Hemorrhoids and Fistulas: New Solutions to Old Problems

Hemorrhoids

Introduction

The term “hemorrhoids” is commonly used to describe symptoms of pain, itching, and bleeding, or any palpable or perceived abnormality in the perianal region. However, hemorrhoids are identifiable normal anatomical structures with defined functions. “Hemorrhoidal disease” properly refers to the symptoms that arise when some inciting process has altered the normal function or position of these structures. Those suffering from symptoms that are considered related to hemorrhoids often seek hemorrhoidal removal; control of symptoms is a safer and more realistic end point and should be introduced as the primary goal of therapy, and several methods may be employed to attain satisfactory symptom control.

Hemorrhoids are vascular cushions of submucosa containing blood vessels, smooth muscle, and elastic and connective tissue, which help maintain anal closure and continence, contributing 15%-20% of the anal resting pressure. A magnetic resonance imaging (MRI) study of the internal sphincter in vitro and in vivo showed a gap of 7-8 mm that could not be occluded by the sphincter mechanism alone; the hemorrhoidal tissue bulk is thought to fill this gap. Continence to saline infused into the rectum is impaired after surgical hemorrhoidectomy, lending credence to this theory. The anal canal and hemorrhoidal tissues are able to discriminate exquisitely between gas and liquid or solid rectal contents, allowing for socially acceptable choices to be made. The loss of bulk and sensory tissue after hemorrhoidectomy can place some patients at risk for disturbance of continence, especially if preoperative continence was impaired. Such disturbance may be temporary or more lasting.

The hemorrhoidal blood vessels are sinusoids rather than arteries or veins, as evidenced by the lack of muscular walls. Hemorrhoidal bleeding is described as “bright red,” suggesting blood that is better oxygenated than venous blood. The classic location of hemorrhoids are in the right anterior, right posterior, and left lateral positions of the anal canal, although variations can occur. The arterial supply arises from terminal branches of the superior hemorrhoidal artery, with some contribution from the middle and inferior hemorrhoidal arteries. There are a variable number of these terminal branches, and the location does not correspond to that of the hemorrhoidal cushions as noted above (right anterior, right posterior, and left lateral). Venous drainage distal to the dentate line is via the inferior rectal veins into the pudendal veins, and also via the middle hemorrhoidal veins; both of these pathways drain into the internal iliac veins. Proximal to the dentate line, venous blood drains through the superior hemorrhoidal veins, into
the inferior mesenteric vein, and then into the portal system. This is an important anatomical consideration; patients with portal hypertension can develop true varices in the anal canal, and if so, attempts at hemorrhoidectomy can be extremely challenging.

Sympathetic and parasympathetic nerves innervate the upper anal canal proximal to the dentate line. The visceral innervation allows perception of fullness and pressure. In contrast, the anal canal distal to the dentate line and the anoderm are innervated by somatic nerves, which supply sensitivity to touch, pain, temperature, pressure, and friction. This is why rubber banding can be used to treat internal hemorrhoids, but not external hemorrhoids. The anoderm is specialized squamous epithelium lacking skin structures such as sweat glands and hair follicles. These skin appendages reappear on the perianal skin more removed from the anal canal.

Etiology and epidemiology

The evidence to support any single theory of hemorrhoidal disease is sparse. It seems most likely that the cause of symptom development is multifactorial, including several patient-specific variables such as diet, toileting behavior, and possibly genetic influences. The most commonly accepted theory for pathogenesis of symptomatic hemorrhoids is Thomson’s theory of a downward sliding of the vascular cushions. Symptomatic hemorrhoids are associated with irregular bowel habits and straining, which occur with both hard stools and diarrhea. Patients with hemorrhoids tend to have abnormal anal pressure profiles and anal compliance. Straining is more likely to push the cushions out of the anal canal and stretch the submucosal Treitz muscle (Fig 1), disrupting the fixation of hemorrhoidal cushions in the anal canal and allowing downward slide and subsequent prolapse. Other factors implicated in causation of hemorrhoidal disease include the erect human posture, a lack of valves in hemorrhoidal plexuses and draining veins, and increased intra-abdominal pressure causing possible obstruction of venous return.

![Fig. 1. Anal cushion showing Treitz muscle fibers derived from longitudinal muscle.](image)
Portal hypertension may lead to engorgement of the veins draining the plexuses, which can result in true varices in the area, as also seen in the lower esophagus and periumbilical area. However, hemorrhoid disease does not appear to be more common in portal hypertension than in the population at large. Pregnancy aggravates hemorrhoidal disease, and by mechanisms not well understood, also predisposes to the development of disease in those who were previously asymptomatic. However, most women find that their hemorrhoidal symptoms largely resolve after delivery, raising the question as to whether pressure and hormonal changes play distinct roles.

The incidence of symptomatic hemorrhoidal disease is difficult to assess accurately. Many patients assume that any symptom in the perianal area is hemorrhoidal in origin, and medication with any of the many over-the-counter products is a common antecedent to the seeking of specialty advice. In addition, advice may be sought from any of a number of specialists, including surgeons, gastroenterologists, family practitioners and internists, gynecologists, or practitioners of alternative medicine. Hemorrhoid-related complaints may be responsible for as many as 36% of patients seeking care in general medical practices. The prevalence of hemorrhoidal disease in the United States is estimated at 4.4%, accounting for 2-3.5 million physician visits and 168,000 hospitalizations annually. Data related to the volume of office-based treatment are currently lacking.

Nomenclature and classification

Hemorrhoids may be considered external or internal. External hemorrhoids are covered with anoderm and perianal skin. They may have the appearance of small soft skin folds or thicker, more fleshy appendages, as may occur after longstanding hemorrhoidal disease. External hemorrhoids contain the portion of the vascular plexus that is distal to the dentate line. Internal hemorrhoids arise above the dentate line, are covered with transitional and columnar mucosa, and contain the vascular plexus that arises proximal to the dentate line. Mixed hemorrhoids describe the setting where both external and internal hemorrhoidal diseases are present.

Internal hemorrhoids are further classified by degree of prolapsed. First-degree hemorrhoids bulge into the anal canal and cause painless bright red bleeding. Second-degree hemorrhoids protrude through the anal opening with a bowel movement but reduce spontaneously. Third-degree hemorrhoids protrude with bowel movements or spontaneously and require manual reduction. Fourth-degree hemorrhoids are permanently prolapsed and not reducible. It is important to note that prolapse does not imply incarceration. The mere presence of prolapse does not require intervention; rather, it is the degree of symptoms and their effect on the patient's quality of life that best guide appropriate therapy.

Clinical presentation

Anorectal symptoms are frequently thought to be caused by hemorrhoids, both by patients and physicians unfamiliar with the appearance and differential diagnosis of perianal and rectal pathology. There are a number of other benign conditions that must be considered, such as pruritus, fistula or abscess, fissure, and condyloma. Malignant conditions must also be excluded, including intraepithelial neoplasms and cancers of the colorectum and anus. Table 1 details the differential diagnosis of common anal symptoms; although extensive, it is not exhaustive.

External hemorrhoids may be related to symptoms such as itching or perianal moisture owing to difficulty cleansing the perianal region. The skin-covered external hemorrhoids may appear edematous at times owing to scratching or vigorous cleansing attempts. Infection is exceedingly rare. External hemorrhoids do not cause pain unless thrombosis is present. In this instance, a firm nodule that has a blue or purple tinge is visible and palpable at the anal orifice. These may be nontender or exquisitely painful, and the contained clot can erode through the overlying stretched skin. When this occurs, the patient should be reassured that the blood seen
is evacuation of old clot and not ongoing blood loss. Resolution of thrombosed external hemorrhoids often leaves a small or larger skin tag. These may reduce in size over time, but typically do not regress completely, and may be associated with symptoms such as itching and difficulty cleansing the region.

Internal hemorrhoids most often cause painless bright red bleeding with stools, on the toilet tissue, or dripping, or even squirting into the toilet water. Internal hemorrhoids can also cause itching and burning, pain or pressure, mucus discharge, and problems with perianal hygiene including soiling of undergarments. Patients describe their pain variously. Some can identify itching and burning as the experienced painful sensation, some identify pressure, but many default to a more vaguely termed “pain” that is located in the perianal or anal region, or both. As internal hemorrhoids do not have somatic innervation, the source of the experienced pain may not be clear, but it remains important to acknowledge the patient’s perceived pain and search for other causes that may require addressing. A high percentage of patients who complain of “painful hemorrhoids” have some element of pelvic floor dysfunction, including entities such as levator spasm, which causes pain with defecation owing to nonrelaxation of that component of the sphincter complex, and discoordination, in which the patient confuses “squeeze” with “push,” producing a functional relative outlet obstruction with defecation-associated pain. Patients with these disorders often complain of more generalized perineal pain or pressure or of “sitting on a ball” and have often used over-the-counter hemorrhoidal preparations for weeks to months with little relief. Proper office examination can quickly identify these functional disorders. Although patients may also have hemorrhoids that prolapse or bleed, it is important to realize that the hemorrhoidal issue is secondary to the pelvic floor dysfunction, and addressing the hemorrhoidal issue without also addressing the pelvic floor dysfunction is therefore unlikely to produce a durable result.

Although painless bright red bleeding with stool is a frequent symptom of hemorrhoidal disease, patients may not be able to distinguish other patterns of rectal bleeding that may be more ominous, such as blood streaked on the stool surface or mixed into the stool. Therefore, bleeding as a symptom must be assessed carefully, and colonoscopic evaluation should be performed appropriately. Anemia due to hemorrhoidal bleeding is exceedingly rare, and a complete gastrointestinal evaluation should be performed before assuming that hemorrhoidal disease is the cause.

Internal hemorrhoids that have lost their fixation to the underlying muscle can prolapse into the anal canal or externally. Related symptoms often include pressure during and after bowel movements, which is sometimes interpreted as incomplete evacuation; a lump or mass protruding through the anus; wetness of the perianal region; or difficulty cleansing the area with soiling of undergarments. Patients should be asked if hemorrhoids require manual reduction; women should be asked about manual splinting of the perineum to assess for possibly related rectocele symptoms. All patients should be asked about other factors that are related to development of hemorrhoidal disease such as chronic heavy lifting or chronic cough from asthma or chronic obstructive pulmonary disease, or unusual toileting behavior such as withholding or limited access to bathroom facilities.
Evaluation

History

A detailed, focused history is mandatory to understand how the patient’s symptoms affect his or her lifestyle, so that an informed decision can be made regarding treatment options. The risk of the intervention should not outweigh the benefits.

The patient’s bowel habits must be discussed, with specifics regarding frequency and consistency of stool as well as any changes from the patient’s usual pattern. Do not rely on the patient’s reporting of “normal” stools, or of “diarrhea” or “constipation,” as their interpretation of these terms may not be congruent with the medical definition. Frequency should be recorded as number of stools per day, or per week. The Bristol visual stool scale (Fig 2) is helpful when patients cannot describe stool texture or shape. Urgency and disturbances of continence must be elicited and recorded. Variability of stool frequency and consistency raises the possibility that the patient may require assessment and management of a functional bowel disturbance; failure to recognize these underlying functional disorders uniformly leads to poor outcomes of surgical intervention.

A dietary history can be helpful in identification of some simple interventions that can resolve symptoms in a high percentage of patients with hemorrhoidal symptoms. Inadequate intake of fiber and noncaffeinated fluid is often found. Specific foods can also cause disturbances in stooling: caffeine, milk or ice cream, chocolate, excessive salads or fruits (except bananas), beer, and artificial sweeteners can cause looser stools, whereas red meats, cheeses, and bananas are associated with harder and drier stools. Recent changes in diet or medications should be elicited. Specific note should be made of recent antibiotic therapy or foreign travel, any pelvic or anorectal surgery, and history of radiation to the pelvis.

A long history of loose stools and anorectal complaints may bring up the possibility of Crohn disease. A tender lump that drains episodically may herald a fistula or other inflammatory lesion. Severe pain during and following bowel movements suggests anal fissure. A history of weight loss is concerning for systemic disease or malignancy.

Physical examination

A general physical examination should seek to identify health issues that would significantly affect the potential range of hemorrhoidal management options, such as chronic obstructive
pulmonary disease, immunocompromise, liver disease, or coagulopathy or use of anticoagulants. Hard stool within the sigmoid colon can often be palpable on abdominal examination. The anorectal examination should be approached mindfully. Patients often face this with trepidation. It is helpful to clearly describe to what degree you expect the patient to disrobe and have a proper drape or gown at hand. Describe how the examination would proceed, reassuring the patient that you respect their privacy and do not intend to cause pain. Encourage the patient to let you know if they experience pain or discomfort during the examination with the express understanding that if they feel pain, the examination would be terminated. Be sure to let the patient know that pressure may be felt, and be clear that this is a normal sensation during the examination. Many patients are fearful that they would not be able to affect a painful situation. Simply letting them know you are willing to cooperate with them often defuses the situation. As patients cannot see you during this examination, it is helpful to “narrate” as the examination proceeds. The patient can be told to anticipate your touch, normal findings can be described, and the patient feels they are a participant in the examination, rather than having something "done to them." Always have an assistant as chaperone for an anorectal examination of either gender patient. Family members or friends or both should not be expected to fill this role.

Examination of the anorectum is often performed in the knee-chest position; however, many patients find this position embarrassing. The lateral decubitus position is less daunting for patients and is more than adequate for most patients if attention is paid to proper positioning, lighting, and use of the assistant or chaperone. The examination begins with inspection of the gluteal cleft and then, with gentle retraction of the buttocks, inspection of the perianal area and perineum. The skin is inspected for findings such as external hemorrhoids, skin tags or hypertrophied papillae, condylomata, skin rash or breakdown, fistulous openings, fissures, other wounds, erythema or mass suggesting abscess, ulcerated mass suggesting neoplasm, and any gape of the anus at rest. The tissues are gently palpated, noting masses, fullness, tenderness, decreased pliability, or any deviation from symmetry that cannot be accounted for. If a fissure is suspected, palpation first anterior to and then posterior to the anus would often reproduce the fissure pain and strongly suggest the diagnosis. How and if the examination proceeds may be dependent on the degree of discomfort caused by this maneuver.

Digital examination of the anus with a well-lubricated gloved finger follows, noting the resting and voluntary squeeze pressures, and if the patient confuses one for the other, signifying pelvic floor discoordination. Diminished squeeze strength in any quadrant should be noted in anatomical terms as anterior-posterior and left-right. Designating anorectal findings as located on a clock face should never be done. The rectal wall should be palpated in every quadrant. Note should be made of any masses found with the location (anterior-posterior and left-right), distance from the anorectal ring, and fixity to surrounding structures. A bidigital examination of the rectovaginal septum should be performed if felt necessary to adequately assess anterior findings; be sure to let the patient know before proceeding with this portion of the examination. Levator spasm can be palpated as a tight muscular band in the posterolateral area on each side, which is tender to pressure. This tenderness often eases if the patient can squeeze and relax several times.

Anoscopy is considered a part of the office anorectal examination. There are many types of anoscopes available for use (Fig 3). Disposable anoscopes are best for routine anorectal inspection; clear plastic anoscopes allow for clear visualization of the entire anal canal and the relationship of any pathology to the dentate line. Some of these are self-lighted. Proctitis can easily be seen with this scope as well; if present, further investigation would be required. If banding is considered, a slotted or side-viewing anoscope allows prolapse of hemorrhoidal tissue into the slotted area for best exposure and access. The slotted scope requires repositioning with the obturator carefully replaced for visualization of each quadrant; if performed incorrectly, tissue can be pinched between the scope and the obturator. Anoscopes require light for appropriate viewing; some have attached light sources and others require a handheld or head-mounted light source.

Any patient with alarm symptoms of bleeding, change in bowel habits, anemia, or weight loss, or patients who have a family history suggestive of hereditary nonpolyposis colorectal
cancer or Lynch syndrome, should be further examined. Rigid or flexible sigmoidoscopy can easily be accomplished in the office setting as no sedation is required, and preparation can be done with a single enema. However, for complete colonic evaluation, colonoscopy, double-contrast enema, or computed tomography (CT) colography should be performed. It is preferable to have complete colonic evaluation, when indicated, which is performed before the intervention for elective hemorrhoidal problems is considered. When examination does not reveal a clear cause for patient symptoms, pelvic floor evaluation should be considered. Anal manometry can reveal abnormalities of the sphincter mechanism and also rectal compliance. Balloon expulsion clarifies if patients can generate sufficient force to extrude stool.

**Management**

Management of symptomatic hemorrhoids is directed by the symptoms themselves. Management strategies can be categorized as medical management, office-based procedures, or surgical management. Patients may arrive at the consultation determined to have their hemorrhoids “removed.” However, proper evaluation should culminate in a management plan individualized for each patient’s particular situation. The risk of intervention should not outweigh the benefit. There is no “one-size-fits-all” therapy, and a poor outcome after surgical intervention can negatively affect many areas of a patient’s function and lifestyle. In many cases, symptoms can be managed successfully with modifications of diet and lifestyle, which are minimal and easily accomplished.

**Conservative management**

*Diet and fiber*

Initial therapy of hemorrhoidal symptoms is best directed at modification of the cause, which is most often related to lifestyle habits, including diet, fluid intake, and toileting behavior, as well as exercise, sleep habits, and stress management. Hemorrhoidal concerns may be the perfect example of why attempts to treat the problem without understanding the context tend to fail.

Much of the initial consultation for a hemorrhoid-related problem consists of counseling the patient on better dietary choices, increasing noncaffeinated fluids, including a fiber supplement...
if appropriate; describing healthier toileting behavior when necessary; and underscoring the value of regular exercise, sleep hygiene, and stress management. Hard or dry stools are usually caused by inadequate intake of dietary fiber and fluid in concert. Looser stools, which can exacerbate hemorrhoidal symptoms, are also often due to dietary choices. Foods most likely to be associated with loose stools include dairy products (except yogurt and hard cheeses); fruits and fruit juices (except bananas); lettuce salads, which are generally low in fiber; caffeine and chocolate; beer; and many artificial sweeteners. Patients with either hard, dry stools, or loose stools are likely to have a relative lack of dietary fiber; increasing dietary fiber is almost always the first recommendation in medical management of hemorrhoidal symptoms.

Most Americans eat half or less of the recommended daily fiber intake (25 g/d for women and 38 g/d for men). It can be difficult to ingest 25–38 g of fiber daily. Bulk-forming agents such as psyllium fiber are inexpensive, well tolerated, and effective. Bulk-forming agents work by absorbing fluid from the intestinal lumen into the stool bolus. In patients with hard, dry stool, a concomitant increase in oral noncaffeinated fluid is needed to produce the desired result of a formed yet deformable stool bolus that abrades the anal canal tissues less. For patients with hemorrhoidal symptoms related to loose stools, the bulking agent absorbs the excess fluid, producing a more formed stool and decreasing anal canal irritation due to frequent loose stools. It is best to have patients ingest the fiber supplement during the day as drinking fluid with the fiber is important for the mechanism of action. Although the addition of fiber to decrease hemorrhoidal symptoms is considered important by all health care providers managing these problems, data to support this recommendation are not robust. This may be related to the difficulty inherent in conducting dietary studies. However, a review of 7 trials using fiber revealed a consistent benefit in reducing bleeding and other hemorrhoid-related symptoms.  

**Stool softeners and laxatives**

For those with persistent hard, dry stool, further agents such as a stool softener (docusate) or lubricant (mineral oil) may be needed in addition to the fiber supplement. The mechanism of action of these agents may enhance the effect of fiber, but should not be used in place of fiber, as these agents will not produce the stool bolus, which is the goal of fiber therapy. Patients with hemorrhoid symptoms and true constipation (bowel movement less frequently than once every third day) may benefit from the judicious use of hyperosmolar (polyethylene glycol), stimulant (senna and bisacodyl), or saline (magnesium citrate) laxatives in the short term, but should be transitioned as soon as possible to a regimen of fiber supplementation with stool softeners as needed. Long-term use of laxatives should be avoided whenever possible; the variability of stools makes hemorrhoidal symptom management more difficult. Laxative abuse should be considered when taking the history, as this has been reported to range from 10%-60% of adults with eating disorders, who also display higher levels of depression. Use of senna-containing laxatives for longer than 9 months often leads to development of dark colonic mucosal pigmentation termed pseudomelanosis or melanosis coli. This was once thought to increase the risk of colorectal cancer; however, more recent studies have concluded that there appears to be no association of increased risk for colorectal adenocarcinoma in melanosis coli.

**Toileting behavior**

Many patient with anorectal complaints have toileting behavior that is counterproductive, including repeated straining and spending a long time on the toilet. Although it is not clear if the behavior causes the symptoms or vice versa, it is key to try and break the cycle of poor toileting behavior. Patients must be counseled that one need not move bowels at the same time every day to be healthy. Reading on the toilet is to be avoided. If a call to stool is not productive of a bowel movement in a few minutes (5 at maximum), the patient should go on about their business until the call to stool returns. Patients who report the need to strain repeatedly should be evaluated for possible pelvic floor dysfunction.
Patients who describe the need for repeated wiping should be evaluated for imperfect anal closure, grades of fecal incontinence, and inadequate fiber intake. Those with pruritus also often wipe excessively, eventually causing skin maceration. The use of moistened tissue or premoistened wipes (sold alongside toilet tissue) helps to minimize abrasion trauma. Remind patients to blot the area dry after use of moistened wipes because chronic moisture in the perianal area can lead to skin breakdown. Witch hazel may be soothing to some; however, others find it burns, especially if there is skin maceration. Use of a zinc oxide ointment such as Balmex or other skin barrier lotion such as Balneol helps allow the irritated perianal skin to heal.

Other medical management

There is a wide array of topical over-the-counter agents marketed to treat hemorrhoidal symptoms, and most patients would have used these for a variable length of time, either on their own or at the direction of another medical provider. Evidence for any beneficial effect is thin. Product types include creams, gels, foams, wipes, and suppositories. Most proprietary products include a combination of agents. The classes of agents and the intended effects are listed in Table 2. Prolonged use can produce irritation due to the delivery vehicle. Steroids in particular are often overused, which causes thinning of the perianal skin and further opportunity for maceration.

Phlebotonics are a heterogeneous class of drugs used to treat first- and second-degree hemorrhoids, episodes of external hemorrhoidal thrombosis, and as adjuncts after surgical hemorrhoidectomy. Although the mechanism of action is not well established, they are associated with decreasing vascular endothelial inflammation and normalizing capillary permeability. Most of these are natural plant products (eg, flavonoids and sapsonides) but some, such as calcium dobesilate, are synthetic compounds. The main adverse effects of flavonoids are gastrointestinal symptoms, whereas calcium dobesilate is associated with a risk of agranulocytosis. Most studies of phlebotonics have come out of Europe and Asia, where these agents are available for oral use. A 2006 meta-analysis reviewed 14 trials evaluating the effect of flavonoids on symptomatic hemorrhoids. The authors noted that methodological variability and quality made it difficult to ascertain any clear benefit. A 2012 Cochrane review of the use of phlebotonics for hemorrhoids showed a statistically significant benefit in pruritus, bleeding, bleeding after hemorrhoidectomy, discharge and leakage, and overall symptom improvement when compared with control. The outcomes for pain, pain after hemorrhoidectomy, or postoperative analgesic use did not improve significantly.

Office-based procedures

A variety of office-based treatment options are available for the treatment of internal hemorrhoids. All are directed at producing fixation of the downward-displaced hemorrhoidal cushion into a more normal, proximal position. The lack of somatic innervation makes office treatment of internal hemorrhoids attractive. External hemorrhoids, which are somatically innervated, cannot be treated by these methods. The choice of therapy may depend on surgeon preference and experience, equipment availability, patient medical comorbidities, and patient preference.

Table 2
Topical over-the-counter agents marketed for treatment of hemorrhoidal symptoms

<table>
<thead>
<tr>
<th>Category</th>
<th>Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anesthetic</td>
<td>Benzocaine, dibucaine, dyclonine, lidocaine, and tetracaine</td>
</tr>
<tr>
<td>Analgesic</td>
<td>Camphor, juniper tar, and menthol</td>
</tr>
<tr>
<td>Anti-inflammatory</td>
<td>Corticosteroids</td>
</tr>
<tr>
<td>Astringents</td>
<td>Calamine and witch hazel</td>
</tr>
<tr>
<td>Barrier or emollient</td>
<td>Aluminum hydroxide, cocoa butter, glycerin, kaolin, lanolin, mineral oil, petrolatum, starch, and zinc oxide</td>
</tr>
<tr>
<td>Vasoconstrictive</td>
<td>Ephedrine, epinephrine, and phenylephrine</td>
</tr>
</tbody>
</table>
Injection sclerotherapy

Injection sclerotherapy uses one of several sclerosing agents injected proximal to the internal hemorrhoid to produce fibrosis and proximal fixation of the tissue. Commonly used agents include 5% phenol in oil, 5% quinine and urea, hypertonic saline, 5% sodium morrhuate, and sodium tetradecyl sulfate. They are injected into the submucosal plane; a more superficial injection into the mucosa may cause slough without fixation, whereas a deeper intramuscular injection would be more painful. A 25-gauge spinal needle is ideal: the gauge reduces bleeding, and the length allows the surgeon to clearly view the tissue through the anoscope without obstruction during the procedure. Two milliliter of the sclerosing solution is injected into the submucosal plane just proximal to the base of the hemorrhoid.

Sclerotherapy is safe in anticoagulated patients because it produces fibrosis rather than slough. The best result is seen in first- and second-degree hemorrhoids, with a high degree of initial success in decreasing bleeding and pain. Long-term durability varies; 20%-53% of patients are symptom free 4 years after sclerotherapy. With the simplicity and safety of sclerotherapy, these rates may be acceptable in patients considered high risk for other procedures. Several sessions may be needed for best effect; the surgeon must be mindful of avoiding stricture.

Rubber band ligation

Rubber band ligation (RBL) is one of the most commonly performed office procedures for the treatment of internal hemorrhoids owing to its ease, safety and efficacy, and cost-effectiveness. A small rubber band is applied at the apex of the internal hemorrhoid to create an inflammatory response and proximal fixation of the hemorrhoidal tissue. The correction of the downward prolapse of the tissue improves the venous drainage and reduces the size of the hemorrhoidal mass, decreasing symptoms of bleeding. No preparation is required; many surgeons prefer the patient to have an enema shortly before the procedure to ensure adequate visualization. Either the knee-chest or lateral position can be used.

The internal hemorrhoids are visualized with a complete anoscopic examination. The redundant mucosa at the hemorrhoidal apex is drawn into the barrel of the banding instrument by a grasping clamp or suction. The band is then applied, reducing the prolapse of the tissue and allowing its fixation back into the proper position. The banded tissue becomes ischemic and sloughs in 5-7 days, leaving a shallow ulcer, which as it heals produces fibrosis and fixes the hemorrhoidal tissue in place. The band must be placed at least 2 cm proximal to the dentate line to avoid causing pain from somatic innervation. It is also critical to recognize that the tissue brought into the banding instrument is the mucosa proximal to the hemorrhoid, not the hemorrhoid itself. The maneuver is intended to fix the hemorrhoidal tissue back into its proper position while retaining its function, not to cause slough of the hemorrhoidal tissue.

A variety of banding instruments are available, each based on the principle of drawing the tissue to be banded into the banding instrument (Fig 4). Requirements include proper positioning, an anoscope, and a bright light. Lighted anoscopes are very helpful (Fig 3). The main difference is whether the surgeon requires an assistant or can perform the banding alone. The classic reusable McGivney ligator requires manual loading of the band onto the instrument, and an Allis-type grasper is used to draw tissue into the barrel; the band is then placed by closure of the handle (Fig 5). This generally requires an assistant to secure the anoscope while the surgeon draws the tissue into the instrument barrel and deploys the band. Bands must be loaded again if additional sites are to be treated. There are several systems that use suction to draw the tissue into the instrument barrel, allowing the surgeon to perform the banding independently. The McGown suction ligator is also reusable; the suction barrel is smaller than the McGivney barrel, so less tissue is banded. Like the McGivney, the McGown instrument also treats 1 site per load. The disposable ShortShot Saeed Hemorrhoidal Multi-Band Ligator (Cook Medical) has 4 preloaded bands. The barrel is placed over the site for banding, suction is applied by occlusion.
of a thumb hole, and the band is deployed. This is convenient if several sites are to be banded at the same setting. A similar system, the O’Regan ligating system, uses a specially developed disposable syringe system (Fig 4). The open end of the syringe is placed against the tissue to be banded. The surgeon draws back on the barrel, producing suction that draws tissue into the barrel; the surgeon’s thumb then deploys the band trigger. Only 1 site can be banded per deployment.

It is safe to band several sites at the same setting, although some studies have suggested a higher incidence of pain and urinary retention if multiple sites are banded. For this reason, some surgeons band 1 site at the first setting and use the patient’s response to guide subsequent banding. In this instance, the largest hemorrhoid is usually banded first. Surgeons often load 2 bands for each site, with the thought that if 1 band slips or breaks, the other will hold. If the patient experiences pain immediately on banding, the site is too close to the dentate line, and the band should be removed at once. This can be avoided by gently testing the chosen site for sensation with a forceps pinch before band placement. Patients can resume normal activities immediately. Patients are also instructed to avoid aspirin and nonsteroidal anti-inflammatory drugs for 7-10 days and are placed on a bowel regimen to avoid hard, dry stools. The band and some tissue are expected to slough 5-7 days after the procedure; some bleeding may occur, and patients should be informed of this likelihood. The expected slough and resultant ulcer are the
reason RBL is relatively contraindicated in patients on anticoagulation or those who have an elevated INR owing to other medical issues.

Complications after RBL are usually minor. The most common complications are pain, bleeding, external hemorrhoidal thrombosis, urinary difficulty, and vasovagal attack. Patients should be cautioned that they might feel a pressure or fullness sensation after band ligation, even with proper placement. This usually resolves in 24-48 hours. Sitz baths may be helpful. Severe pain is unusual with banding. If it occurs immediately on band placement, the site is too close to the dentate line and the band should be removed. This may require local anesthetic in the office. If severe, the patient may be taken to the operating room for removal. Delayed severe pain dictates investigation; if it is owing to external thrombosis, then is managed appropriately (discussed later in the article). If the cause is not apparent externally, examination under anesthesia is indicated with band removal, or rarely, operative hemorrhoidectomy. Abscess may occur, usually at 5-7 days. Examination under anesthesia establishes the diagnosis and allows drainage. Those patients with latex allergies should be counseled to consider other forms of treatment, as most rubber bands for this use contain latex.

The most severe complication of RBL is pelvic sepsis, usually heralded by fever, severe pain, and urinary retention. This is extremely rare but potentially fatal if not recognized early and managed aggressively. Evaluation should include CT scan of the abdomen and pelvis to assess for extrarectal inflammation and gas, followed by examination under anesthesia with debridement, and possibly exploratory laparotomy with fecal diversion if indicated. Early reports indicated a high risk of pelvic sepsis when human immunodeficiency virus (HIV)-positive individuals underwent RBL. More recent information indicates that in the era of highly effective highly active antiretroviral therapy, RBL is safe and effective.35

Banding has the best outcome with first- and second-degree hemorrhoids, with 70%-90% success after 1 treatment.36-38 Several treatments may be needed for the treatment of third-degree hemorrhoids, and durability is less with bulkier hemorrhoidal disease, or if more than 4 bands are needed.36 Forlini and colleagues37 report 10- to 17-year follow-up, with 69% of the cases being asymptomatic, 28% having some symptoms, and 3% seeking additional treatment. Recurrent hemorrhoids can be reband with good outcomes; Iyer and colleagues36 reported success rates of 74%, 61%, and 65% for first, second, and third recurrences, respectively. A 1997 meta-analysis found that RBL produced more durable results than sclerotherapy or infrared coagulation, with less pain and fewer complications as compared with excisional hemorrhoidectomy.39 A 2005 Cochrane review comparing RBL to excisional hemorrhoidectomy concluded that RBL was the treatment of choice for grade 2 hemorrhoids, providing results similar to those of excisional hemorrhoidectomy with fewer side effects, and suggested that excisional hemorrhoidectomy be reserved for grade 3 hemorrhoids or recurrence after banding.40

Energy methods of fixation

Infrared photocoagulation, bipolar diathermy, and direct current electrotherapy are similar to RBL in that these energy methods produce fixation of the prolapsing hemorrhoid. Patient preparation, positioning, and selection are essentially the same as those for banding.

Infrared photocoagulation produces heat, which fixes the tissue at the apex of the hemorrhoid. The applicator tip is passed through an anoscope to the desired spot, and 3-4 applications are delivered at the site. The device produces a 4-mm² focus of coagulation with a 2.5-mm deep ulceration. Up to 3 sites can be treated at the same setting. Complications are rare and usually minor; pain may occur if the site is too close to the dentate line, and bleeding may follow excessive energy use. Immediate pain is suggested to be less after infrared coagulation than RBL, with similar efficacy.41 The technique can also be used safely through an endoscope with significant symptom improvement.42 The equipment cost is significantly higher than that for RBL systems.

Bipolar diathermy directs bipolar radiofrequency energy to the point of fixation until the tissue coagulates, with a depth of penetration of 2.2 mm. Success rates are inferior to RBL and heater-probe treatment in randomized studies.43,44
Direct current electrotherapy requires 10 minutes to deliver a 110-V direct current to the chosen site up to the maximum tolerable level, approximately 16 mA. This technique is not widely used owing to the time required for treatment and the inability to treat grade 3 hemorrhoids.

**Historical notes: Cryotherapy and anal dilation**

Cryotherapy uses liquid nitrogen or nitrous oxide to cool a probe to freezing temperatures (between –70°C and –196°C). The probe is applied to the area to be treated. The procedure is time-consuming, and patients experience pain and a foul-smelling rectal discharge that persists for 5–8 days. Significant complications including anal stenosis, sphincter damage, and fecal incontinence have been reported. This technique should be abandoned.

Anal dilatation, also called Lord's procedure, is described as a stretch of the anal canal sufficient to accommodate 4 fingers of both of the surgeon's hands. This produces uncontrolled sphincter injury and postprocedure incontinence. This technique has no place in modern surgery.

**Surgical management of internal hemorrhoids**

**Operative hemorrhoid management**

Only 5%-10% of patients with hemorrhoidal concerns require operative treatment. Operative hemorrhoid management includes excisional hemorrhoidectomy, stapled hemorrhoidopexy (SH), and Doppler-guided transanal devascularization. Excisional hemorrhoidectomy is the standard to which all other hemorrhoidal management techniques are compared for pain, durability, and complications. Operative hemorrhoid management is best used for those who have failed nonoperative hemorrhoidal management, those in whom the degree of disease is unlikely to respond to nonoperative techniques, or those with a significant external hemorrhoidal component. Hemorrhoids in the presence of other anorectal pathology that requires surgery may also be best managed with hemorrhoidectomy. Finally, coagulopathic patients requiring management of hemorrhoidal bleeding are best managed in the controlled setting of the operating room.

**Closed hemorrhoidectomy (Ferguson technique)**

The Ferguson procedure (Fig 6) is the excisional hemorrhoidectomy technique most often used in the United States. Patients may be prepared with an enema alone; bowel preparation and antibiotics are not required. Prone jackknife, lithotomy, or lateral decubitus position can be used, but prone jackknife with buttocks taped apart is preferred by most American surgeons for best visualization. Anesthesia can be general, regional, or local with intravenous (IV) sedation. The choice of anesthesia varies with surgeon preference and patient comorbidities. Sedation with local anesthetic is safe and facilitates recovery and discharge to home. Hemorrhoidectomy always begins with anoscopic examination, and proctoscopy or flexible sigmoidoscopy, if indicated.

The Ferguson procedure involves grasping the hemorrhoidal bundle and dissecting the tissue in a cephalad manner, starting the incision on the perianal skin and proceeding toward the anorectal ring. Care is taken to excise the minimal amount of anoderm necessary to avoid stricture. Scissors, scalpel, or cautery may be used to dissect skin and subcutaneous tissues, elevating the external hemorrhoid. Dissection proceeds proximally, separating the vascular bundle from the external and internal sphincter fibers, which must be clearly visualized. This is the critical portion of the procedure. Muscle fibers can be swept gently downward off the tissue to be excised. The apex of the vascular bundle is transfixed with a suture ligature. This may be done before beginning the dissection, after its completion but before amputation of the bundle. The specimen is amputated just distal to the apex stitch, which is then used to close the wound. The stitch can be locked for hemostasis. The edges of the anoderm should match up in the stitch
closure to avoid mucosal ectropion. The last 5 mm are left open to provide for drainage. One, 2, or 3 quadrants may be excised, but care should be taken to preserve bridges of viable skin and mucosa between excision sites to prevent stenosis. Dressings usually consist of antibiotic or anesthetic ointment, or both, and nonadherent gauze and mesh briefs. Most hemorrhoidectomies are performed as outpatient procedures in the United States. In this author's experience, sending each quadrant separately for pathologic inspection is sensible. Although the number of occult cancers found at hemorrhoidectomy is low, knowledge of the exact location of the neoplasm is invaluable in planning the least morbid treatment. Postoperative care consists of appropriate pain control, minimizing constipating opiates, and a bowel regimen to avoid hard, dry stools.

Fig. 6. Ferguson closed hemorrhoidectomy. (A) Hemorrhoid bundle is grasped; dissection proceeds cephalad. (B) Apex is transfixed with suture; bundle is amputated. (C) Suture is used to close wound, leaving a few millimeters open for drainage.

Open hemorrhoidectomy (Milligan-Morgan technique)

The Milligan-Morgan technique is more common in the United Kingdom. Perioperative management is the same as for the Ferguson technique. The external components are grasped with clamps and retracted caudally to expose the internal hemorrhoids and these are also grasped with clamps. Traction exposes the apex of each bundle. A V-shaped incision is made on the anoderm extending up to the mucocutaneous junction. The fibers of the external and internal sphincters are dissected away from the hemorrhoid as in the Ferguson technique. While grasping the hemorrhoid bundle in the clamps, the pedicle is suture ligated, and the bundle is amputated. The wound is left open to granulate. One to 3 columns can be excised, with the same caveat regarding preservation of viable bridges of skin and mucosa. Postoperative care is the same as after a closed hemorrhoidectomy.
Historical note: Whitehead hemorrhoidectomy

The Whitehead hemorrhoidectomy technique involves a circumferential excision of internal hemorrhoidal tissue and redundant anoderm just proximal to the dentate line. It was more common in the United Kingdom in years past, but has become much less popular. This procedure never gained wide acceptance in the United States, in part owing to a high incidence of postoperative complications including anal stenosis, mucosal ectropion, and disturbed continence. Most centers have abandoned this approach.

Outcomes of excisional hemorrhoidectomy

The long-term results of hemorrhoidectomy are excellent, with low rates of recurrence requiring reoperation.45,46 Studies comparing open vs closed hemorrhoidectomy have found similar postoperative pain, need for analgesics, and complications. Results from a prospective randomized trial of open vs closed technique noted a shorter operative time, less early postoperative pain, lower morbidity, and a longer healing time in the open group.47 Sohn and colleagues48 found a shorter operative time with open technique, but all other outcomes including morbidity were equal. A prospective randomized trial comparing open vs closed hemorrhoidectomy revealed a significantly lower need for postoperative opiates and faster wound healing after closed technique.49 A meta-analysis evaluating 6 trials of open vs closed hemorrhoidectomy revealed no difference in cure rate; open technique was again noted to be faster, while healing was more rapid after closed technique.50

Complications of excisional hemorrhoidectomy

Bleeding is one of the more common complications of hemorrhoidectomy, although delayed severe bleeding occurs in less than 5% and seems related to the narrow male pelvis and individual surgeon.51 Although packing of the anal canal and balloon tamponade have been suggested, this author’s preference is for surgical control in the operating room, under direct vision with good light and anesthesia. The large amount of clot that may be present in the rectum and sigmoid should be evacuated as much as possible. Other common complications of hemorrhoidectomy include urinary retention and urinary tract infection, fecal impaction, anal stenosis and disturbances of continence, and fistula in ano.52

The most feared effect of hemorrhoidectomy is postoperative pain, which is variable among patients. Lasers were studied 2 decades ago; their use in hemorrhoidectomy was associated with higher cost but no improvement in postoperative pain.53 Diathermy has been compared with scissor excision with no significant difference in outcomes.54 A number of more recent studies have compared radiofrequency energy devices with diathermy excision. The main differences identified have been less reported pain and less use of pain medication,55,56 earlier return to work,55 and faster wound healing.56 A Cochrane review of 12 studies of LigaSure vs diathermy hemorrhoidectomy showed that the pain benefit derived from the use of the LigaSure device disappeared by the 14th postoperative day, and there was no difference in postoperative complications, bleeding, or incontinence. Patients treated with LigaSure technique spent 9 fewer minutes in the operating room and returned to work 4 days earlier on average.57 Previously, studies that included costs often evaluated only the direct costs: operating room or hospital time, drugs, and supplies used. The cost of these energy devices is not offset by 9 fewer minutes spent in the operating room. However, in the near future, how soon patients return to the work force may also be an important consideration of the “cost” of a procedure to the third party payer. Further studies of relative cost-efficiency may be in order as new devices and drugs continue to appear in the marketplace.

Stapled hemorrhoidopexy

SH, first described by Italian surgeons, is designed to excise a circular strip of mucosa and submucosa well above the hemorrhoidal zone, elevating and fixing the hemorrhoids back into their usual position, thereby treating hemorrhoidal prolapse and the symptoms thereof while avoiding the pain of incisions in the perianal area. The excision may devascularize the
hemorrhoids, although this is not a primary goal. The main benefit is considered to be the lack of pain as compared with conventional hemorrhoidectomy, to which it must be compared. Indications are second- and third-degree hemorrhoids that have failed nonoperative methods, or patient choice. Patients with thrombosed internal hemorrhoids or significant external hemorrhoidal disease who require excision are not generally considered candidate for SH nor are patients with fourth-degree hemorrhoids.

Patient preparation, positioning anesthesia, and perioperative management are identical to excisional hemorrhoidectomy. The anal canal is inspected as usual. Familiarity with the stapler kit and steps of the procedure are integral to the successful performance of this procedure. The stapler comes in a kit with a specially designed disposable anoscope, which is transparent to allow visualization of the dentate line. It is imperative that the anoscope be inserted to the appropriate depth or the purse string would be placed too low. The anoscope can be sutured into place to avoid loss of exposure. The obturator is removed and replaced by a slotted anoscope, which is also provided in the kit. This allows placement of the purse string suture (2-0 polypropylene) while protecting the mucosa opposite. The purse string must be placed 2 cm proximal to the hemorrhoidal apex. The slotted anoscope is removed, the head of the opened stapler is then passed through the purse string suture, and the suture is tightened about the shaft of the stapler head, drawing the redundant tissue into the stapler. The stapler is closed and fired, excising a 1- to 3-cm wide ring of mucosa and submucosa, and creating a stapled anastomosis proximal to the dentate line. The stapler is partially opened and carefully extracted. The staple line must be inspected carefully for bleeding, and if found, oversewing is the management of choice.

Correct placement of the purse string suture is integral to success. If placed too proximally, the hemorrhoids would not be lifted into their natural position, and if placed too distally, the staple line would be too near the dentate line and cause pain. The depth of the purse string suture is also key: if too deep, a full-thickness excision may result, with the risk of pelvic abscess, fistula, or iatrogenic stapled rectovaginal fistula. The posterior vaginal wall must be assessed several times during purse string placement and before stapler firing to avoid this complication.

Outcomes of SH

A number of prospective randomized studies have been performed to evaluate safety and efficacy of SH. An American multicenter prospective randomized trial comparing SH and Ferguson hemorrhoidectomy reported that SH was associated with less postoperative pain and less analgesic use, with similar symptom control and need for additional hemorrhoid treatment at 1 year of follow-up. However, subsequent studies found that conventional hemorrhoidectomy was superior at preventing long-term recurrence of hemorrhoids. The consensus seems to be that SH is safe and offers several short-term benefits, but is associated with a significantly higher incidence of recurrent hemorrhoids and additional operations compared with conventional hemorrhoidectomy.

Complications of SH

Rectal obstruction, rectal perforation, retroperitoneal sepsis, and pelvic sepsis have all been documented as complications of SH. There are several complications of SH that must be specifically noted. There is potential for sphincter injury if muscle is incorporated into the stapler, which has been documented. Iatrogenic stapled rectovaginal fistula is of concern as well. These complications are very rare with conventional hemorrhoidectomy but remain a significant concern in SH performance. A small percentage of patients experience continued pain, bleeding, anal fissure, fecal urgency, and frequency following SH, and most require surgical reintervention. The most common reinterventions were excisional hemorrhoidectomy, staple removal, and surgical management for fissure. Reintervention was effective in treating pain and other symptoms, but a high rate of posttreatment bleeding and soiling was found.
Transanal hemorrhoidal dearterialization

Transanal hemorrhoidal dearterialization (THD) is a nonexcisional technique described by Morinaga and colleagues to identify discrete arterial inflow to the hemorrhoids with Doppler technology, allowing transanal ligation of the hemorrhoidal arterial supply. The technique was introduced in the United States in 2008. The arterial supply is quite variable, with 4-9 arteries commonly identified, not necessarily related to the location of the internal hemorrhoids. Interruption of the arterial supply is hypothesized to produce hemorrhoidal shrinkage, decreased bleeding, and prolapse. Mucopexy or hemorrhoidopexy was added to the procedure to address the problem of continued postoperative bleeding and prolapse.

Patient preparation, positioning anesthesia, and perioperative management are identical to excisional hemorrhoidectomy. The anal canal is inspected as usual. A specialized anoscope is required, which contains a removable Doppler probe. The anoscope is rotated to identify a feeding artery. A slot in the anoscope allows suture ligation to be performed at the site identified, well proximal to the dentate line; loss of the Doppler signal confirms successful ligation. Rotation of the anoscope with arterial ligation continues until no further signal can be identified. Mucopexy or hemorrhoidopexy follows. The same suture can be used to oversee the redundant mucosa from proximal to distal, terminating the suture proximal to the dentate line. The proximal and distal tails of the suture are tied together to lift the hemorrhoid proximally. The mucopexy is done in 2-4 positions within the anal canal. Early experience showed the THD procedure to be safe, although the data were not robust. A systematic review published in 2009 which included 17 trials, only 1 of which was randomized, showed that a second THD was required in 27% of cases for persistent prolapse. In addition, recurrent or persistent prolapse at 1 year was reported in 11% of cases, with bleeding in 10% and pain in 9%.68

More recent randomized trials of THD vs simple suture ligation, excisional hemorrhoidectomy, and SH have failed to demonstrate a durable advantage of THD-mucopexy. In a study of 82 patients with grades 2 and 3 hemorrhoids randomized to transanal artery ligation with and without Doppler guidance, there was no difference with respect to blood loss, pain, and defecatory problems. The non-Doppler group had more improvement of prolapse symptoms, and a higher percentage of the non-Doppler group was complaint-free at 6 months after operation.69 A study that randomized 40 patients with grades 2 and 3 hemorrhoids to THD vs excisional hemorrhoidectomy and evaluated outcomes at 2-4 months and 1 year after surgery showed that the THD group had less pain during the first postoperative week only. Although pain, bleeding, and need for manual hemorrhoid reduction were improved in both groups after 1 year, soiling was significantly decreased only in the excisional hemorrhoidectomy group, and there was a trend for more THD patients to have persistent grade 2 hemorrhoids after 1 year.70 Another study randomly assigned 124 patients with grades 3 and 4 hemorrhoids to undergo THD with mucopexy or SH. Patients were followed up by phone interview at a median of 42 months. The primary outcome was recurrent prolapse, which occurred in 16 (25.4%) patients of the THD group compared with 5 (8.2%) of the SH group.71 It appears that THD has its best outcome in grade 2 and possibly grade 3 hemorrhoids; however, the risk for recurrent or persistent prolapse and need for subsequent surgery is not inconsequential.

External hemorrhoids

Thrombosed external hemorrhoids

Acute thrombosis of external hemorrhoids usually evolves over a period of hours. Although this is thought to be related to an inciting event, such as a hard stool or unusual physical activity such as heavy lifting, often this history cannot be elicited. The pain is sudden and often intense; a firm lump can be palpated at the anal opening. The natural history is for the pain to increase for 24-36 hours and then diminish. The thrombus would then begin to resolve. At times, the thrombus erodes though the overlying skin and necessitates, which may ease the discomfort. Management is directed at pain relief. If the patient presents in the first 24-72 hours, and the thrombus is very firm to palpation, excision of the clot can be performed with good pain relief. If
the external hemorrhoid is simply edematous with no firm clot, or if the clot has begun to soften and resorb, nonoperative symptomatic care is indicated.

Excision of the thrombus can be performed in the office. It is important to understand that the thrombus is a group or cluster of small clotted vessels, not 1 large clot, and so would not resolve with simple incision as is sometimes done in emergency departments. The patient must be able to cooperate with positioning and injection of local anesthetic. Good light and an assistant are important to the patient’s comfort and the procedure’s success. Either 0.5% lidocaine with 1:200,000 epinephrine or 0.25% bupivacaine with 1:200,000 epinephrine can be used to produce a field block at the site of the thrombosis. An ellipse of skin overlying the thrombus is excised, with the axis of the ellipse beginning on the perianal skin and proceeding toward the anal canal (Fig 7). A small tenotomy scissor is ideal to excise the cluster of small clots; effort should be made to excise all the small clots that can be removed without excessive anodermal undermining. Bleeding should be minimal because the feeding vessels should be clotted off; the epinephrine in the local anesthetic also helps. The skin can be left open or closed per surgeon’s preference. The patient is instructed to avoid hard stools and straining. Sitz baths provide comfort. Nonopiate pain medications are usually sufficient after clot removal as most of the pain is owing to the acutely stretched skin.

Nonoperative management is indicated when patients are not candidates for excision, such as when the tissue is generally edematous but no clot is present, or if the clot is in the process of resolution, or if the patient is anticoagulated. Patients are instructed to use a bulking fiber supplement with appropriate water intake; a stool softener may also be helpful. Sitz baths provide comfort and local anesthetic creams may be used for a short time as well. Patients can be told that a skin tag may result after resolution, which may or may not require attention. Further investigation, including anoscopic examination and flexible endoscopy, as indicated, should be done at some point after resolution to rule out proximal pathology.

**Hemorrhoidal skin tags and fibroepithelial polyps**

Patients often complain of symptoms that they relate to external skin tags and fibroepithelial polyps, which may be the residua of previous hemorrhoidal episodes. It can be challenging to determine if the related symptoms are in fact caused by these findings. In the author’s experience, firm fibroepithelial polyps are more likely to cause symptoms of soiling and discomfort than more bland-appearing external skin tags. Patients should be examined carefully for additional pathology. Excision of these entities can be performed safely in the outpatient
setting. Discussion with the patient should cover potential complications, including but not limited to bleeding, infection, and scarring that may alter stooling and sensation, and unresolved symptoms.

**Special situations**

**Strangulated hemorrhoids**

Strangulated hemorrhoids are internal hemorrhoids that have prolapsed and become incarcerated owing to internal sphincter spasm. Thrombosis of the external hemorrhoids often accompanies this condition. The incarcerated internal hemorrhoids may be beefy red, or ulcerated and necrotic, depending on the length of time of incarceration. If not necrotic, circumferential injection of local anesthetic and reduction of the strangulated hemorrhoids can be accomplished, followed by bed rest. One small randomized trial published in 1991 compared reduction followed by banding of the internal component and excision of the external thromboses with excisional hemorrhoidectomy; 13.5% patients treated with reduction and banding went on to require excisional hemorrhoidectomy. Unless the patient has prohibitive operative risk, the best option for strangulated hemorrhoids is expeditious excisional hemorrhoidectomy; in the presence of necrosis, excision is a necessity. Either an open or a closed technique can be used. If tissues are very edematous, or if devitalized tissue is present, one may consider leaving the wounds open to prevent abscess. Postoperative care is as usual after excisional hemorrhoidectomy. The outcomes are good.

**Hemorrhoids in pregnancy**

Engorgement of the internal hemorrhoids and edema of the external hemorrhoids are common during pregnancy, possibly related to impaired venous return, constipation, and pressure on the pelvic floor. However, hemorrhoidal issues almost always resolve after delivery. The usual recommendations of fiber, stool softeners, water intake, and sitz baths should be offered. Surgical intervention for hemorrhoids in pregnancy is reserved for strangulated hemorrhoids, or occasionally a very symptomatic external thrombosis. When necessary, operation should be performed using local anesthesia with the patient positioned in the left lateral position to avoid compression of the inferior vena cava.

**Hemorrhoids, varices, and portal hypertension**

Rectal varices and hemorrhoids are distinct and different. Incidence of hemorrhoidal symptoms in patients with portal hypertension is similar to that in the general population. Although rectal varices are common in patients with portal hypertension, they bleed much less commonly than esophageal varices. In the rare instance of bleeding from rectal varices, multimodal treatment should be considered, including medical management of portal hypertension, direct control methods such as sclerotherapy and suture ligation, to transjugular intrahepatic portosystemic shunt and surgical portosystemic shunts.

**Hemorrhoids in Crohn disease**

As many patients with Crohn disease have loose stools, engorged hemorrhoids may occasionally be seen. In the background of rectal inflammation, conservative management is indicated. Older literature describes a high rate of poor wound healing and complications with hemorrhoidectomy in Crohn disease, and many patients with anorectal Crohn disease describe a hemorrhoidectomy with poor outcome as immediately preceding their inflammatory bowel disease diagnosis. However, in appropriately selected patients who are well controlled medically and have no rectal inflammation or other anorectal disease, a good outcome can be attained.
Wolkomir and Luchtefeld reported healing in 15 of 17 patients with Crohn disease with ileocolic disease after hemorrhoidectomy. Karin reported on a group of 13 patients with Crohn disease without rectal involvement who had symptomatic grade 3 hemorrhoids. All underwent transanal hemorrhoidal dearterialization. There were no deaths, new incontinence, fecal impaction, or persistent pain. At 18 months, 10 patients were without hemorrhoid-related symptoms.

Hemorrhoids in the immunocompromised patient

Anorectal pathology is increasingly seen in immunocompromised patients, including those with medically induced immunosuppression, such as solid organ transplant recipients and patients receiving steroids or chemotherapy, as well as those with disease-induced immunosuppression, including HIV. One must recall that this population is heterogeneous. For those in whom the immunocompromise can be expected to resolve, conservative management should be pursued aggressively until immunity is normal or nearly so. For those with an ongoing degree of immunocompromise, medical management should be the primary approach, reserving direct intervention only after medical failure and with careful consideration of the implications of complications in this population. RBL and excisional hemorrhoidectomy have been shown to be safe in HIV-positive patients on highly active antiretroviral therapy with acceptable CD4 counts.

Summary

Symptoms thought related to hemorrhoids must be carefully considered before intervention. The first line of therapy for any hemorrhoidal complaint remains conservative management with increased fluid and fiber intake and appropriate modification of toileting behavior. Bleeding in grades 1 and 2 hemorrhoids that does not respond to this can be satisfactorily and safely managed with office-based therapies; some grade 3 hemorrhoids would also respond to this, though more treatment sessions would likely be required. Operative therapy is the best choice for management of persistently symptomatic grade 2 disease and for grades 3 and 4 symptomatic hemorrhoids as well. With proper patient selection and preparation, along with a familiarity with instrumentation and techniques, good results can be obtained with newer operative interventions for internal hemorrhoids. Outcomes must always be compared with those obtained with classic excisional hemorrhoidectomy.

Fistula in Ano

Introduction

Familiarity with anorectal anatomy and the pathogenesis and classification of fistula is essential to successful fistula management. At its simplest, the pelvic floor consists of 2 funnel-shaped structures, 1 within the other. The inner structure is the lower end of the circular muscle of the rectum, which becomes thick and rounded as it condenses into the structure known as the internal anal sphincter. Surrounding this is a funnel of pelvic floor muscle formed by the levator ani, the puborectalis, and the external anal sphincter. The intersphincteric space lies between these 2 funnels and is continuous inferiorly with the perianal space and superiorly with the rectal wall. The perianal space is located in the area of the anal verge and becomes continuous with the ischioanal space laterally. The ischioanal space extends from the levator superiorly to the perineum inferiorly and is bound anteriorly by the transverse perinei muscles and posteriorly by the gluteus maximus and sacrotuberous ligament. In the midportion of the anal canal at the level of the dentate line, the ducts of the anal glands empty into the anal crypts.
**Etiology**

Fistula in ano, the most common form of perineal sepsis, is an abnormal communication between the anal canal or rectum and the perianal skin. Most arise because of cryptoglandular infection. Anal crypt glands penetrate the anal sphincter complex to varying depths. Obstruction of these glands leads to suppuration, which tends to track toward the skin; the path taken determines the abscess location, and hence the type of fistula that may develop (Fig 8). Fistula is twice more common in men, and the mean age of diagnosis is approximately 40 years. There is approximately a 50% chance of developing an anal fistula after a perianal abscess is drained. An internal opening is infrequently identifiable at the time of abscess drainage, possibly owing to inflammation and edema. In a study of 1023 patients with anal abscess, the internal opening was identified in 34.7%. Another study followed up 232 patients after anal abscess drainage for up to 13 years, reporting development of fistula in ano in 66% of the cohort. Most surgeons would drain a perianal abscess without acutely searching for a fistula. Vigorous probing can cause iatrogenic fistulas, and those who would develop a fistula would present in due time. Etiologies that should be considered in the differential diagnosis of cryptoglandular fistula are listed below. Here, we consider primarily the diagnosis and management of cryptoglandular fistulas.

**Crohn disease**

Fistula in ano is the most common perianal manifestation in patients with Crohn disease, seen in 6%-34% of patients. Perineal fistulas are present in most patients with rectal Crohn disease and are commonly seen with Crohn colitis as well. Multiple or recurrent fistulas or those with secondary openings more than 3 cm forming the anal verge should raise suspicion for Crohn disease. Some patients with Crohn disease that is medically well managed may become candidates for directed fistula management.

**Pilonidal disease**

The gluteal cleft should always be carefully examined when seeing someone with a presumed perianal fistula. Fewer than 5% of pilonidal sinuses track caudad, but if this rare occurrence is misdiagnosed as an anal fistula, complex iatrogenic fistulas that are difficult to manage may result.

**Fig. 8.** Cryptoglandular suppuration: (A) anal crypt with suppuration and (B) pathways along which the abscess may extend.
Lymphogranuloma venereum

Lymphogranuloma venereum (LGV) is caused by *Chlamydia trachomatis*. Multiple complex perineal fistulas can be seen in longstanding LGV. Recent outbreaks of LGV in the developed world are due to sexual transmission among men having sex with men. Most of these patients will have associated proctitis and many are also HIV positive. LGV should be considered in a patient with fistula in ano, proctitis, and inguinal bubos. Response to medical management determines if any surgical treatment is feasible.

*Actinomycosis and tuberculosis*

These diseases are rare in the general population but can be seen in immunocompromised individuals; these etiologies should be considered in patients with a fistula that is stubbornly recurrent or unusually complex. As in LGV, response to medical management will dictate if surgical intervention is indicated.

Hidradenitis suppurativa

Hidradenitis results from inflammation of apocrine sweat glands, which abound in the perineum, groins, and axilla, and can mimic fistula in ano. Patients typically give a history of repeated abscesses and drainage. Physical examination shows associated scarring. Although hidradenitis may involve perianal skin distal to the dentate line owing to apocrine glands in the area, there cannot be an involvement of the anus at or above the dentate line or the rectum.

*Classification*

The most widely accepted classification of fistula in ano is proposed by Parks and colleagues, which describes the fistula track in relation to anal sphincter complex. This is integral to selecting appropriate treatment options. There are 4 general types of fistulas according to Parks’ classification (Fig 9).

![Fig. 9. Types of anal fistulas: (A) intersphincteric; (B) transsphincteric; (C) suprasphincteric; and (D) extrasphincteric. See text for discussion.](image-url)
**Intersphincteric fistula**

Comprising approximately 70% of all perianal fistulas, this type usually results from a perianal abscess. The track passes within the intersphincteric space to the perineum with a variable amount of internal sphincter involved. The external opening, if present, is in the anal canal. No external sphincter is involved, or this would be a transsphincteric fistula. The suppuration may pass into the intersphincteric plane and terminate as a blind track with no perineal opening. Suppuration may also spread cranially in the intersphincteric plane to lie above the levator or may originate as a pelvic abscess that tracks along the intersphincteric plane to manifest in the perineal area.

**Transsphincteric fistula**

Accounting for roughly 25% of fistulas, these usually arise from an ischioanal abscess. The track traverses portions of both the internal and external sphincters into the ischioanal fossa and then to the perineum. A high blind track may pass toward the apex of the ischioanal fossa or extend through the levator into the pelvis. A rectovaginal fistula is a type of transsphincteric fistula.

**Suprasphincteric fistula**

This results from a supralelevator abscess and accounts for approximately 5% of anal fistulas. The track arises in the intersphincteric space and tracks cranially, passing above the puborectalis muscle into the ischioanal fossa and then to the perianal skin. A high blind track may occur and result in a horseshoe extension.

**Extrasphincteric fistula**

The track passes from the rectum above the levators and to the perianal skin through the ischioanal fossa. This is the rarest type of fistula. Common causes include iatrogenic through inadvertent vigorous probing during fistula surgery, penetrating injury to the perineum or rectum, Crohn disease, or carcinoma and its treatment.

Fistula in ano may also be categorized as simple or complex. Simple fistulas, which include intersphincteric and low-lying transsphincteric fistulas, involve a minimum of external sphincter muscle, and when otherwise uncomplicated are mainly treated by primary fistulotomy.

Complex fistulas are considered to include suprasphincteric and extrasphincteric fistulas; fistulas involving more than 30% of the external sphincter; fistulas with multiple tracks; anterior fistula in a woman; rectovaginal fistulas; fistulas in patients with impaired continence; recurrent fistulas; or fistulas secondary to inflammatory bowel disease, infectious diseases including tuberculosis and HIV, radiation, or neoplasm.

**History**

Patients with fistula often give a history of episodic drainage near the anus that may or may not be related to a lump or opening. Many give no history of having had an abscess, though patients with anorectal abscess have approximately a 50% risk of developing a fistula. The nature of the drainage may be bloody, purulent, or clear. The drainage may be associated with relief of pain, although many patients with fistula do not report pain. The differential diagnosis includes Crohn disease, anorectal neoplasms, caudad-draining pilonidal abscess, sexually transmitted infections including HIV and LGV, inflammatory infections such as actinomycosis or tuberculosis (unusual in the United States), or other unusual neoplasms such as invasive squamous cell cancer, lymphoma, or melanoma.

**Physical examination**

The physical examination begins with inspection of perianal area and gluteal cleft. Although only 4% of pilonidal cysts drain in a caudad direction, misidentification of this as fistula in ano
can lead to complex iatrogenic fistulas that are difficult to treat. The external, or secondary, opening can often be identified in the perianal region draining fluid or harboring granulation tissue. The location and number of external openings help to identify the internal opening. Goodsall’s rule states that a fistula with the external opening lying posterior to a line drawn transversely across the perineum between the ischial spines has a curved track that originates from an internal opening in the posterior midline, whereas a fistula with an external opening anterior to this line usually originates from a radially located anal crypt with a straight track (Fig 10). The accuracy of Goodsall’s rule is reported to vary. One retrospective study reported that 90% of posterior external openings had curved tracks with the primary opening in the posterior midline, whereas 71% of anterior openings tracked to an opening in the anterior midline (90% of women, 62% of men). Another study found that the predictive accuracy of Goodsall’s rule was 71% for anterior external openings but only 41% for posterior openings. A Belgian study suggested that the accuracy of Goodsall’s rule was not affected by Crohn disease, while noting that fistulas with anterior external openings were seen more commonly in women and patients with Crohn disease. Goodsall’s rule also states that if the distance between the external opening and the anal margin exceeds 3 cm, there is an increased chance of complicated extensions of the fistula track through surrounding tissues. A simple yet elegant Israeli study measuring the distance between external opening and anal verge reported that distance correctly predicted whether a fistula was simple (mean = 2.8 cm) or complex (mean = 4.4 cm, \( P < 0.0001 \)). The authors also found that 80% of the anterior external openings had a straight track and 56% of posterior external openings had a curved track, confirming the validity of Goodsall’s rule.

Digital rectal examination should pay special attention to resting tone and voluntary squeeze, because pretreatment continence factors prominently in recommendations regarding treatment options and anticipated outcomes. Induration or scarring in the anal canal is noted. Bidigital examination of the anal canal and perianal area notes any lateral asymmetry. An indurated cordlike structure may be palpable extending from the external opening toward the anus.

Investigations

Anoscopy and proctoscopy or flexible sigmoidoscopy may be performed in the outpatient clinic as part of the office examination, or in the outpatient procedure setting. Anoscopy can sometimes identify the internal, or primary, opening of the fistula track. Proctoscopy or sigmoidoscopy can be performed to exclude other pathology such as proctitis or neoplasm. Any
patient with symptoms suggestive of inflammatory bowel disease, including multiple or recurrent fistulas, should undergo colonoscopy and small bowel imaging such as CT or MR enterography. Although a good sense of sphincter adequacy can be gained on digital rectal examination, anal manometric studies may be useful as an adjunct in management planning for patients with Crohn disease, diabetics, women with anterior fistulas, or anytime there is a concern for pretreatment impaired continence. Preoperative imaging is generally reserved for definition of complex fistula anatomy or demonstration of clinically undetected sepsis to serve as a guide to surgical intervention and decrease recurrence rates. Imaging modalities include fistulography, endoanal ultrasonography, and CT and MRI scans.

**Fistulography**

Classic radiographic fistulography involves insertion of a small caliber catheter into the external opening of a fistula and injection of radiographic contrast material directly into the fistula track. Radiographs from different angles are then obtained to determine the fistula type and anatomy. Previously used in evaluation of recurrent fistulas, this modality became much less common owing to several drawbacks. Debris in secondary tracks often prevents their identification, and excessive injection force can disrupt previously uninvolved tissues. The level of the internal opening and location of sphincters may be difficult to see owing to absence of precise radiopaque landmarks. In 1 study of 25 patients, fistulography was accurate in only 16% and produced false-positive findings in 10% when compared with operative findings.86 Another study of 27 patients reported that information obtained from fistulogram revealed unexpected pathology or directly altered surgical management in 48%.87 These results led to the development of methods of enhanced fistulography techniques, including endoanal ultrasound (EAS) with hydrogen peroxide (H2O2) injected into the track, CT scan with fistulography, and MR fistulography.

**Endoanal ultrasound**

The aims of using EAS in the evaluation of perianal fistula disease are to establish the relationship of the track to the sphincters and determine the complexity and number of tracks. A prospective study of 38 patients comparing physical examination and endoanal ultrasonography found no difference between expert physical examination and EAS in identification of intersphincteric and transspincteric tracks; however, EAS was unable to correctly identify primary superficial, intersphincteric, and extrasphincteric tracks or secondary supralelevator and infrarelevator tracks.88 A prospective study of 21 patients comparing physical examination, conventional EAS, and H2O2-enhanced EAS reported that H2O2-enhanced EAS was superior to clinic examination and standard EAS in identifying anatomical fistula course, though it was less successful than physical examination at identification of primary opening.89 H2O2 EAS also identified secondary extensions in 7 patients; 5 of these had the secondary extension found at surgery. The 2 patients whose secondary extensions were not identified at surgery developed recurrent fistulas, leading the authors to conclude that H2O2-enhanced EAS had value in planning the operative strategy.89 Two prospective studies with 143 and 151 patients compared H2O2-enhanced EAS and findings at surgery. These studies showed high rates of concordance with internal opening identification: 63% concordance overall, and 77% with transspincteric fistulas in 1 study and 93% in the other.90,91 However, a study comparing physical examination and EAS in 401 patients treated for acute or chronic fistula noted that EAS was significantly more accurate in identifying the primary opening in chronic fistula as compared with acute fistula (89.5% vs 76.8%; P < 0.0001).92 A prospective study of 19 patients with recurrent or complex fistula compared 3-dimensional EAS reconstructions done before and after H2O2 enhancement with MR and surgical findings. Results showed that EAS was more accurate in detection of primary tracks and internal openings than in detection of extensions, and although H2O2-enhanced EAS helped identify some tracks and internal openings, and may have been helpful in difficult cases, no overall benefit was demonstrated.93 EAS can be performed rapidly and is well tolerated, but it is operator-interpreter dependent. Scars or defects from previous surgery or
trauma can complicate interpretation. The addition of H2O2 as a contrast medium allows better identification of internal openings and tracks, reducing the risks of recurrence and potentially also incontinence.89

CT scan

CT scan with IV and rectal contrast is used in the assessment of the perirectal spaces, often to identify abscess or differentiate abscess from pelvic cellulitis.94 A retrospective study of 113 patients who had a CT scan less than 48 hours before surgical drainage of an anorectal abscess revealed an overall sensitivity for CT scan detecting perirectal abscess of 77%, but noted that CT lacked sensitivity in immunocompromised patients.95 The limited resolution of CT makes it difficult to differentiate between inflammatory soft tissue streaking and a fistula tract.96 CT is inconsistently able to identify a track’s relationship to the pelvic floor muscles. CT fistulography has been considered as a method of extending the usefulness in the fistula disease. However, owing to radiation exposure concerns, this method has largely been replaced by EAS and MRI.

Magnetic resonance imaging

MRI with body coil, endorectal coil, and phase array has been evaluated for its utility in the assessment of complex and recurrent fistula disease and in the previously operated patient with disruption of normal anatomy. Multiplanar views clarify differentiation of suprarelevator from infrafascial lesions.97 MRI has been shown to be valuable in identification of the primary track as well as the presence, position, and course of secondary extensions. A prospective study comparing MR findings with blinded operative findings showed concordance of 86% for the presence and course of primary track, 91% for the presence and site of secondary extension or abscess, and 97% for the presence of horseshoeing.98 The authors note that the 9% rate of failure to heal was related to pathology identified on MRI but missed at surgery98 (Fig 11). Results of a subsequent study in which the surgeon was blinded to preoperative MR results were less striking, showing that MRI detected 50% of tracks, 74% of internal openings and 46% of external openings, and 33% of abscesses.99 Interpretation of MR images can be challenging because scars and neurovascular structures may be mistaken for fistulas, and image artifacts may simulate a fluid-filled track.100,101 A learning curve has been demonstrated in interpretation of these images.99 Adjuncts for improving image resolution include saline instillation into fistulas, gadolinium rectal instillation, use of an endorectal coil, and IV contrast agents. Saline injected into fistula tracks was noted to improve delineation of fistula extent and make fluid collections more conspicuous, improving visualization of fistulas and the relationship to normal anatomical structures.102 Use of the endorectal coil showed correct identification of the internal opening in 80%103 and has been shown superior to external MRI in demonstration of sphincter anatomy, although definition lessens outside the sphincters and tracks that extend

![Fig. 11. MR image showing abscess distant from fistula. (Color version of figure is available online.)](image-url)
beyond this may not be fully evaluated. MR images obtained before and after the rectal administration of gadolinium were compared with surgical findings in 50 patients with cryptoglandular fistula disease. Overall, 54 of 68 tracks detected at surgery were correctly identified by noncontrast short T1 inversion recovery (STIR) sequences and postcontrast STIR images, with postcontrast T2 images correctly identifying 58 of 68 tracks. The authors concluded that both noncontrast STIR and postcontrast T2-weighted sequences were adequate for fistula classification, but postcontrast T2-weighted images were superior in complex recurrent fistula disease. MR fistulography employing IV gadobenate dimeglumine in a study of 36 patients with anal fistula or abscess reported complete concordance of MR and surgical findings in 32 patients (89%). The 4 patients in whom there was no concordance had complex anal Crohn disease.

A study comparing the diagnostic ability of endoanal MRI, H2O2-enhanced EAS, and surgical exploration in 21 patients with cryptoglandular fistula and a visible external opening noted excellent agreement among modalities for classification of primary track and location of internal opening (81%-90%), and good agreement for secondary tracks, noting agreement was higher for linear tracks (71%-81%) than curved tracks (57%-71%). Another study compared the relative accuracy of physical examination, EAS, and MRI in 104 patients suspected of having fistula in ano. Both EAS and MR were found superior to physical examination in correct classification of primary track and abscess (P < 0.001), horseshoe extension (P = 0.003), and identification of internal opening (P < 0.001). Authors reported that EAS correctly identified internal opening location in 91% vs 97% with MRI, noting that although MR was superior overall in imaging, EAS is a viable alternative for identification of internal opening location. MRI in expert hands provides superiority in definition of complex anal and perineal fistula disease, and owing to the cost and limited availability of specialized MRI, EAS remains a low cost, widely available and useful tool in the evaluation of complex and recurrent fistula disease.

Operative management

General considerations

The goals of fistula management are elimination of the fistula with preservation of sphincter function and prevention of recurrence. Any preoperative discussion must include all these outcomes, clearly outlining the risks related to the planned intervention. Identification of the primary and secondary openings is the first step in fistula classification, which is integral to choosing the proper operative management option. The long-term functional outcomes of primary and staged fistulotomy have led to the search for alternative management methods.

The external opening is commonly readily apparent. Identification of the internal opening can be more challenging. There are number of ways to accomplish this. Examination under anesthesia may be all that is needed to clearly identify the internal opening. A probe can then be passed carefully and gently through to the external opening, thereby defining the track. This direction, from internal to external, is preferred because it is less likely to cause a false track. However, when the internal opening is not readily apparent, the probe may be passed carefully from the external opening toward the area thought to harbor the internal opening. Goodsall’s rule (Fig 10) can be used to guide this maneuver, always being mindful of its pitfalls. Diluted dye such as methylene blue, H2O2, or milk can be injected into the external opening, watching for its appearance at the dentate line. Following the granulation tissue present in the fistula track always helps identify the internal opening, although this requires tissue division before the internal opening is clarified. Grasping the track and noting the puckering of the anal crypt when traction is placed on the fistula track is useful in simple fistulas, but openings may be missed in complex fistula disease.

Most fistula procedures can be performed easily and safely with the patient in prone jackknife position and buttocks taped apart for exposure. Local anesthesia, (0.5% lidocaine or 0.25% bupivacaine with 1:200,000 epinephrine injected circumferentially and submucosally) with IV sedation as adjunct is commonly used, although general anesthesia may be used in select cases.
for airway control issues. Although regional anesthesia can be used, caudal blocks have lost popularity, and spinal anesthesia has a relatively high rate of postoperative urinary retention.

**Low, simple fistula**

*Lay open technique*

This is used chiefly for simple intersphincteric and low transsphincteric fistulas. This is defined in the Practice Parameters for the Treatment of Perianal Abscess and Fistula-in-Ano prepared by the Standards Task Force of the American Society of Colon and Rectal Surgeons as including a single, nonrecurrent track crossing less than 30%-50% of the external sphincter, not an anterior fistula in women, in subjects with unimpaired continence and no history of Crohn disease or pelvic radiation. A probe is inserted into the track; the tissue overlying the probe is divided and the track curetted of epithelial and granulation tissue. If there is any concern for neoplasia, the curettings can be sent for pathologic evaluation, although in general the yield is low. The wound is most commonly allowed to heal by secondary intention, but marsupialization is sometimes done. The wound is generally too saucerlike to pack effectively.

Recurrence and rates of fecal incontinence are low with proper patient selection. A review of 624 patients treated for fistula reported that recurrence was associated with complex or horseshoe fistula, failure to identify the internal opening or lateral location of the internal opening, and previous fistula surgery. Alterations in continence were associated with female gender, high fistula, type of fistula surgery, and prior fistula surgery. van Koperen and colleagues reported on patients treated surgically for fistula with median 76-month follow-up. Of 109 patients with low fistula treated by fistulotomy, the 3-year recurrence rate was 7%; however, soiling was reported at 40%. Tyler and colleagues reported that 38 patients with submucosal fistulas healed after primary fistulotomy with no recurrence. A prospective study of 148 patients with intersphincteric fistula managed by fistulotomy reported postoperative soiling in 6, incontinence to flatus in 27, and incontinence to liquid stool in 4 patients. The authors also noted decreases in maximum resting pressure and length of high-pressure zone, but no change in voluntary contraction pressure. Multivariate analysis revealed low voluntary contraction pressure and multiple previous operations to be independent risk factors for postoperative continence disturbance.

**High or complex fistula**

*Staged fistulotomy with seton*

Preservation of continence is more challenging when managing high transsphincteric fistulas, as simple laying open of the involved muscle produces a high rate of fecal incontinence. These procedures are often performed in a staged fashion with use of a seton. The seton may be any nonabsorbable loop passed through the track; commonly used materials include silk or other nonabsorbable suture, soft drains, rubber bands, or silastic vessel loops. The external and internal openings of the fistula track are identified; skin, anal mucosa, and other non-muscle tissues are divided to expose the sphincter; and the seton is passed through the track and secured. Silk setons are tied to themselves; other materials can be secured with 2 silk sutures. Sufficient room is left between the knot and the tissues to allow manipulation of the seton via the long knot. Situations considered for seton use are shown in Table 3. Any seton used as a drain or to prevent abscess collection, or both, should be nonreactive such as a silastic vessel loop. Use of a silk suture as a seton promotes inflammation and fibrosis, with the aim of allowing a second-stage fistulotomy to divide the remaining sphincter muscle when the divided ends will be kept in close proximity by the fibrosis. Tying the seton tightly about the tissues to promote tissue ischemia and allow the seton to “cut through” the tissue is painful for patients and has been associated with a high rate of incontinence, ranging from a gas incontinence rate of 9.5% at 1 year to an average rate of 12% incontinence reported in a 2009 review. The Practice Parameters for the Treatment of Perianal Abscess and Fistula-in-Ano prepared by the Standards...
Task Force of the American Society of Colon and Rectal Surgeons note rates for minor incontinence as 34%-63% and major incontinence as 2%-26% after seton use.108 The Association of Coloproctology of Great Britain and Ireland has recommended that cutting setons be used only for low transsphincteric fistula.116

High transsphincteric fistulas involve the entire external sphincter complex as well as the puborectalis; laying open the entire tract would certainly produce incontinence. Several alternatives have been used to manage this type of fistula. Parks described division of the internal sphincter and the superficial portion of the external sphincter to the external opening, placing a seton around the remaining external sphincter, with 63% healing reported.117 A modification in which no external sphincter is divided reported 66% healing in posterior and 88% in anterior fistulas.118 Rates of healing and continence are often inversely related, particularly for complex or recurrent fistula disease.

Horseshoe fistulas are suprasphincteric fistulas with complete sphincter involvement, and often have multiple external openings that are at a significant distance from the internal opening. Treatment requires identification of the internal opening and proper drainage of the postanal space. This is classically accomplished by unroofing the postanal space starting at the internal opening and dividing the internal sphincter. Some surgeons prefer to unroof the deep postanal space through a skin incision and place a seton through the internal opening in the posterior midline. Although complete opening of the lateral extensions has been described, most surgeons now prefer the Hanley technique of management, consisting of postanal space drainage with or without a seton, and counterincisions to drain the lateral extensions (Fig 12). Tracks are curetted, and some surgeons place penrose or other drains through the lateral extensions for several days of drainage. With the inciting cryptoglandular source obliterated, the lateral tracks should heal secondarily; however, the recurrence rate is as high as 18% and disturbance in continence as high as 40%. Anterior horseshoe fistulas are very uncommon and can be difficult to manage. One must remember that there is no puborectalis muscle anteriorly, and the abscess or fistula track may lie deep to the transverse perinei muscle. Immediate fistulotomy would guarantee incontinence. Anterior drainage is provided by division of the inferior half of the internal sphincter and seton drainage. Counterincisions may be performed for lateral tracks.

There are several small series in the literature of patients with high fistulas treated by completely laying open the fistula with division of internal and external sphincters, excision of accessory tracks, and repair with overlapping sphincteroplasty.119,120 Preoperative continence disturbance was present in 30%-50% of patients; most of the patients showed improved continence scores postoperatively. However, 8%-25% of patients with no preoperative continence disturbance reported new continence alterations postoperatively. The fistula recurrence rate was reported as 5.7%-6.3%. These are small nonrandomized studies of extremely complex surgical management. Randomized comparison with other methods of fistula management would help to clarify the role of this type of approach.

Continence-preserving procedures

The risk of incontinence with classic fistula management led to the development of various procedures designed to preserve continence while obliterating the fistula. These include dermal
or endorectal advancement flap, fibrin glue, fistula plug, ligation of intersphincteric fistula tract (LIFT) procedure, and several investigational procedures. However, sphincter-preserving procedures are associated with a recurrence rate of 30%-50% overall.121

Dermal or endorectal advancement flap

The aim of advancement flap procedures is obliteration of the internal opening, while avoiding division of any sphincter muscle, leaving the track and external opening to drain and close by secondary intention. If the internal opening is at the dentate line, a dermal flap is preferred to avoid a “wet anus” postoperatively. If the internal opening is higher, an endorectal flap may be employed (Fig 13). Large fistulas may require combined dermal and endorectal flaps.122 Patients are prepared with mechanical bowel preparation and IV antibiotics. Both internal and external openings and the track must be identified. The external opening is saucerized to allow curettage of debris and irrigation; the internal opening is carefully excised of fibrous tissue that would hamper healing. A flap of well-vascularized tissue (skin and subcutaneous tissue for dermal flaps; mucosa, submucosa, and some muscle for endorectal flaps) is raised to allow tension-free coverage of the internal opening. The flap base should be twice the width of the tip to maintain good blood supply. Thicker flaps are associated with lower recurrence.123,124 Recurrence rates range from 23%-40%.122,123,125,126 Separate closure of the internal sphincter was associated with lower recurrence,122 and this became part of the plug procedure, discussed later in this section; however, later studies of internal sphincter closure with flap or as a stand-alone technique did not show improved healing, reporting essentially identical recurrence rates of 23%.127,128

Two studies noted poorer outcomes of flaps in patients with Crohn disease.125,126 In 1 study, patients with Crohn disease had fewer recurrences identified.122 A 2010 review showed success and incontinence rates of 80.8% and 13.2%, respectively, for cryptoglandular disease and 64% and 9.4%, respectively, for Crohn-related fistulas.129 Reasonable success can be expected for advancement flaps in Crohn disease if there is no active rectal inflammation.

Fibrin glue

The use of fibrin glue for therapeutic purposes dates back to World War I, but was discontinued owing to hazards of virus transmission. Improvements in virus-elimination technology allowed the Food and Drug Administration to reapprove its use in 1972. This modality involves plugging the entire fistula track with fibrin glue, which is thought to
help healing by stimulating the migration of fibroblasts and pluripotent endothelial cells into the fistula tract. The use of fibrin glue for anal fistula is appealing owing to its simplicity and avoidance of continence disturbance. The procedure can be repeated in the case of failure with very low risk. As with fistulotomy, both the internal and external openings of the fistula track must be clearly identified, and the track is brushed or curetted to remove debris. A commercially available preloaded double-barrel syringe is introduced into the tract until the tip is seen through the internal opening. The syringe is emptied slowly and steadily, allowing the components of the glue to mix while steadily withdrawing the syringe outwards to fill the fistula tract from the internal opening out, avoiding any gaps in filling the track. The injection is followed by a 10-minute wait to allow the reaction to stabilize the clot.

Early results of fibrin glue in anal fistula were promising. A pilot study of 26 patients using autologous fibrin tissue adhesive reported with 81% initial closure rate at 3.5 months. However, follow-up revealed that recurrences became apparent as late as 11 months after the procedure using autologous or commercial fibrin sealant. Subsequent studies reported success for first-time treatment ranging between 38% and 74%. A review of 12 studies of anal fistula treated with fibrin glue noted the studies were widely variable in fistula etiology and complexity, and in quality of data. Overall healing rate was 53%, with a range of 10%-78%. Factors associated with poorer healing rates included fistula complexity and shorter track length.

Dislodgement of the fibrin plug is considered to be a cause of early failure. Inadequate fistula tract curettage, unresolved sepsis, and postoperative infection have been proposed as other potential causes of failure. To address these concerns, Singer and colleagues performed a prospective randomized trial comparing outcomes of fibrin glue containing cefoxitin, closure of fistula internal opening, or both, with mean 27-month follow-up. The initial healing rate was 21% with intra-adhesive antibiotic, 40% with internal opening closure, and 31% with combined treatment. One patient in each group was retreated successfully, bringing the final healing rates.

Fig. 13. Endorectal advancement flap. (A) Anatomy of track. (B) Track curettage. (C) Endorectal flap raised. (D) Flap advancement and securing; distal tip harboring fistula opening has been excised.
to 25%, 44%, and 35%, respectively; these differences were not statistically significant ($P = 0.38$). A study comparing outcomes of seton or fibrin glue for transsphincteric fistula showed significantly better healing in the seton group (87.5% vs 39.5%, $P = 0.0007$) but worsening of anal manometry and fecal continence issues; patients treated with glue had less pain and no deterioration of continence. A randomized controlled trial that sought to compare the outcome of mucosal or anodermal advancement flap alone with flap plus fibrin glue for transsphincteric fistula found a recurrence rate after flap was 20%, whereas the recurrence rate after flap plus glue was 46.4%. A case-control study that evaluated flap alone and flap plus glue for high perianal fistulas had similar results; the recurrence rate after flap was 13%, and recurrence after flap plus glue was 56%. A multicenter randomized controlled trial using fibrin glue in patients with Crohn fistulas showed that those treated with fibrin glue had a remission rate of 38% compared with 16% in the group which did not receive fibrin glue treatment ($P = 0.04$). Although the sample was small and the success modest, this can be a meaningful improvement in this patient group.

Despite the inconsistent success rates, most studies showed that fibrin glue can achieve 30%-60% success rates in properly selected patients. The technique is simple, does not affect continence, can be repeated, and in case of failure, does not preclude the patient from receiving other methods of treatment.

**Anal fistula plug**

The anal fistula plug was conceived as another sphincter-preserving treatment option for fistula in ano. The biologic plug (Surgisis Anal Fistula Plug, Cook Surgical, Belington, IN, USA) is manufactured from porcine small intestinal submucosa. The synthetic plug (GORE BIO-A Fistula Plug, W. L. Gore and Associates, Flagstaff, AZ, USA) is a polyglycolic acid-trimethylene carbonate bioabsorbable polymer. The plug is intended to be passed through the track and fixed into place, allowing ingrowth of normal tissues that would obliterate the track. This form of treatment has appeal similar to fibrin glue in its simplicity of technique and preservation of continence. The results are variable. Early enthusiasm was tempered by lower success rates in long-term studies, and plug dislodgement and perianal sepsis have been consistently reported.

Preoperative bowel preparation and perioperative antibiotics are preferred by most surgeons. The prior use of a seton is suggested to allow sepsis to resolve, as well as to make the wall of the track more fibrotic, and facilitate the procedure by identifying the fistula anatomy. The details of plug placement vary according to manufacturer and also experience published in the literature.

A prospective cohort study compared the outcome of anal fistula plug with fibrin glue in patients with high transsphincteric or more complex fistulas. Ten patients were treated with glue and 15 were treated with the plug. At 3 months, there was 40% healing in the glue group compared with 87% healing in the plug group. Subsequent studies reported less encouraging results. Most studies are small and nonrandomized; healing rates range between 24% and 62% in most studies. Failure was associated with more external sphincter involvement, shorter tracks, posterior fistula, tobacco smoking, diabetes, and previous failed attempts at repair. The reported rate of postprocedural sepsis is 5%-29%. Plug dislodgment occurs in somewhere between 3.3% and 9.7% of patients. The data for plug treatment of anal fistulas in Crohn disease is sparse; the studies are small, with the largest including 20 patients. Reported success ranges widely from 9%-80%.

Two retrospective studies compared the outcome of advancement flap and fistula plug with nearly identical findings. Success rates after flap procedures for fistulas classified as complex or transsphincteric were 62% and 63%, respectively. Success rates after fistula plug in these studies were 34% and 32%, respectively. A randomized trial in Spain was closed prematurely when it was noted that 12 of 15 patients treated with plug had recurred after 1 year, compared with 2 of 16 flap patients ($P < 0.001$). A Dutch multicenter randomized trial reported 48% success after flap procedure compared with 29% after fistula plug with 11-month follow-up.

Most of the studies currently in the literature are small, and few are randomized. It appears that technique may play an important role in success with the fistula plug. Whether the type of
plug also plays a role is not clear. Although the fistula plug healing rates are lower than initially reported, and postoperative sepsis remains a concern, these issues do not impair function, and use of the fistula plug in selected patients with concern for continence seems a safe alternative.

**LIFT procedure**

The LIFT procedure is a relatively new sphincter-sparing approach with promising results. As with the fistula plug, sepsis must first be controlled; placement of a seton for a few weeks before operation is also recommended to allow the track to mature for best results. The procedure begins with a curvilinear incision in the intersphincteric groove; the fistula track is then identified and dissected out (Fig 14). The track is ligated next to the internal opening with a 3-0 absorbable suture. The lateral track is curetted, then suture ligated externally to the first site; the track is then divided. Track division must be confirmed by injection or probing. Fecal continence is preserved in almost all of the studies reported. The initial report showed healing in 94% (17/18 patients) at 4 weeks.\(^{161}\)

Longer follow-up seemed to reveal later failures, as well as a range in success rates. Success when LIFT was performed as the primary fistula procedure ranges from 40%-90%.\(^{162-164}\) For patients with recurrent fistulas, success rates are somewhat lower, at 57%-82%.\(^{162,165-168}\) The time to diagnosis of failure generally ranges from 7-20 weeks.\(^{165,166,168}\) Liu and colleagues\(^{168}\) noted that 80% of failures noted occurred within 6 months of the LIFT procedure.

LIFT procedures fail in 3 ways. Type 1 failures are residual sinus tracks without an internal opening. Type 2 failures are represented by a downstaged tract, with healing having occurred from the external opening to the intersphincteric incision. This produces a less complex intersphincteric fistula. Type 3 failures, the least common, are complete failures that extend from a previous internal opening to 1 or more external skin openings. One may consider type 2 failure as still a benefit, as a high transsphincteric fistula is converted to an intersphincteric fistula.\(^{163,164}\) Tan and colleagues\(^{169}\) followed up patients after LIFT for 4 years to analyze reasons for failure and recurrence. Seven of 93 patients (7.5%) failed, with discharge noted at the intersphincteric wound. Four of these also had an unhealed internal opening, and these were treated with fistulotomy. Three patients with discharge at the intersphincteric wound underwent ultrasound, which showed no demonstrable track, and had the intersphincteric wound treated with silver nitrate only. Six of 93 (6.5%) recurred, with a demonstrable track extending from the previous internal opening to an external opening, and healing of the intersphincteric wound. These were treated successfully with fistulotomy, repeat LIFT, or flap closure.\(^{169}\) Some surgeons have added interposition of a bioprosthetic mesh at the

![Fig. 14. Ligation of intersphincteric fistula track.](image)
intersphincteric site. A retrospective series of 31 patients managed in this way revealed a clinical healing rate of 94%, with no complications that required intervention; the minimum follow-up was 1 year. A second, smaller study reported healing a rate of 68.8% (8/13) with a median follow-up of 26 weeks. The 5 failures had isolated discharge at the intersphincteric wound; at press time, 2 had undergone successful fistulotomy.

A study combining LIFT with a flap procedure performed concomitantly, based on the rationale that flap failures may be due to ongoing sepsis in the persistent fistula track, failed to show improved outcomes. Primary healing was seen in 51% (21/41 patients). Of the 20 patients who failed, the original transsphincteric fistula persisted in 12; in the remaining 8 patients, the fistula was converted into an intersphincteric fistula, and these successfully underwent fistulotomy. A small randomized study designed to compare LIFT and flap in complex fistulas reported a similar failure rate: 8% after LIFT (2/25 patients) and 7% after flap (1/14 patients). LIFT was 30 minutes swifter, and patients returned to work earlier. However, a retrospective comparison of LIFT and flap outcomes found a lower rate of success after LIFT. The LIFT success rate was 62.5% (15/24 patients) compared with flap success rate of 93.5% (29/31 patients).

The LIFT procedure appears to be a safe and effective sphincter-sparing management option for complex fistulas, with a very acceptable rate of success, even in recurrent disease. Failure is higher in anterior and longer fistulas, but repeat procedures remain feasible. Downstaged tracks may be amenable to fistulotomy. Longer-term results of the bioprosthetic mesh at the intersphincteric site variant would be of interest.

Newer modalities under investigation

Stem cells. Adipose-derived stem cells (ASCs) have emerged as a promising therapy for wound healing. Experimental studies have shown that ASCs have a number of effects that significantly accelerate wound closure, including increasing epithelialization and granulation tissue deposition, spontaneous site-specific differentiation into epithelial and endothelial lineages, and increasing neovascularization. A phase II study of expanded ASCs in the treatment of complex perianal fistulas reported 71% healing in patients treated with fibrin glue plus ASCs compared with 16% healing in those treated with fibrin glue alone (P < 0.001). Healing rates were similar in cryptoglandular and Crohn fistulas. A phase III randomized trial performed by the same investigators compared ASC treatment alone with ASC plus fibrin glue and to fibrin glue with internal opening closure. Healing rates at 26 weeks were equivalent: 39.1%, 43.3%, and 37.3%, respectively. Although healing was noted to increase to approximately 50% at 1 year in the 2 groups treated with ASCs, it was not statistically improved over healing in the fibrin glue group. Long-term follow-up showed that 58% of ASC-treated patients remained recurrence-free after 3 years.

Summary

The most important step in the management of fistula in ano is identification of the track; without proper and correct anatomical definition, success is unattainable. The next most important consideration is discussion of the risks with the patient; a realistic understanding of the anticipated outcome is imperative. Low simple fistulas can safely be treated with a lay open technique. For tracks incorporating no muscle, effect on continence should be nil in the absence of complication. Intersphincteric tracks and some low transsphincteric tracks can safely be managed with fistulotomy in most patients as well. Exceptions include those with preexisting sphincter compromise, any anterior fistula in a woman, and recurrent disease.

Complex and recurrent fistulas should be managed with sphincter-sparing techniques, understanding that success rates may be lower than those seen after fistulotomy, but continence would be less affected. Outcomes tend to be better after a track has matured with a seton in place; this temporizing measure burns no bridges when appropriately managed. If a patient has a complex fistula with an abscess, the abscess can be drained and a seton placed; the patient can
be definitively managed at a later date. Fibrin glue and anal fistula plug may be considered in select patients; there is little risk, the procedure can be repeated, and though sepsis may be seen, it is easily managed. Endorectal or dermal advancement flaps can be used safely when the underlying principles are well understood and adhered to; failure can preclude subsequent attempts at flaps owing to the scarring involved. The LIFT procedure is becoming more widely used. The initial excellent results have matured to more sober outcomes, but these are still very acceptable. Some LIFT failures can even be considered advantageous, as when a type 2 failure downstages a transphincteric fistula to an intersphincteric fistula that can be safely managed with fistulotomy.

ASCs are being studied in several diseases, including fistula in ano; although results from the use of these seem to be equivalent to fibrin glue at this time, future data may provide clues as to how stem cells might boost healing in this persistent disease.

References


