HEMORRHOIDS

Anthony J. Senagore, MD, MS, MBA

There have been references to the medical management of symptomatic hemorrhoids dating back to the first era of written records.[1,2] In fact, many of the proposed therapies are not all that dissimilar from those available today and included anal dilation, topical ointments, and destructive therapy.[3,4] Even the Roman Catholic Church recognized the significance of the malady by assigning St. Fiachre as the patron saint of gardeners and hemorrhoidal sufferers.[5]

Anatomy and Etiology

The classic orientations of the hemorrhoidal cushions are the right anterior, right posterior, and left lateral positions, although there may be intervening secondary hemorrhoidal complexes that blur this classic anatomy.[6] The arterial blood supply, which contributes to the frequent complaint of bright red rectal bleeding, is derived from the superior rectal artery, a branch of the inferior mesenteric; the middle rectal arteries arising from the internal iliac arteries; and the inferior rectal arteries arising from the pudendal arteries [see Figure 1]. The venous drainage transitions from the portal venous system above the level of the dentate line to the systemic venous system below this level.[6]

Although the vascular cushions contribute to the maintenance of anal continence, excessive straining results in abnormalities within the connective tissue of these cushions, producing bleeding with or without prolapse of the hemorrhoidal tissue.[6–8] Recognizing the alterations that occur over time in the anal canal (to include the anal transitional zone and the anoderm) provides a strategy for the management of symptomatic hemorrhoids. At the earliest disease stages, the major manifestation is transudation of blood through thin-walled, damaged veins and/or arterioles, which may be effectively managed with astringents of local ablation of the vessels. Later, as the damage progresses to significant disruption of the mucosal suspensory ligament, a technique capable of relocating the prolapse to its normal location and fixing the tissue at that location will be required.[9] Internal anal sphincter dysfunction may play a role because a number of investigators have demonstrated increased internal anal sphincter tone in patients with hemorrhoidal disease.[10–12] In reality, probably a combination of all of these factors is important for the ultimate development of large prolapsing hemorrhoidal disease.

The standard classification for hemorrhoidal diseases includes four grades [see Table 1].[13]
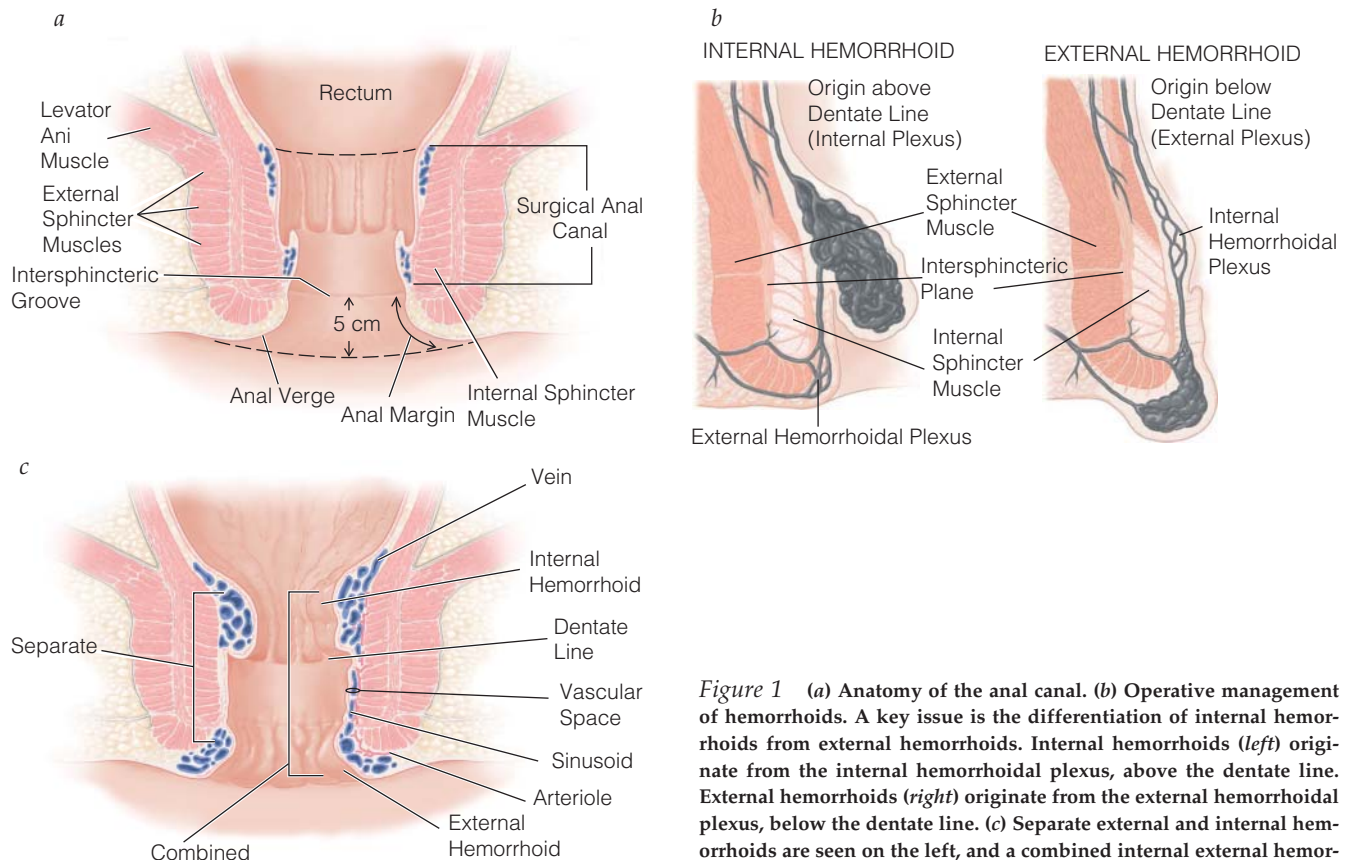

Figure 1   (a) Anatomy of the anal canal. (b) Operative management of hemorrhoids. A key issue is the differentiation of internal hemorrhoids from external hemorrhoids. Internal hemorrhoids (left) originate from the internal hemorrhoidal plexus, above the dentate line. External hemorrhoids (right) originate from the external hemorrhoidal plexus, below the dentate line. (c) Separate external and internal hemorrhoids are seen on the left, and a combined internal external hemorrhoidal complex is seen on the right.

Table 1 Standard Classification for Hemorrhoidal Diseases[13]	
Grade	*Clinical Signs*
I	Bleeding
II	Protrusion with spontaneous reduction
III	Protrusion requiring manual reduction
IV	Irreducible protrusion of hemorrhoidal tissue

Clinical Evaluation

Bleeding, protrusion, and pain are among the most common symptoms associated with hemorrhoidal disease. However, Mazier reported (W.P. Mazier, personal communication, 1995) on a series of 500 patients with anorectal complaints they associated with their hemorrhoids, and, ultimately, only 35% of patients were found to have any significant hemorrhoidal disease.[14] Therefore, vigilance for other colorectal disorders that may produce the same symptoms is important during the assessment of the patient [*see Table 2*]. The bleeding that typically occurs is bright red blood either on the toilet paper or into the commode after bowel movements and is generally painless in nature. The bleeding can become more severe as the hemorrhoids enlarge and are either partially or completely trapped in a prolapsed position. Usually, prompt reduction of the protruding mass causes this symptom to abate. Acute thromboses of internal or external hemorrhoids are usually associated with severe pain in association with a palpable perianal mass. These patients are generally quite uncomfortable, and the diagnosis is immediately obvious on clinical examination.

Examination of the patient with hematochezia, although tailored by the age of the patient, should include sufficient investigations to rule out a proximal source of bleeding such as inflammatory bowel disease and neoplasia. Hemorrhoids should not be dismissed as the cause of iron deficiency anemia as this is an uncommon occurrence. The examination should include both anoscopy and proctosigmoidoscopy to allow complete assessment of the anorectum. A careful digital examination of the anal canal and distal rectum should be performed to include the prostate in men. The description of the hemorrhoids can be assessed using the grading system mentioned above; however, a clear description of the degree of enlargement, mucosal irritation, and prolapse at each of the three common locations is very important to guided therapy. A description of associated anal skin tags, which often contribute to the patient's symptoms, should also be included.

Nonexcisional Options

Most patients evaluated for hematochezia that ultimately proves to be hemorrhoidal in origin can be managed with fiber supplementation and any of the available anal ointments. Although it is not clearly proven that constipation is causal, it appears to be of practical utility to improve bowel function and thereby reduce hemorrhoidal complaints in most early-stage patients. Similarly, the ointments available, although homeopathic, may minimize ongoing trauma to the hemorrhoidal cushions and similarly reduce symptoms. The remaining nonoperative and operative interventions should be reserved for patients with advanced hemorrhoidal disease who are unresponsive to conservative medical management [*see Table 3*].

Sclerotherapy

Sclerotherapy of symptomatic internal hemorrhoidal disease was described as far back as 1871 and has stood the test of time as a low–risk, highly effective means of managing early-stage hemorrhoidal symptoms, primarily bleeding.[13] Sclerotherapy produces local tissue destruction, which simultaneously ablates small vessels in the submucosa, producing both tissue fixation and atrophy of the tissue injected due to scarification of the hemorrhoidal complex. The most common agents used today are sodium morrhuate and sodium tetradecyl sulfate. Briefly, the procedure involves anoscopic identification of the hemorrhoidal complex followed by instillation of the sclerosant into the submucosa using a 25-gauge spinal needle. The syringe should be aspirated prior to injection to avoid a direct intravascular injection. Typically, 1 to 2 mL of sclerosant is adequate. The surgeon can inject as many locations as desired because the procedure is essentially painless. It is important, however, not to circumferentially inject the anal canal because this may induce stricture formation.

Bipolar Diathermy

Bipolar diathermy converts electrical current into heat energy to coagulate the hemorrhoidal tissue, including the mucosa and submucosa.[15,16] The machine generates a 2-second pulse of energy to accomplish the treatment. The

Table 2 Anal Symptoms Mistakenly Attributed to Hemorrhoids	
Symptom	*Cause*
Pain and bleeding after bowel movement	Ulcer/fissure disease
Forceful straining to have bowel movement	Pelvic floor abnormality (paradoxical contraction of anal sphincter)
Blood mixed with stool	Neoplasm
Drainage of pus during or after bowel movement	Abscess/fistula, inflammatory bowel disease
Constant moisture	Condyloma acuminatum
Mucous drainage and incontinence	Rectal prolapse
Anal pain with no physical findings	Caution: possible psychiatric disorder

Table 3 Treatment Alternatives for Hemorrhoids					
	Internal (Grade)				
Treatment	1	2	3	4	External
Diet modification	X				
Sclerotherapy	X	X			
Infrared coagulation	X	X	(X)		
Rubber band ligation	(X)	X	X		
Stapled anoplasty (PPH)		X	X		
Excisional hemorrhoidectomy		(X)	X	X	X

PPH = procedure for prolapsing hemorrhoids; (X) = selected patients.

Figure 3 **The infrared photocoagulator creates a small thermal injury. Thus, several applications are required for each hemorrhoidal column.**[4]

technique produces the same basic effect as sclerotherapy; therefore, the indications for treatment are very similar. Other variations on the use of energy to destroy internal hemorrhoids include infrared coagulation and Ultroid (direct current) therapy (Ultroid Hemorrhoid Management System, Vascular Technologies, Tampa, FL).[16,17] The infrared coagulation employs a tungsten halogen lamp that generates heat energy generally for a 1.5-second period, resulting in destruction of the mucosa and submucosa at the application site [see Figure 2]. The depth of penetration of this injury is usually 3 mm. Conversely, the Ultroid system uses electrical current that is applied for up to 10 minutes per complex treated. Ultimately, all of these modalities are a variation on the theme of local tissue destruction and fixation of the hemorrhoidal tissue at the appropriate level [see Figure 3].
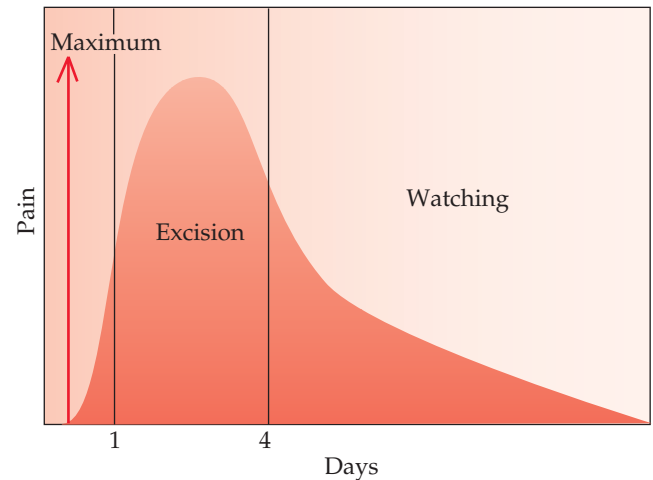
There is probably no advantage of one technique over the other; however, the acquisition cost of the machines and cleaning between procedures should be considered.

Hemorrhoidal Ligation with Rubber Bands

Barron was the first to describe hemorrhoidal banding using rubber bands in 1963.[18] Since this original description, there have been a multitude of reports confirming both the safety and the efficacy of the procedure, especially for grade
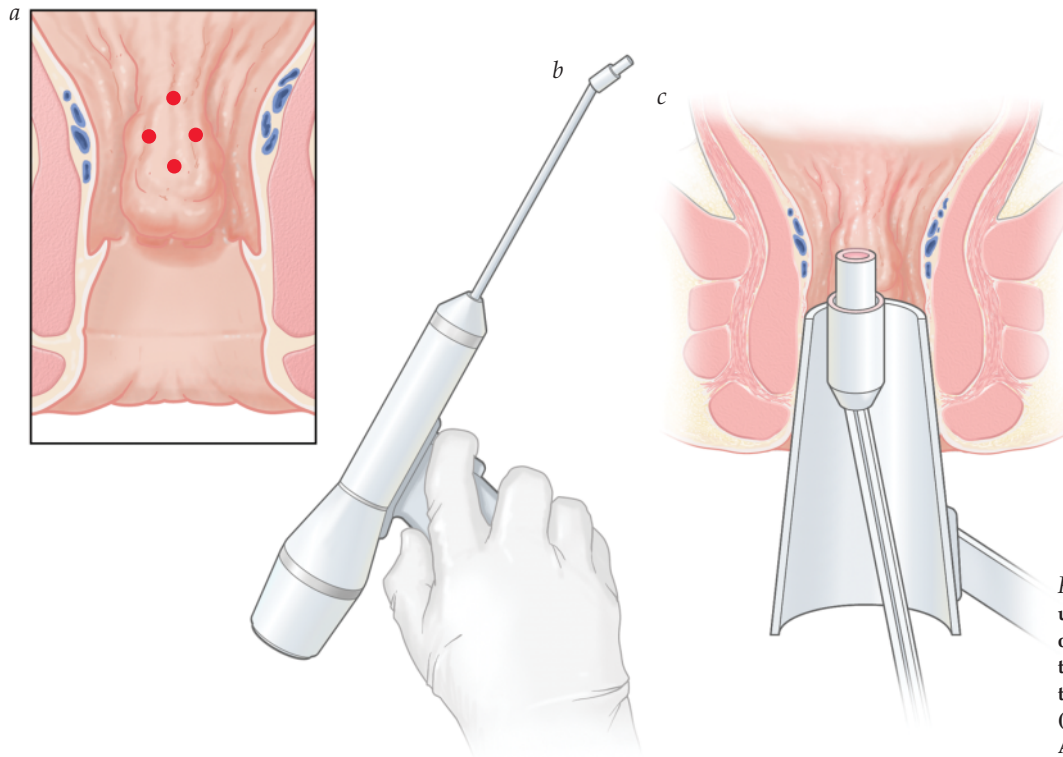

Figure 2 **The infrared coagulator is applied to each hemorrhoid bundle three or four times for 1 to 1.5 seconds at a time. (*a*) Sites of coagulation. (*b*) Infrared coagulator. (*c*) Application of infrared coagulator to sites of coagulation.**

II and III internal hemorrhoids.[19–23] There is minimal pain both during and after the procedure, assuming that the band is placed above the level of the dentate line [*see Figure 4 for a demonstration of this technique*]. Discomfort immediately after band placement may be reduced by the injection of a local anesthetic agent; however, this does not appear to be a long-lasting benefit.[24] Banding does carry the rare but frequently fatal complication of postbanding sepsis, which is heralded by the symptoms of increasing rectal pain, fever, and inability to void.[25–28] It is essential to treat these symptoms early and aggressively with early antibiotic treatment coupled with aggressive surgical drainage.[25]

Bayer and colleagues reported a series of 2,934 patients with 79% of patients achieving complete relief of symptoms following a single session of banding at only one or two locations.[20] Using this approach, patients required multiple sessions for control of symptoms (two sessions, 32%; three sessions, 17%; four sessions, 25%; and five or more sessions, 20%). Although the multiple sessions required are a negative aspect of this technique, only 2.1% of patients required excisional hemorrhoidectomy. It may be possible to achieve a similar outcome with a shorter duration of therapy, albeit at the expense of greater posttreatment pain, by banding all symptomatic hemorrhoidal sites at the initial visit.[29,30] Banding techniques appear to be durable after initial control of symptoms, with 69% of patients maintaining long-term relief and only 7.5% ultimately requiring excisional hemorrhoidectomy.[21] This method is cost effective in treating grade II hemorrhoids, as shown by McKenzie and colleagues in a randomized controlled trial comparing banding with stapled hemorrhoidopexy (SH).[31] The authors found that the cost for SH was £1,483 greater than for rubber band ligation (95% CI 1,339 to 1,676), and there was no evidence of statistical difference in quality of life years despite higher recurrence rates for banding (OR = 0.18, 95% CI 0.03 to 0.86) at 12 months.

Excisional Hemorrhoidectomy

Similarly, as with any surgical procedure, the decision to proceed to excisional hemorrhoidectomy requires a reasoned discussion of the risks and benefits and should probably be preceded by failure of either medical or nonexcisional options. Selection of an excisional procedure is usually predicated by findings of significantly thickened and enlarged hemorrhoids that prolapse or remain fixed outside the anal canal. Associated symptoms caused by hemorrhoidal prolapse include discomfort, anal seepage, and difficulties with anal hygiene. Excisional hemorrhoidectomy can also be a highly effective strategy for acutely thrombosed [*see Figure 5*] and gangrenous internal hemorrhoids. The most important technical issue when excising gangrenous internal hemorrhoids is to recall the classic three locations (right anterior, right posterior, and left lateral) for the hemorrhoidal columns. Injection of local anesthetic with 1:100,000 epineprhrine into the base of the columns and several minutes of gentle pressure will reduce the edema and visualization of the columns. Excision may then proceed while safely ensuring broad intact anoderm between the excision sites. A simple trick to ensure this is to pinch the base of each column as tightly as possible with a DeBakey forceps and incise immediately beneath the forceps. This will restrict the amount of anoderm excised. Although acutely thrombosed external hemorrhoids are not truly hemorrhoids, surgical excision may also be warranted when
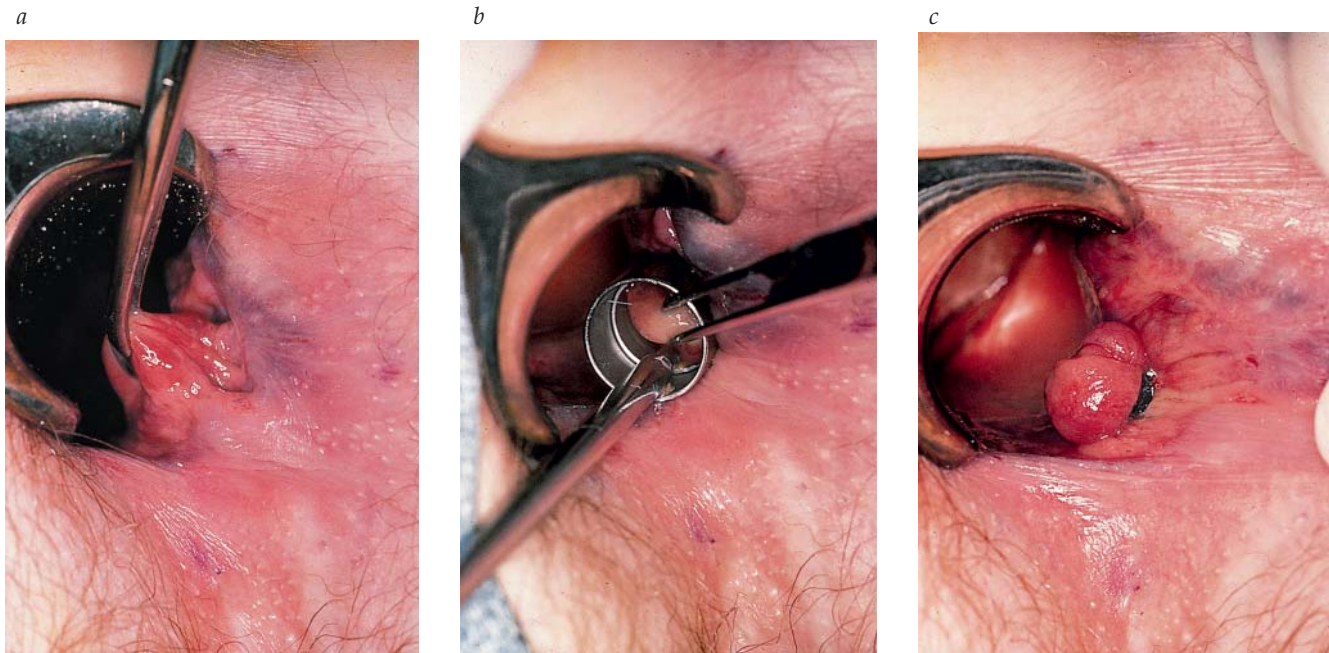

Figure 4 **Operative management of hemorrhoids: the elastic ligation technique for internal hemorrhoids. (*a*) The hemorrhoidal tissue is identified. (*b*) The hemorrhoid is grasped and pulled through the drum. (*c*) The elastic band is applied to the base of the hemorrhoid.**
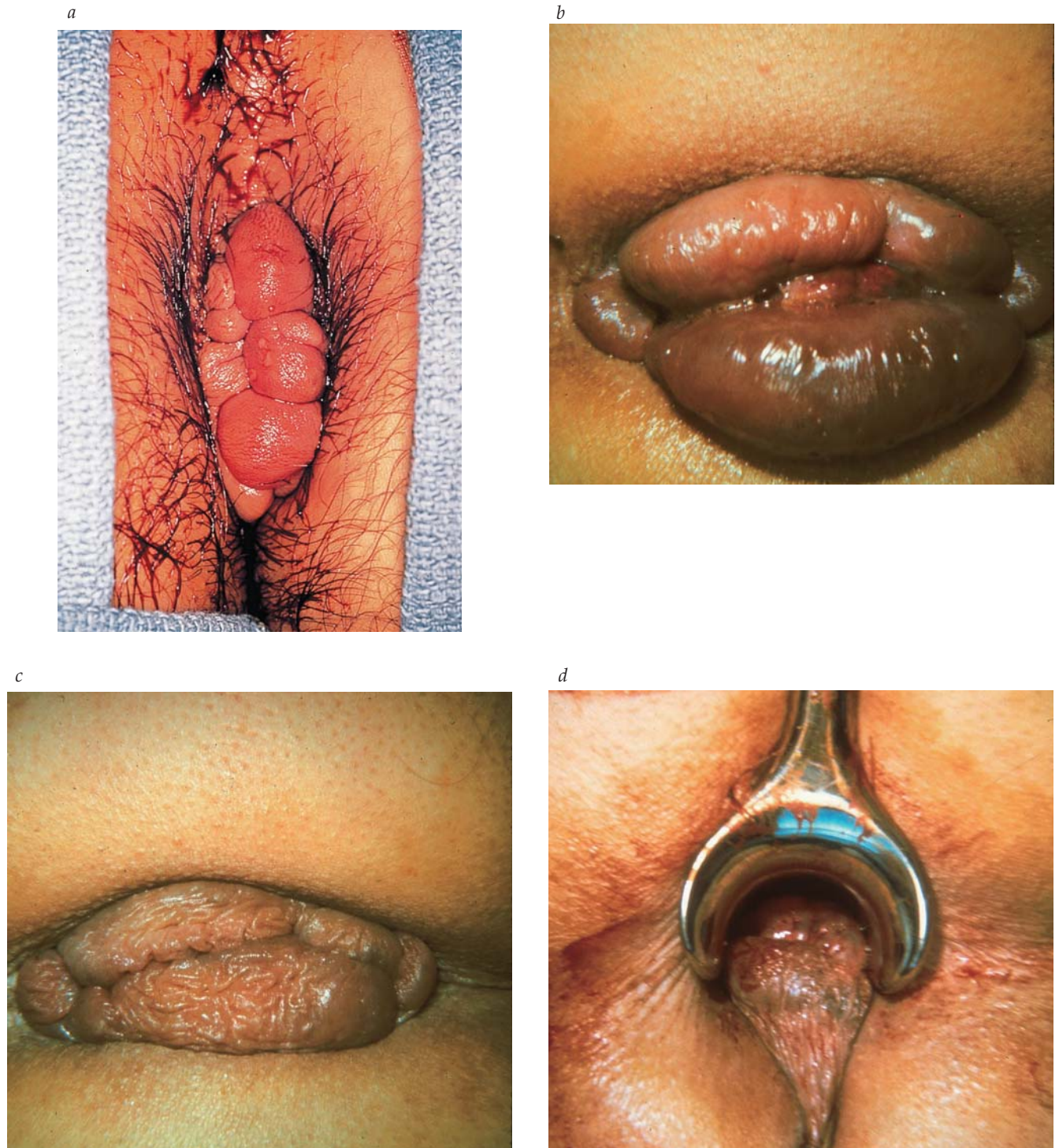
Figure 5 **Operative management of hemorrhoids. (***a***) A massive edema and thrombosis, as seen in the postpartum rosette of tissue, can be reduced after a local anesthetic is injected and the muscle is allowed to relax. (***b***) Circumferential thrombosed and prolapsing internal hemorrhoids with associated involvement of the distal anoderm of the anal canal are visualized in the preoperative state. (***c***) The reduction of edema within the circumferentially thrombosed and prolapsing hemorrhoids after injection of a local anesthetic agent with 1/200,000 epinephrine. (***d***) Even with significant edema and thrombosis, the classic hemorrhoidal pedicles can be reduced and identified after injection of the thrombosed hemorrhoidal complex with local anesthetic and 1/200,000 epinephrine, along with gentle pressure. This is an important step to limit unnecessary excision of anoderm and the resultant risk of anal stenosis.**

they are large and identified within 72 hours. These external thromboses are usually easily managed in the office setting with local anesthesia and complete excision with or without skin closure.

Options for excisional hemorrhoidectomy include the following techniques: Milligan-Morgan hemorrhoidectomy, Ferguson closed hemorrhoidectomy, Whitehead hemorrhoidectomy, and the more recently described SH. The procedures are usually performed in the operating theater after minimal preoperative preparation of the bowel. Operative treatment of hemorrhoids, like the vast majority of anorectal procedures, is often taught to be performed in the prone-flexed position [see Figure 6]. However, the left lateral modified Sims position is a very convenient position and much easier on the surgical team, especially the anesthesiologist. The use of lasers for excisional hemorrhoidectomy offers no advantage and in fact causes delayed healing, increased pain, and increased cost.[32] Anesthetic selection is usually left to the anesthesiologist and patient; however, local anesthesia supplemented by the administration of intravenous narcotics and propofol is highly effective and short acting. The use of spinal anesthesia, although effective, may increase the risk of postoperative urinary retention due to a higher intraoperative administration of intravenous fluids.

The Milligan-Morgan hemorrhoidectomy, which is widely practiced in Europe, was originally described in 1937, and its efficacy has been subsequently documented in many series.[33–35] This technique includes resection of the entire enlarged internal hemorrhoid complex, ligation of the arterial pedicle, and preservation of the intervening anoderm.[33] The distal anoderm and external skin are left open to minimize the risk of infection in the wounds. The results from this technique have shown it to be a safe and effective means for managing advanced hemorrhoidal disease.[33] However, the fact that the external wounds are left open for delayed healing can be a cause of considerable discomfort and prolonged morbidity after this procedure. The closed Ferguson hemorrhoidectomy was proposed as an alternative to the Milligan-Morgan technique and enjoys a similar large

Figure 6 Operative management of hemorrhoids. The patient is positioned on the operating table in the prone-flexed position, with a soft roll under the hips.

body of evidence regarding its safety and efficacy.[36–39] This technique employs an hourglass-shaped (centered at the midportion of the anoderm) excision of the entire internal/external hemorrhoidal complex, preservation of the internal and external anal sphincters, and primary closure of the entire wound [see Figure 7]. Occasionally, it is necessary to undermine flaps of anoderm and perianal skin to allow removal of intermediate hemorrhoidal tissue while preserving the bridges of anoderm between pedicles. This technical adjustment avoids postoperative strictures.

The Whitehead hemorrhoidectomy, described in 1882, was devised to eradicate the enlarged internal hemorrhoidal tissue in a circumferential fashion and to relocate the prolapsed dentate line that is often a component of prolapsing hemorrhoids.[40] Although this technique enjoyed a long period of widespread application, it was subsequently largely abandoned because of the high rates of mucosal ectropion and anal stricture [see Figure 8].[41–44] The technique has enjoyed renewed support, with several authors documenting minimal stricture rates and no occurrences of mucosal ectropion.[45,46] Despite these promising reports, the Whitehead procedure is technically demanding because of the need to accurately identify the dentate line and relocate it to its proper location.

Instrumentation for Excisional Hemorrhoidectomy

The use of advanced instrumentation versus scalpel or scissors needs to be assessed using a strategy of comparative effectiveness given the current climate of cost consciousness in health care. The efficacy of cold steel is unquestioned in hemorrhoidectomy. The theoretical value of the energy-based cutting devices is simultaneous tissue division and coagulation with a reduction in the need for suturing tissue. The disadvantage of these devices is significantly greater cost.

The first energy cutting tool applied to hemorrhoidectomy was standard monopolar electrocautery; however, it is usually used in conjunction with various degrees of wound closure by suture, ranging from pedicle ligation only to complete wound closure.[47–49] Despite the value of hemostasis, the thermal spread leaves patients with significant postoperative pain compared with SH. The Stapled or Open Pile Procedure (STOPP) trial study group compared diathermy hemorrhoidectomy with SH in a randomized controlled trial for grade III and IV hemorrhoids. Hemorrhoidal prolapse was corrected equally by either operation at 1 year, but total pain scores were significantly higher in the first 14 days using diathermy (daily 25.2 versus 36.8, $p = .002$; peak 41.7 versus 61.1, $p < .001$.[47] Similar findings were reported by Thaha and colleagues looking at grade II, III, and IV hemorrhoids, but the superiority of diathermy excision was related to prolapsed control at 1 year ($p = .087$).[48]

Laser technology has been evaluated as both a means of cutting hemorrhoidal tissue and a technique for ablation; however, laser surgery is simply a different strategy for tissue destruction.[32] Conversely, Zahir and colleagues assessed the neodymium:yttrium-aluminum-garnet (Nd:YAG) laser for excision and coagulation of residual tissue and reported a reduction in postoperative pain and a greater percentage of patients returning to work at 1 week.[49] Hodgson and Morgan evaluated a series of patients with second- and
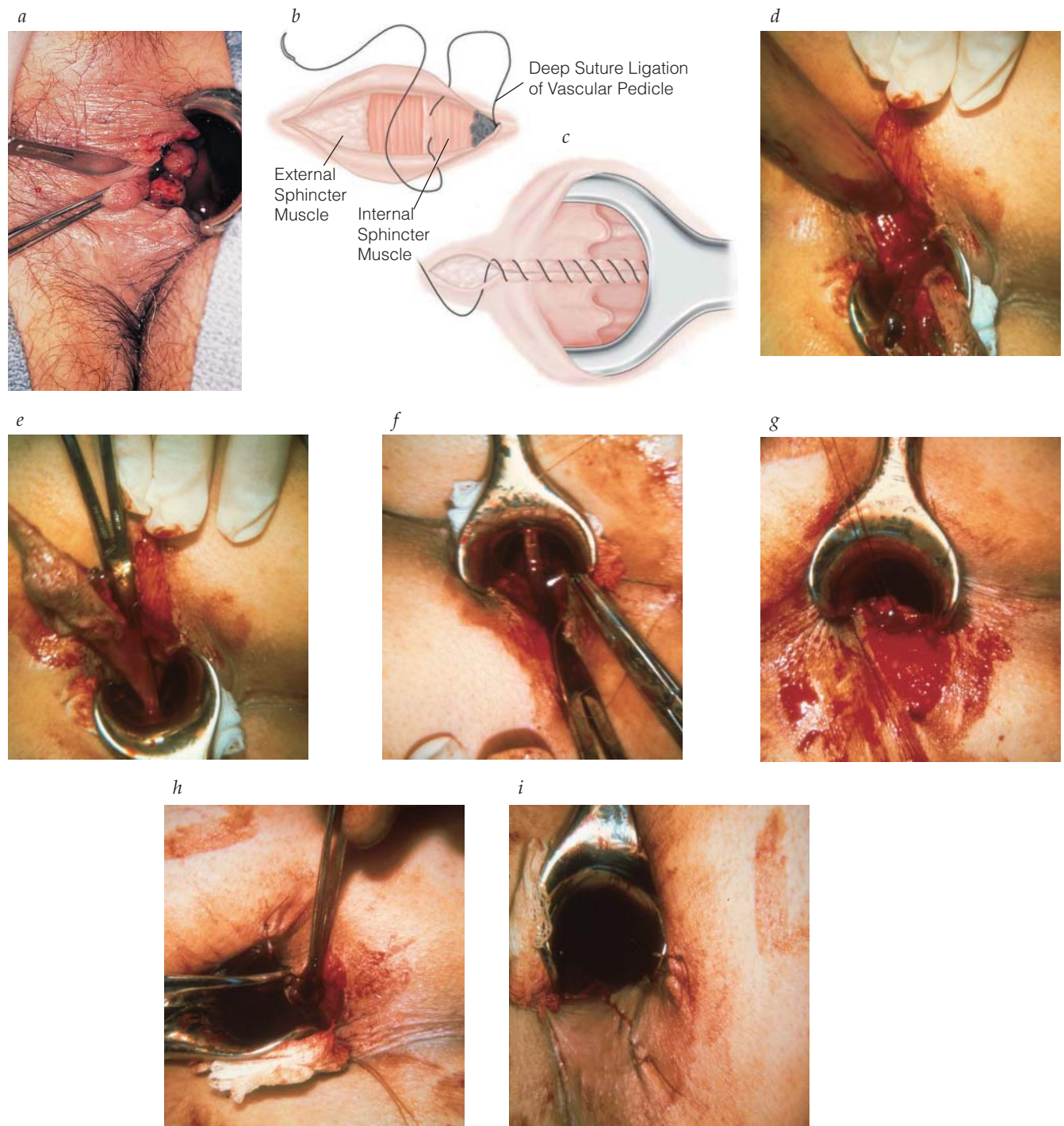
a

b

Deep Suture Ligation
of Vascular Pedicle

c

External
Sphincter
Muscle

Internal
Sphincter
Muscle

d

e

f

g

h

i

Figure 7 **Operative management of hemorrhoids: an excisional hemorrhoidectomy. (*a*) An elliptical incision is made in the perianal skin. (*b*) A continuous suture is used in a three-point placement in such a way as to incorporate skin edges and muscle. (*c*) The elliptical defect is closed, and the dead space is obliterated. (*d*) The beginning of the dissection of the hemorrhoidal complex from distal to proximal with identification of the intersphincteric groove and the surface of the internal anal sphincter, which should be preserved to avoid continence issues postoperatively. (*e*) The appropriate dissection of the hemorrhoidal complex off the surface of the internal anal sphincter and narrowing of the incision toward the vascular pedicle at the level of the anorectal junction. (*f*) The positioning of the clamp on the vascular pedicle to allow manipulation of the pedicle to its appropriate location at the anorectal junction for ligation and suture fixation with 3-0 polyglycolic acid suture. (*g*) The appropriate suture ligation and fixation of the hemorrhoidal pedicle at the anorectal junction. (*h*) The technique of gently undermining the anoderm to allow removal of smaller dilated hemorrhoidal veins adjacent to the main pedicle without sacrifice of additional anoderm. (*i*) The final wound after correctly ligating and fixing the hemorrhoidal pedicle at the anorectal junction so that it lies flat within the canal. In addition, the rectal mucosa, anoderm, and perianal skin are reconstructed. The suture is brought out through the end of the wound and then out on the skin to minimize the creation of skin tags.**
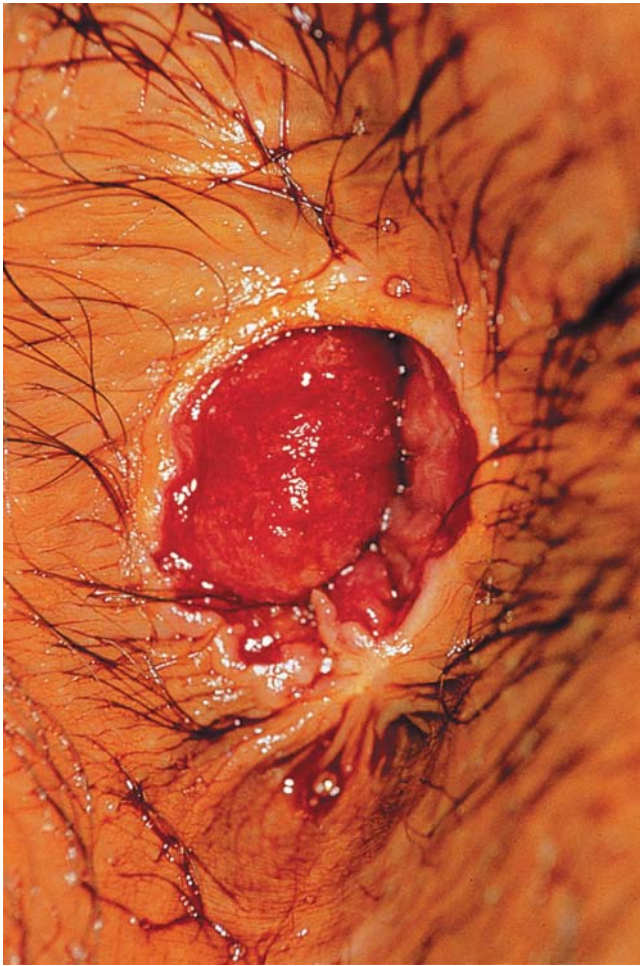
Figure 8 **Operative management of hemorrhoids. Stenosis and ectropion often result from radical circumferential (Whitehead) procedures.**

third-degree hemorrhoids managed by CO_2 excision, with only one patient readmitted for postoperative hemorrhage.[50] The data suggest that either Nd:YAG or CO_2 laser excision may be performed; however, it is not clear that the added expense or benefits are superior to scalpel or scissor excision.[51]

A bipolar cautery device capable of simultaneous tissue division and blood vessel coagulation has been compared with monopolar diathermy hemorrhoidectomy, with most of the data suggesting reductions in operative time and early postoperative pain.[51,52] Chung and Wu compared a sutureless LigaSure technique (Covidien, Dublin, Ireland) with the standard closed Ferguson hemorrhoidectomy and confirmed a reduction in operative time and pain reduction during the first 48 hours.[53] However, there were no significant differences in wound complications or time to full recovery. Fareed and colleagues found improvement in pain over 2 weeks compared with the Ferguson hemorrhoidectomy in addition to shorter hospital stay and shorter time to achieve complete wound healing, 4.4 ± 0.7 versus 6.4 ± 1.0 week ($p = .001$).[54] Postoperative manometric testing and squeeze pressures were significantly decreased in the Ferguson group with a 6-week follow-up. Similarly, a comparison

of the LigaSure technique with a standard Milligan-Morgan hemorrhoidectomy confirmed reductions in operating time and early postoperative pain.[55] A meta-analysis compared hemorrhoidectomy with the LigaSure technique with conventional excisional techniques and found similar cure rates, but decreased operative times, pain, wound healing times, and time off from work were all in favor of the LigaSure excision for hemorrhoidal disease.[56] A competing technology is the Harmonic scalpel (Ethicon Inc., Cincinnati, OH), which relies on a rapidly reciprocating blade to generate heat for coagulation and tissue transection. The largest reported experience was provided by Armstrong and colleagues with 500 consecutive excisional hemorrhoidectomies.[56] They reported a low postoperative hemorrhage rate (0.6%). The overall postoperative complication rates were low, with urinary retention in 2%, fissure in 1%, and abscess/fistula in 0.8%. Several subsequent prospective randomized comparisons of diathermy with a Harmonic scalpel failed to confirm any advantages between the two tools.[57–59] A randomized controlled trial from Abo-hashem and colleagues compared bipolar electrocautery hemorrhoidectomy with the Harmonic scalpel and found favorable results in regard to pain scores and return to work, but complications were similar except for urinary retention, which was significantly less frequent in the Harmonic group (9.4% versus 34.4%, $p < .05$).[60]

Probably the best guidance on this topic is the study by Chung and colleagues, who evaluated scissor/Milligan-Morgan, Harmonic scalpel, and bipolar scissors for hemorrhoidectomy.[61] The Harmonic scalpel demonstrated superior early pain scores to scissor; however, the long-term recovery was similar between the groups. Therefore, the cumulative data suggest that patient benefits are modest for any of the energy-delivering techniques and the cost differential is significant.

Procedure for Prolapsing Hemorrhoids

Another option for advanced hemorrhoidal disease is a circular stapled approach to reduction of the hemorrhoidal tissue with fixation of the reduced complex by the deep partial-thickness resection of rectal wall. The procedure is referred to as the procedure for prolapsing hemorrhoids (PPH).[62] The technique employs a transanal purse-string suture placed 0.5 cm above the top of the hemorrhoidal complex to allow partial resection of the rectal wall in less sensitive distal rectum above the hemorrhoidal tissue. The procedure provides for a repositioning of both the anoderm and hemorrhoidal columns to the appropriate locations within the anal canal and fixation of these structures via the rectal staple line as well as a reduction in vascular in-flow to the hemorrhoids.

Since the introduction of the PPH technique, there have been a large number of prospective randomized trials comparing this approach with excisional hemorrhoidectomy, although interest in the United States appears to be waning.[63–66] Most of the data support the concept that PPH is associated with a lesser degree of early postoperative pain and a general reduction in the duration of this pain after surgery.[63–68] A multicenter trial comparing PPH with Ferguson closed hemorrhoidectomy confirmed similar benefits and reported a reduction in the need for early reoperation

for complications in the PPH group.[64] There have been a number of meta-analyses; however two recent assessments confirmed the benefits of less pain and reduced operative time and hospital stay in addition to an earlier return to normal activity compared with the standard excisional techniques. Complications did not differ, but the rate of recurrence may be higher in PPH.[65–67] Ganio and colleagues attempted to answer the question of long-term outcome for PPH in a separate analysis looking at randomized controlled trials that had follow-up of 1 year or longer comparing PPH with conventional hemorrhoidectomy.[68] Fifteen articles met their inclusion criteria, for a total of 1,201 patients. Outcomes at 1 year showed a significantly higher rate of prolapse recurrence in the PPH group (14 studies, 1,063 patients; OR = 5.5; $p < .001$), and patients were likely to undergo further treatment to correct recurrent prolapses compared with the conventional hemorrhoidectomy group (10 studies, 824 patients; OR = 1.9; $p < .002$). The authors concluded correctly that it is a matter of discretion as to whether to accept a higher recrurrence rate to take advantage of the short-term benefits of PPH. The final publication took into account cost and found that due to a shorter operative time and hospital stay, the cost of the stapling gun was offset.[69] Similar finding have been published comparing the LigaSure technique with PPH.[70]

Despite the large amount of supportive literature, there have been several reports of complications. In the report by Bove and colleagues, there were five cases (6.6%) of bleeding, four cases of acute urinary retention, one case of external hemorrhoid thrombosis, and one case of hematoma of the rectal wall. Ten percent were late complications, and there were five cases of fecal urgency (improved after 6 months), six cases of moderate asymptomatic strictures, and four cases of persistent skin tags.[71] The recurrence rate was modest at 5.1% and was associated with grade III and IV patients. A more experienced group assessed reoperation in a series of 1,233 PPH cases performed over a 10-year period.[72] The reoperation rate was 10%, with the majority stapler-related, recurrent/persistent hemorrhoidal symptoms or other anorectal issues not addressed by the circular SH procedure. No life-threatening complications occurred, and the need for both early and late reoperations decreased significantly over time ($p < .05$). Case reports have been published of severe pelvic sepsis after SH. Molloy and Kingsmore reported a case of severe pelvic sepsis, likely resulting from an inadvertent rectal injury.[73] Cheetham and colleagues also raised concern over persistent severe anorectal pain as a possible sequela of PPH.[74]

Doppler-Guided Hemorrhoidal Dearterialization

A new technique that is gaining popularity is Doppler-guided hemorrhoidal artery ligation (DGL), or transanal hemorrhoidal dearterialization (THD) depending on the manufacturer.[75] The Doppler-guided technique is simultaneous reduction of the arterial blood flow, reduction of the prolapse (or mucosopexy), and tissue destruction by oversewing the reduced hemorrhoidal tissue. A specifically designed proctoscope is used coupled with a Doppler transducer. At the distal end, there is a small window that allows suturing of the rectal mucosa 2 to 3 cm above the dentate

line. The reduction of blood flow is thought to lead to shrinkage of the hemorrhoidal complex. In addition, a mucosopexy can be performed that lifts up the prolapsing tissue into its normal anatomic position. Giordiano and colleagues published an extensive review of the current evidence on THD looking specifically at the safety and effectiveness of the technique.[76] Sixteen of the 17 articles that met the inclusion criteria were observational studies, and the study quality ranged from low to very low. The majority of patients treated had grade II to III disease. Of the 1,996 patients who were involved in these studies, the most common early postoperative event was postoperative pain (18.5%). Residual protrusion, bleeding, and fever were complications documented with an incidence over 3%. When the studies with a follow-up of 1 year or more were analyzed (six of 17 publications), the incidence of prolapse was 10.8%, of bleeding was 9.7%, and of pain on defecation was 8.7%.

Postoperative Management after Hemorrhoid Surgery

Postoperative management of the hemorrhoidectomy patient is primarily focused on effective analgesia, avoidance of urinary retention, and constipation. A variety of analgesic regimens have been recommended, usually consisting of a combination of oral and parenteral narcotics.[71–81] The use of local infiltration of bupivacaine into the wounds and perianal skin has been variably successful in long-term pain reduction [*see Figure 9*].[82,83] A new long-acting bupivacaine delivery system has shown additional efficacy, albeit at a significant increase in the cost of care.[84]

Ketorolac has demonstrated considerable efficacy in managing posthemorrhoidectomy pain.[77] The use of alternative administration routes for narcotics either by patch or subcutaneous pump has been successful in controlling pain; however, the management of these routes of administration can be risky in the outpatient setting because of the risk of narcotic-induced respiratory depression and is therefore not recommended.[81] The most appropriate regimen following outpatient hemorrhoidectomy appears to be intraoperative use of ketorolac, sufficient doses of oral narcotic analgesics for home administration, and supplementation of the narcotics by an oral nonsteroidal medication.

Urinary retention is a frequent postoperative problem following hemorrhoidectomy, ranging in incidence from 1 to 52%.[85–88] A variety of strategies have been used to treat the problem; the best approach, however, seems to be a strategy of prevention that includes limiting perioperative fluid administration to 250 mL, an anesthetic approach that avoids the use of spinal anesthesia, avoidance of anal packing, and an aggressive oral analgesic regimen.[85]

Early postoperative bleeding (< 24 hours) occurs in approximately 1% of cases and represents a technical error requiring return to the operating theater for resuturing of the offending wound.[89] Delayed hemorrhage occurs in 0.5 to 4% of cases of excisional hemorrhoidectomy at 5 to 10 days postoperatively.[89] The etiology has been held to be early separation of the ligated pedicle before adequate thrombosis in the feeding artery can occur.[89–91] The bleeding in this scenario is usually significant and requires some method for control of ongoing hemorrhage. Options include return to the operating theater for suture ligation or tamponade at the
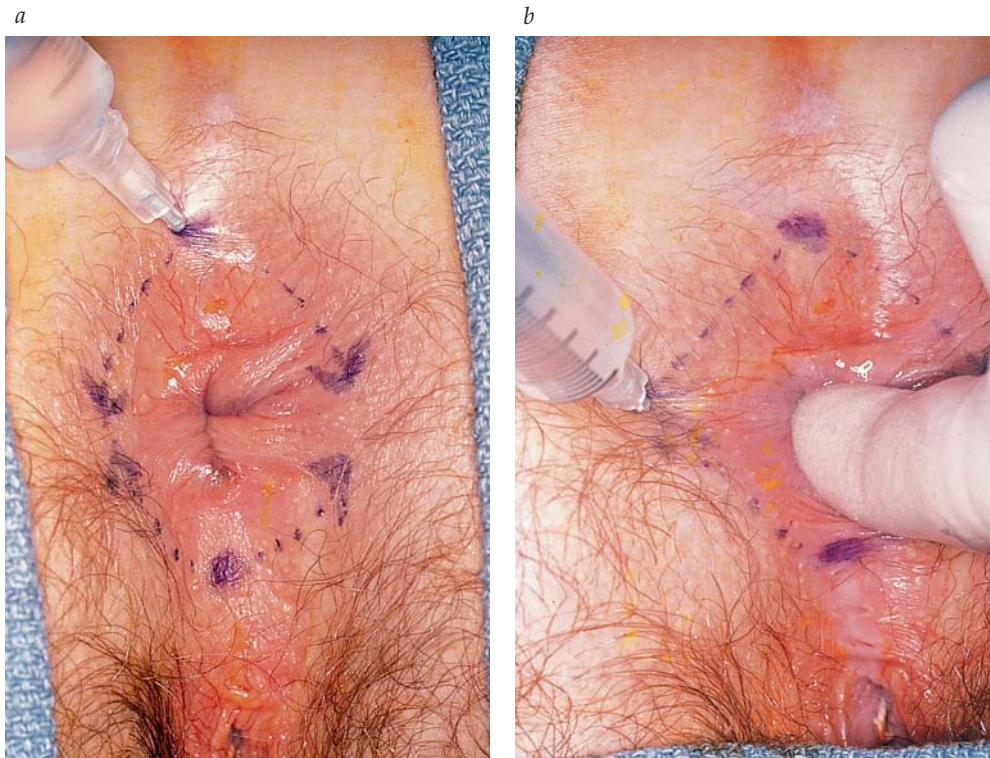
Figure 9 **Operative management of hemorrhoids. (*a*) Five milliliters of bupivacaine is injected into subcutaneous tissue. (*b*) Ten milliliters of local anesthetic is injected deep into the sphincter muscle on each side of the anal canal.**

bedside by Foley catheter or anal packing.[89–91] The subsequent outcome after control of secondary hemorrhage is generally good, with virtually no risk of recurrent bleeding. It may be helpful to irrigate the distal colorectum with posthemorrhage enemas or at the time of intraoperative control of bleeding to avoid confusion when the residual clots pass per anum.

Conclusion

The management of symptomatic hemorrhoidal disease should be adapted to the clinical presentation of the patient and the severity of the symptoms. The vast majority of patients can be managed in an office setting, often without any procedure. Proceeding from the least invasive means of eradicating the hemorrhoidal tissue, ultimately to excisional hemorrhoidectomy, should be done in conjunction with the desires of the patient.

References

1. Holley CJ. History of hemorrhoidal surgery. South Med J 1946;39:536.
2. Madoff RD. Biblical management of anorectal disease. Presented at the Midwest Society of Colon and Rectal Surgeons' Meeting; 1991 March; Breckenridge, CO.
3. Dirckx JH. The Biblical plague of "hemorrhoids." Am J Dermatopathol 1985;7:341–6.
4. Maimonides M. Treatise on hemorrhoids: medical answers. Philadelphia: JB Lippincott; 1969.
5. Rachochot JE, Petourand CH, Riovoire JO. Saint Fiacre: the healer of hemorrhoids and patron saint of proctology. Am J Proctol 1971;22:175.
6. Thompson WHF. The nature of haemorrhoids. Br J Surg 1975;62:542–52.
7. Morgado PJ, Suarez JA, Gomez LG, et al. Histoclinical basis for a new classification of hemorrhoidal disease. Dis Colon Rectum 1988;31:474–80.
8. Burkitt DP, Graham-Stewart CW. Hemorrhoids—postulated pathogenesis and proposed prevention. Postgrad Med J 1975;51:631–6.
9. Haas PA, Fox TA, Haas GP. The pathogenesis of hemorrhoids. Dis Colon Rectum 1984;27:442–50.
10. Hancock BD. Internal sphincter and the nature of haemorrhoids. Gut 1977;18:651–5.
11. Arabi Y, Alexander-Williams J, Keighley MRB. Anal pressures in hemorrhoids and anal fissure. Am J Surg 1977;134:608–10.
12. Arscia SD, editor. Morphological and physiological aspects of anal continence and defecation. Brussels: Presses Academiques Europeenes; 1969. p. 150–1.
13. Goligher J. Haemorrhoids or piles. In: Surgery of the anus, rectum and colon. 5th ed. London: Baillière Tindall; 1984. p. 98–149.
14. Benyon J. Endorectal and anal sonography in surgery of the colon, rectum, and anus. Philadelphia: WB Saunders; 1995.
15. Dennison AR, Whiston RJ, Rooney S, et al. A randomized comparison of infrared photocoagulation with bipolar diathermy for the outpatient treatment of hemorrhoids. Dis Colon Rectum 1990;33:32–4.
16. Hinton CP, Morris DL. A randomized trial comparing direct current therapy and bipolar diathermy in the outpatient treatment of third-degree hemorrhoids. Dis Colon Rectum 1990;33:931–2.

17. Zinberg SS, Stern DH, Furman DS, Wittles JM. A personal experience of comparing three nonoperative techniques for treating internal hemorrhoids. Am J Gastroenterol 1989; 84:5.

18. Barron J. Office ligation for internal hemorrhoids. Am J Surg 1963;105:563–70.

19. Marshman D, Huber PJ, Timmerman W, et al. Hemorrhoidal ligation: a review of efficacy. Dis Colon Rectum 1989;32:369–77.

20. Bayer I, Myslovaty B, Picovsky BM. Rubber band ligation of hemorrhoids: convenient and economic treatment. J Clin Gastroenterol 1996;23:50–2.

21. Wrobleski DE, Corman ML, Veidenheimer MC, Coller JA. Long-term evaluation of rubber ring ligation in hemorrhoidal disease. Dis Colon Rectum 1980;23:478–82.

22. Wrobleski DE. Rubber band ligation of hemorrhoids. R I Med 1995;78:172–3.

23. Oueidat DM, Jurjus AR. Management of hemorrhoids by rubber band ligation. J Med Liban 1994;42:11–4.

24. Alemdaroglu K, Ulualp KM. Single-session ligation treatment of bleeding hemorrhoids. Surg Gynecol Obstet 1993; 177:62–3.

25. Scarpa FJ, Hillis W, Sabetta JR. Pelvic cellulitis: a life-threatening complication of hemorrhoidal banding. Surgery 1988;103:383–5.

26. Clay LD III, White JJ Jr, Davidson JT, Chandler JJ. Early recognition and successful management of pelvic cellulitis following hemorrhoidal banding. Dis Colon Rectum 1986; 29:579.

27. Quevado-Bonilla G, Farkas AM, Abcarian H, et al. Septic complications of hemorrhoidal banding. Arch Surg 1988; 123:650–1.

28. Russell TR, Donohue JH. Hemorrhoidal banding: a warning. Dis Colon Rectum 1985;28:291–3.

29. Lau WY, Chow HP, Poon GP, Wong SH. Rubber band ligation of three primary hemorrhoids in a single session: a safe and effective procedure. Dis Colon Rectum 1982;25:336–9.

30. Lee HH, Spencer RJ, Beart RW Jr. Multiple hemorrhoidal bandings in a single session. Dis Colon Rectum 1994;37: 37–41.

31. McKenzie L, de Verteuil R, Cook J, et al. Economic evaluation of the treatment of grade II haemorrhoids: a comparison of stapled haemorrhoidopexy and rubber band ligation. Colorectal Dis 2010;12:587–93.

32. Senagore A, Mazier WP, Luchtefeld MA, et al. The treatment of advanced hemorrhoidal disease: a prospective randomized comparison of cold scalpel versus contact Nd: YAG laser. Dis Colon Rectum 1993;6:1042–9.

33. Milligan ET, Morgan CN, Lond LE. Surgical anatomy of the anal canal, and the operative treatment of hemorrhoids. Lancet 1937;2:1119–24.

34. Duhamel J, Romand-Heuer Y. Technische Besonderheiten bei der Hamorrhoidektomie nach Milligan und Morgan. Coloproctology 4:265–6.

35. Tajana A. Hemorrhoidectomy according to Milligan-Morgan: ligature and excision technique. Int Surg 1989;74: 158–61.

36. Ferguson JA, Heaton JR. Closed hemorrhoidectomy. Dis Colon Rectum 1959;2:176–9.

37. Muldoon JP. The completely closed hemorrhoidectomy: a reliable and trusted friend for 25 years. Dis Colon Rectum 1981;24:211–4.

38. McConnell JC, Khubchandani IT. Long-term follow-up of closed hemorrhoidectomy. Dis Colon Rectum 1983;26: 797–9.

39. Ganchrow MJ, Mazier WP, Friend WG, Ferguson JA. Hemorrhoidectomy revisited: a computer analysis of 2038 cases. Dis Colon Rectum 1971;14:128–33.

40. Whitehead W. The surgical treatment of hemorrhoids. BMJ 1882;1:148–50.

41. Andrews E. Disastrous results following Whitehead's operation and the so-called American operation. Columbus Med J 1895;15:97–106.

42. Andrews E. Some of the evils caused by Whitehead's operation and by its modification, the American operation. Trans Ill Med Soc 1895;433–46.

43. Khubchandani M. Results of Whitehead operation. Dis Colon Rectum 1984;27:730–2.

44. Rand AA. The sliding skin-flap graft operation for hemorrhoids: a modification of the Whitehead procedure. Dis Colon Rectum 1969;12:265–76.

45. Wolff BG, Culp CE. The Whitehead hemorrhoidectomy. Dis Colon Rectum 1988;31:587–90.

46. Bonello JC. Who's afraid of the dentate line? The Whitehead hemorrhoidectomy. Am J Surg 1988;156:182–6.

47. Nyström PO, Qvist N, Raahave D, et al. Randomized clinical trial of symptom control after stapled anopexy or diathermy excision for haemorrhoid prolapse. Br J Surg 2010;97:167–76.

48. Thaha MA, Campbell KL, Kazmi SA, et al. Prospective randomised multi-centre trial comparing the clinical efficacy, safety and patient acceptability of circular stapled anopexy with closed diathermy haemorrhoidectomy. Gut 2009;58: 668–78.

49. Zahir KS, Edwards RE, Vecchia A, et al. Use of the Nd-YAG laser improves quality of life and economic factors in the treatment of hemorrhoids. Conn Med 2000;64:199–203.

50. Hodgson WJ, Morgan J. Ambulatory hemorrhoidectomy with CO2 laser. Dis Colon Rectum 1995;38:1265–9.

51. Leff EI. Hemorrhoidectomy—laser versus nonlaser: outpatient surgical experience. Dis Colon Rectum 1992;35:743–6.

52. Franklin EJ, Seetharam S, Lowney J, Horgan PG. Randomized, clinical trial of LigaSure versus conventional diathermy in hemorrhoidectomy. Dis Colon Rectum 2003;46: 1380–3.

53. Chung YC, Wu HJ. Clinical experience of sutureless closed hemorrhoidectomy with LigaSure. Dis Colon Rectum 2003; 46:87–92.

54. Fareed M, El-Awady S, Abd-El monaem H, et al. Randomized trial comparing LigaSure to closed Ferguson hemorrhoidectomy. Tech Coloproctol 2009;13:243–6.

55. Milito G, Cadeddu F, Muzi MG, et al. Haemorrhoidectomy with Ligasure vs conventional excisional techniques: meta-analysis of randomized controlled trials. Colorectal Dis 2010;12:85–93.

56. Armstrong DN, Frankum C, Schertzer ME, et al. Harmonic scalpel hemorrhoidectomy: five hundred consecutive cases. Dis Colon Rectum 2002;45:354–9.

57. Armstrong DN, Ambroze WL, Schertzer ME, Orangio GR. Harmonic scalpel versus electrocautery hemorrhoidectomy: a prospective evaluation. Dis Colon Rectum 2001;44:558–64.

58. Khan S, Pawlak SE, Eggenberger JC, et al. Surgical treatment of hemorrhoids: prospective, randomized trial comparing closed excisional hemorrhoidectomy and the Harmonic scalpel technique of excisional hemorrhoidectomy. Dis Colon Rectum 2001;44:845–9.

59. Tan JJ, Seow-Choen F. Prospective, randomized trial comparing diathermy and Harmonic scalpel hemorrhoidectomy. Dis Colon Rectum 2001;44:677–9.

60. Abo-hashem AA, Sarhan A, Aly AM. Harmonic scalpel compared with bipolar electro-cautery hemorrhoidectomy: a randomized controlled trial. Int J Surg 2010;8:243–47.

61. Chung CC, Ha JP, Tai YP, et al. Double-blind, randomized trial comparing Harmonic scalpel hemorrhoidectomy, bipolar scissors hemorrhoidectomy, and scissors excision: ligation technique. Dis Colon Rectum 2002;45:789–94.

62. Kohlstadt CM, Weber J, Prohm P. Stapler hemorrhoidectomy: a new alternative to conventional methods. Zentralbl Chir 1999;124:238–43.

63. Rowsell M, Bello M, Hemingway DM. Circumferential mucosectomy (stapled haemorrhoidectomy) versus conventional haemorrhoidectomy: randomised controlled trial. Lancet 2000;355:779–81.

64. Mehigan BJ, Monson JR, Hartley JE. Stapling procedure for haemorrhoids versus Milligan-Morgan haemorrhoidectomy: randomised controlled trial. Lancet 2000;355:782–5.

65. Khalil KH, O'Bichere A, Sellu D. Randomized clinical trial of sutured versus stapled closed haemorrhoidectomy. Br J Surg 2000;87:1352–5.

66. Boccasanta P, Venturi M, Orio A, et al. Circular hemorrhoidectomy in advanced hemorrhoidal disease. Hepatogastroenterology 1998;45:969–72.

67. Ganio E, Altomoare DF, Gabrielli F, et al. Prospective randomized multicentre trial comparing stapled with open haemorrhoidectomy. Br J Surg 2001;88:669–74.

68. Ganio E, Altomare DF, Milito G, et al. Long-term outcome of a multicentre randomized clinical trial of stapled haemorrhoidopexy versus Milligan-Morgan haemorrhoidectomy. Br J Surg 2007;94:1033–7.

69. Madiba TE, Esterhuizen TM, Thomson SR. Procedure for prolapsed haemorrhoids versus excisional haemorrhoidectomy—a systematic review and meta-analysis. Afr Med J 2009;99:43–53.

70. Laughlan K, Jayne DG, Jackson D, et al. Stapled haemorrhoidopexy compared to Milligan-Morgan and Ferguson haemorrhoidectomy: a systematic review. Int J Colorectal Dis 2009;24:335–44.

71. Bove A, Bongarzoni G, Palone G, et al. Effective treatment of haemorrhoids: early complication and late results after 150 consecutive stapled haemorrhoidectomies. Ann Ital Chir 2009;80:299–303.

72. Kahlke V, Bock JU, Peleikis HG, Jongen J. Six years after: complications and long-term results after stapled hemorrhoidopexy with different devices. Langenbecks Arch Surg 2011;396:659–67.

73. Molloy RG, Kingsmore D. Life-threatening pelvic sepsis after stapled hemorrhoidectomy. Lancet 2000;355:810.

74. Cheetham MJ, Mortenson NJ, Nystrom PO, et al. Persistent pain and fecal urgency after stapled haemorrhoidectomy. Lancet 2000;356:730–3.

75. THD America, Inc. 2013. Available at: http://www.thdamerica.com (accessed May 21, 2014).

76. Giordano P, Tomasi I, Pascariello A, et al. Transanal dearterialization with targeted mucopexy is effective for advanced haemorrhoids. Colorectal Dis 2014;16:373–6.

77. O'Donovan S, Ferrara A, Larach S, Williamson P. Intraoperative use of Toradol facilitates outpatient hemorrhoidectomy. Dis Colon Rectum 1994;37:793–9.

78. Kuo RJ. Epidural morphine for post-hemorrhoidectomy analgesia. Dis Colon Rectum 1984;27:529–30.

79. Kilbride MJ, Senagore AJ, Morse M. Improving patient safety with transdermal fentanyl for post-hemorrhoidectomy pain [Letter]. Dis Colon Rectum 1994;37:104.

80. Kilbride MJ, Morse M, Senagore AJ. Transdermal fentanyl improves management of postoperative hemorrhoidectomy pain. Dis Colon Rectum 1994;37:1070–2.

81. Goldstein ET, Williamson PR, Larach SW. Subcutaneous morphine pump for postoperative hemorrhoidectomy pain management. Dis Colon Rectum 1993;36:439–46.

82. Hussein MK, Taha AM, Haddad FF, Bassim YR. Bupivacaine local injection in anorectal surgery. Int Surg 1998;83:56–7.

83. Chester JF, Stanford J, Gazet JC. Analgesic benefit of locally injected bupivacaine after hemorrhoidectomy. Dis Colon Rectum 1990;33:487–9.

84. Haas E, Onel E, Miller H, et al. A double-blind, randomized, active-controlled study for post-hemorrhoidectomy pain management with liposome bupivacaine, a novel local analgesic formulation. Am Surg 2012;78:574–81.

85. Hoff SD, Bailey HR, Butts DR, et al. Ambulatory surgical hemorrhoidectomy—a solution to postoperative urinary retention? Dis Colon Rectum 1994;37:1242–4.

86. Petros JG, Bradley TM. Factors influencing postoperative urinary retention in patients undergoing surgery for benign anorectal disease. Am J Surg 1990;159:374–6.

87. Tammela T, Kontturi M, Lukkarinen O. Postoperative urinary retention: I. Incidence and predisposing factors. Scand J Urol Nephrol 1986;20:197–201.

88. Leventhal A, Pfau A. Pharmacologic management of postoperative over-distension of the bladder. Surg Gynecol Obstet 1976;146:347–8.

89. Rosen L, Sipe P, Stasik JJ, et al. Outcome of delayed hemorrhage following surgical hemorrhoidectomy. Dis Colon Rectum 1993;36:743–6.

90. Cirocco WC, Golub RW. Local epinephrine injection as treatment for delayed hemorrhage after hemorrhoidectomy. Surgery 1995;117:235–7.

91. Basso L, Pescatori M. Outcome of delayed hemorrhage following surgical hemorrhoidectomy [Letter]. Dis Colon Rectum 1994;37:288–9.