Laser hemorrhoidoplasty procedure versus harmonic scalpel hemorrhoidectomy: a comparative study for the treatment of grades III and IV hemorrhoids

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Background
Hemorrhoids are one of the most commonly presented diagnoses of colorectal diseases. This study aimed to evaluate and compare the outcomes of laser hemorrhoidoplasty (LHP) and harmonic scalpel hemorrhoidectomy (HSH) in the management of grades III and IV hemorrhoids, focusing on some postoperative complications.

Patients and methods
A randomized, controlled, clinical trial involving 34 patients with grades III and IV hemorrhoids was conducted at the General Surgery Department, Faculty of Medicine, Helwan University, from June 2022 to March 2023. Ethical considerations were adhered to, and patients provided informed consent. The groups underwent either LHP or HSH, and comprehensive patient information was collected, including demographics and preoperative assessments. Postoperative care and follow-up evaluations assessed outcomes such as pain, bleeding, discharge, wound healing, incontinence, recurrence, and stenosis.

Results
Demographic distribution was similar between the LHP and HSH groups, with comparable operative times. Postoperative bleeding did not significantly differ between groups. HSH was associated with more early discharge, longer wound healing times, and significantly higher postoperative pain levels up to the third week. No significant differences were observed in stenosis, incontinence, or recurrence between the two groups.

Conclusion
Both HSH and LHP techniques were found to be safe and effective for managing hemorrhoids. LHP demonstrated advantages, including lower postoperative pain levels, reduced seromucous discharge, and faster wound healing compared with HSH. These findings provide valuable insights for clinicians in optimizing patient care during the management of hemorrhoids.

Keywords:
harmonic scalpel hemorrhoidectomy, hemorrhoids, laser hemorrhoidoplasty

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Introduction

Hemorrhoidal columns represent normal anatomic clusters comprising vascular and connective tissue, smooth muscle, and overlying epithelium; they are crucial for maintaining continence. When these structures become engorged, hypertrophied, and subsequently symptomatic, they transition into a pathological state. Primary risk factors are middle age (45–65 years) and obesity [1,2].

Hemorrhoids rank highest among colorectal diseases, with an estimated prevalence of 13–36% within the general population [3]. Only one-third of self-reporting cases are presented for treatment [4]. In screening colonoscopy reports, ~38% of the population exhibits hemorrhoids; however, only 44% of them manifest symptoms [1,5].

Clinically, hemorrhoids are classified as external or internal. The external type is covered by skin below the dentate line, while the internal type is located proximal to the dentate line. A combination of these types results in intro-external hemorrhoids. Internal hemorrhoids are graded as follows: grade I: bleeding and possible protrusion into the anal canal without prolapse; grade II: prolapse on defecation with spontaneous reduction; grade III: requiring manual reduction; and grade IV: irreducible and permanently prolapsed [1,6].

The treatment of symptomatic hemorrhoids has evolved, with contemporary physicians using diverse surgical options and treatment modalities. Hemorrhoidectomy stands out as the most effective and definitive treatment for grade III or IV hemorrhoids. Currently, traditional surgical approaches, such as the open (Milligan–Morgan) and closed (Ferguson and Parks) hemorrhoidectomy, are still used. However, both procedures share similar complications, notably bleeding and prolonged postoperative pain, leading to longer recovery [7].

Many techniques and devices have been developed to alleviate postoperative pain. These include offering modifications to existing techniques, perioperative administration of lactulose and metronidazole, the incorporation of lateral internal sphincterotomy, or intraoperative injection of botulinum neurotoxin, and the introduction of new surgical instruments. These instruments included the circular stapler, harmonic scalpel, laser, and advanced bipolar electrothermal device. These innovations aim to facilitate rapid wound healing and enable a swift return to normal activities [8].

Numerous studies have suggested that both the harmonic scalpel and the LigaSure system are associated with less postoperative pain compared with conventional diathermy, with particular emphasis on the effectiveness of the harmonic scalpel [9]. A harmonic scalpel is a vessel-sealing system that uses piezoelectric disks to convert electrical energy to ultrasonic (55.5 kHz) mechanical vibrations of a cutting blade, which allows to cut tissue and control bleeding simultaneously [10,11].

In addition to harmonic scalpels, laser hemorrhoidoplasty (LHP) presents a new minimally invasive and painless day-surgery procedure for treating symptomatic hemorrhoids. This technique induces the shrinkage of hemorrhoidal piles using a diode laser. The laser beam causes tissue shrinkage and degeneration at different depths, determined by the laser power and duration of laser light application [12]. The LHP technique, characterized by using a diode-laser device, uses pulses of laser photothermal coagulation to stop the feeding vessels, ultimately leading to the shrinkage of hemorrhoids [13].

The objective of this study was to evaluate and compare LHP and harmonic scalpel hemorrhoidectomy (HSH) in the management of grades III and IV hemorrhoids. The assessment focused on postoperative complications among patients, including pain and discomfort, bleeding, discharge, wound healing, incontinence, recurrence, and stenosis.

Patients and methods

The study was a randomized, controlled clinical trial involving 34 patients diagnosed with grades III and IV hemorrhoidal diseases. The participants were admitted to the General Surgery Department at the Faculty of Medicine, Helwan University, presenting with symptomatic hemorrhoidal diseases. The study spanned from June 2022 to March 2023. According to the mean difference of the operation time which was 15.94±3.5 min in the hemorrhoid laser procedure [2] and was 8±11 min in the harmonic scalpel procedure [9], the estimated total sample size was 34 (17 in the laser group and 17 in the harmonic group).

The sample was calculated using OpenEpi at a power of the study 80% and a confidence interval (CI) of 95%.

Ethical considerations were observed, and the study protocol was submitted and approved by the Faculty of Medicine, Helwan University Research Ethics Committee. All patients were thoroughly informed about the study protocol, the surgical intervention, and the potential long-term outcomes of the technique. Informed written consent was obtained from each participating patient.

Eligible patients were randomly allocated, using the closed envelope method, into one of two groups, group A (LHP) comprising 17 patients and group B (HSH) with 17 patients. Exclusion criteria included patients with recurrent hemorrhoids, acutely thrombosed hemorrhoids, and those affected by inflammatory bowel disease or liver diseases.

Comprehensive patient information, including name, age, sex, symptoms, family history, and the course of symptoms, was collected. General and local examinations, including anoscopy and rigid proctoscopy or colonoscopy, if indicated, were conducted to exclude other pathological lesions. Routine preoperative investigations were performed, and patients were prepared with a rectal enema the day before surgery to evacuate the colon.

All surgical operations were conducted under spinal anesthesia, with patients in the supine lithotomy position. The surgical team adhered to a standardized procedure for each group. In both groups, the first step was examination under

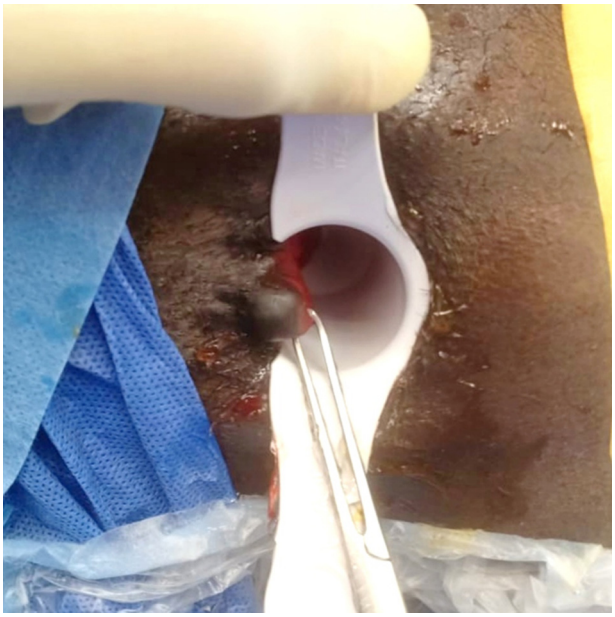
anesthesia. In LHP, the GBOX-12D laser (GIGAALASER Group, Wuhan, China) was used (Fig. 1). Starting with a clinical examination under anesthesia. A disposable proctoscope (23 mm diameter) was inserted (Fig. 2). The procedure started through a small incision to the skin, ~1 cm distance from the anal edge (Fig. 3). Laser safety goggles were used (Fig. 4). At the base of each hemorrhoid, the laser fiber was introduced into the hemorrhoidal plexus taking into consideration that the fiber should be parallel to the anal canal to avoid injury or burn of the mucosa or internal sphincter. The 1470 nm diode laser was used in a pulsed manner to reduce undesired degeneration of the periarterial normal tissue. The depth of shrinkage could be controlled by the power and duration of the laser beam. A total of 10–12 laser shots were generated at a power of 8 W with a duration of 3 s of ~24 J, each shot followed by a pause of 0.5 s causing shrinkage of tissues up to a depth of 5 mm. An ice finger was applied, for 0.5–1 min, after each hemorrhoid, and anal wounds were left open.

The HSH group, the harmonic scalpel (HARMONIC FOCUS+Shears, with a GEN11 Generator by ETHICON; Johnson & Johnson, New Brunswick, New Jersey, USA) was used for resection of the hemorrhoidal column up to the dentate line without ligation of the proximal pedicle (Fig. 5).

Figure 1

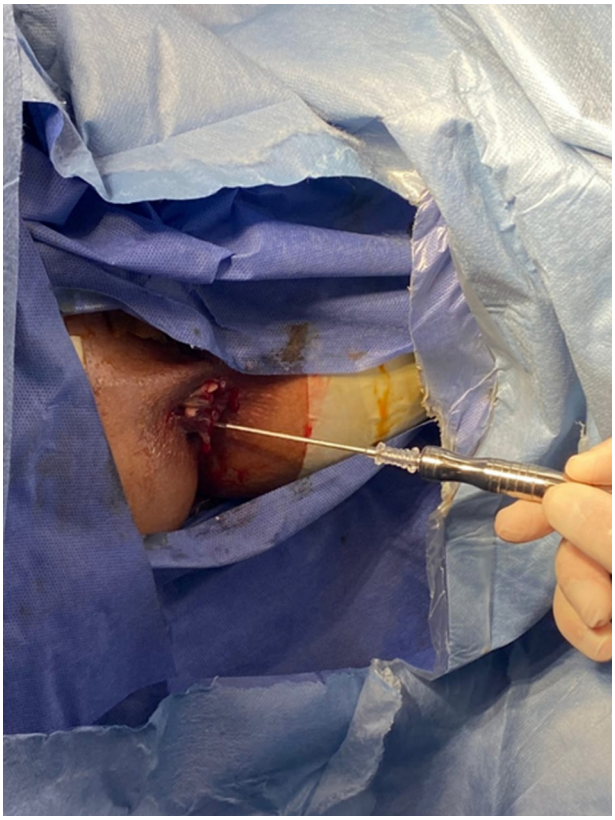
GBOX-12D laser.

Figure 2



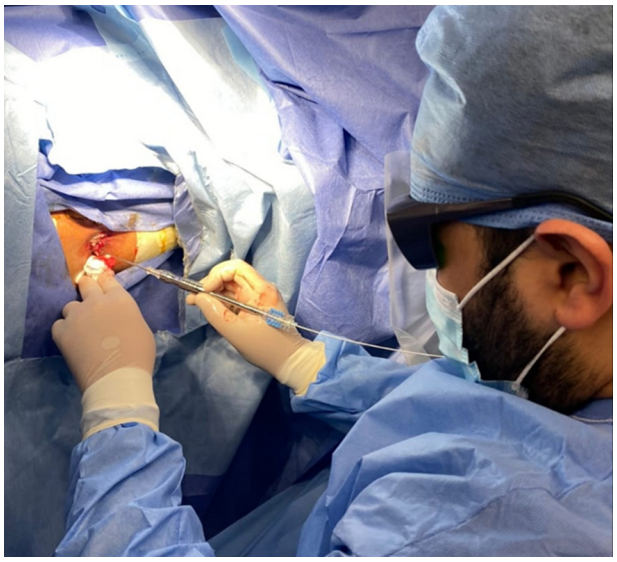
Disposable proctoscope inserted in the anal canal.

Figure 3



Small incision to the skin in the anal edge.

Figure 4



Anti-laser glass and laser fiber probe.

Postoperative care included a prescription of analgesia (diclofenac sodium 100), antibiotics (Metronidazole 500), and stool softeners. Patients were discharged 6–8 h after surgery if no complications were observed, and urination occurred without difficulties.

Follow-up evaluations were conducted at 1 day, 1, 3 and 6 weeks postoperatively. Perianal examinations and anoscopy were conducted during the follow-up visits. The main outcomes included postoperative pain assessed by the visual analog scale, bleeding, seromucous discharge, changes in bowel habits, fecal incontinence, wound healing, and the time needed to resume daily activities.

Data analysis was performed using SPSS software (IBM Corp, New York, New York, USA), version 25.0 with qualitative data described using numbers and percentages, and quantitative data presented with measures such as mean, SD, median, and interquartile range.

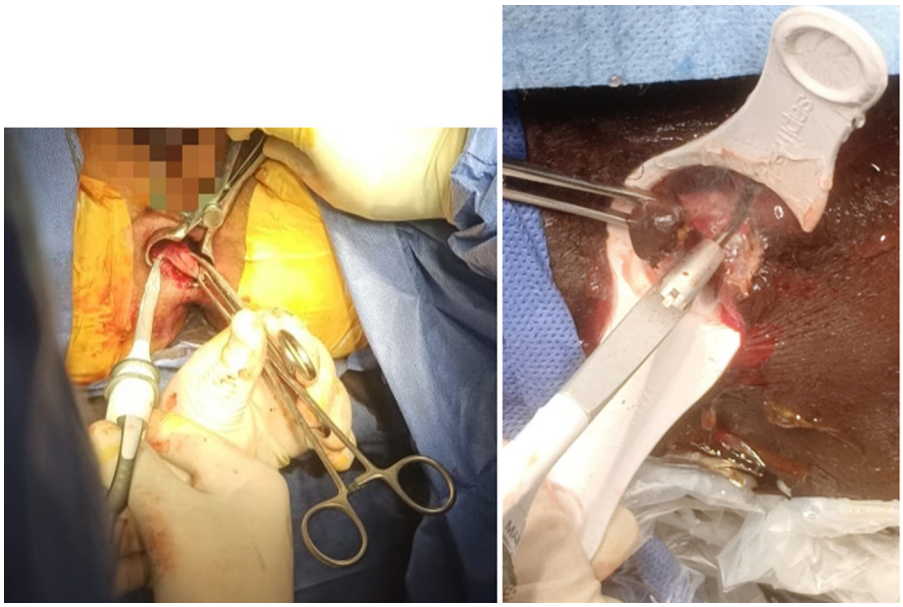
Results

In this study, a cohort of 34 patients were recruited, and their demographic data are outlined in Table 1. The distribution of age in the studied population revealed mean values of 36.0±10.85 for the LHP group and 41.65±8.83 for the HSH group and the age range spanned from 20 to 59 years. No significant statistical difference was observed between the two groups. Similarly, there was no notable distinction in the distribution of sex, with both groups being closely matched. Males constituted the majority in both cohorts. Degrees of hemorrhoids were evenly distributed between the studied groups.

Table 1 Demographic information

	Group A (*N*=17)	Group B (*N*=17)	*P*
Sex (male/female, %)	12/5, 70.6/29.4	9/8, 52.9/47.1	0.290
Age (mean±SD, years)	36.0±10.85	41.65±8.83	0.106
Piles degree (III/IV, %)	13/4, 76.5/23.5	14/3, 82.4/17.6	1

Figure 5



Grab a portion of the anal skin tail using the forceps and dissection of the hemorrhoid using a harmonic scalpel.

The operative time for procedures exhibited a distribution of 17.18±2.21 min in the LHP group (range, 13.0–20.0 min) and 15.59±2.40 min in the HSH group (range, 12.0–20.0 min). No statistically significant difference in operative time was identified between the two groups (Table 2).

No statistically significant difference was elicited regarding postoperative bleeding in the follow-up period. The HSH group exhibited a significant association with postoperative discharge on both the first day and first week, although no discharge was reported after the first week in either group (Table 3).

Wound healing times were inspected, revealing a mean duration of 6.94±1.56 days (range, 5.0–10.0) in the LHP group and 13.76±2.31 days (range, 10.0–18.0) in the HSH group. This difference in healing times between the two groups reached statistical significance, indicating a longer healing time in the HSH group (Table 2).

A notable finding emerged in the assessment of postoperative pain. A highly significant statistical difference was observed between the LHP and HSH groups, particularly up to the third week. Notably, the use of analgesia was significantly higher in the HSH group during this period (Table 4).

There were no significant differences between the two groups in postoperative stenosis, incontinence, and recurrence.

Table 2 Operative time and wound healing time

	Group A (*N*=17)	Group B (*N*=17)	*P*
Operative time (min)			
Minimum–maximum	13.0–20.0	12.0–20.0	0.053
Mean±SD	17.18±2.21	15.59±2.40	
Wound healing (days)			
Minimum–maximum	5.0–10.0	10.0–18.0	<0.001*
Mean±SD	6.94±1.56	13.76±2.31	

*Significant difference between the 2 methods according to time needed for wound healing.

Table 3 Postoperative bleeding and discharge

	Group A (*N*=17) [*n* (%)]	Group B (*N*=17) [*n* (%)]	*P*
Bleeding			
24 h	2 (11.8)	3 (17.6)	1.000
1 week	1 (5.9)	2 (11.8)	1.000
Discharge			
24 h	0 (0.0)	7 (41.2)	0.007*
1 week	2 (11.8)	8 (47.1)	0.024*

*Statistically significant difference.

Table 4 Postoperative pain

Postoperative pain	Group A (*N*=17)	Group B (*N*=17)	*P*
24 h			
Minimum–maximum	2.0–6.0	3.0–8.0	<0.001*
Mean±SD	2.94±1.09	6.35±1.66	
1 week			
Minimum–maximum	1.0–3.0	2.0–6.0	<0.001*
Mean±SD	1.18±0.53	3.76±1.09	
3 weeks			
Minimum–maximum	1.0–2.0	1.0–5.0	0.038*
Mean±SD	1.06±0.24	1.71±1.05	
6 weeks			
Minimum–maximum	1.0–1.0	1.0–1.0	1.000
Mean±SD	1.0±0.0	1.0±0.0	

*Statistically significant difference.

Discussion

This study involved patients with ages ranging from 20 to 59 years, with a mean age of 41.65±8.83 in group A (LHP) and 36.0±10.85 in group B (HSH). The sex distribution demonstrated a lack of significant disparity, with males constituting the majority in both cohorts. This distribution aligns with studies by Eskandaros and Darwish [14] and Talha *et al.* [9], who reported similar age and sex distribution patterns. Operative times for LHP and HSH were similar in our study, supporting the efficiency of both techniques in achieving comparable operative durations, as reported by Naderan *et al.* [15] and Talha *et al.* [9].

The assessment of postoperative bleeding showed no significant differences between the LHP group and the HSH group at various follow-up time points. The majority of cases in the LHP group experienced no bleeding, with a small percentage reporting minimal bleeding in the first 24 h. Studies by Maloku *et al.* [16] and Talha *et al.* [9] and their groups emphasize the idea that both LHP and HSH are effective in minimizing postoperative bleeding compared with traditional approaches.

Concerning postoperative discharge, the HSH group was significantly associated with discharge on the first day and first week. Similar results were reported by Brusciano *et al.* [12], who reported that the presence of slightly significant incisions in LHP led to minimal seromucous discharge. However, by the end of the first[t] week, both groups demonstrated no discharge in 100% of cases. The minimal seromucous discharge associated with LHP was also highlighted by Hussein [17].

Wound healing time emerged as a notable difference between the two groups, with LHP demonstrating a significantly faster healing time compared with HSH, consistent with findings reported by Poskus *et al.* [18] who found that the time to return to regular activity or work was 15 in the LHP (5–14), as also noted by Abo-hashem *et al.* [19].

A pivotal observation in our study concerns postoperative pain levels. From the first day until the third week, the HSH group displayed significantly higher pain levels on the visual analog scale compared with the LHP group. However, post the third week, no significant differences were noted between the two groups, suggesting a convergence in pain experiences. Lower postoperative pain in laser-based anal procedures compared with traditional methods is constantly reported by many authors [3,15,20]. Talha *et al.* [9] reported the superior pain control achieved with a harmonic scalpel in comparison to the advanced bipolar shear during the initial postoperative week.

Remarkably, both LHP and HSH groups in our study showed no cases of recurrence, fecal incontinence, or anal stenosis during the 6-week follow-up period, consistent with findings from Poskus *et al.* [18], Mohammed *et al.* [13], Sarkar *et al.* [21], and Alsisy *et al.* [22]. These outcomes highlight the favorable outcomes of both procedures in minimizing these postoperative complications. However, in some studies with longer follow-up periods, ~10% of those undergoing LHP suffer from recurrence after 1 year [19].

Conclusion

In conclusion, our study affirms that both HSH and LHP techniques are safe and effective for the management of hemorrhoids. LHP, in particular, demonstrated advantages, including lower postoperative pain levels, reduced seromucous discharge, and a shorter time for wound healing compared with HSH. Our results contribute valuable insights into the comparative outcomes of these procedures, aiding clinicians in making informed decisions for optimizing patient care in the management of hemorrhoids.

Recommendations

We recommend a large-scale study to be carried out for clarification of the minor differences between LHP and HSH.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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