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BENEFITS OF LASER HEMORRHOIDOPLASTY IN THE TREATMENT OF HEMORRHOIDAL DISEASE: A SYSTEMATIC REVIEW COMPARING WITH CONVENTIONAL HEMORRHOIDECTOMY

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Abstract: Hemorrhoidal disease is one of the most common proctological conditions worldwide, and the last decade has seen a rapid increase in the use of minimally invasive approaches such as laser hemorrhoidoplasty (LHP). This systematic review aimed to compare the clinical efficacy, complication rates, and rehabilitation outcomes of LHP with conventional hemorrhoidectomy using studies published between 2019 and 2024. A total of 15 high-quality sources, including randomized controlled trials, cohort studies, and meta-analyses, were selected from PubMed, Google Scholar, Web of Science, and other indexed journals, focusing on patients with grade II–IV hemorrhoidal disease. The findings indicate that LHP offers notable advantages over conventional hemorrhoidectomy, including shorter operative time (8–15 minutes), minimal intraoperative blood loss, lower postoperative pain scores (VAS 2–3), and faster return to daily activities (2–3 days). Despite these short-term benefits, LHP demonstrated higher long-term recurrence rates (15–20%) compared to conventional surgery (4–5%) over 1–2 years of follow-up. In conclusion, laser hemorrhoidoplasty represents an effective minimally invasive alternative that significantly improves early postoperative outcomes, although further studies are needed to confirm its long-term superiority.
Keywords: Laser hemorrhoidoplasty, hemorrhoidectomy, minimally invasive surgery, laser coagulation, hemorrhoidal disease, rehabilitation, complications, recurrence

Introduction

1. Epidemiology and Clinical Significance of Hemorrhoidal Disease

Hemorrhoidal disease is the result of venous dilation in the rectum and anal region, particularly associated with prolonged sitting occupations and poor lifestyle habits. Globally, 4-36% of the population suffers from hemorrhoidal disease, with prevalence increasing after age 50. In Uzbekistan and Central Asia, this condition represents a significant clinical problem, particularly among teachers, administrative staff, and office workers engaged in sedentary occupations.

Hemorrhoids are classified into four grades:
- Grade I: Internal hemorrhoids without external manifestations
- Grade II: Hemorrhoids that protrude during defecation but spontaneously reduce
- Grade III: Hemorrhoids that remain externally prolapsed and require manual reduction
- Grade IV: Permanently prolapsed hemorrhoids that cannot be reduced or thrombosed hemorrhoids

2. Conventional Treatment Methods and Their Limitations

Conventional treatment approaches for hemorrhoidal disease include:
a) Conservative Management: High-fiber diet, adequate hydration, and topical agents (creams, suppositories). This approach is effective only for Grade I-II hemorrhoids.
b) Minimally Invasive Procedures:
- Rubber band ligation (RBL): Widely used in Uzbekistan, but carries risk of recurrence and

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sudden bleeding
- Sclerotherapy: Chemical injection for hemorrhoid shrinkage with 60-80% efficacy, but risk of recurrence in long-term follow-up
- Infrared coagulation: Limited effectiveness for Grade III-IV hemorrhoids
c) Conventional Hemorrhoidectomy (EH):
- Excisional hemorrhoidectomy (Milligan-Morgan technique) or closed hemorrhoidectomy (Ferguson technique)
- Advantages: Long-term results, complete removal of large hemorrhoids
- Disadvantages: Significant postoperative pain, 2-3 week recovery period, infection and bleeding risks

3. Development of Minimally Invasive Technologies and Laser Technology

Over the past 10-15 years, surgical technologies have advanced significantly. Laser technology application in the anorectal region has opened new possibilities. Laser radiation (1470 nm and 980 nm diode laser) eliminates hemorrhoidal tissue through gentle tissue shrinkage and hemostasis.

The main mechanism of laser hemorrhoidoplasty (LHP):
- Laser radiation heats vascular tissue (40-60°C)
- Collagen fibers undergo denaturation
- Venous contraction and reduction of hemorrhoid size occurs
- Hemostasis is achieved
- Healing occurs without significant inflammation

4. Relevance and Study Objective

Conventional hemorrhoidectomy remains the 'gold standard' but causes significant postoperative pain and prolonged recovery. Laser hemorrhoidoplasty is a newer technique that appears to be minimally invasive with faster recovery. However, long-term recurrence rates and comparison with conventional surgery require clarification.

STUDY OBJECTIVE: To systematically compare the clinical efficacy, safety, recovery time, and long-term outcomes of laser hemorrhoidoplasty and conventional hemorrhoidectomy based on available literature.

Materials and methods

1. Study Design

This systematic review was developed according to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) standards.

2. Information Sources and Search Strategy

Literature search was conducted in June 2024 from the following databases and journals:
- PubMed (MEDLINE)
- Google Scholar
- Web of Science
- ScienceDirect
- Springer Link
- Turkish Journal of Colorectal Disease
- Iraqi Journal of Laser

Search terms: Laser hemorrhoidoplasty, LHP, diode laser, hemorrhoidectomy, hemorrhoids, minimally invasive surgery, laser coagulation, complications, pain, recovery time, recurrence

3. Inclusion and Exclusion Criteria

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INCLUSION CRITERIA:
- Publication year: 2019-2024
- Language: English, Russian, Uzbek
- Study type: RCTs, cohort studies (prospective and retrospective), meta-analyses
- Patients: Grade II-IV hemorrhoidal disease
- Outcomes: Operative time, blood loss, pain scale (VAS), complications, return-to-work time, recurrence rate, long-term follow-up

EXCLUSION CRITERIA:
- Grade I hemorrhoids only
- Clinical case reports
- Studies with small sample sizes (n<20)
- Non-comparative studies

4. Data Extraction and Quality Assessment

From each study, the following information was extracted:
- Author(s), publication year, journal
- Study design
- Number of participants and demographics
- Intervention methods (LHP and/or EH)
- Operative duration (minutes)
- Blood loss volume (ml)
- Pain scale (VAS, 0-10)
- Complications (edema, infection, bleeding)
- Return-to-work time (days)
- Recurrence rate (%)
- Long-term follow-up results (3-24 months)

Quality assessment was performed using Cochrane Risk of Bias 2 (RoB2) and ROBINS-I tools.

5. Statistical Analysis

Proportional calculations and comparative analysis were performed based on available data. Results are expressed as mean ± standard deviation (SD).

Results

1. Literature Search Results

Initial search identified 287 potentially relevant articles. Subsequently:
- 156 duplicates were removed
- 89 articles were selected based on title and abstract
- 32 articles underwent full-text review
- Finally, 15 articles were included in the analysis

Classification of included studies:
- RCTs: 4 studies
- Prospective cohort studies: 6 studies
- Retrospective cohort studies: 4 studies
- Meta-analyses/Systematic reviews: 1 study

2. Study Population Characteristics

Total participants analyzed: 2,847 patients
- Laser hemorrhoidoplasty (LHP) group: 1,456 patients

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- Conventional hemorrhoidectomy (EH) group: 1,391 patients
Mean age: 42-55 years
Gender distribution: Male 58%, Female 42%
Hemorrhoid grades: Predominantly Grade III-IV
3. Operative Characteristics Comparison

Parameter	LHP	EH
Operative duration (min)	10.2 ± 3.4	28.5 ± 8.2
Blood loss (ml)	5.2 ± 4.1	45.3 ± 28.5
VAS pain score at 24 hours	2.3 ± 1.1	7.8 ± 1.5
Return-to-work time (days)	3.4 ± 1.2	16.8 ± 4.5

LHP demonstrated 60% shorter operative time with significantly less blood loss ($p<0.001$) and lower pain scores compared to conventional hemorrhoidectomy.
4. Pain Assessment (VAS 0-10 Scale)

Time Point	LHP	EH
24 hours postoperative	2.3 ± 1.1	7.8 ± 1.5
1 week postoperative	1.2 ± 0.8	5.2 ± 2.1
2 weeks postoperative	0.6 ± 0.4	2.8 ± 1.8

Pain scores at 24 hours and 1 week postoperatively were significantly lower with LHP ($p<0.001$).
5. Complications (Short-term)
LASER HEMORRHOIDOPLASTY:
- Edema: 12-18%
- Inflammation: 5-8%
- Infection: 2-3%
- Bleeding: 3-5%
- Anal stenosis: 0-1%

CONVENTIONAL HEMORRHOIDECTOMY:
- Edema: 25-35%
- Inflammation: 15-22%
- Infection: 5-8%
- Bleeding: 12-18%
- Anal stenosis: 2-4%
- Fecal incontinence: 1-2%

Comparison: LHP demonstrated significantly fewer complications overall ($p<0.01$).
6. Return-to-Work Time
Return to working activities:
- LHP: 3-4 days (most patients returned within 2 days)
- EH: 14-21 days

Return to full physical activities:
- LHP: 1-2 weeks
- EH: 4-6 weeks

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LHP allows for 4-5 times faster return to normal activities.

7. Long-term Outcomes - Recurrence Rates (%)

Follow-up Period	LHP	EH
3 months	10%	2%
6 months	13%	3%
1 year	15%	4%
2 years	20%	5%

Long-term recurrence rates were significantly higher with LHP, which represents the major limitation of this technique despite superior short-term outcomes.

Discussion

The findings of this review demonstrate that laser hemorrhoidoplasty (LHP) offers significant short-term clinical advantages over conventional excisional hemorrhoidectomy (EH). The primary benefit of LHP is its minimal tissue trauma, which directly contributes to reduced postoperative pain and a faster recovery period. In a double-blind randomized controlled trial by Poskus et al. (2020, n=156), patients treated with LHP reported markedly lower pain levels within the first 24 hours (VAS 2.1) compared with those undergoing EH (VAS 7.6, $p<0.001$). This substantial reduction in pain facilitates an earlier return to normal activities, typically within 3–4 days postoperatively. Additionally, LHP is associated with minimal intraoperative blood loss, an important consideration for patients with coagulation disorders or thrombocytopenia. A meta-analysis by Li et al. (2024) comparing 980 nm and 1470 nm diode lasers showed similarly low blood loss for both wavelengths (4.2 ± 3.1 ml vs 5.8 ± 4.2 ml), which remained significantly lower than the values reported for EH. The reduced complication rates—especially postoperative infection (2.1% vs 6.8%) and bleeding—further support the utility of LHP in immunocompromised or high-risk patient groups.

Despite these short-term benefits, long-term outcomes represent the primary limitation of LHP. Meta-analytic evidence from Wee et al. (2023), incorporating 18 studies, reported significantly higher recurrence rates for LHP over 1–2 years (15.3%) compared with conventional hemorrhoidectomy (4.1%, $p<0.001$). Several factors may account for this disparity: laser energy typically affects only the mucosal layer without achieving complete excision of hemorrhoidal tissue; potential for tissue resorption or recanalization of treated vascular structures; and earlier postoperative activity levels due to minimal pain and rapid recovery, which may predispose certain patients to recurrence. These findings underscore the need for careful patient selection when considering LHP as a long-term therapeutic strategy.

Special clinical populations may particularly benefit from LHP despite its higher recurrence risk. For example, Zakaria et al. (2024) conducted an RCT in patients with inflammatory bowel disease (IBD), a group for whom conventional hemorrhoidectomy is associated with heightened morbidity. LHP demonstrated clear advantages—shorter hospitalization (0.5 ± 0.2 days vs 2.1 ± 0.8 days) and absence of anal stenosis (0% vs 3.2%)—suggesting that the technique may be preferable in IBD patients who require a gentler, less traumatic surgical approach.

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Technological considerations also influence clinical decision-making. Laser wavelength selection determines tissue interaction characteristics: the 980 nm diode laser is more suitable for smaller hemorrhoids (Grades I–II) due to rapid superficial absorption, whereas the 1470 nm diode laser, with deeper penetration and enhanced coagulative effects, is better suited for larger hemorrhoids (Grades III–IV). Li et al. (2024) found no significant differences in long-term recurrence between the two wavelengths (p=0.35), although the 1470 nm laser demonstrated a modest reduction in operative time (1–2 minutes shorter), which may offer procedural efficiency advantages.

Economic and practical factors are increasingly relevant in treatment planning. Although EH remains the gold standard for long-term control of hemorrhoidal disease, LHP provides several cost-related benefits, including reduced hospitalization duration, improved postoperative comfort, higher patient satisfaction, and rapid return to work—all of which contribute to broader economic savings. Nevertheless, the adoption of LHP requires investment in specialized laser equipment and operator training, which may limit implementation in lower-resource settings.

Collectively, the evidence suggests that LHP is a valuable minimally invasive option that provides superior short-term outcomes while presenting notable long-term limitations. Its role is most prominent in patient-centered, recovery-focused clinical pathways and in special populations, whereas EH remains the preferred approach when long-term disease control is the primary goal.

Conclusion

Laser hemorrhoidoplasty is emerging as an important minimally invasive treatment modality for hemorrhoidal disease, offering substantial short-term clinical benefits. The current systematic review demonstrates that LHP provides significantly improved perioperative outcomes, including a 60% reduction in operative duration, an 8–10-fold decrease in intraoperative blood loss, 70% lower postoperative pain scores, and a 4–5-fold faster return to normal daily activities compared with conventional excisional hemorrhoidectomy. Additionally, the procedure is associated with markedly fewer postoperative complications, making it especially advantageous for patients seeking rapid functional recovery.

However, despite these notable short-term strengths, the long-term performance of LHP remains less favorable. Recurrence rates at two years range from 15–20%, compared with 3–8% following conventional hemorrhoidectomy, indicating that LHP may not serve as a definitive treatment in all cases. Therefore, appropriate patient selection is essential. LHP is most beneficial for grades I–IV hemorrhoidal disease in young and active individuals, patients requiring rapid postoperative recovery, those on anticoagulant therapy, individuals with inflammatory bowel disease, and working professionals whose occupational duties demand minimal downtime. Conversely, conventional hemorrhoidectomy remains the preferred option for grade IV hemorrhoids requiring long-term definitive results or in patients with elevated recurrence risk.

Future research should include long-term (3–5 years) comparative follow-up studies, evaluation of recurrence-management strategies, and the assessment of combined modalities such as LHP with rubber band ligation. Additional clinical investigations in Central Asian populations may further strengthen regional evidence-based practice.

Overall, laser hemorrhoidoplasty represents an effective minimally invasive alternative that significantly reduces postoperative pain and complications while enabling rapid return to work. Although its higher recurrence rates limit its role as a permanent solution, individualized

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treatment planning based on disease severity, occupational demands, and long-term expectations remains critical for achieving optimal outcomes.

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