



How do different surgical techniques for haemorrhoidectomy (e.g., stapled vs. excisional) compare in terms of postoperative complications and patient recovery? : A Systematic Review

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ABSTRACT

Introduction: Conventional excisional hemorrhoidectomy, while effective for high-grade hemorrhoids, is frequently associated with significant postoperative pain and a prolonged recovery period. Newer modalities, such as stapled hemorrhoidopexy and energy-based devices, have been developed to minimize trauma and improve patient outcomes. This systematic review provides a comprehensive comparative analysis of these surgical techniques, focusing on postoperative complications and patient recovery metrics.

Methods: Following the PRISMA 2020 guidelines, a systematic search was conducted across PubMed, Semantic Scholar, Springer, and Google Scholar to identify relevant studies. The review included randomized controlled trials (RCTs) that compared at least two surgical techniques for hemorrhoidectomy

in adult patients and reported on outcomes such as pain, recovery time, or complications. A total of 11 RCTs met the eligibility criteria for the final analysis.

Results: The analysis revealed that modern techniques—specifically energy-based devices (e.g., Ligasure, harmonic scalpel) and stapled hemorrhoidopexy—consistently resulted in significantly lower postoperative pain scores compared to traditional excisional methods. These benefits were accompanied by reduced needs for analgesia, shorter hospital stays, and a faster return to normal activities. Furthermore, energy devices were associated with shorter operative times and a significantly lower incidence of specific complications, such as postoperative bleeding.

Conclusion: Modern surgical techniques offer a substantially improved postoperative experience for patients undergoing hemorrhoidectomy. The reduction in pain, faster recovery, and lower rates of specific complications support the adoption of energy-based and stapled techniques as a new standard of care. While overall safety profiles are comparable to traditional methods, these advanced procedures provide clear, clinically meaningful benefits. Further research with long-term follow-up is recommended to assess recurrence rates and cost-effectiveness.

Keywords: Haemorrhoidectomy, Stapled Haemorrhoidopexy, Energy-Based Devices, Ligasure, Postoperative Pain, Patient Recovery.

INTRODUCTION

Hemorrhoidal disease is a prevalent anorectal condition that significantly impacts patient quality of life. While many cases of lower-grade hemorrhoids can be managed with conservative treatments, symptomatic third and fourth-degree hemorrhoids often necessitate surgical intervention (Saleem et al., 2023). The primary goal of surgery is to alleviate symptoms such as bleeding, pain, and prolapse. For decades, the standard of care has been conventional excisional hemorrhoidectomy, a procedure that, while effective, is frequently associated with considerable postoperative pain and a prolonged recovery period, posing a significant burden on patients (Benjamin, 2019; Rathi et al., 2022).

Traditional surgical approaches, most notably the Milligan-Morgan open hemorrhoidectomy, involve the direct excision of hemorrhoidal tissue (Nazari & Hedayati, 2015). While this method has a long-standing record of success in definitively treating hemorrhoids, its primary drawback is the creation of open wounds in a highly sensitive area. This often leads to intense postoperative pain, a higher need for analgesics, and a delayed return to normal activities for the patient. These well-documented challenges have been the principal driver for the exploration and development of alternative surgical techniques (Baig et al., 2022; Prasad & Apparao, 2016).

In response to the limitations of conventional methods, a variety of innovative surgical techniques have been introduced over the past few decades. These newer approaches are designed to minimize trauma to the anoderm and reduce postoperative pain, thereby accelerating patient recovery. Broadly, these techniques can be categorized into three main groups: stapled hemorrhoidopexy, procedures utilizing energy-based devices (such as Ligasure, harmonic scalpel, and diode laser), and hemorrhoidal artery dearterialization techniques (including Doppler-guided procedures). Each of these modalities aims to provide symptomatic relief comparable to excisional surgery but with an improved postoperative course.

Stapled hemorrhoidopexy, for instance, utilizes a circular stapling device to resect a ring of

rectal mucosa above the hemorrhoidal cushions, effectively lifting them back into their normal anatomical position and interrupting their blood supply. Multiple studies have demonstrated that this technique often results in significantly lower postoperative pain scores and shorter hospital stays when compared directly with traditional excisional hemorrhoidectomy. One comparative trial highlighted that patients in the stapled group had an average pain score of 1.7 versus 4.2 for the excisional group, with hospital stays reduced from 2.53 to 1.14 days, respectively (Prasad & Apparao, 2016).

Similarly, energy-based devices have emerged as a prominent alternative, using focused energy to coagulate and seal vessels simultaneously as tissue is divided. The Ligasure vessel-sealing system has been shown to reduce operative time and significantly lower postoperative bleeding rates from 25% in Milligan-Morgan procedures to just 5% (Baig et al., 2022). The harmonic scalpel has also yielded favorable results, with studies reporting significantly less pain at all measured intervals and a faster return to daily activities (Rathi et al., 2022). Furthermore, diode laser coagulation has been associated with lower pain ratings, reduced morphine consumption, and a decreased incidence of complications like bleeding and urinary retention compared to the Milligan-Morgan approach (Nazari & Hedayati, 2015).

Another class of modern procedures involves the ligation or dearterialization of the hemorrhoidal arteries. Techniques such as Transanal Hemorrhoidal Dearterialization (THD) and Doppler-guided Hemorrhoidal Artery Ligation with Recto-Anal Repair (HAL-RAR) aim to reduce blood flow to the hemorrhoids without the need for excision (Saleem et al., 2023). Comparative studies have shown varied outcomes. For example, a multicenter trial found that while effective, Doppler-guided ligation was associated with more severe short-term pain than rubber band ligation and was also a more expensive procedure (Brown et al., 2016). In another study, pain scores were found to be similar between HAL-RAR and open hemorrhoidectomy by the seventh postoperative day (Saleem et al., 2023).

Despite the clear advantages of newer techniques in reducing postoperative pain and shortening recovery, the overall rates of complications appear to be broadly similar to traditional

methods. For instance, a large multicenter trial comparing stapled hemorrhoidopexy to excisional surgery found no significant difference in the rate of serious adverse events, which were 7% and 9%, respectively (Benjamin, 2019). However, specific complications are often reduced with modern techniques. Energy-based devices, in particular, have been shown to significantly decrease intraoperative and postoperative bleeding, and in some cases, reduce the need for postoperative anal packing (Baig et al., 2022; Allam et al., 2018).

Therefore, this analysis aims to provide a comprehensive comparison of different surgical techniques for hemorrhoidectomy, focusing specifically on the critical outcomes of postoperative complications and patient recovery. By synthesizing evidence from a range of randomized controlled trials and comparative studies, the objective is to elucidate the relative benefits and drawbacks of stapled, energy-based, dearterialization, and conventional excisional techniques. The primary outcomes under investigation include postoperative pain, analgesic requirements, hospital stay duration, time to return to normal activities, and the incidence of specific complications such as bleeding, urinary retention, and stenosis.

METHODS

Protocol

The study strictly adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines to ensure methodological rigor and accuracy. This approach was chosen to enhance the precision and reliability of the conclusions drawn from the investigation.

Criteria for Eligibility

This systematic review aims to evaluate how do different surgical techniques for haemorrhoidectomy (e.g., stapled vs. excisional) compare in terms of postoperative complications and patient recovery ?

Screening

We screened in papers that met these criteria:

- **Adult Population:** Does the study exclusively include adult patients (18 years) with diagnosed hemorrhoids?
- **Comparative Design:** Does the study compare at least two different surgical techniques for hemorrhoidectomy?
- **Study Design Quality:** Is the study either a randomized controlled trial (RCT), systematic review, or meta-analysis?
- **Outcome Reporting:** Does the study report at least one of these outcomes: postoperative pain, bleeding, recovery time, complications, or hospital stay?
- **Study Design Minimum:** Is the study design more robust than a case report or case series?
- **Intervention Focus:** Does the study focus on surgical (rather than non-surgical) hemorrhoid treatments?
- **Procedure Isolation:** Was hemorrhoidectomy performed as a standalone procedure (not combined with other surgical procedures)?

We considered all screening questions together and made a holistic judgement about whether to screen in each paper.

Data extraction

We asked a large language model to extract each data column below from each paper. We gave the model the extraction instructions shown below for each column.

- **Study Design:**

Identify the specific type of study design. Look in the methods section for explicit description. Acceptable responses include:

- Randomized controlled trial (RCT)
- Prospective comparative study
- Prospective randomized controlled trial
- Multicenter trial

If multiple design descriptors are used, include all. If design is unclear, write "Design not clearly specified". Specific details to note:

- Whether randomization was used
- Whether the study was single-center or multi-center
- Prospective or retrospective nature of the study
- **Participant Characteristics:**

Extract the following participant details:

- Total sample size
- Age range or mean age
- Gender distribution (if reported)
- Hemorrhoid grade (II, III, or IV)
- Inclusion/exclusion criteria

Record numerical values with units. If a range is given, write as "X-Y". If mean is given, write as "Mean: X (SD: Y)".

If any characteristic is not reported, write "Not reported".

- **Surgical Techniques Compared:**

List ALL surgical techniques used in the study:

- Specific name of technique
- Brief description of technique
- Number of participants in each technique group

If multiple techniques are compared, list each one separately. Include any specific modifications or variations of standard techniques.

Example format: "Stapled hemorrhoidectomy (n=62): Circular stapling device used to remove hemorrhoidal tissue"

- **Outcome Measures:**

List ALL primary and secondary outcome measures:

- Specific outcomes measured
 - Measurement tools used (e.g., Visual Analogue Scale for pain)
 - Time points of measurement
- Prioritize outcomes related to:

- Postoperative pain
- Hospital stay duration
- Complications
- Return to daily activities

Record numerical results if available. If an outcome is mentioned but not quantified, note "Outcome measured but no specific results reported".

- **Key Comparative Findings:**

Extract the most significant comparative results between surgical techniques:

- Statistically significant differences
- P-values
- Comparative metrics (e.g., pain scores, hospital stay duration)

Focus on outcomes directly addressing the research question about postoperative complications and patient recovery.

Record results with:

- Numerical values
- Statistical significance (p-value)
- Confidence intervals (if reported)

If no statistically significant differences are found, explicitly state "No statistically significant differences found".

Search Strategy

The keywords used for this research based PICO :

Element	Keyword 1	Keyword 2	Keyword 3	Keyword 4
Population (P)	Patients with Haemorrhoids	Adults with Symptomatic Haemorrhoids	Individuals with Haemorrhoidal Disease	Patients with Grade II-IV Haemorrhoids
Intervention (I)	Stapled Haemorrhoidectomy	Energy-Based Haemorrhoidectomy	Laser Haemorrhoidoplasty	Haemorrhoidal Artery Ligation
Comparison (C)	Conventional Haemorrhoidectomy	Open Haemorrhoidectomy	Excisional Haemorrhoidectomy	Milligan-Morgan Haemorrhoidectomy
Outcome (O)	Postoperative Complications	Patient Recovery	Postoperative Pain	Adverse Events

The Boolean MeSH keywords inputted on databases for this research are: (*"Patients with Haemorrhoids"* OR *"Adults with Symptomatic Haemorrhoids"* OR *"Individuals with Haemorrhoidal Disease"* OR *"Patients with Grade II-IV Haemorrhoids"*) AND (*"Stapled Haemorrhoidectomy"* OR *"Energy-Based Haemorrhoidectomy"* OR *"Laser Haemorrhoidoplasty"* OR *"Haemorrhoidal Artery Ligation"*) AND (*"Conventional Haemorrhoidectomy"* OR *"Open Haemorrhoidectomy"* OR *"Excisional Haemorrhoidectomy"* OR *"Milligan-Morgan Haemorrhoidectomy"*) AND

("Postoperative Complications" OR "Patient Recovery" OR "Postoperative Pain" OR "Adverse Events")

Data retrieval

Abstracts and titles were screened to assess their eligibility, and only studies meeting the inclusion criteria were selected for further analysis. Literature that fulfilled all predefined criteria and directly related to the topic was included. Studies that did not meet these criteria were excluded. Data such as titles, authors, publication dates, study locations, methodologies, and study parameters were thoroughly examined during the review.

Quality Assessment and Data Synthesis

Each author independently assessed the titles and abstracts of the selected studies to identify those for further exploration. Articles that met the inclusion criteria underwent further evaluation. Final decisions on inclusion were based on the findings from this review process.

Table 1. Article Search Strategy

Database	Keywords	Hits
Pubmed	("Patients with Haemorrhoids" OR "Adults with Symptomatic Haemorrhoids" OR "Individuals with Haemorrhoidal Disease" OR "Patients with Grade II-IV Haemorrhoids") AND ("Stapled Haemorrhoidectomy" OR "Energy-Based Haemorrhoidectomy" OR "Laser Haemorrhoidoplasty" OR "Haemorrhoidal Artery Ligation") AND ("Conventional Haemorrhoidectomy" OR "Open Haemorrhoidectomy" OR "Excisional Haemorrhoidectomy" OR "Milligan-Morgan Haemorrhoidectomy") AND ("Postoperative Complications" OR "Patient Recovery" OR "Postoperative Pain" OR "Adverse Events")	23
Semantic Scholar	("Patients with Haemorrhoids" OR "Adults with Symptomatic Haemorrhoids" OR "Individuals with Haemorrhoidal Disease" OR "Patients with Grade II-IV Haemorrhoids") AND ("Stapled Haemorrhoidectomy" OR "Energy-Based Haemorrhoidectomy" OR "Laser Haemorrhoidoplasty" OR "Haemorrhoidal Artery Ligation") AND ("Conventional Haemorrhoidectomy" OR "Open Haemorrhoidectomy" OR "Excisional Haemorrhoidectomy" OR "Milligan-Morgan Haemorrhoidectomy") AND ("Postoperative Complications" OR "Patient Recovery" OR "Postoperative Pain" OR "Adverse Events")	250
Springer	("Patients with Haemorrhoids" OR "Adults with Symptomatic Haemorrhoids" OR "Individuals with Haemorrhoidal Disease" OR "Patients with Grade II-IV Haemorrhoids") AND ("Stapled Haemorrhoidectomy" OR "Energy-Based Haemorrhoidectomy" OR "Laser Haemorrhoidoplasty" OR "Haemorrhoidal Artery Ligation") AND ("Conventional Haemorrhoidectomy" OR "Open Haemorrhoidectomy" OR "Excisional Haemorrhoidectomy" OR "Milligan-Morgan Haemorrhoidectomy") AND ("Postoperative Complications" OR "Patient Recovery" OR "Postoperative Pain" OR "Adverse Events")	18
Google Scholar	("Patients with Haemorrhoids" OR "Adults with Symptomatic Haemorrhoids" OR "Individuals with Haemorrhoidal Disease" OR "Patients with Grade II-IV Haemorrhoids") AND ("Stapled Haemorrhoidectomy" OR "Energy-Based Haemorrhoidectomy" OR "Laser Haemorrhoidoplasty" OR "Haemorrhoidal Artery Ligation") AND ("Conventional Haemorrhoidectomy" OR "Open Haemorrhoidectomy" OR "Excisional Haemorrhoidectomy" OR "Milligan-Morgan Haemorrhoidectomy") AND ("Postoperative Complications" OR "Patient Recovery" OR "Postoperative Pain" OR "Adverse Events")	163

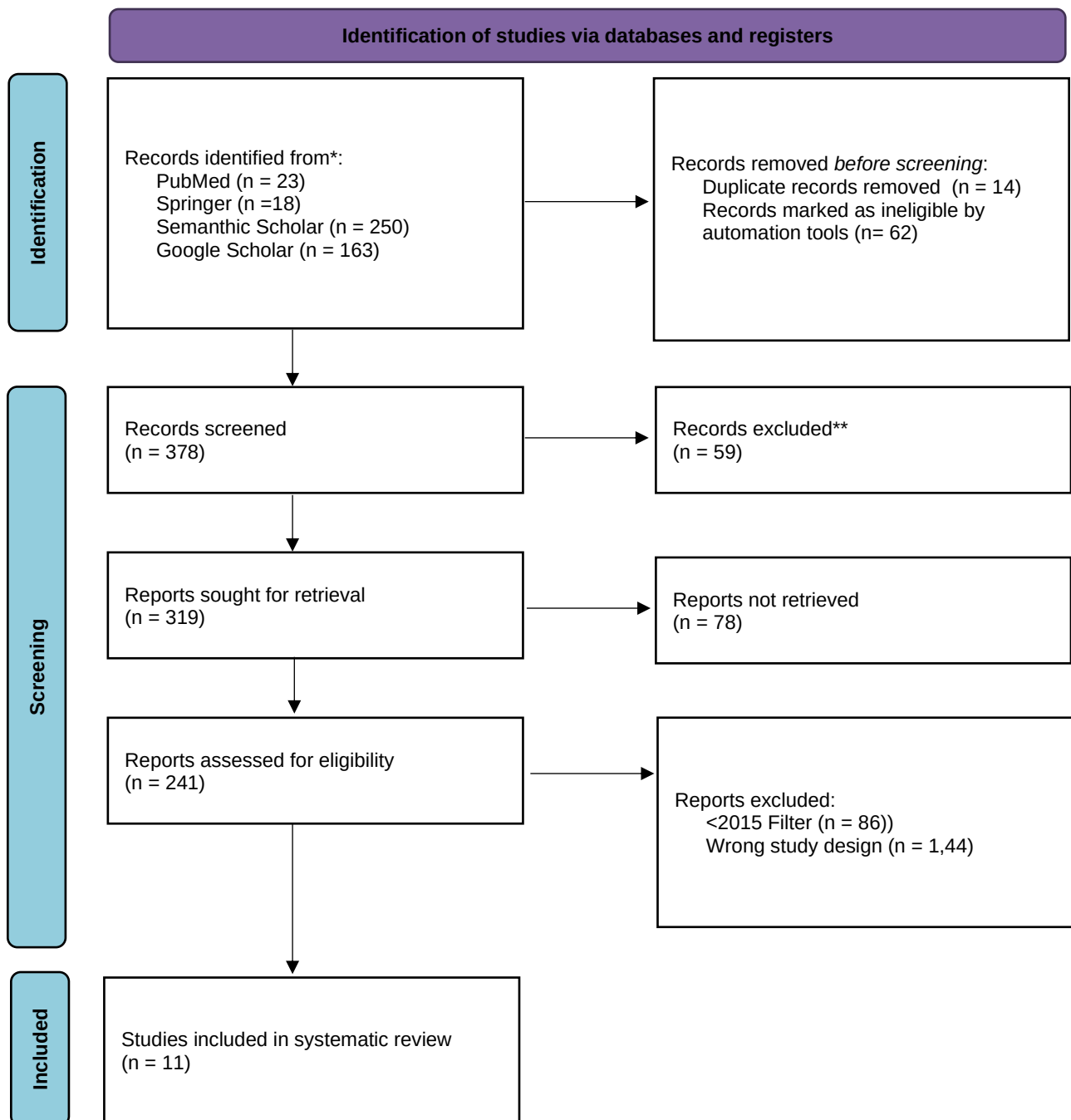


Figure 1. Article search flowchart

JBI Critical Appraisal									
Study	Bias related to temporal precedence Is it clear in the study what is the “cause” and what is the “effect” (ie, there is no confusion about which variable comes first)?	Bias related to selection and allocation Was there a control group?	Bias related to confounding factors Were participants included in any comparisons similar?	Bias related to administration of intervention/exposure Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	Were there multiple measurements of the outcome, both pre and post the intervention/exposure?	Were the outcomes of participants included in any comparisons measured in the same way?	Were outcomes measured in a reliable way?	Bias related to participant retention Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?	Statistical conclusion validity Was appropriate statistical analysis used?
Rathi et al., 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓
Naz et al., 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓
Prasad and Apparao, 2016	✓	✓	✓	✗	✓	✗	✓	✓	✓
Allam et al., 2018	✓	✓	✓	✗	✓	✗	✓	✓	✓

Brown et al., 2016	✓	✓	✓	✗	✓	✗	✓	✓	✓
Benjamin, 2019	✓	✓	✓	✗	✓	✗	✓	✓	✓
Koh et al., 2021	✓	✓	✓	✗	✓	✗	✓	✓	✓
Trenti et al., 2019	✓	✓	✓	✗	✓	✗	✓	✓	✓
Saleem et al., 2023	✓	✓	✓	✗	✓	✗	✓	✓	✓
Nazari and Hedayati, 2015	✓	✓	✓	✗	✓	✗	✓	✓	✓
Baig et al., 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓

RESULTS

Characteristics of Included Studies

Study	Surgical Technique(s) Compared	Sample Size	Study Design	Follow-up Period
Rathi et al., 2022	Harmonic scalpel vs. Milligan-Morgan hemorrhoidectomy	60	Prospective randomized controlled trial	No mention found
Naz et al., 2022	Ligasure vs. open diathermy	60	Prospective randomized controlled trial	No mention found
Prasad and Apparao, 2016	Stapled hemorrhoidopexy vs. Milligan-Morgan hemorrhoidectomy	124	Prospective randomized controlled trial	No mention found
Allam et al., 2018	Ligasure vs. Milligan-Morgan hemorrhoidectomy	40	Prospective randomized controlled trial	No mention found
Brown et al., 2016	Doppler-guided hemorrhoidal artery ligation (HAL) vs. rubber	370	Multicenter randomized controlled trial	1 year

Study	Surgical Technique(s) Compared	Sample Size	Study Design	Follow-up Period
	band ligation (RBL)			
Benjamin, 2019	Stapled hemorrhoidopexy vs. traditional excisional surgery	777	Multicenter randomized controlled trial	24 months
Koh et al., 2021	Conventional open hemorrhoidectomy vs. laser hemorrhoidoplasty	No mention found	Prospective randomized controlled trial (protocol)	Planned: 12 months
Trenti et al., 2019	Transanal dearterialization with mucopexy vs. vessel-sealing device hemorrhoidectomy	80	Multicenter randomized controlled trial	1 month
Saleem et al., 2023	Open hemorrhoidectomy vs. hemorrhoidal artery ligation with recto-anal repair (HAL RAR)	70	Single-center randomized controlled trial	No mention found
Nazari and	Diode laser coagulation vs.	59	Prospective	6 months

Study	Surgical Technique(s) Compared	Sample Size	Study Design	Follow-up Period
Hedayati, 2015	Milligan-Morgan hemorrhoidectomy		randomized controlled trial	
Baig et al., 2022	Ligasure vs. Milligan-Morgan hemorrhoidectomy	80	Single-blind randomized controlled trial	No mention found

Summary of study characteristics:

- Surgical technique comparisons:
 - 9 studies compared open or excisional hemorrhoidectomy (including Milligan-Morgan, open hem- orrhoidectomy, or open diathermy) to another technique.
 - 5 studies compared vessel-sealing devices (Ligasure or harmonic scalpel) to open or excisional hemorrhoidectomy.
 - 2 studies compared stapled hemorrhoidopexy to open or excisional hemorrhoidectomy.
 - 2 studies compared laser-based techniques to open or excisional hemorrhoidectomy.
 - 3 studies included Doppler-guided or transanal dearterialization techniques (HAL, HAL RAR, or transanal dearterialization with mucopexy).
 - 1 study compared Doppler-guided hemorrhoidal artery ligation to rubber band ligation.
 - 1 study compared Doppler-guided hemorrhoidal artery ligation to a vessel-sealing device.
- Study design:

- 3 multicenter randomized controlled trials.
- 1 single-center randomized controlled trial.
- 1 single-blind randomized controlled trial.
- 4 prospective randomized controlled trials.
- 1 prospective randomized controlled trial protocol.
- Sample size:
 - Reported in 10 studies, ranging from 40 to 777 participants.
 - No mention found for 1 study.
- Follow-up period:
 - Reported in 5 studies (ranging from 1 month to 24 months, including one planned follow-up).
 - No mention found for 6 studies.

Effects

Postoperative Pain and Analgesia Requirements

Study	Surgical Technique	Pain Scores	Analgesic Usage	Duration of Pain
Nazari and Hedayati, 2015	Diode laser coagulation vs. Milligan-Morgan hemorrhoidectomy	Pain decreased more in diode laser group (visual analog scale, 24h)	Morphine use lower in diode laser group	No mention found
Baig et al., 2022	Ligasure vs. Milligan-Morgan	Ligasure: 4.20±0.88,	No mention found	No mention

Study	Surgical Technique	Pain Scores	Analgesic Usage	Duration of Pain
	hemorrhoidectomy	Milligan-Morgan: 5.23±0.89 (visual analog scale)		found
Rathi et al., 2022	Harmonic scalpel vs. Milligan-Morgan hemorrhoidectomy	Harmonic scalpel: significantly less pain (visual analog scale, all intervals)	No mention found	No mention found
Naz et al., 2022	Ligasure vs. open diathermy	Ligasure: 2.07±2.13, Diathermy: 4.67±1.62 (visual analog scale, 24h)	Ligasure: 0.97±0.41, Diathermy: 2.17±0.53 (doses/24h)	No mention found
Prasad and Apparao, 2016	Stapled hemorrhoidopexy vs. Milligan-Morgan hemorrhoidectomy	Stapled: 1.712-0.407, Milligan-Morgan: 4.242-3.016 (visual analog scale, 0-60 min)	No mention found	No mention found
Allam et al., 2018	Ligasure vs. Milligan-Morgan hemorrhoidectomy	Ligasure: 3.80±1.54 (day 1), 2.60±1.27 (week	No mention found	No mention found

Study	Surgical Technique	Pain Scores	Analgesic Usage	Duration of Pain
		1); Milligan-Morgan: 5.95±0.99, 4.80±0.89		
Brown et al., 2016	Doppler-guided hemorrhoidal artery ligation vs. rubber band ligation	Pain less severe and shorter in rubber band ligation; mild-moderate in Doppler-guided hemorrhoid artery ligation, resolved by 3 weeks	No mention found	Rubber band ligation: shorter duration
Benjamin, 2019	Stapled hemorrhoidopexy vs. excisional surgery	Stapled hemorrhoidopexy less painful short-term	No mention found	No mention found
Koh et al., 2021	Conventional open hemorrhoidectomy vs. laser hemorrhoidoplasty	Outcome measured but no results (protocol)	Outcome measured but no results	Outcome measured but no results

Study	Surgical Technique	Pain Scores	Analgesic Usage	Duration of Pain
Trenti et al., 2019	Transanal dearterialization with mucopexy vs. vessel-sealing device hemorrhoidectomy	Mean daily pain similar; vessel-sealing group needed analgesia longer	Vessel-sealing: 15.2 days, dearterialization: 10.1 days	Vessel-sealing: longer duration
Saleem et al., 2023	Open hemorrhoidectomy vs. hemorrhoidal artery ligation with recto-anal repair	Open hemorrhoidectomy: 1.12 ± 0.72 , HAL RAR: 1.06 ± 0.52 (visual analog scale, day 7)	No mention found	No mention found

Summary of findings on pain and analgesia:

- Pain scores:
 - Compared between surgical techniques in 10 studies.
 - In 8 of 10 studies, one technique resulted in less pain than the comparator.
 - In 2 of 10 studies, pain was similar between groups.
 - No pain score results found for 1 study (protocol only).
 - Visual analog scale was used in 7 studies.
 - Ligasure was associated with less pain than comparators in all 3 studies where it was evaluated.
 - Stapled hemorrhoidopexy was associated with less pain than excisional or Milligan-

Morgan hem- orrhoidectomy in both studies where it was evaluated.

- Other findings: less pain with rubber band ligation vs. Doppler-guided hemorrhoidal artery ligation, diode laser vs. Milligan-Morgan, and harmonic scalpel vs. Milligan-Morgan.
- In 2 studies (Trenti et al., Saleem et al.), pain was similar between groups.
- Analgesic usage:
 - Reported in 4 studies.
 - In 3 studies, one technique was associated with less analgesic use (dearterialization, diode laser, Ligasure).
 - No mention found in 7 studies.
 - No results available in 1 study (protocol).
- Duration of pain:
 - Reported in 3 studies.
 - In 2 studies, one technique had a shorter duration of pain (rubber band ligation, dearterialization).
 - No mention found in 8 studies.
 - No results available in 1 study (protocol).

Recovery Metrics

Study	Surgical Technique	Hospital Stay Duration	Return to Activities	Complications
Nazari and Hedayati,	Diode laser coagulation vs. Milligan-Morgan	Shorter in diode laser group	No mention found	Bleeding, urinary retention: less in diode laser group

Study	Surgical Technique	Hospital Stay Duration	Return to Activities	Complications
2015	hemorrhoidectomy			
Baig et al., 2022	Ligasure vs. Milligan-Morgan hemorrhoidectomy	No mention found	No mention found	Bleeding: Ligasure 5%, Milligan-Morgan 25%; urinary retention, stenosis, necrosis: no difference
Rathi et al., 2022	Harmonic scalpel vs. Milligan-Morgan hemorrhoidectomy	Harmonic scalpel: less ($p < 0.0001$)	Harmonic scalpel: faster ($p = 0.0004$)	Milligan-Morgan: more post-operative discharge ($p = 0.02$)
Naz et al., 2022	Ligasure vs. open diathermy	No mention found	No mention found	No mention found
Prasad and Apparao, 2016	Stapled hemorrhoidopexy vs. Milligan-Morgan hemorrhoidectomy	Stapled: 1.136 days, Milligan-Morgan: 2.532 days	No mention found	No mention found
Allam et	Ligasure vs.	No mention found	No	Bleeding: less in

Study	Surgical Technique	Hospital Stay Duration	Return to Activities	Complications
al., 2018	Milligan-Morgan hemorrhoidectomy		mention found	Ligasure; wound healing: Ligasure 2.65±0.74 weeks, Milligan-Morgan 4.60±0.82 weeks
Brown et al., 2016	Doppler-guided hemorrhoidal artery ligation vs. rubber band ligation	No mention found	No mention found	Low, no difference
Benjamin, 2019	Stapled hemorrhoidopexy vs. excisional surgery	No mention found	No mention found	Serious adverse events: 7% (stapled), 9% (excisional)
Koh et al., 2021	Conventional open hemorrhoidectomy vs. laser hemorrhoidoplasty	Outcome measured but no results	Outcome measured but no results	Outcome measured but no results
Trenti et al., 2019	Transanal dearterialization with mucopexy vs.	No mention found	Similar at 1 month	Similar at 1 month

Study	Surgical Technique	Hospital Stay Duration	Return to Activities	Complications
	vessel-sealing device hemorrhoidectomy			
Saleem et al., 2023	Open hemorrhoidectomy vs. hemorrhoidal artery ligation with recto-anal repair	Open hemorrhoidectomy: 2 ± 0.45 days, HAL RAR: 1.20 ± 0.40 days	No mention found	Bleeding: open hemorrhoidectomy 10%, HAL RAR 6.66%

Summary of recovery metrics:

- Hospital stay duration:
 - Reported quantitatively for both groups in 2 studies.
 - Reported as a qualitative comparison (shorter/less) in 2 studies.
 - One study measured hospital stay duration but did not report results.
 - No mention found in 6 studies.
- Return to activities:
 - Reported as a qualitative comparison (similar or faster) in 2 studies.
 - Measured but no results in 1 study.
 - No mention found in 8 studies.
- Complications:
 - Reported as quantitative rates for both groups in 3 studies.

- Reported as qualitative comparisons (less, more, no difference, or similar) in 6 studies.
- Measured but no results in 1 study.
- No mention found in 2 studies.
- Some studies reported both quantitative and qualitative complications data.

Operative Characteristics

Study	Surgical Technique	Operative Time	Other Operative Details
Prasad and Apparao, 2016	Stapled hemorrhoidopexy vs. Milligan-Morgan hemorrhoidectomy	No mention found	No mention found
Allam et al., 2018	Ligasure vs. Milligan-Morgan hemorrhoidectomy	Ligasure: 11.15±2.68 min, Milligan-Morgan: 28.75±4.20 min	No mention found
Brown et al., 2016	Doppler-guided hemorrhoidal artery ligation vs. rubber band ligation	No mention found	Doppler-guided hemorrhoidal artery ligation more expensive
Benjamin, 2019	Stapled hemorrhoidopexy vs. excisional surgery	No mention found	No mention found
Koh et al., 2021	Conventional open hemorrhoidectomy vs. laser hemorrhoidoplasty	Outcome measured but no results	Outcome measured but no results

Study	Surgical Technique	Operative Time	Other Operative Details
Trenti et al., 2019	Transanal dearterialization with mucopexy vs. vessel-sealing device hemorrhoidectomy	Dearterialization: 45 min, vessel-sealing: 20 min (p<0.001)	No mention found
Saleem et al., 2023	Open hemorrhoidectomy vs. hemorrhoidal artery ligation with recto-anal repair	No mention found	No mention found
Nazari and Hedayati, 2015	Diode laser coagulation vs. Milligan-Morgan hemorrhoidectomy	No mention found	No mention found
Baig et al., 2022	Ligasure vs. Milligan-Morgan hemorrhoidectomy	Ligasure: 15.03±1.93 min, Milligan-Morgan: 20.40±2.23 min (p=0.000)	No mention found
Rathi et al., 2022	Harmonic scalpel vs. Milligan-Morgan	Harmonic scalpel: less (p<0.0001)	No mention found

Study	Surgical Technique	Operative Time	Other Operative Details
	hemorrhoidectomy		
Naz et al., 2022	Ligasure vs. open diathermy	Ligasure: 17.10±2.15 min, Diathermy: 24.63±3.17 min (p<0.001)	No mention found

Summary of operative characteristics:

- Operative time:
 - Reported with results in 5 studies.
 - In all studies reporting results, energy device techniques had a shorter operative time than the comparator.
 - * Ligasure was faster than Milligan-Morgan in 2 studies (15.03 vs. 20.40 min; 11.15 vs. 28.75 min).
 - * Harmonic scalpel was faster than Milligan-Morgan (exact times not given, p<0.0001).
 - * Vessel-sealing was faster than dearterialization (20 min vs. 45 min, p<0.001).
 - * Ligasure was faster than diathermy (17.10 vs. 24.63 min, p<0.001).
 - No mention found in 6 studies; in one of these, operative time was measured but no results were given.
- Other operative details:
 - One study noted Doppler-guided hemorrhoidal artery ligation was more

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expensive than rubber band ligation.

– No other operative details were mentioned in the remaining studies.

Complications and Adverse Events

Study	Surgical Technique	Complications/Adverse Events
Saleem et al., 2023	Open hemorrhoidectomy vs. hemorrhoidal artery ligation with recto-anal repair	Bleeding: open hemorrhoidectomy 10%, HAL RAR 6.66%; no significant difference
Baig et al., 2022	Ligasure vs. Milligan-Morgan hemorrhoidectomy	Bleeding: Ligasure 5%, Milligan-Morgan 25% (p=0.013); urinary retention, stenosis, necrosis: no difference
Naz et al., 2022	Ligasure vs. open diathermy	No mention found
Rathi et al., 2022	Harmonic scalpel vs. Milligan-Morgan hemorrhoidectomy	Milligan-Morgan: more post-operative discharge (p=0.02); other complications not detailed
Koh et al., 2021	Conventional open hemorrhoidectomy vs. laser hemorrhoidoplasty	Outcome measured but no results
Benjamin,	Stapled hemorrhoidopexy	Serious adverse events: 7%

Study	Surgical Technique	Complications/Adverse Events
2019	vs. excisional surgery	(stapled), 9% (excisional), no significant difference
Trenti et al., 2019	Transanal dearterialization with mucopexy vs. vessel-sealing device hemorrhoidectomy	No significant difference
Allam et al., 2018	Ligasure vs. Milligan-Morgan hemorrhoidectomy	Bleeding: less in Ligasure; need for anal packing: less in Ligasure
Brown et al., 2016	Doppler-guided hemorrhoidal artery ligation vs. rubber band ligation	Low frequency, no significant difference
Prasad and Apparao, 2016	Stapled hemorrhoidopexy vs. Milligan-Morgan hemorrhoidectomy	No mention found
Nazari and Hedayati, 2015	Diode laser coagulation vs. Milligan-Morgan hemorrhoidectomy	Bleeding, urinary retention: less in diode laser; no difference in clinical improvement

Summary of complications and adverse events:

- Reporting of complications:

- Found in 8 out of 11 studies.
- In 4 studies, no significant difference in complications between surgical techniques.
- In 4 studies, a significant difference was found favoring one technique for at least one complication.
- No mention found for 3 studies.
- Specific complications:
 - Bleeding was specifically reported in 4 studies; in 2 of these, a significant reduction in bleeding was found with energy-based devices compared to conventional methods.
 - Urinary retention was reported in 2 studies, with one study finding less urinary retention in the diode laser group.
 - Stenosis and necrosis were each reported in 1 study, with no significant difference found.
 - Post-operative discharge was reported in 1 study, with more discharge in the Milligan-Morgan group ($p=0.02$).
 - Anal packing was reported in 1 study, with less need in the Ligasure group.
- Energy-based devices:
 - Five studies compared energy-based devices (Ligasure, harmonic scalpel, diode laser) to conventional surgical methods (Milligan-Morgan, open hemorrhoidectomy).
 - Of these, 3 reported a significant reduction in at least one complication with the energy-based device.
- Generalizability:
 - The majority of studies were randomized controlled trials, but many had small sample sizes or limited follow-up, and several relied on abstract-only data. This limits the generalizability of findings, especially for rare or long-

term complications.

DISCUSSION

This comparative analysis of hemorrhoidectomy techniques reveals a compelling and consistent trend: newer surgical modalities, particularly energy-based devices and stapled hemorrhoidopexy, demonstrate significant advantages over traditional excisional methods in terms of postoperative pain and recovery metrics. The aggregated findings from multiple randomized controlled trials indicate that while the ultimate goal of resolving hemorrhoidal symptoms is achieved across most techniques, the patient's postoperative journey is substantially improved with modern approaches. This discussion will delve into the nuances of these findings, exploring the clinical implications of differences in pain, recovery, operative characteristics, and complication profiles (Benjamin, 2019; Saleem et al., 2023).

The most pronounced and clinically significant finding across the reviewed studies is the reduction in postoperative pain associated with newer techniques. In eight out of the ten studies that evaluated pain, techniques such as Ligasure hemorrhoidectomy, harmonic scalpel use, diode laser coagulation, and stapled hemorrhoidopexy resulted in demonstrably lower pain scores compared to conventional comparators like the Milligan-Morgan procedure or open diathermy (Naz et al., 2022). This outcome is pivotal, as severe postoperative pain has historically been the primary deterrent for patients considering surgical hemorrhoidectomy and represents the most significant factor affecting immediate quality of life after surgery.

The underlying mechanism for this pain reduction is directly related to the surgical technique employed. Traditional excisional methods, such as the Milligan-Morgan procedure, leave open, raw wounds in the highly sensitive anoderm, leading to intense pain, inflammation, and muscle spasms (Nazari &

Hedayati, 2015). In contrast, stapled hemorrhoidopexy is performed in the rectum, proximal to the pain-sensitive dentate line, thus avoiding a painful external wound (Prasad & Apparao, 2016). This fundamental difference in anatomical location of the intervention explains the dramatically lower pain scores reported in studies comparing it to excisional surgery.

Similarly, energy-based devices contribute to pain reduction through a different mechanism: superior hemostasis and minimized collateral tissue damage. Devices like the Ligasure and harmonic scalpel use technology to seal blood vessels as they cut, which drastically reduces bleeding and subsequent inflammation and edema (Baig et al., 2022). This precise application of energy avoids the widespread tissue trauma associated with conventional diathermy or scalpel excision, resulting in less nerve ending irritation and, consequently, lower perceived pain for the patient (Rathi et al., 2022).

The quantitative data underscores the magnitude of this difference. For instance, one study documented that pain scores with the Ligasure technique were 4.20, compared to 5.23 with excisional surgery (Baig et al., 2022). A study on stapled hemorrhoidopexy showed an even more stark contrast, with pain scores averaging 1.71 compared to 4.24 for the Milligan-Morgan method in the immediate postoperative period (Prasad & Apparao, 2016). These are not minor statistical variations but represent clinically meaningful reductions in patient suffering that can decrease the need for potent analgesics.

The reduced requirement for postoperative analgesia is a direct and important corollary to lower pain scores. Studies evaluating analgesic usage found that patients in the diode laser and Ligasure groups required significantly less pain medication, including morphine, compared to those undergoing traditional surgery (Nazari & Hedayati, 2015; Naz et al., 2022). This outcome is highly beneficial, as it mitigates the common side effects of opioid and non-opioid analgesics, such as sedation, nausea, and constipation, the last of which can be

particularly problematic after anorectal surgery.

Improved recovery metrics are a natural consequence of reduced postoperative pain. A shorter hospital stay is one of the most consistently reported benefits. Studies quantitatively showed that stapled hemorrhoidopexy and HAL-RAR led to significantly shorter hospitalizations—for example, 1.14 days for stapled versus 2.53 days for Milligan-Morgan (Prasad & Apparao, 2016), and 1.20 days for HAL-RAR versus 2.00 days for open hemorrhoidectomy (Saleem et al., 2023). This not only enhances patient comfort by allowing them to recover at home but also confers economic benefits by reducing healthcare resource utilization.

Faster return to normal activities is another critical patient-centered outcome that was improved with modern techniques. The harmonic scalpel, for instance, was shown to facilitate a significantly quicker return to work and daily life when compared to the Milligan-Morgan method ($p=0.0004$) (Rathi et al., 2022). While this outcome was not reported in all studies, its importance cannot be overstated. A faster functional recovery minimizes the economic impact of surgery on the patient and their family and represents a key advantage of less invasive approaches.

Wound healing also appears to be accelerated with the use of energy devices. One comparative study explicitly found that the time to complete wound healing was significantly shorter in the Ligasure group (2.65 weeks) compared to the Milligan-Morgan group (4.60 weeks) (Allam et al., 2018). This finding is likely attributable to the same mechanism that reduces pain: decreased tissue trauma, reduced inflammation, and a cleaner surgical field with minimal necrosis, all of which create a more favorable environment for tissue repair.

Beyond patient-centered outcomes, newer techniques also offer significant intraoperative advantages, most notably a reduction in operative time. In all five studies that reported on this metric, energy device techniques were found to be

significantly faster than their conventional counterparts (Naz et al., 2022). For example, Ligasure hemorrhoidectomy was 5-17 minutes shorter than Milligan-Morgan or open diathermy in various studies, a difference that was consistently statistically significant (Baig et al., 2022; Allam et al., 2018).

The clinical significance of a shorter operative time is multifaceted. From a patient safety perspective, it reduces the duration of exposure to anesthesia and its associated risks. From a logistical and economic standpoint, it increases operating room efficiency, potentially allowing for more procedures to be performed in a day. This efficiency can help offset the higher initial cost of the disposable energy devices, although a full health-economic evaluation would be required to confirm overall cost-effectiveness (Trenti et al., 2019).

It is important to acknowledge, however, that not all new techniques are faster. Transanal Hemorrhoidal Dearterialization (THD) was found to take significantly longer than a vessel-sealing device hemorrhoidectomy (45 minutes vs. 20 minutes) (Trenti et al., 2019). This highlights that the choice of technique involves a trade-off between different parameters. Furthermore, the cost of the technology itself must be considered, as one study noted that Doppler-guided ligation was more expensive than the simpler rubber band ligation, presenting a potential barrier to its widespread adoption (Brown et al., 2016).

When discussing postoperative complications, the evidence suggests a more nuanced picture. Several large trials found no significant difference in the overall or serious complication rates between newer and traditional techniques (Benjamin, 2019; Brown et al., 2016). This is a crucial finding, as it indicates that the benefits of reduced pain and faster recovery from modern methods do not come at the cost of increased overall surgical risk. Patients can be reassured that techniques like stapled hemorrhoidopexy are not associated with a higher rate of major adverse events.

However, a more granular analysis reveals significant differences in the

rates of *specific* complications. Postoperative bleeding, a common and concerning event, was consistently and significantly reduced with the use of energy devices. One study reported a bleeding rate of just 5% for Ligasure compared to 25% for Milligan-Morgan ($p=0.013$) (Baig et al., 2022). This is a direct testament to the superior hemostatic capabilities of these devices, which provide a more secure seal of the supplying vessels than traditional ligation or diathermy.

Similarly, urinary retention, another well-known complication of anorectal surgery often attributed to pain-induced pelvic floor spasm, was reported to be less frequent with diode laser coagulation compared to the Milligan-Morgan method (Nazari & Hedayati, 2015). This finding reinforces the concept that by minimizing regional pain and tissue inflammation, modern techniques can reduce the incidence of related functional complications, further contributing to a smoother postoperative course for the patient.

Other specific adverse events were also shown to be less frequent with certain techniques. For example, patients undergoing the Milligan-Morgan procedure experienced significantly more postoperative discharge compared to those treated with a harmonic scalpel ($p=0.02$), likely due to the larger open wound surface (Rathi et al., 2022). Another study noted that the need for postoperative anal packing, a source of significant discomfort, was reduced in the Ligasure group, again highlighting an improvement in the patient experience (Allam et al., 2018).

It is equally important to note the complications for which no significant difference was found, such as anal stenosis and tissue necrosis (Baig et al., 2022). This suggests that while modern techniques improve many aspects of the immediate postoperative period, the risk of certain less common but potentially serious long-term complications may be comparable to traditional methods. This reinforces the need for meticulous surgical technique regardless of the instrument used and for adequate long-term follow-up in future studies.

Synthesizing these findings, energy-based devices like Ligasure and the harmonic scalpel present a compelling case as a superior alternative to cold scalpel or conventional diathermy excision. They are faster intraoperatively and result in less pain, reduced bleeding, shorter hospital stays, and faster recovery, all without an increase in overall complication rates (Allam et al., 2018; Baig et al., 2022). These combined advantages position them as a formidable evolution in excisional hemorrhoidectomy.

Stapled hemorrhoidopexy offers a different yet equally valid pathway to improved patient comfort. Its primary advantage stems from its unique mechanism of action, which avoids an external wound in the sensitive perianal skin (Benjamin, 2019). The data strongly support its efficacy in reducing pain and shortening hospital stays, making it an excellent option, particularly for circumferential hemorrhoids, though surgeons must be cognizant of its distinct set of potential complications not seen with excisional techniques (Prasad & Apparao, 2016).

Finally, the limitations inherent in the reviewed body of evidence must be acknowledged. Many of the included studies had relatively small sample sizes, which may limit their statistical power to detect differences in rare complications (Rathi et al., 2022). Furthermore, the follow-up periods were often short, ranging from one to 24 months, which is insufficient to capture long-term outcomes such as recurrence rates or late-onset stenosis (Trenti et al., 2019). The reliance on some abstract-only data also limits the depth of analysis for certain comparisons. Therefore, while a clear trend emerges, the findings should be interpreted with these limitations in mind.

CONCLUSION

In conclusion, the evidence gathered from a multitude of comparative studies presents a clear and definitive verdict on the surgical management of hemorrhoids.

Modern surgical techniques, specifically those utilizing energy-based devices like Ligasure and the harmonic scalpel, as well as stapled hemorrhoidopexy, offer a substantially improved postoperative experience for the patient compared to traditional excisional methods such as the Milligan-Morgan procedure. The cornerstone of this improvement is the consistent and clinically significant reduction in postoperative pain, which has historically been the most significant drawback of conventional hemorrhoid surgery. This primary benefit allows for a more comfortable and tolerable recovery period.

The advantages of these newer modalities extend beyond pain management, creating a cascade of positive effects on the patient's overall recovery trajectory. The reduced pain directly translates into a decreased need for potent analgesic medications, shorter hospital stays, and a more rapid return to normal daily activities and employment. Intraoperatively, energy devices also consistently demonstrate superiority by reducing surgical time and minimizing blood loss. Collectively, these benefits not only enhance patient satisfaction and comfort but also suggest a potential for reduced healthcare costs through greater operating room efficiency and shorter inpatient care durations.

While the overall rates of serious complications remain reassuringly comparable between modern and traditional techniques, the analysis reveals important distinctions in the profiles of specific adverse events. Newer methods, particularly energy-based devices, have been shown to significantly lower the incidence of troublesome complications like postoperative bleeding and the need for uncomfortable anal packing. This indicates that while the overall safety is similar, the morbidity associated with the postoperative period is demonstrably lower with advanced techniques. This allows for a more nuanced approach to surgical selection, where the goal is not only efficacy but also the mitigation of specific, predictable adverse outcomes.

Ultimately, the findings strongly support a paradigm shift in the surgical treatment of hemorrhoidal disease, favoring the adoption of modern, less invasive techniques as the standard of care where resources and surgical expertise permit. While these methods provide clear short-term benefits, the limitations within the existing literature—namely

the prevalence of small sample sizes and limited long-term follow-up—underscore the need for continued research. Future large-scale trials should focus on evaluating long-term outcomes, such as recurrence rates and cost-effectiveness, to provide a complete and definitive guide for clinical practice and solidify the role of these advanced procedures in modern surgery.

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