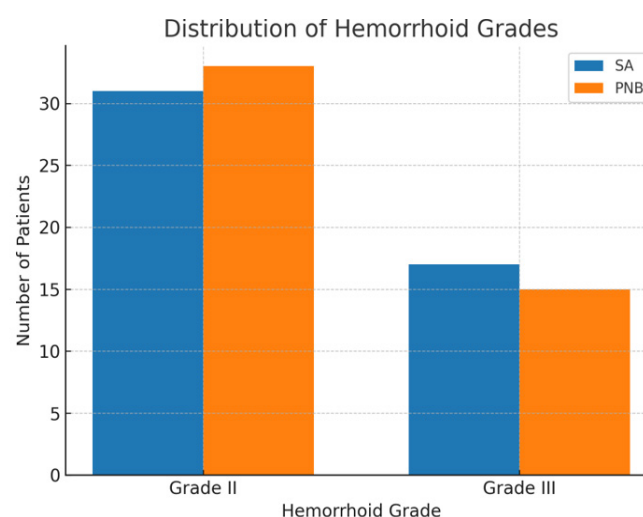


Figure 2. Distribution of hemorrhoid grades (II–III) in the SA and PNB groups
PNB: Pudendal nerve block, SA: Spinal anesthesia

Postoperative Pain Scores

Postoperative pain was assessed using the VAS. At all assessment time points, the PNB group recorded significantly lower pain scores than the SA group (all $p<0.001$). Within the first 2 hours, the mean VAS score was 2.46 in the SA group versus 1.21 in the PNB group. This difference persisted at 4

and 8 hours, indicating markedly better early postoperative analgesia with PNB. At 16, 48, and 72 hours, pain scores in the PNB group remained significantly lower. Collectively, these findings show that PNB provides superior analgesia not only in the early postoperative period but also in the later follow-up (Table 2).

Table 2. Postoperative pain scores (VAS 0–10)

Time point	SA group (n=48)	PNB group (n=48)	p-value
2 hours	2.46±0.92	1.21±0.89	<0.001
4 hours	2.15±0.89	0.92±0.79	<0.001
8 hours	3.27±0.91	2.52±1.07	<0.001
16 hours	3.50±0.98	1.96±1.03	<0.001
48 hours	2.63±1.31	1.56±1.05	<0.001
72 hours	2.52±0.87	1.58±1.06	<0.001

VAS: Visual Analog Scale, SA: Spinal anesthesia, PNB: Pudendal nerve block

Postoperative Outcomes and Complications

The incidence of urinary retention was 22.9% in the SA group and 4.2% in the PNB group ($p=0.007$). This higher rate in the SA group is plausibly related to suppression of pelvic parasympathetic innervation by the spinal block, whereas the pudendal block does not affect bladder innervation, consistent with the lower rate observed in the PNB group. Analgesic consumption at 0–24 hours averaged 9.08 in the SA group versus 4.58 in the PNB group ($p<0.001$); the PNB group likewise required significantly less analgesia at 24–72 hours ($p<0.001$), supporting effective and sustained analgesia with PNB. Pain at first defecation was significantly lower in the PNB group (median 3 [2–4]) than in the SA group (median 5 [4–6]) ($p<0.001$), a clinically meaningful difference for postoperative comfort after anorectal surgery. Time to mobilization was earlier with PNB (4.05 h vs 6.3 h; $p<0.001$), which may contribute to shorter hospital stay and reduced complication risk. The incidences of postoperative hypotension (2.1%) and respiratory depression (0%) were low in the PNB group and did not differ significantly from the SA group ($p=0.60$ for both comparisons). Nausea and vomiting were less frequent with PNB (2.1%) than with SA (18.9%; $p=0.008$). Patient satisfaction favored PNB ($p<0.001$). See Table 3 for detailed results.

Figure 3 clearly illustrates the postoperative advantages of the PNB approach over SA. Specifically, the incidence of urinary retention is approximately fivefold higher with SA; the cumulative analgesic requirement during the first 72 hours is reduced by more than 50% with PNB; patient satisfaction is significantly higher in the PNB group; and time to mobilization is about 2 hours shorter, supporting ambulatory pathways. Postoperative nausea–vomiting is roughly ninefold more frequent with SA, a clinically important determinant of patient comfort. Taken together, these findings strongly support PNB as an anesthetic strategy that reduces postoperative complications, provides more effective analgesia, enables earlier mobilization, and improves patient satisfaction.

Table 3. Postoperative outcomes and complications

Variable	SA group (n=48)	PNB group (n=48)	p-value
Urinary retention (0–24 h), n (%)	11 (22.9%)	2 (4.2%)	0.007
Analgesic consumption (0–24 h)	9.08±1.52	4.58±1.18	<0.001
Analgesic consumption (24–72 h)	7.23±1.34	3.23±1.13	<0.001
Pain at first defecation, median [IQR]	5 [4–6]	3 [2–4]	<0.001
Time to mobilization (h), median [IQR]	6.3 [5–8]	4.05 [3–4.9]	<0.001
Intraoperative hypotension, n (%)	2 (4.2%)	1 (2.1%)	0.60
Intraoperative respiratory depression, n (%)	1 (2.1%)	0 (0%)	0.60
Postoperative nausea–vomiting (0–48 h), n (%)	9 (18.9%)	1 (2.1%)	0.008
Patient satisfaction, median [IQR]	3 [2–4]	4 [3–5]	<0.001

SA: Spinal anesthesia, PNB: Pudendal nerve block, IQR: Interquartile range

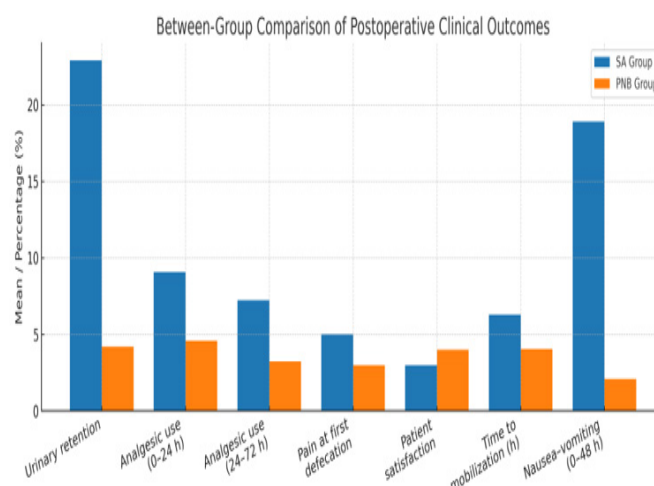


Figure 3. Between-group comparison of postoperative clinical outcomes (PNB vs SA)

SA: Spinal anesthesia, PNB: Pudendal nerve block

DISCUSSION

In this study, we evaluated the impact of ultrasound-guided bilateral PNB versus SA on clinical outcomes in patients undergoing LHP. Our findings indicate a clear advantage of PNB over SA with respect to both postoperative pain control and recovery parameters. VAS pain scores were significantly lower at all assessment points in the PNB group, consistent with prior evidence showing that PNB provides more sustained analgesia.¹⁵ Likewise, the randomized trial by He et al.¹⁶ reported markedly lower 24 hour pain scores and reduced analgesic requirements with PNB plus sedation compared with SA. In our cohort, the time to first analgesic request was approximately twice as long in the PNB group, further supporting the long-acting analgesic effect of this technique.

The approximately fivefold higher incidence of urinary retention in the SA group is plausibly explained by blockade of the sacral nerve roots, which can induce transient detrusor dysfunction. Consistent with this mechanism, SA

has been identified in the literature as an independent risk factor for postoperative urinary retention.^{17,18} By contrast, PNB provides a more localized block without meaningful autonomic involvement, thereby preserving bladder function and minimizing the risk of retention. In a randomized, prospective clinical trial with 1-year follow-up, Castellví et al.¹⁹ reported a significantly lower rate of urinary retention after hemorrhoid surgery in patients receiving PNB compared with SA. The ~2-hour earlier mobilization observed in the PNB group is likewise clinically meaningful, indicating more rapid recovery of motor function and earlier return to daily activities; in line with this, previous reports highlight that PNB facilitates early discharge and reduces length of hospital stay.^{20,21}

In our cohort, the technical performance and safety profile of PNB were confirmed. Ultrasound guidance, by allowing direct visualization of key anatomical landmarks, enabled precise needle placement, and no vascular or neural injuries occurred during block administration. Although the safety of performing the pudendal block at the level of Alcock's canal (pudendal canal) has been debated, our experience indicates that when performed by experienced clinicians under real-time imaging PNB is both effective and safe.²² No patients developed neurologic deficits or chronic pain attributable to the block (e.g., pudendal neuralgia). Furthermore, the incidences of hypotension and respiratory depression in the PNB group were similarly low to those observed with SA, supporting the conclusion that both techniques maintain hemodynamic stability in this setting.

Our findings align with existing evidence. A 2021 meta-analysis reported that, among patients undergoing hemorrhoidectomy, PNB was associated with significant reductions in opioid consumption, pain scores, complication rates, and length of hospital stay.¹⁵ Likewise, the 2024 study by Şahin et al.¹⁴ showed that PNB yielded lower pain scores and better functional outcomes than SA across proctologic procedures—effects that were particularly pronounced in the hemorrhoidectomy and LHP subgroups. By demonstrating comparable advantages specifically in LHP, our study supports the clinical value of PNB and adds meaningful evidence to the current literature.

CONCLUSION

In patients undergoing laser hemorrhoid surgery (LHP), ultrasound-guided PNB combined with propofol sedation provided more sustained and effective postoperative analgesia, lower analgesic requirements, reduced incidences of urinary retention and postoperative nausea/vomiting, higher patient satisfaction, and earlier mobilization compared with SA. These findings support PNB as a safe and effective anesthetic alternative that enhances patient comfort in minimally invasive hemorrhoid procedures. PNB may be particularly preferable in ambulatory pathways, given its association with rapid recovery and a favorable complication profile.

This study is limited by its single center design and modest sample size, which may constrain generalizability. Multicenter randomized trials with larger cohorts are warranted to validate and extend these results.

ETHICAL DECLARATIONS

Ethics Committee Approval

This study was approved by the Amasya University Non-interventional Clinical Researches Ethics Committee (Date: 24.02.2025, Decision No. E-30640013-050.04-246920).

Informed Consent

All patients signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

- Gallo G, Martellucci J, Sturiale A, et al. Consensus statement of the Italian society of colorectal surgery (SICCR): management and treatment of hemorrhoidal disease. *Tech Coloproctol*. 2020;24(2):145-164. doi:10.1007/s10151-020-02149-1
- Sanchez C, Chinn BT. Hemorrhoids. *Clin Colon Rectal Surg*. 2011;24(1):5-13. doi:10.1055/s-0031-1272818
- Sun XW, Xu JY, Zhu CZ, Li SJ, Jin LJ, Zhu ZD. Analysis of factors impacting postoperative pain and quality of life in patients with mixed hemorrhoids: a retrospective study. *World J Gastrointest Surg*. 2024; 16(3):731-739. doi:10.4240/wjgs.v16.i3.731
- Shaikh AR, Dalwani AG, Soomro N. An evaluation of Milligan-Morgan and Ferguson procedures for haemorrhoidectomy at Liaquat University Hospital Jamshoro, Hyderabad, Pakistan. *Pak J Med Sci*. 2013;29(1):122-127. doi:10.12669/pjms.291.2858
- Symeonidis D, Spyridakis M, Zacharoulis D, et al. Milligan-Morgan hemorrhoidectomy vs. hemorrhoid artery ligation and recto-anal repair: a comparative study. *BMC Surg*. 2022;22(1):416. doi:10.1186/s12893-022-01861-z
- di Schiano di Visconte M. Laser hemorrhoidoplasty: procedure, outcomes and future directions. *ANZ J Surg*. 2025. doi:10.1111/ans.70242
- Durgun C, Yiğit E. Laser hemorrhoidoplasty versus ligasure hemorrhoidectomy: a comparative analysis. *Cureus*. 2023;15(8):e43119. doi:10.7759/cureus.43119
- Lie H, Caesarini EF, Purnama AA, et al. Laser hemorrhoidoplasty for hemorrhoidal disease: a systematic review and meta-analysis. *Lasers Med Sci*. 2022;37(9):3621-3630. doi:10.1007/s10103-022-03643-8
- Bansal H, Jenaw RK, Mandia R, Yadav R. How to do open hemorrhoidectomy under local anesthesia and its comparison with spinal anesthesia. *Indian J Surg*. 2012;74(4):330-333. doi:10.1007/s12262-012-0438-3
- Olawin AM, Das JM. Spinal anesthesia. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. 2025.
- Ghanavatan S, Leslie SW, Derian A. Pudendal nerve block. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. 2025.
- Lee B, Schug SA, Joshi GP, Kehlet H; PROSPECT Working Group. Procedure-specific pain management (PROSPECT)-an update. *Best Pract Res Clin Anaesthesiol*. 2018;32(2):101-111. doi:10.1016/j.bpa.2018.06.012

13. Tepetes K, Symeonidis D, Christodoulidis G, Spyridakis M, Hatzitheofilou K. Pudendal nerve block versus local anesthesia for harmonic scalpel hemorrhoidectomy: a prospective randomized study. *Tech Coloproctol*. 2010;14(Suppl 1):S1-S3. doi:10.1007/s10151-010-0614-z
14. Şahin S, Yazkan C, Dere Ö, Kayıhoğlu I, Özcan Ö. Comparison of pudendal nerve block and spinal anesthesia in proctological surgeries: efficacy, safety, and patient outcomes. *Medicina (Kaunas)*. 2024;60(10):1651. doi:10.3390/medicina60101651
15. Mongelli F, Treglia G, La Regina D, et al. Pudendal nerve block in hemorrhoid surgery: a systematic review and meta-analysis. *Dis Colon Rectum*. 2021;64(5):617-631. doi:10.1097/DCR.0000000000001985
16. He J, Zhang L, Li DL, et al. Ultrasound-guided pudendal nerve block combined with propofol deep sedation versus spinal anesthesia for hemorrhoidectomy: a prospective randomized study. *Pain Res Manag*. 2021;2021:6644262. doi:10.1155/2021/6644262
17. Pomajzl AJ, Siref LE. Postoperative urinary retention. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. 2025.
18. Hadi Shalan B, Tariq Hasson Z, Hadi Shaalan A, Abd Elmohsen Abo El nour R. Post-operative urinary retention beyond spinal anesthesia. *Egyptian J Health Care*. 2024;15(3):1020-1027. doi:10.21608/ejhc.2024.383668
19. Castellví J, Sueiras A, Espinosa J, Vallet J, Gil V, Pi F. Ligasure versus diathermy hemorrhoidectomy under spinal anesthesia or pudendal block with ropivacaine: a randomized prospective clinical study with 1-year follow-up. *Int J Colorectal Dis*. 2009;24(9):1011-1018. doi:10.1007/s00384-009-0715-1
20. Pan P, Jiang J, Zhang X, Yang W, Ding W. Ultrasound-guided pudendal nerve block for postoperative pain management in procedures for prolapse and hemorrhoids: a randomized, double-blinded trial. *Int J Colorectal Dis*. 2025;40(1):159. doi:10.1007/s00384-025-04953-3
21. Bonatti L, Soncini S, Bellocchia AB, et al. Pudendal nerve block: a safe, simple and effective approach in surgical proctological patients. *Minerva Surg*. 2022;77(3):257-262. doi:10.23736/S2724-5691.21.08810-9
22. Soucy B, Luong DH, Michaud J, Boudier-Revéret M, Sobczak S. Accuracy of ultrasound-guided pudendal nerve block in the ischial spine and alcock's canal levels: a cadaveric study. *Pain Med*. 2020;21(11):2692-2698. doi:10.1093/pm/pnaa136