

# Updates of surgical treatment in hemorrhoidal disease

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## Abstract

Hemorrhoidal disease is one of the most prevalent and frequently occurring conditions worldwide. Treatment modalities for hemorrhoids are multifaceted and tailored according to the severity of the condition. Various surgical procedures and modified approaches had been invented since 1937. Here we review the workflow, advantages, and disadvantages of different types of hemorrhoid surgery (conventional excisional hemorrhoidectomy, modified excisional surgery, stapled/partial stapled hemorrhoidopexy, and Doppler-guided hemorrhoidal artery ligation). There is no single treatment that fits all hemorrhoid patients. Surgeons should make the operation plan based on patients' conditions and wills.

## KEYWORDS

hemorrhoidectomy, hemorrhoids, review, surgical treatment

## BACKGROUND

Hemorrhoids, which are swollen and inflamed blood vessels situated in the lower rectum and the anus, represent one of the most prevalent and frequently occurring conditions worldwide [1]. It is estimated that the prevalence rate of hemorrhoids is up to 44% in the general population [2]. Hemorrhoids manifesting clinical symptoms are categorized as internal, external, or mixed contingent upon their anatomical location, stratified into Grades I through IV based on the severity [3]. The ramifications of hemorrhoids extend far beyond mere physical discomfort. The consequent pain, itching, bleeding, and potential complications significantly undermine an individual's quality of life [4].

Treatment modalities for hemorrhoids are multifaceted and tailored according to the severity of the condition. According to the guidelines, these approaches are broadly categorized as pharmacological therapies, non-pharmacological interventions, outpatient procedures, and surgical treatments [4, 5]. Medications, particularly topical agents, serve to alleviate symptoms, reduce

inflammation, and provide relief. Nondrug interventions might include dietary changes, enhanced fluid intake, and sitz baths, which can collectively ameliorate symptoms and potentially reduce the frequency of flare-ups. In patients where basic treatment has not resulted in acceptable symptom reduction, further outpatient procedures (i.e., rubber band ligation, sclerotherapy (SCL), or infrared coagulation (IRC)) should be considered due to their economical and rapid efficiency [6].

However, for hemorrhoids of Grade III and Grade IV, which represent the more severe end of the spectrum and characterized by significant prolapse, are often best managed through surgical interventions according to the guideline of the American Society of Colon and Rectal Surgeons [1, 5]. Traditional excisional surgery is the most commonly used surgical treatment for hemorrhoids. This surgery involves the removal of the hemorrhoidal tissue, followed by suturing the wound. The past few decades have witnessed the evolution of surgical techniques, with several modifications being introduced to the classical excisional approach. These modifications aim to mitigate postoperative pain and expedite the

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**TABLE 1** Characteristics of different types of hemorrhoid surgery.

Treatment strategy	Surgical approach	Characteristics
Conventional excisional hemorrhoidectomy (EH)	Open hemorrhoidectomy (OH)	V-shaped incision, stripping of internal hemorrhoids, tying off vascular pedicle, and removal of extra tissue
	Closed hemorrhoidectomy (CH)	Incision at hemorrhoid border, ligation, and closure with sutures. Faster healing compared to open surgery
Modified excisional surgery	Segmental-sutured hemorrhoidectomy	Two sutures to ligate base, reducing bleeding and anal stenosis
	Medication injection combined with hemorrhoidectomy	Combines injections to reduce post-op pain and inflammation
Stapled/partial stapled hemorrhoidopexy	Sphincterotomy	Adjunct treatment to reduce pain by incising sphincter
	Transverse division with longitudinal ligation (TDLL)	Divides hemorrhoid, lowers pain and edema
Stapled/partial hemorrhoidopexy	Stapled hemorrhoidopexy (SH)	Extracts tissue ring to reduce post-op pain. Associated with unique complications
	Partial stapled haemorrhoidopexy (PSH)	Modified version, seeks to reduce complications. Data on efficacy pending

recovery process. Among the contemporary surgical interventions, the partial stapled haemorrhoidopexy and hemorrhoidal artery ligation have gained significant traction. The former involves the repositioning of the prolapsed hemorrhoidal tissue using a circular stapling device. The latter seeks to restrict blood flow to the hemorrhoidal tissue by ligating the arteries that supply them.

Here, we review the indications, workflow, advantages, and disadvantages of different types of hemorrhoid surgery, for helping physicians to select the appropriate surgical treatment based on the most recent clinical evidence. Characteristics of different types of hemorrhoid surgery are shown in Table 1.

## CONVENTIONAL EXCISIONAL HEMORRHOIDECTOMY

### Open hemorrhoidectomy

One of the standard and most commonly used open surgical procedures is Milligan-Morgan [M-M] hemorrhoidectomy [7]. The surgery is operated by making a V-shaped surgical incision in the anal skin. Then the attached tissues of the internal hemorrhoids are stripped out up to the mucocutaneous junction. A transfixation ligature is placed through the fibrous and vascular pedicle and then tied. Finally, the extra skin wrinkles and hemorrhoids are removed.

### Closed hemorrhoidectomy

Ferguson reported the closed operation in 1959 [8]. The incision begins at the external border of the hemorrhoid

until the varicosities with only a mucosal pedicle that remains attached and then ligated. The wound edge was secured to the anal canal and closed thoroughly by the same continuous suture.

Several literatures compared between the open and closed operations in terms of postoperative pain, wound healing, and morbidity with Grade III to IV hemorrhoids. The result showed the closed technique is more advantageous with respect to less pain during the early postoperative period and faster wound healing [9]. Another study assessed the time taken for wounds to heal, the postoperative complications, and cost of management in patients with Grade II to III hemorrhoids. The results showed no statistically significant differences in the cost per patient and morbidity; however, healing was significantly faster after the closed approach [10]. A meta-analysis also found similar results that the closed approach had clinically measurable advantages over the open approach in terms of reduced postoperative pain, lower risk of postoperative bleeding, and faster wound healing [11].

## MODIFIED EXCISIONAL SURGERY

Surgeons would face a dilemma when dealing with circumferential hemorrhoids. The prolapsed hemorrhoids merged together without clear boundaries, which would increase the difficulty and duration time during an operation. The outcomes of the conventional surgery are usually dissatisfactory in terms of painfulness, edema, residual hemorrhoids, urinary retention, and anal stenosis. A meta-analysis found out that the conventional hemorrhoidectomies (closed and open) have worse outcomes for postoperative pain and have more clinical complications after surgery. However,

hemorrhoidectomy is still the primary and standard solution to the Grade III–IV hemorrhoids [1, 12]. In order to achieve a better recovery in the aspect of piles removal, anal function protection, pain and edema control, surgeons developed several modified hemorrhoidectomy approaches [13].

### Segmental-sutured hemorrhoidectomy

Instead of using a single suture to ligature the fibrous and vascular pedicle, this modified surgical technique passed two No.7 silk sutures through the middle basal part of the hemorrhoid and tied from the proximal and distal sides separately. Then the remaining edges of the wound were either sutured or kept open in different studies.

Patients had less quantity of bleeding during the surgery and fewer percentage of archostegnosis after the surgery compared to the traditional hemorrhoid surgery [14]. In addition, a similar effective rate is obtained between two techniques in Grade II–III patients, while a higher rate is obtained with segmental sutured hemorrhoidectomy in Grade IV patients [15].

### Medication injection combined with hemorrhoidectomy

Many studies reported the combined therapeutic regimen of sclerotherapy or traditional Chinese medicine injection with surgery. The operation involves injection of a sclerotic agent into the hemorrhoidal sacs to block the blood flow. The combination therapy was confirmed to have a better efficacy with less postoperative pain, inflammation, or swelling [16–18].

### Sphincterotomy

Postoperative pain is the most obvious shortcoming of EH. One contributing factor may be the sphincterismus due to the exposure and pressure around the internal anal sphincter [19]. Sphincterotomy was widely used following EH as an adjunct treatment. Partial incision of the external and internal sphincter would help to reduce the tension in the anal canal after the suture ligation of hemorrhoids.

Normally, surgeons set internal and external sphincter incisions at 3, 7, or 9 o'clock to lose the tension [20–22]. He [23] and Chen [24] made an incision at 6 o'clock (lithotomy position), which extended from 0.2 cm above the dentate line to 1 cm outside the anus. The skin and subcutaneous tissue around the incision were trimmed, including the subcutaneous part of the external sphincter, creating a tension-free inverted isosceles triangular incision with an angle of approximately 30°.

### Transverse division with longitudinal ligation approach

Simple application of the conventional EH in the treatment of severe circumferential mixed hemorrhoids could possibly form a narrow ring in the anal canal. Sometimes, aiming for a smooth mucosal surface, surgeons would remove the piles as much as possible, which leads to a damage to the anal canal skin, resulting in postoperative incision scar contracture, anal stenosis, and high anal pressure. This situation would cause in the poor drainage of secretions and difficulty during defecation. When the patient tries to defecate, the stimulation of defecation aggravates the pain and the anal verge edema, thus worsening the postoperative experiences. Here, we introduce our modified approach as an alternative choice when dealing with circular or oversized hemorrhoids.

Two forceps were used to clamp and unfold the oversized hemorrhoid. A radial incision was made by using a scalpel, and the incision extended from 0.5 to 1 cm outside the external hemorrhoid to 0.5 cm above the dentate line, with depth to partial sphincter layer according to the tension of the anal canal. The hemorrhoid was divided into two parts, followed by the typical M-M operation process. Occasionally, the mucosal pedicle was still large after the division, and segmental-sutured hemorrhoidectomy could be applied during the surgery [25].

Clinical researches proved that patients had significant lower visual analog scale scores in pain and lower incidence of perianal edema after TDLL hemorrhoidectomy compared to the conventional M-M approach, with approximate effective rate, recovery duration, and incidence of urinary retention and anal stenosis [26].

### STAPLED/PARTIAL STAPLED HEMORRHOIDOPEXY

#### Stapled hemorrhoidopexy

Stapled hemorrhoidectomy (SH) garnered global acceptance, especially in recent years. Instead of conventionally removing the hemorrhoids and the anoderm, it extracts a 3-cm ring of the sliding tissue and consequently suspends the hemorrhoidal veins. This surgical maneuver optimizes the vascular inflow/outflow dynamics. The prolapsed mucosal and submucosal tissues are anchored above the dentate line, restoring the perianal folds' normal disposition and gas continence. By confining the surgical impact to areas devoid of somatic innervation, the procedure drastically reduces postoperative pain [27].

However, a multitude of studies has reported that SH has been associated with unique complications,

including rectovaginal fistula, staple line bleeding, and stricture at the staple line [28]. A comprehensive review that analyzed 784 articles, incorporating data from 14,232 patients, highlighted a median complication rate of 16.1% with 5 mortalities reported [29]. During the period from 2000 to 2009, scholarly publications documented 40 instances of rectal perforation following SH. Among these cases, 35 patients required laparotomy accompanied by fecal diversion, and one underwent a low anterior resection [30]. These findings underscore the gravity of potential complications associated with SH and emphasize the importance of a comprehensive risk assessment when considering this therapeutic approach. Additionally, since anemia and advanced age increase the risk of complications after SH surgery, SH therapy is not recommended for such patients [31].

### Partial stapled haemorrhoidopexy

The introduction of partial stapled hemorrhoidopexy (PSH), a modified version of SH, seeks to diminish these drawbacks [32]. The PSH process entails a selective purse-string suturing of the protruding hemorrhoidal tissues using a specialized window connected to an anoscope. Post this, hemorrhoids are excised using the auto-suturing apparatus identical to SH's original version, ensuring that normal mucosa covers the excision sites. It is suggested that PSH, employing fewer staples compared to SH, may have diminished side effects. However, conclusive data on this hypothesis remains pending [33]. Another focal point of ongoing research is the potential complications of PSH, such as recurrence and hemorrhage.

While the employment of staples initially faced skepticism, subsequent research has illuminated the safety of these titanium staples [32]. Most are either embedded within the mucosa or naturally expelled with feces. It is advised that a rectal exam after 6 weeks should verify the feasibility of such engagements [1, 4].

### DOPPLER-GUIDED HEMORRHOIDAL ARTERY LIGATION

Doppler-guided hemorrhoidal artery ligation (DGHL) technique employs specially designed anoscope embedded with a doppler ultrasound probe to discern and ligate individual hemorrhoidal arteries meticulously [34]. By ligating and blocking the arterial blood vessels supplying the hemorrhoidal tissue, the blood supply to the hemorrhoids is cut off, thereby causing the hemorrhoidal tissue to atrophy and alleviates the symptoms of hemorrhoidal prolapse.

Studies on DGHL have generally shown promising short-term outcomes. An analysis of 28 trials, which

encompasses 2904 patients with hemorrhoids, indicated a variable recurrence rate between 3.0% and 60.0%, with an aggregated rate of 17.5% [35]. Notably, recurrence was most frequent in grade IV cases. The necessity for postoperative pain relief varied, which was needed in 0%–38% of participants. Postoperative complications were minimal, characterized by a bleeding incidence of 5.0% and a reintervention frequency of 6.4%. The duration of the surgical procedure fluctuated between 19 and 35 min. However, the quest for comprehensive data on its effectiveness and recurrence rates for advanced lesions persists. Avital et al. reported a varying recurrence rate, depending on times [36]. At a 1-year postoperative mark, grade III hemorrhoids exhibited a recurrence rate of 13%. Extending this timeline to 5 years, the recurrence rates elevated to 31%. Although the morbidity rate associated with DGHL is relatively high, primarily manifesting as pain or tenesmus, it remarkably induces lesser postoperative pain compared to other surgical counterparts. Encompassing these attributes, DGHL is poised with significant potential to evolve as a preferred hemorrhoid treatment modality in clinical settings [37].

### DISCUSSION

The treatment efficacy of various procedures for hemorrhoids has been the subject of multiple systematic reviews. Comparing the treatment outcomes of SH with hemorrhoidectomy, the consensus from various reviews reveals that SH has certain short-term advantages [38, 39]. Notably, patients undergoing SH typically experience milder postoperative pain, have better wound healing outcomes, and shorter duration of hospitalization [40]. Furthermore, the time taken for SH and the time required for patients to resume their normal activities post SH are both shorter. SH also boasts lower incidences of postoperative bleeding, wound complications, constipation, and itching, thus leading to higher patient satisfaction.

However, there are concerns about long-term efficacy of SH. Studies have found that patients who undergo SH tend to have a higher incidence of postoperative prolapse and a higher rate of reinterventions for prolapse [28, 40]. A meta-analysis incorporating five RCTs compared the therapeutic effects of SH with the M-M hemorrhoidectomy and found that SH had longer operative times, higher incidences of residual skin tags and prolapse, and a higher postoperative recurrence rate [28]. Another meta-analysis, this time comprising four RCTs, discerned that for patients with grade III–IV hemorrhoids, there was no significant difference between SH and M-M hemorrhoidectomy in terms of postoperative pain scores and bleeding rates [41]. Nevertheless, SH demonstrated a significantly higher risk of prolapse recurrence within 2 years post-

surgery. Given these findings, for hemorrhoid patients seeking less painful alternatives, SH can be considered as one of the alternatives to traditional hemorrhoidectomy. However, it is crucial for physicians to inform patients about the potential risks associated with SH, including its higher recurrence rate and risk of prolapse, despite its short-term benefits.

As for DGHL and traditional hemorrhoidectomy, a systematic review encompassing 98 studies indicated that compared to open or closed hemorrhoidectomy, DGHL led to reduced postoperative bleeding, significantly fewer emergency surgical interventions, and quicker recovery [39]. However, DGHL had a higher recurrence rate. An additional meta-analysis involving three RCTs revealed that DGHL resulted in significantly less postoperative pain compared to SH, making it a preferred treatment choice for patients with grade III internal hemorrhoids [42]. Various studies have also highlighted that compared to hemorrhoidectomy and SH, patients post DGHL surgery tend to experience less pain, though DGHL has a higher recurrence rate compared to traditional hemorrhoidectomy [29].

Given the above results, traditional hemorrhoidectomy, especially modified excisional surgery should still be considered in patients seeking a low recurrence rate. On the other hand, DGHL, SH, or PSH may be recommended for patients who are afraid of pain, with full consideration of their contraindications and the possibility of complications. In conclusion, it is evident that no single treatment emerges as the definitive best option for all hemorrhoid patients. The choice of a surgical procedure should be tailored to the specific needs and circumstances of the patient, taking into consideration their unique risk factors, desired outcomes, and potential complications. It is of paramount importance to respect the individual preferences of patients, as the final determination of the surgical method should be a collaborative decision between the physician and the patient.

#### AUTHOR CONTRIBUTIONS

**Jianan Li:** Conceptualization; Writing – original draft. **Huangfu Ma:** Writing – review & editing. **Yue Wang:** Writing – original draft. **Lixia Lai:** Writing – review & editing. **Xuecheng Zhang:** Writing – original draft. **Yanmei Wang:** Conceptualization; funding acquisition; project administration.

#### ACKNOWLEDGMENTS

This work was supported by a grant from the National High-level of Hospital Clinical Research Funding of China-Japan Friendship Hospital (No. 2022-NHLHCRF-LX-02-0120).

#### CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

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**How to cite this article:** Li J, Ma H, Wang Y, Lai L, Zhang X, Wang Y. Updates of surgical treatment in hemorrhoidal disease. *Adv Chin Med*. 2024;1(3):156-161. <https://doi.org/10.1002/acm4.25>