Medscape

Anal Surgery for Hemorrhoids

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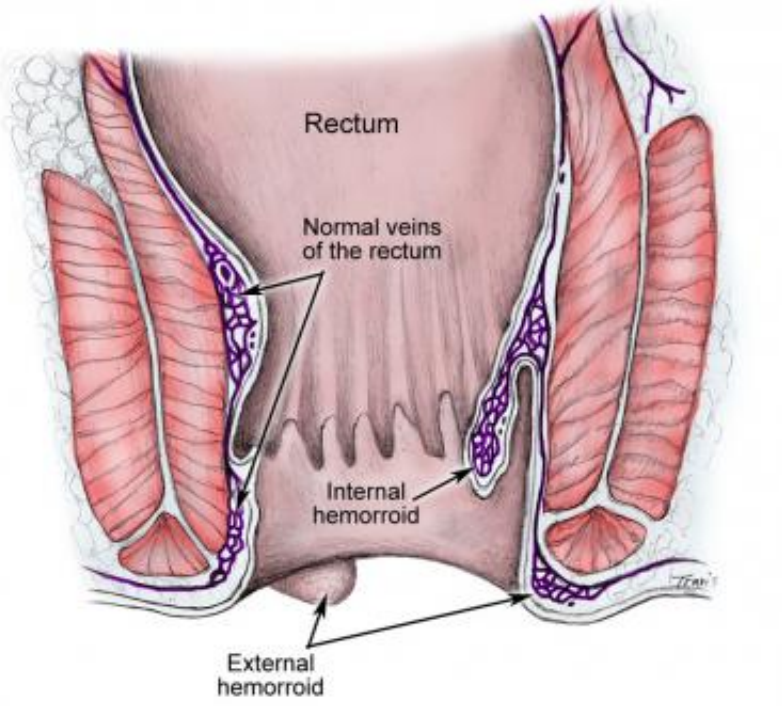
Overview

Background

Hemorrhoids result from disruption of the anchoring of the anal cushions. They occur most commonly in the right anterior position and are associated with straining and irregular bowel habits. During defecation, straining engorges the cushions, resulting in their displacement. Repetition of this displacement results in stretching and eventual prolapse of the anal cushions, known as hemorrhoids (see the image below).



Hemorrhoids. Image reproduced from original with permission of the American Society of Colon & Rectal Surgeons.

Constipation and all conditions that result in abnormal anal pressure and compliance predispose to the formation

of hemorrhoids. Acquired conditions such as portal hypertension cause engorgement of these venous plexuses, which can also contribute to anal cushion displacement. Pregnancy can also cause or aggravate symptoms; direct pressure may play a role, but other factors (eg, hormonal fluctuations) may contribute.

Inflammatory bowel disease (IBD) and consistent diarrhea can cause hemorrhoidal disease. Any patient with a combination of hemorrhoidal and IBD should be viewed with caution.[1]

Classification

Hemorrhoids may be broadly classified as either external or internal. External hemorrhoids are located distal to the dentate line and cause pain when they thrombose. This area is covered with sensate squamous epithelium, and thus, the patient typically reports pain, swelling, itching, or a combination of these symptoms.

Internal hemorrhoids are located proximal to the dentate line. This area is composed of insensate columnar-glandular epithelium. Internal hemorrhoids bleed, prolapse, or both. Patients typically present with sudden painless bleeding, usually after a bowel movement. Patients should undergo anoscopic examination or colonoscopy to rule out malignancy or diverticular disease.

Internal hemorrhoids may be graded as follows:

- Grade I (primary) - These slide below the dentate line with strain but retract with relaxation; patients are typically treated with dietary changes, including increased fiber intake; if hemorrhoids persist, sclerotherapy or rubber band ligation may be offered
- Grade II (secondary) - These prolapse past the anal verge but reduce spontaneously; patients are typically treated with sclerotherapy or rubber band ligation
- Grade III (tertiary) - These prolapse past the anal verge and must be reduced manually; depending on the size of the hemorrhoids and the symptoms noted, patients may be treated with sclerotherapy, rubber band ligation, or surgery
- Grade IV (quaternary) - These prolapse past the anal verge and are not reducible; surgical treatment (eg, hemorrhoidectomy) is indicated [1]

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Indications

Depending on the severity of the symptoms, hemorrhoids are managed either medically or surgically.

The 2010 practice parameters published by the American Society of Colon and Rectal Surgeons (ASCRS) provide recommendations for evaluating patients with hemorrhoids, for identifying patients who require endoscopic evaluation of the colon, and for treatment options such as diet modification, office-based procedures, and surgical hemorrhoidectomy.[2]

In general, the treatment options vary by hemorrhoid severity or grade. For example, office-based procedures are reserved for patients with grades I, II, and III hemorrhoids and who have failed medical management. Surgical treatment of hemorrhoid disease is customarily offered for patients whose disease does not respond to or who are not able to tolerate office-based procedures, as well as for patients with large external hemorrhoids or grade III/IV combined internal/external hemorrhoids.

For grade I and II hemorrhoids, medical treatment is indicated as first-line management. Medical treatment consists of dietary changes and bulk-forming agents. Dietary management is the first line of therapy. Patients are advised to ingest adequate fiber and water and avoid straining. This conservative management is effective for hemorrhoids with lesser degrees of prolapse.[3, 4]

For grade I and II hemorrhoids—as well as some prolapsed grade II hemorrhoids and some grade III hemorrhoids—and for cases in which medical management is not adequate, an office procedure may be indicated. Such procedures include the following:

- Rubber band ligation
- Infrared photocoagulation
- Electrocoagulation
- Sclerotherapy
- Cryotherapy

Surgery is reserved for cases in which conservative management is not adequate—for instance, hemorrhoids refractory to office procedures, large external hemorrhoids, hemorrhoids with significant bleeding, and prolapsed internal hemorrhoids. The following surgical procedures may be indicated, with excisional hemorrhoidectomy being the gold standard:

- Open vs closed excisional hemorrhoidectomy
- Transanal hemorrhoidal artery ligation (HAL)
- Stapled hemorrhoidopexy

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Contraindications

Contraindications for office treatments include the following:

- Anal stenosis
- Bleeding hemorrhoids
- Grade III or IV hemorrhoids
- Use of nonsteroidal anti-inflammatory drugs (NSAIDs) or blood thinners

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Technical Considerations

Anatomy

Hemorrhoidal cushions are anal cushions of tissue composed of blood vessels, smooth muscle, and connective tissue. These cushions are located in the upper anal canal at three different sites: left lateral, right anterolateral, and right posterolateral. They are separate structures rather than a continuous ring of vascular tissue and therefore allow the anal canal to dilate during defecation without tearing.

Anal cushions are thought to aid in anal continence, though their function is not entirely understood. During the act of defecation, the anal cushions become engorged and tense with blood, cushioning the anal canal lining.

The anal canal above the dentate line is supplied by the terminal branches of the superior rectal (hemorrhoidal) artery, which is the terminal branch of the inferior mesenteric artery. The middle rectal artery (a branch of the internal iliac artery) and the inferior rectal artery (a branch of the internal pudendal artery) supply the lower anal canal. For more information about the relevant anatomy, see Anal Canal Anatomy.

Outcomes

Xu et al carried out a meta-analysis of five randomized, controlled trials with the aim of evaluating the outcomes of LigaSure (Covidien, Minneapolis, MN) hemorrhoidectomy against those of Ferguson hemorrhoidectomy.[5] In the 318 patients who met the inclusion criteria, LigaSure hemorrhoidectomy was associated with lower urinary retention rates, lower early postoperative pain scores, shorter operating times, shorter hospital stays, and less intraoperative blood loss.

De Nardi et al performed a prospective randomized trial to assess the short- and long-term results of Doppler-guided transanal hemorrhoid dearterialization with mucopexy against those of excision hemorrhoidectomy in patients with grade III hemorrhoids.[6] They found the two approaches to be similar with respect to postoperative pain, postoperative morbidity, and long-term cure rate.

Trenti et al, in a single-center longitudinal study evaluating Doppler-guided transanal hemorrhoidal dearterialization with mucopexy against conventional excisional hemorrhoidectomy for grade III-IV hemorrhoids, found that the former was not inferior to the latter with regard to postoperative complications and long-term recurrence of symptoms.[7] The overall rate of urinary retention and postoperative hemorrhoid thrombosis was higher in the HAL group, though the difference was not statistically significant.

A 2006 Cochrane review examined differences in outcomes between stapled hemorrhoidopexy and conventional excisional hemorrhoidectomy.[8] The study showed significant increases in the recurrence rate and the need for additional procedures in the stapled hemorrhoidopexy group.

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Periprocedural Care

Equipment

For all treatments, a conventional anal retractor (eg, a Parks or Fansler retractor) is required. For hemorrhoidectomy, the following additional equipment is required:

- Scalpel
- Scissors
- Diathermy
- Absorbable suture (if the open surgical wound is closed)

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Patient Preparation

Anesthesia

For office treatments, local anesthesia is used. For surgical treatments, general anesthesia or local anesthesia

combined with mild sedation may be used. No matter what type of anesthesia is employed, the procedure begins with local injection of the entire anal canal with bupivacaine or lidocaine with epinephrine.

Positioning

For both office and surgical treatments, place the patient in a jack-knife prone, lithotomy, or left lateral decubitus position.

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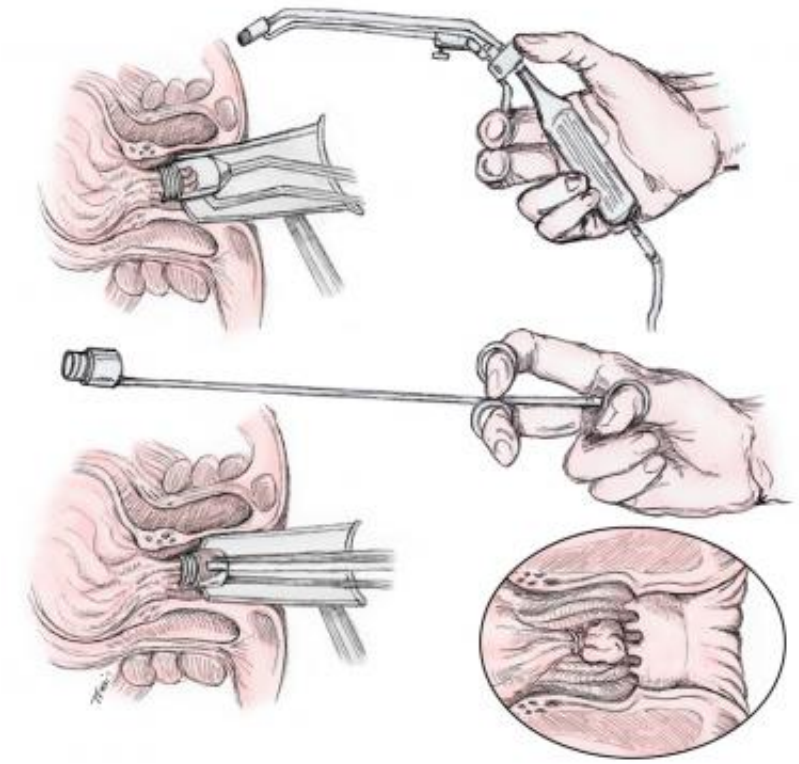
Technique

Rubber Band Ligation

The procedure is performed through an anoscope with a rubber band ligator. Using a Lurz-Goltner suction hemorrhoidal ligator, draw the hemorrhoid mass into the cup with suction. The most prominent hemorrhoid with acute stigmata of bleeding is treated first. Place the band on the rectal mucosa at the base of the internal hemorrhoid (see the image below). Ensure that the patient has no feeling of pain. Perform ligation one site at a time. Band consecutive hemorrhoids in a similar fashion, going from largest to smallest.



Rubber band ligation. Image reproduced from original with permission of the American Society of Colon & Rectal Surgeons.

The patient rarely experiences pain during the procedure. If the patient does experience pain, the band must be removed immediately. Conventional suture-removal scissors can be inserted to cut the band from the

hemorrhoids. Other methods of cutting the band can be used, such as a scalpel, but this tends to precipitate bleeding.

Coagulation

Infrared photocoagulation

An infrared photocoagulator produces infrared radiation, coagulates tissue protein, and evaporates water in the cells. The advantage of infrared coagulation is that the physician may treat one area at a time or ablate all hemorrhoidal areas.

Infiltrate the area with 2-5 mL of 0.5% bupivacaine. The area to be treated can be visually determined; adjust the dosing of the local anesthetic accordingly.

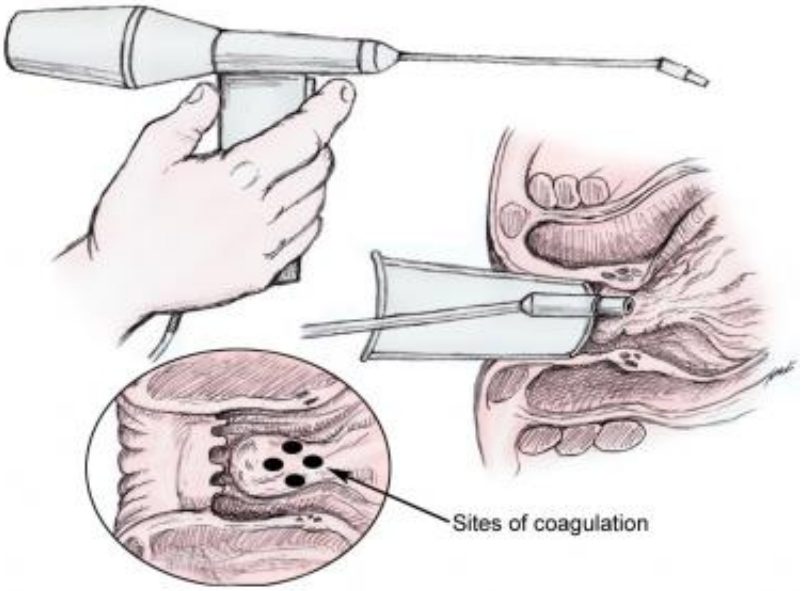
Apply an infrared probe just proximal to the internal hemorrhoids through an anoscope. The standard recommendation is to apply the probe for 1.5 seconds and repeat the application three times on each internal hemorrhoid.[9, 10, 11, 12, 13, 14] The radiation causes protein coagulation in an area 3 mm wide and 3 mm deep, for a use of three to five pulses.

After the coagulation, the tissue appears white and circular in nature. It progresses to a darker color over the following week. Eventually, a slightly elevated, pink-red eschar results.

Bipolar electrocoagulation

Bipolar electrocoagulation is similar to infrared photocoagulation. It is simple to use and is typically done as an outpatient procedure. No anesthesia is typically required. However, this procedure is typically time-consuming and is not as popular as other treatment options.[15, 16, 17, 18]

Using the anoscope, apply the side of the probe tip directly to the hemorrhoid, above the dentate line (see the image below). Use the infinity setting on the electrode generator. This is activated by the physician with a foot switch. A white coagulum stream is generated that is approximately 3 mm deep. Set the current to a maximal tolerable level and continue for 10 minutes. All hemorrhoids are typically treated in a single session.



Electrocoagulation for hemorrhoids. Image reproduced from original with permission of the American Society of Colon & Rectal Surgeons.

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Sclerotherapy

Sclerotherapy involves the injection of chemical agents into the hemorrhoids to create fibrosis and prevent prolapse. The solutions used are phenol in oil, quinine urea, and sodium morrhuate. Sclerotherapy used to be the treatment of choice for grade I, II, and III hemorrhoids. It has been used with rubber band ligation with increased success rates.[19, 20, 21, 22, 23, 24, 25, 26]

Attach a 10-mL syringe to a standard-sized 25-gauge angled hemorrhoid needle. Introduce the needle into the center mass of veins, through the mucous membrane. Take care not to enter the lumen of the vein or traverse the sensitive margin of the dentate line. To ensure that the needle does not enter the lumen, draw it back before injecting. No antiseptic is necessary.

When the needle is in position, inject 0.5 mL of the sodium morrhuate or 5% phenol solution into the submucosa above the internal hemorrhoid, at the anorectal ring. Do not inject intravascularly. If the sodium morrhuate solution is used, the total amount injected should be no more than 3 mL. If the 5% phenol solution is used, up to 3 mL can be injected into each site.

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Cryotherapy

Cryotherapy uses a special probe that uses nitrous oxide to freeze the hemorrhoid. The temperature of the probe can get as low as –196˚C with liquid nitrogen. Cryotherapy was once advocated by many surgeons for the treatment of hemorrhoids and was associated with the least amount of pain.

Insert and manipulate the fingers, a modified plastic proctoscope, or a vaginal speculum so as to isolate one primary hemorrhoidal plexus at a time. A metal instrument is not recommended, because it conducts cold, and the procedure is reliant on a water-soluble jelly that is used for contact between the probe and the hemorrhoid.

Apply the cryoprobe so that the tissue freezes around the tip. The distance between the tip and the outer portion of the probe is equal to the depth of the probe. This allows the surgeon to visually determine how much tissue is being destroyed. Changes that occur in the margin of space between the tip of the probe and the normal tissue are reversible; theoretically, therefore, no destruction has taken place.

Considerable edema can result within 24 hours after the procedure. This swelling does not interfere with the patient's ability to have a normal bowel movement.

Drainage of the area from the degradation and breakdown of tissue begins several hours after the procedure. It starts out fairly heavy for the first 3-4 days and decreases over the next 2-3 weeks. Instruct patients to use a clean or sterile pad, changed several times a day, for the first 3-4 days. This aids in the prevention of infection.

By postoperative day 5 or 6, the hemorrhoid appears pale and black. Gangrenous areas may appear, but the necrosis is typically complete by postoperative day 7-9. By postoperative day 18, the area disintegrates completely, leaving a normal-appearing anus.

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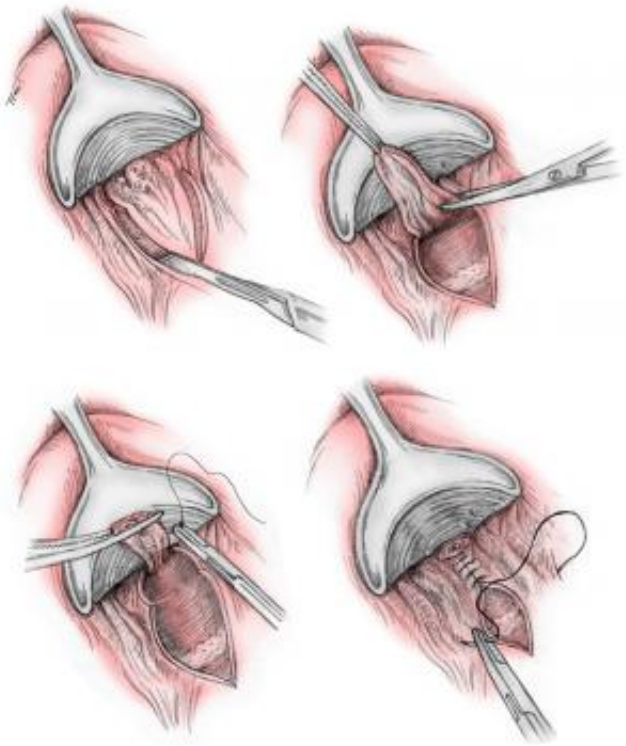
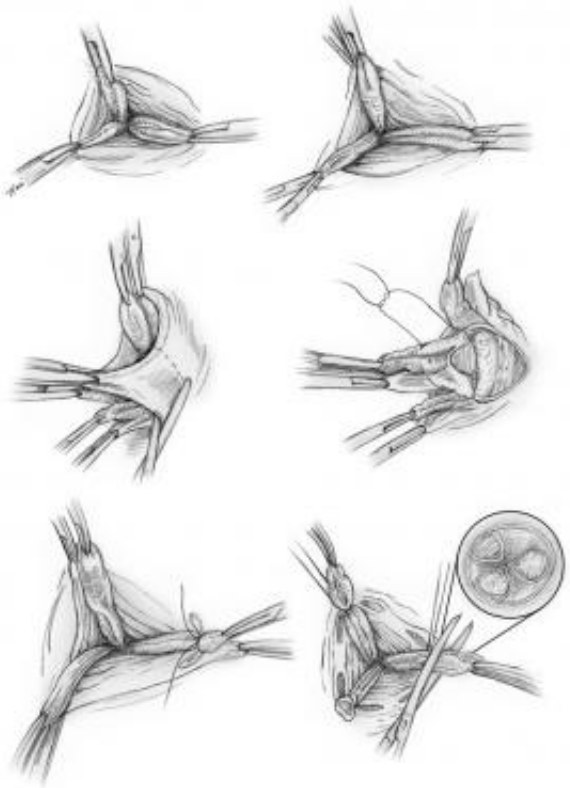
Open or Closed Hemorrhoidectomy

Hemorrhoidectomy allows full-thickness excision of mucosa and submucosa without injury to the underlying sphincter muscle. If, at the end of the procedure, the mucosa is closed with an absorbable suture, the procedure is a closed hemorrhoidectomy (see the first image below); if the mucosa is left open, the procedure is an open hemorrhoidectomy (see the second image below). Because of its relatively low recurrence rate, excisional hemorrhoidectomy remains the gold standard treatment.



Closed hemorrhoidectomy. Image reproduced from original with permission of the American Society of Colon & Rectal Surgeons.



Open hemorrhoidectomy. Image reproduced from original with permission of the American Society of Colon & Rectal Surgeons.

Make an elliptical incision at the perianal skin, and continue it to the anorectal ring in a vertical fashion. The incision should include the internal and external hemorrhoids. At all times, ensure that the submucosa is lifted from the underlying sphincter complex without injury to the muscles. The resection can be performed with a surgical scalpel, a diathermy, a laser, or an ultrasonic scalpel.[27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38]

Patients are typically sore for as long as 3-10 days after surgery. For pain control, prescribe oral narcotics and, if necessary, a topical anesthetic cream.

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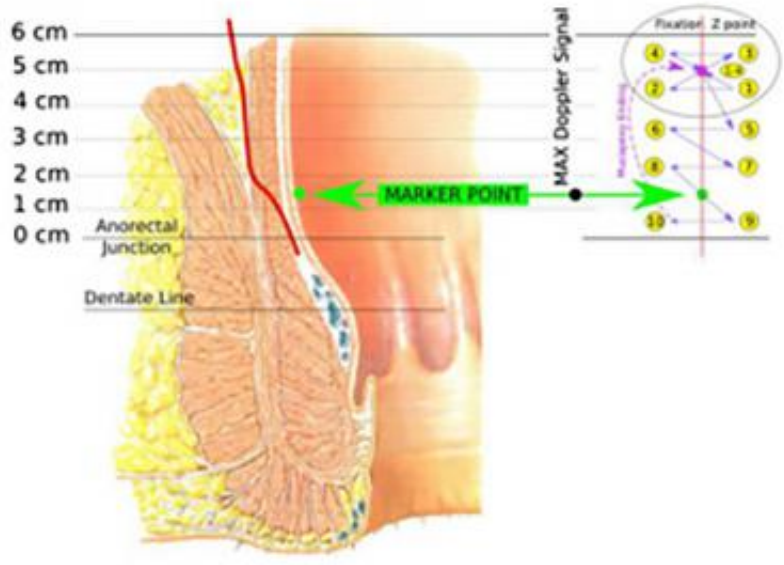
Transanal Hemorrhoidal Artery Ligation

Doppler-guided hemorrhoidal artery ligation (HAL),[39, 40] a procedure first described in 1995, involves the use of a proctoscope that allows the insertion of a Doppler transducer through it.

There are, on average, eight hemorrhoidal arteries (all branches of the superior hemorrhoidal artery) that are located in the submucosa within 2 cm of the dentate line. These arterial branches are identified by means of the Doppler device and ligated with an absorbable suture. In the case of grade III or IV hemorrhoids, a mucopexy is also performed to prevent prolapse.[41] This procedure is typically performed in the operating room with the patient under either general or locoregional anesthesia. (See the image below.)



Transanal hemorrhoidal artery ligation (HAL). Marking of rectal mucosa at location of best Doppler signal to identify site for ligation of hemorrhoidal artery and subsequent mucopexy. Courtesy of SpringerNature, Springer International Publishing AG.

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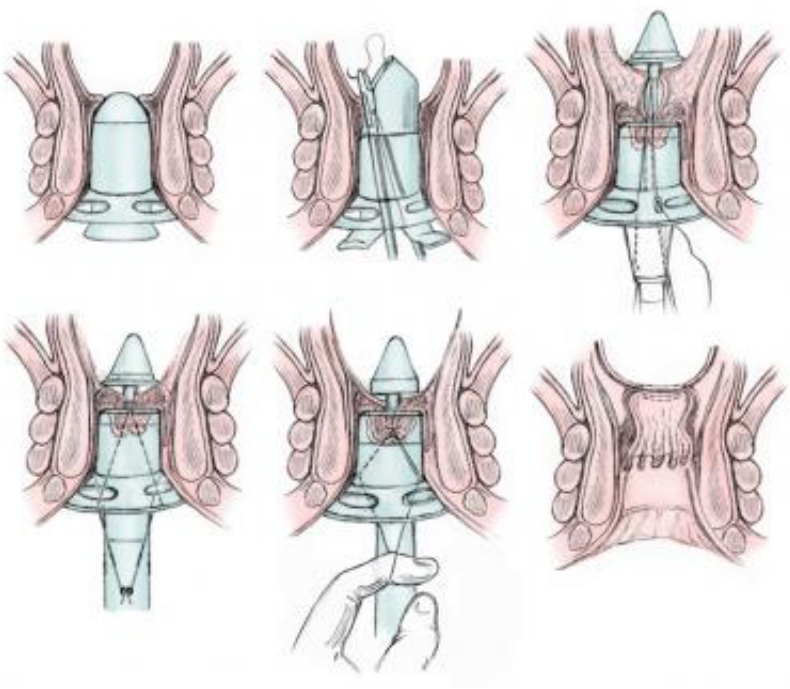
Stapled Hemorrhoidopexy

In a stapled hemorrhoidopexy, a modified circular stapler resects the excess prolapsed hemorrhoidal tissue and fixes the rest of hemorrhoidal tissue to the distal rectal wall (see the image below).



Stapled hemorrhoidopexy. Image reproduced from original with permission of the American Society of Colon & Rectal Surgeons.

Insert a circular anal dilator, and anchor it to the skin with a heavy suture on a cutting needle. Apply countertraction to the skin to facilitate insertion.

Introduce the purse-string suture anoscope through the circular anal dilator. The rotation effect of the suture anoscope allows the placement of a purse-string suture in a circular fashion at the correct height (3-4 cm above the dentate line) and depth (mucosa and submucosa). Place small bites close together with a 2-0 monofilament suture on a 25-30 mm curved needle. No “dog-ears” or gaps should be present.

Insert the fully open stapler head through the purse-string, and throw one knot on the purse-string. Then, draw back the two tails of the suture through the lateral channels in the head of the anvil. Further secure the purse-string under direct visualization. Knot the tails or clamp them with forceps.

Align the stapler along the axis of the anal canal and close it while maintaining downward tension with the lateral tails. The 4 cm mark should be at the level of the anal verge. If the patient is female, pass a finger into the vagina to ensure the posterior wall is not caught in the stapler. Fire the stapler, then open the head and remove the stapler. Inspect the staple line for bleeding and reinforce the staples, if needed.

Multiple studies have shown that in comparison with open or closed hemorrhoidectomy, stapled hemorrhoidopexy results in less pain and faster return to normal activity.[42, 43, 44] Some authors suggest that stapled hemorrhoidopexy presents an increased risk of septic complications (eg, rectal perforation, pelvic sepsis, persistent severe pain and fecal urgency, rectal stricture, rectal obstruction, and rectovaginal fistula). There is no evidence to suggest that prophylactic antibiotics are appropriate or helpful. Because of its high recurrence rates, stapled hemorrhoidopexy is not performed at the authors’ institution; excisional hemorrhoidectomy is preferred.

Partial stapled hemorrhoidopexy has been suggested as a viable alternative to circular stapled hemorrhoidopexy for some patients with grade III-IV proplapsing hemorrhoids.[45] In this procedure, only the mucosa and submucosa overlying the hemorrhoidal columns are included, so as to create a partial purse-string rather than a circumferential purse-string. In theory, using fewer staples could lead to less inflammation and possibly decreased postoperative pain, tenesmus, incontinence, and fistula risk. At present, however, the available long-term data are insufficient for full evaluation of these outcomes.[45, 46, 47]

Complications

Office treatments

Complications of rubber band ligation may include the following:

- Bleeding (3%; higher rates in patient taking aspirin or nonsteroidal anti-inflammatory drugs [NSAIDs] and blood thinners)
- Thrombosed external hemorrhoids (2%)
- Bacteremia (0.09%)
- Posthemorrhoidal banding sepsis (rare complication characterized by fever and severe pelvic pain)

No additional complications are associated with doing more than one rubber band ligation of more than one site, and this approach can be more cost-effective.[48, 49, 50, 51, 52, 53, 54, 55]

Complications of cryotherapy may include the following:

- Pain
- Tissue necrosis
- Very long healing time
- Destruction of the anal sphincter muscle (which can cause anal stenosis or incontinence; therefore, this method is not frequently used [56, 57, 58, 55])

Complications of other office treatments may include the following:

- Anal stenosis
- Anal incontinence

Surgical treatments

Complications of hemorrhoidectomy may include the following[27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37] :

- Bleeding
- Urinary retention
- Incontinence

Complications of stapled hemorrhoidopexy include the aforementioned complciations, as well as the following:

- Rectovaginal fistulas
- Substantial hemorrhage
- Retroperitoneal sepsis

A complication specific to HAL is hemorrhoid thrombosis. This is often treated with thrombectomy for pain relief.[7]

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References

1. Nivatongs S. Hemorrhoids. Gordon SH, Nivatongs S, eds. Principles and Practice of Surgery for the Colon, Rectum, and Anus. 3rd ed. New York: Informa Healthcare USA; 2007. 143-64.

2. [Guideline] Rivadeneira DE, Steele SR, Ternent C, Chalasani S, Buie WD, Rafferty JL, et al. Practice parameters for the management of hemorrhoids (revised 2010). Dis Colon Rectum. 2011 Sep. 54 (9):1059-64. [Medline]. [Full Text].

3. Senapati A, Nicholls RJ. A randomised trial to compare the results of injection sclerotherapy with a bulk laxative alone in the treatment of bleeding haemorrhoids. Int J Colorectal Dis. 1988 Jun. 3(2):124-6. [Medline].

4. Moesgaard F, Nielsen ML, Hansen JB, Knudsen JT. High-fiber diet reduces bleeding and pain in patients with hemorrhoids: a double-blind trial of Vi-Siblin. Dis Colon Rectum. 1982 Jul-Aug. 25(5):454-6. [Medline].

5. Xu L, Chen H, Lin G, Ge Q. Ligasure versus Ferguson hemorrhoidectomy in the treatment of hemorrhoids: a meta-analysis of randomized control trials. Surg Laparosc Endosc Percutan Tech. 2015 Apr. 25 (2):106-10. [Medline].

6. De Nardi P, Capretti G, Corsaro A, Staudacher C. A prospective, randomized trial comparing the short- and long-term results of doppler-guided transanal hemorrhoid dearterialization with mucopexy versus excision hemorrhoidectomy for grade III hemorrhoids. Dis Colon Rectum. 2014 Mar. 57 (3):348-53. [Medline].

7. Trenti L, Biondo S, Galvez A, Bravo A, Cabrera J, Kreisler E. Distal Doppler-guided transanal hemorrhoidal dearterialization with mucopexy versus conventional hemorrhoidectomy for grade III and IV hemorrhoids: postoperative morbidity and long-term outcomes. Tech Coloproctol. 2017 May. 21 (5):337-344. [Medline].

8. Jayaraman S, Colquhoun PH, Malthaner RA. Stapled versus conventional surgery for hemorrhoids. Cochrane Database Syst Rev. 2006 Oct 18. CD005393. [Medline].

9. Khan S, Pawlak SE, Eggenberger JC, Lee CS, Szilagy EJ, Wu JS. Surgical treatment of hemorrhoids: prospective, randomized trial comparing closed excisional hemorrhoidectomy and the Harmonic Scalpel technique of excisional hemorrhoidectomy. Dis Colon Rectum. 2001 Jun. 44(6):845-9. [Medline].

10. Jayne DG, Botterill I, Ambrose NS, Brennan TG, Guillou PJ, O'Riordain DS. Randomized clinical trial of Ligasure versus conventional diathermy for day-case haemorrhoidectomy. Br J Surg. 2002 Apr. 89(4):428-32. [Medline].

11. Ibrahim S, Tsang C, Lee YL, Eu KW, Seow-Choen F. Prospective, randomized trial comparing pain and complications between diathermy and scissors for closed hemorrhoidectomy. Dis Colon Rectum. 1998 Nov. 41(11):1418-20. [Medline].

12. Andrews BT, Layer GT, Jackson BT, Nicholls RJ. Randomized trial comparing diathermy hemorrhoidectomy with the scissor dissection Milligan-Morgan operation. Dis Colon Rectum. 1993 Jun. 36(6):580-3. [Medline].

13. Ui Y. Anoderm-preserving, completely closed hemorrhoidectomy with no mucosal incision. Dis Colon Rectum. 1997 Oct. 40(10 Suppl):S99-101. [Medline].

14. Patel N, O'Connor T. Suture haemorrhoidectomy: a day-only alternative. Aust N Z J Surg. 1996 Dec. 66(12):830-1. [Medline].

15. Senagore A, Mazier WP, Luchtefeld MA, MacKeigan JM, Wengert T. Treatment of advanced hemorrhoidal disease: a prospective, randomized comparison of cold scalpel vs. contact Nd:YAG laser. Dis Colon Rectum. 1993 Nov. 36(11):1042-9. [Medline].

16. Tan JJ, Seow-Choen F. Prospective, randomized trial comparing diathermy and Harmonic Scalpel hemorrhoidectomy. Dis Colon Rectum. 2001 May. 44(5):677-9. [Medline].

17. Armstrong DN, Ambroze WL, Schertzer ME, Orangio GR. Harmonic Scalpel vs. electrocautery hemorrhoidectomy: a prospective evaluation. Dis Colon Rectum. 2001 Apr. 44(4):558-64. [Medline].

18. Seow-Choen F, Ho YH, Ang HG, Goh HS. Prospective, randomized trial comparing pain and clinical function after conventional scissors excision/ligation vs. diathermy excision without ligation for symptomatic prolapsed hemorrhoids. Dis Colon Rectum. 1992 Dec. 35(12):1165-9. [Medline].

19. Wang JY, Chang-Chien CR, Chen JS, Lai CR, Tang RP. The role of lasers in hemorrhoidectomy. Dis Colon Rectum. 1991 Jan. 34(1):78-82. [Medline].

20. Iwagaki H, Higuchi Y, Fuchimoto S, Orita K. The laser treatment of hemorrhoids: results of a study on 1816 patients. Jpn

J Surg. 1989 Nov. 19(6):658-61. [Medline].

21. Chung CC, Ha JP, Tai YP, Tsang WW, Li MK. Double-blind, randomized trial comparing Harmonic Scalpel hemorrhoidectomy, bipolar scissors hemorrhoidectomy, and scissors excision: ligation technique. Dis Colon Rectum. 2002 Jun. 45(6):789-94. [Medline].

22. Palazzo FF, Francis DL, Clifton MA. Randomized clinical trial of Ligasure versus open haemorrhoidectomy. Br J Surg. 2002 Feb. 89(2):154-7. [Medline].

23. Bleday R, Pena JP, Rothenberger DA, Goldberg SM, Buls JG. Symptomatic hemorrhoids: current incidence and complications of operative therapy. Dis Colon Rectum. 1992 May. 35(5):477-81. [Medline].

24. Granet E. Hemorrhoidectomy failures: causes, prevention and management. Dis Colon Rectum. 1968 Jan-Feb. 11(1):45-8. [Medline].

25. MacRae HM, McLeod RS. Comparison of hemorrhoidal treatment modalities. A meta-analysis. Dis Colon Rectum. 1995 Jul. 38(7):687-94. [Medline].

26. Varma JS, Chung SC, Li AK. Prospective randomised comparison of current coagulation and injection sclerotherapy for the outpatient treatment of haemorrhoids. Int J Colorectal Dis. 1991 Feb. 6 (1):42-5. [Medline].

27. Ferguson JA, Mazier WP, Ganchrow MI, Friend WG. The closed technique of hemorrhoidectomy. Surgery. 1971 Sep. 70(3):480-4. [Medline].

28. Milligan ET, Morgan CN, Jones LE. Surgical anatomy of the anal canal and the operative treatment for hemorrhoids. Lancet. 1937. 2:119-1124.

29. Devien CV, Pujol JP. Total circular hemorrhoidectomy. Int Surg. 1989 Jul-Sep. 74(3):154-7. [Medline].

30. Boccasanta P, Venturi M, Orio A, Salamina G, Reitano M, Cioffi U. Circular hemorrhoidectomy in advanced hemorrhoidal disease. Hepatogastroenterology. 1998 Jul-Aug. 45(22):969-72. [Medline].

31. Wolff BG, Culp CE. The Whitehead hemorrhoidectomy. An unjustly maligned procedure. Dis Colon Rectum. 1988 Aug. 31(8):587-90. [Medline].

32. Whithead W. The surgical treatment of hemorrhoids. Br Med J. 1882. 1:148-150.

33. Bonello JC. Who's afraid of the dentate line? The Whitehead hemorrhoidectomy. Am J Surg. 1988 Sep. 156(3 Pt 1):182-6. [Medline].

34. Ho YH, Seow-Choen F, Tan M, Leong AF. Randomized controlled trial of open and closed hemorrhoidectomy. Br J Surg. 1997. 4:1729-1730.

35. Carapeti EA, Kamm MA, McDonald PJ, Chadwick SJ, Phillips RK. Randomized trial of open versus closed day-case haemorrhoidectomy. Br J Surg. 1999 May. 86(5):612-3. [Medline].

36. Arbman G, Krook H, Haapaniemi S. Closed vs. open hemorrhoidectomy--is there any difference?. Dis Colon Rectum. 2000 Jan. 43(1):31-4. [Medline].

37. Gençosmanoglu R, Sad O, Koç D, Inceoglu R. Hemorrhoidectomy: open or closed technique? A prospective, randomized clinical trial. Dis Colon Rectum. 2002 Jan. 45(1):70-5. [Medline].

38. Milito G, Lisi G, Aronadio E, Campanelli M, Venditti D, Grande S, et al. LigasureTM hemorrhoidectomy: how we do. Minerva Gastroenterol Dietol. 2017 Mar. 63 (1):44-49. [Medline].

39. Scheyer M, Antonietti E, Rollinger G, Lancee S, Pokorny H. Hemorrhoidal artery ligation (HAL) and rectoanal repair (RAR): retrospective analysis of 408 patients in a single center. Tech Coloproctol. 2015 Jan. 19 (1):5-9. [Medline].

40. Figueiredo MN, Campos FG. Doppler-guided hemorrhoidal dearterialization/transanal hemorrhoidal dearterialization: Technical evolution and outcomes after 20 years. World J Gastrointest Surg. 2016 Mar 27. 8 (3):232-7. [Medline]. [Full

Text].

41. Ratto C. THD Doppler procedure for hemorrhoids: the surgical technique. Tech Coloproctol. 2014 Mar. 18 (3):291-8. [Medline]. [Full Text].

42. Boccasanta P, Capretti PG, Venturi M, Cioffi U, De Simone M, Salamina G. Randomised controlled trial between stapled circumferential mucosectomy and conventional circular hemorrhoidectomy in advanced hemorrhoids with external mucosal prolapse. Am J Surg. 2001 Jul. 182(1):64-8. [Medline].

43. Hetzer FH, Demartines N, Handschin AE, Clavien PA. Stapled vs excision hemorrhoidectomy: long-term results of a prospective randomized trial. Arch Surg. 2002 Mar. 137(3):337-40. [Medline].

44. Shalaby R, Desoky A. Randomized clinical trial of stapled versus Milligan-Morgan haemorrhoidectomy. Br J Surg. 2001 Aug. 88(8):1049-53. [Medline].

45. Jeong H, Hwang S, Ryu KO, Lim J, Kim HT, Yu HM, et al. Early Experience With a Partial Stapled Hemorrhoidopexy for Treating Patients With Grades III-IV Prolapsing Hemorrhoids. Ann Coloproctol. 2017 Feb. 33 (1):28-34. [Medline]. [Full Text].

46. Lin HC, He QL, Ren DL, Peng H, Xie SK, Su D, et al. Partial stapled hemorrhoidopexy: a minimally invasive technique for hemorrhoids. Surg Today. 2012 Sep. 42 (9):868-75. [Medline].

47. Lin HC, Ren DL, He QL, Peng H, Xie SK, Su D, et al. Partial stapled hemorrhoidopexy versus circular stapled hemorrhoidopexy for grade III-IV prolapsing hemorrhoids: a two-year prospective controlled study. Tech Coloproctol. 2012 Oct. 16 (5):337-43. [Medline].

48. Madoff RD, Fleshman JW,. American Gastroenterological Association technical review on the diagnosis and treatment of hemorrhoids. Gastroenterology. 2004 May. 126(5):1463-73. [Medline].

49. Poen AC, Felt-Bersma RJ, Cuesta MA, Devillé W, Meuwissen SG. A randomized controlled trial of rubber band ligation versus infra-red coagulation in the treatment of internal haemorrhoids. Eur J Gastroenterol Hepatol. 2000 May. 12(5):535-9. [Medline].

50. BARRON J. Office ligation treatment of hemorrhoids. Dis Colon Rectum. 1963 Mar-Apr. 6:109-13. [Medline].

51. O'Regan PJ. Disposable device and a minimally invasive technique for rubber band ligation of hemorrhoids. Dis Colon Rectum. 1999 May. 42(5):683-5. [Medline].

52. Armstrong DN. Multiple hemorrhoidal ligation: a prospective, randomized trial evaluating a new technique. Dis Colon Rectum. 2003 Feb. 46(2):179-86. [Medline].

53. Poon GP, Chu KW, Lau WY, Lee JM, Yeung C, Fan ST. Conventional vs. triple rubber band ligation for hemorrhoids. A prospective, randomized trial. Dis Colon Rectum. 1986 Dec. 29(12):836-8. [Medline].

54. Law WL, Chu KW. Triple rubber band ligation for hemorrhoids: prospective, randomized trial of use of local anesthetic injection. Dis Colon Rectum. 1999 Mar. 42(3):363-6. [Medline].

55. Templeton JL, Spence RA, Kennedy TL, Parks TG, Mackenzie G, Hanna WA. Comparison of infrared coagulation and rubber band ligation for first and second degree haemorrhoids: a randomised prospective clinical trial. Br Med J (Clin Res Ed). 1983 Apr 30. 286(6375):1387-9. [Medline].

56. Franklin EJ, Seetharam S, Lowney J, Horgan PG. Randomized, clinical trial of Ligasure vs conventional diathermy in hemorrhoidectomy. Dis Colon Rectum. 2003 Oct. 46(10):1380-3. [Medline].

57. Walker AJ, Leicester RJ, Nicholls RJ, Mann CV. A prospective study of infrared coagulation, injection and rubber band ligation in the treatment of haemorrhoids. Int J Colorectal Dis. 1990 May. 5(2):113-6. [Medline].

58. Leicester RJ, Nicholls RJ, Mann CV. Infrared coagulation: a new treatment for hemorrhoids. Dis Colon Rectum. 1981 Nov-Dec. 24(8):602-5. [Medline].