Anorectal Abscess and Fistula-in-Ano: Evidence-Based Management

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Anorectal abscess, and the fistula that may result, are long established processes that were originally described at the beginning of recorded medical history as part of the “Corpus Hippocraticum” in a treatise termed “On Fistulae.” The basic principles regarding the treatment of this disease have remained the same: resolution of perianal sepsis, and treatment of the resulting fistula without leading to impairment in continence. This second principle remains a challenge, and there are continued efforts to achieve an optimal form of therapy. A recent surge of interest in this disease process occurred after the release of the collagen anal fistula plug. Hopefully this will lead to an improvement in the care of patients with this inconvenient and embarrassing condition.

PATHOPHYSIOLOGY

Anorectal abscess occurs commonly in normal, healthy individuals. The most widely recognized cause is described in the cryptoglandular theory, which suggests that an anal crypt gland becomes obstructed with inspissated debris and leads to infection. These glands penetrate the anal sphincter complex to varying degrees, and the suppuration tends to follow the path of least resistance. The abscess collects in whichever anatomic space the gland terminates, or wherever the path of least resistance leads. A basic understanding of anorectal anatomy and the perianal and perirectal spaces is critical for grasping this concept.
Anal fistulas develop in approximately one-third of patients who undergo drainage of an anorectal abscess. In a series of 170 patients without previous fistulas who were followed for an average of 99 months after abscess drainage, a fistula occurred in 37% and recurrent abscess was reported in an additional 10%. A retrospective cohort study of 148 patients with anorectal abscesses showed a 37% rate of fistula formation. Patients younger than 40 years and nondiabetic patients had a higher likelihood of developing a fistula-in-ano over the mean follow-up of 38 months. Any recurrent abscess that occurs at the same site as a previous abscess can be considered a fistula and treated as such. There are other notable causes of atypical/complicated abscess and fistula, including inflammatory bowel disease, fungal infection, mycobacterial infection, neoplasm, and trauma. Fistulas that are secondary to these processes are classified as complex and require the use of nonstandard methods of management.

CLASSIFICATION

Anorectal abscesses are classified based on their location. Four types of anorectal abscesses are commonly described: perianal (superficial), ischiorectal (perirectal), intersphincteric, and suprallevator. Perianal is the most common type and is the simplest to treat. The collections are located in the superficial perianal tissues and are typically located close to the anal verge. Ischiorectal abscesses are located more deeply in the ischiorectal fossa and may communicate to the contralateral side via the deep postanal space; this would be a classic example of a horseshoe abscess. Intersphincteric abscesses are often difficult to diagnose as they may reside completely within the anal canal. They are located in the intersphincteric space between the internal and external sphincter muscles. Patients affected by this process complain of severe anal pain and often cannot tolerate an examination without anesthesia. The fluctuant collection may be found only by performing a digital rectal examination or anoscopy. Suprallevator abscesses are rare and are typically diagnosed through computed tomographic scanning. A patient presenting with this condition might complain of pelvic and rectal pain with tenesmus. The abscess can sometimes be palpated through a digital rectal examination performed by an experienced examiner. These abscesses are often related to perforated diverticular disease, inflammatory bowel disease, or rarely neoplastic disease in the pelvis. Sometimes an abscess occurs in the suprallevator location because cryptoglandular suppuration followed the path of least resistance. Simple internal drainage often ameliorates this problem. The management of the processes already mentioned outside drainage is complex and is beyond the scope of this discussion. A study of more than 1000 patients who presented with anorectal abscess revealed that perianal abscess occurred in 42.7%, ischiorectal in 22.7%, intersphincteric in 21.4%, and suprallevator in 7.33%.

A question that often arises is whether or not to treat a fistula that is noted during a procedure performed to drain perianal sepsis. A randomized clinical trial comparing simple drainage alone to drainage plus fistula tract treatment was published in 2002. The investigators randomized 200 patients to one of the two treatment arms, excluding any patient who had incontinence or a history of inflammatory bowel disease. Internal openings were found in 83% of the patients and they were treated with simple fistulotomy or seton fistulotomy if they had been randomized to the tract-treatment arm. Recurrence was noted in 29% of the group who received drainage only compared with 5% of the group who received tract treatment. In low fistulas treated by fistulotomy, incontinence was seen in only 2.8%. Patients who had high fistulas that were managed by seton (delayed) fistulotomy developed
incontinence 37% of the time. This result illustrates a major concern in the treatment of high fistula tracts. A later meta-analysis addressing this same issue evaluated 5 trials containing 405 patients and found an 83% reduction in recurrence in those who had their fistula tracts addressed at the initial procedure with no significant increase in the rate of postoperative incontinence.5

Fistulas are classified based on their relation to the anal sphincter complex. They are typically divided into 5 common classifications: submucosal, intersphincteric (Fig. 1), trans-sphincteric (divided into high and low) (Fig. 2), suprasphincteric (Fig. 3), and extrasphincteric (Fig. 4). Trans-sphincteric fistulas cross through the internal and external sphincter muscles to varying degrees. Low fistulas involve only the outer or distal one-third of the external sphincter muscle, whereas high fistulas involve greater degrees of the external sphincter. This characteristic is clinically significant because division of greater amounts of the external sphincter leads to higher rates of fecal incontinence. Intersphincteric fistulas cross through the internal sphincter and exit through the intersphincteric plane. They do not involve the external sphincter muscle and can therefore be opened without high risk of incontinence. Submucosal fistulas typically originate at an offending crypt at the level of the dentate line, but track only just beneath the submucosa and do not involve the sphincter complex. These fistulas may be opened without fear of compromising continence. Suprasphincteric fistulas typically originate at the dentate line internally, cross above the external sphincter but below the puborectalis, and exit onto the perianal skin through the ischiorectal

![Fig. 1. An intersphincteric fistula. (From Belliveau P. Anal fistula. In: Fazio VM, Church JM, Delaney CP, editors. Current therapy in colon and rectal surgery. 2nd edition. Philadelphia: Elsevier Mosby; 2005. p. 28; with permission.)](image_url)
fossa. Extrasphincteric fistulas are rare and do not involve the sphincter complex. They typically arise from the pelvis or rectum above the dentate line, cross proximal to the sphincter complex into the ischiorectal fossa, and exit onto the perianal skin. These fistulas do not have a cryptogenic origin and are often associated with inflammatory bowel disease, pelvic inflammatory processes, and neoplasia.

TREATMENT

The treatment of anal fistula is dictated by the classification and the amount of sphincter complex that is involved with the tract. Simple fistulas, intersphincteric, and low trans-sphincteric of cryptoglandular origin, can be treated easily with a fistulotomy with minimal risk to continence. Complex fistulas, high fistulas, and those related to inflammatory bowel disease must be treated through more intricate methods. The primary surgical approach to successful resolution of an anal fistula is appropriately addressing the internal opening, which requires the internal opening to be located with certainty, and then either closed through various methods or opened widely and allowed to heal by secondary intention. Obliteration of the internal opening is key to the success of treatment.7

Simple observation is a viable option in a patient who is minimally symptomatic or presents a prohibitive operative risk. The most significant risk associated with
observation of an anal fistula is recurrent anorectal abscess. This abscess can usually be managed by simple repeat incision and drainage, although this may lead to a more complex fistula if the process is repeated indefinitely. There have been rare case reports of malignancies arising in long-standing anal fistula tracts, but this unusual occurrence should not drive a clinician’s treatment plan. Multiple methods can be used to address this problem, and as previously stated, this decision is based on fistula anatomy, cause, prior attempts at treatment, the patient’s preoperative fecal continence, and comorbid conditions.

MEDICAL MANAGEMENT

The major morbidity associated with the surgical treatment of fistula-in-ano is fecal incontinence. Kim and colleagues retrospectively studied 404 male patients with fecal incontinence and found that in patients younger than 70 years, the second most common association was a prior surgical fistulotomy or hemorrhoidectomy. Lindsey and colleagues performed anal manometry and endoanal ultrasonography in 93 patients being evaluated for fecal incontinence after anal surgery. They had universal findings of internal sphincter disruption and reversal of the normal resting pressure gradient seen in the anal canal. They caution clinicians to investigate sphincter-sparing alternatives in the primary management of anorectal maladies.

Fig. 3. A suprasphincteric fistula. (From Belliveau P. Anal fistula. In: Fazio VM, Church JM, Delaney CP, editors. Current therapy in colon and rectal surgery. 2nd edition. Philadelphia: Elsevier Mosby; 2005. p. 29; with permission.)
Medical management of fistula-in-ano is most often associated with patients suffering from inflammatory bowel disease. As mentioned previously, there is little harm in observing a fistula that is minimally symptomatic. After first draining the perianal suppuration, simple observation and medical treatment of associated Crohn’s disease led to healing in 8 of 15 patients followed for 10 years.11 Halme and Sainio12 noted a similar healing rate of 50% in patients with Crohn’s disease with anal fistulas who were only observed. Oral metronidazole is a useful agent in the medical management of fistula-in-ano in the population with Crohn’s disease. A dosage of 20 mg/kg/d divided into 3 or 4 doses has been shown to eliminate drainage, erythema, and induration in as many as 80% of patients treated within 8 weeks.13 Compliance with this

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**Fig. 4.** An extrasphincteric fistula. (From Belliveau P. Anal fistula. In: Fazio VM, Church JM, Delaney CP, editors. Current therapy in colon and rectal surgery. 2nd edition. Philadelphia: Elsevier Mosby; 2005. p. 29; with permission.)
regimen can be poor secondary to associated nausea, metallic taste, and peripheral neuropathy from the use of the drug. Other investigators have evaluated the use of topical metronidazole preparations to assist with nonoperative management without the side effects associated with oral use of the drug. A prospective, nonrandomized study of 14 patients with anorectal Crohn’s disease evaluated the perianal Crohn’s disease activity index (PCDAI) in patients treated with 10% topical metronidazole cream for 4 weeks.\textsuperscript{14} The investigators showed a significant decrease in the PCDAI after 4 weeks of therapy. The largest improvements noted were diminished perianal pain, discharge, and induration.

Surgery is not contraindicated in patients with Crohn’s-associated anal fistulas, but should be undertaken cautiously. A retrospective review of 66 patients with perianal Crohn’s disease showed that surgery was performed to treat fistula-in-ano in 71%.\textsuperscript{15} Fistulotomies were performed in 35 patients and draining setons were placed in 24. Of this group, 61% retained a functional anus during the 10-year study. The investigators state that fistulotomy involving the lower portion of the sphincter complex is safe. Another study\textsuperscript{16} evaluating the use of long-term draining setons in patients with high, Crohn’s-associated fistulas showed that simple removal of the seton resulted in a 39% recurrence rate, but that staged fistulotomy resulted in no recurrences with a 12% rate of fecal incontinence. A more recent 10-year retrospective review of Crohn’s-associated anal fistula disease showed that 45% of patients with complex fistula-in-ano or rectovaginal fistulas recur in the long term after surgery.\textsuperscript{1} The investigators also showed that 20% of patients who demonstrated recurrence went on to require a proctectomy. Observations like these encourage the clinician to exhaust medical therapy before undertaking surgery in this group of patients.

The use of infliximab (Remicade, Centocor Ortho Biotech Inc, Horsham, PA, USA), a monoclonal antibody to tumor necrosis factor, has been shown to be effective in the treatment of luminal Crohn’s disease.\textsuperscript{17} A short-term trial of infliximab use showed its effectiveness in the closure of anal fistulas, although there was a high recurrence rate and the median duration of response was only 12 weeks.\textsuperscript{18} Sands and colleagues\textsuperscript{19} showed that in patients who have an initial favorable response to infliximab, maintenance therapy for 54 weeks resulted in sustained fistula closure in 36%, although those treated with placebo healed only 19% of the time ($P = .009$). Although these are compelling data, surgeons cannot free themselves of responsibility to these patients. Gaertner and colleagues\textsuperscript{20} reviewed their experience with the operative treatment of Crohn’s-related perianal fistulas and found that healing was no better in patients who underwent surgery alone compared with those treated with surgery and concomitant infliximab therapy. Based on these data it seems wise to use medical therapy as primary treatment of anal fistulas associated with Crohn’s disease with surgery reserved for those that fail in the long term. It should also be noted that surgical drainage of perianal suppuration and the liberal use of draining setons should be employed in the “medical” management of these patients.

**PREOPERATIVE PLANNING**

Simple submucosal, intersphincteric, and low trans-sphincteric fistulas are effectively managed by fistulotomy with minimal risk to fecal continence. In the past, the patient had to undergo an examination under anesthesia to determine the type of fistula and the amount of sphincter mechanism that was involved. If a simple fistula was found, then definitive management was typically undertaken. Complex fistulas would be managed through staged approaches. These decisions hinge on the clinician’s intraoperative physical diagnostic skill. Techniques such as palpation of the offending
crypt and tract injection with hydrogen peroxide or methylene blue assist the surgeon in identification of the internal opening, with the subsequent procedure being dictated by its location and the path of the tract. A review of 101 patients showed that primary crypt palpation was possible in 93% of patients. Hydrogen peroxide was seen to drain through the internal opening of 83% of those who underwent injection via the external opening of the fistula. Newer technologies are available to the clinician that may assist in preoperative planning in these patients so that definitive management may be undertaken immediately, and appropriate patients may be selected for sphincter-sparing alternatives. A prospective study in which 102 patients with anal fistula were examined preoperatively with a 3-dimensional endoanal ultrasonography system showed that the anatomy of the primary fistula tract was correctly identified in 94% of patients and that internal openings were correctly localized in 91%. The imaging was augmented by the injection of hydrogen peroxide into the external openings of the tracts and the imaging findings were confirmed or refuted during examination under anesthesia. The investigators showed that preoperative imaging with this system assisted in preoperative planning and counseling. Another study of preoperative imaging showed that tract angulation, as imaged by magnetic resonance imaging, correlated with internal opening location. Tracts that showed acute angulation from the internal opening tended to be high transsphincteric tracts, whereas those exhibiting obtuse angulation tended to be lower fistulas. Both studies demonstrate the ability of noninvasive preoperative imaging to assist the surgeon in preoperative planning, counseling, and selection of the appropriate procedure.

**FIBRIN GLUE**

Because traditional methods to repair complex fistulas, including fistulectomies, fistulotomies, and advancement flaps, have resulted in high rates of incontinence, investigations into less invasive procedures have been performed. Fibrin glue first made its appearance in surgery during World War I, when it was used for hemostasis, and then later in the 1940s as a sealant for skin-graft procedures. In 1992, Hjortrup and colleagues first used it as a sealant for anal fistulas and since that time there have been several publications regarding its use in this complex disease.

The principle of its sealant properties is based on clot formation and to understand its mode of action, knowledge of the clotting cascade is mandatory. Fibrin glue is a mixture of fibrinogen, thrombin, and calcium ions, which when combined form a soluble clot, because fibrinogen is cleaved into fibrin. This soluble clot is transformed into an insoluble, stable clot as the thrombin and calcium activate factor XIII. This reaction seals the fistula tract within 30 to 60 seconds as the glue sets. The glue also stimulates the migration and proliferation of fibroblasts and pluripotent endothelial cells to heal the fistula. Between days 7 and 14, plasmin that is present in the surrounding tissue lyses the fibrin clot as the tract is replaced by synthesized collagen.

There are 2 forms of fibrin glue preparation: autologous, which is prepared from pooled human blood, and a commercial preparation, which first became widely available in the United States in 1998. The autologous product carries rare but potentially lethal disadvantages, such as the risk of viral transmission (mainly hepatitis B, C and human immunodeficiency virus). Both formulations also carry the rare risk of allergic reaction. Studies have promoted the commercial glue as having a higher fibrinogen concentration, with the result being a stronger and more consistent plug and easier and quicker preparation than autologous glue. Other studies, however, have demonstrated no success advantage between the 2 preparations.
The procedure is promoted as simple and repeatable with no significant learning curves, in direct contrast to other procedures, such as the advancement flap. Both openings of the tract are identified and the tract is mechanically curetted and irrigated with normal saline or hydrogen peroxide. The double-barreled syringe, containing the 2 components of the glue, is inserted through the external opening until the tip is seen at the internal opening. The syringe is depressed, which mixes the 2 components as they are injected into the canal. The tract is filled completely until a blob of glue is seen at the external opening. The glue is allowed to set for 30 to 60 seconds to form its stable clot. Different investigators have advocated suturing the internal or external opening around the bead of glue, although others have demonstrated no statistically significant benefit. Postoperatively, the use of antibiotics and diet restrictions was variable, but sitz baths, excessive straining, or vigorous exercise were prohibited uniformly to prevent dislodgement of the plug. Preoperative bowel preparations, the use of perioperative antibiotics, and the use of setons is widely variable with none shown to confer a benefit.

A variable range of success has been achieved, from 31% to 85%, because of the complexity of the disease and the variation in tactics used to tackle the problem (Table 1). Each investigator has postulated various reasons for success or lack thereof, either in the technical aspects of the procedure or perioperative care. Sentovich dedicated much of his success to using the commercial fibrin glue preparation, which he believes forms a stronger plug than autologous glue. This initial study had a follow-up of 10 months and the data held up over a longer follow-up period of 22 months, with success decreasing to 69%. This result raises an important element of the fibrin glue procedure: the length of follow-up of these patients is crucial as most failures have been shown to occur within 6 months. Some investigators advocate as long as 2 years for follow-up but the optimum time has been almost universally agreed on to be no less than 6 months.

Reasons for failure of the glue have been postulated by many, with dislodgement being most common. For this reason, patients are instructed not to take sitz baths and to avoid vigorous exercise and excessive straining (some are given stool softeners or put on a liquid diet to aid with this). Recurrence of fistulas is another issue and is

<table>
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<th>Author (Reference Number)</th>
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<th>No. of Subjects</th>
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believed to be caused by inadequate removal of granulation tissue during tract preparation with mechanical curetting and irrigation and the natural course of fistula disease. Another cause of failure is abscess formation, which has been quoted as high as 5% in some studies. This is believed to be caused by a lack of complete tract filling with glue, representing a technical error, or a lack of proper tract cleansing before glue instillation. Some investigators have sought to prevent this by making a glue/antibiotic mixture, whereas others have irrigated the tract before glue instillation with an antibiotic irrigant.

A controversy continues to exist regarding the length of the tract and its impact on glue success. Patrlj and colleagues and Lindsey and colleagues demonstrated greater success with longer tracts, attributing this to the ability of glue to leak from shorter tracts (<3.5 cm) more easily. On the contrary, Sentovich, Cintron and colleagues, and Maralcan and colleagues had greater success with shorter tracts. To date, there is no consensus on the tract length most amenable to success with glue and therefore no patient should be excluded by tract length.

Two main advantages of glue that should be remembered are that no patient experienced a decrease in level of continence from the procedure, and that treatment with fibrin glue does not preclude the patient from receiving other treatments, such as repeat fibrin glue instillation, or conventional fistula treatments. Despite its varying success to date, fibrin glue offers the patient a less invasive option for first-line fistula treatment.

**FISTULA PLUG**

Fibrin glue studies failed to achieve results that were reproducible, but did show promise in muscle-sparing, noninvasive operative techniques for anal fistulas. This result led to the development of additional sphincter-sparing therapies. The concept of a plug was first introduced in 2006 by Robb and colleagues and Johnson and colleagues with the idea that securing the plug into the primary opening of a fistula tract could close the tract more reliably than previous procedures, without compromising continence because the sphincters were not incised or divided. The biologic plug (Surgisis Anal Fistula Plug, Cook Surgical, Bloomington, IN) is made of lyophilized porcine small intestinal submucosa, which has an inherent resistance of infection, generates no foreign body or giant cell reaction, and is repopulated by host cell tissue within 3 months. Its conical shape allows for added mechanical stability as high pressures within the anal canal maintain the plug in its proper position, avoiding dislodgement during straining.

Regarding the procedure, the critical points for correct plug insertion are as follows: the plug must be rehydrated first, usually in a 0.9% normal saline solution for 3 to 5 minutes, before insertion; it must be inserted in the internal (also known as primary) opening and then pulled through the tract until light resistance is met; and it must be sutured securely in the primary opening. Various suture types have been used for securing the plug. Champagne and colleagues noticed plug dislodgement as the primary cause of failure in their study, prompting them to use a 2–0 Vicryl (Ethicon Inc, Sommerville, NJ) to provide a stronger securing suture. This choice resulted in a lower incidence of dislodgement and consequently a lower failure rate. Trimming excess plug from the external (secondary) opening at the skin level and irrigating the tract with hydrogen peroxide before insertion are options during the procedure. The external (secondary) opening must be partially open at the end of the procedure as this is the path that allows drainage and prevents a closed-space infection. The use of a bowel preparation, choice of preoperative antibiotics, patient position (lithotomy verses prone jackknife), and the concurrent use of setons are dictated by...
surgeon preference. A recent consensus statement of 15 colorectal surgeons certified by the American Board of Medical Specialties stated that a seton should always be temporally employed until there is no evidence of acute inflammation or drainage. There was no consensus on the use of bowel preparation or best patient position.45

Since introduction of the plug in early 2006, it has achieved a wide range of success, reported between 14% and 87% (Table 2). Several investigations have been undertaken to elucidate variables that are predictors of success and reasons for failure. In one of the pioneer studies, Johnson and colleagues41 achieved 87% success in a follow-up of nearly 14 weeks in a prospective study of 25 patients. Along with following the critical operative technique as outlined earlier, these patients underwent mechanical bowel preparation, had their tracts irrigated with hydrogen peroxide before plug placement, received topical metronidazole after the procedure, and had strict activity limitations for 2 weeks. This success rate persisted for a longer median follow-up time of 12 months, with 83% success shown in the Champagne and colleagues43 study, which followed Johnson’s patients in the long term. Other studies aimed to reproduce this success rate, and a few investigators came close with a modified technique. O’Connor and colleagues46 achieved 80% success in Crohn’s patients by using a similar technique to Johnson and colleagues,41 except nearly all their patients had setons placed to “mature” the tract and facilitate plug placement by identifying the primary opening and narrowing the diameter of the tract to make it more amenable to plugging. Garg48 achieved a slightly lower success rate of 71%, with the only technical difference being not using hydrogen peroxide to clean the tract before plug placement, which may offer a reason for decreased success as all epithelial and granulation tissue was not cleansed from the fistula tract, leading to a barrier to cell migration. This explanation was also theorized as a reason for failure by Schwander and colleagues,49 who reported an overall success rate of 61%, with fistula persistence being the cause of 40% of their failures.

Regarding reasons for failure of the plug, the first important issue is proper securing of the plug to the primary opening in an effort to create immediate closure. Plug dislodgement continues to be the most common reason for failure in numerous

### Table 2

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studies. Steps to prevent dislodgement include adequately securing the plug to the primary opening, ensuring it is not dangling, and instructing the patient to avoid strenuous activity for at least 2 weeks. Avoidance of securing the plug at the secondary opening has been advocated because it provides countertraction to the suture at the primary opening, leading to dislodgement. Another cause of dislodgement is enlarging the fistula tract, which has been done by curetting or overdebridement of the tract. Multiple fistula tracts are often associated with a higher failure rate caused by the persistence of 1 or more tracts, usually those not treated by the plug at the time of the initial procedure. These tracts are candidates for plug insertion at a later date. The importance of ensuring that the secondary opening remains open as a site for drainage cannot be overemphasized because this prevents the formation of abscesses, which is not only a cause of failure but also a cause of mortality in these patients because of perineal sepsis.

There are a few controversies about the various modifications of the procedure that can be performed and their influence on the success rate. The most published modification is the concurrent use of the seton. The concept of the seton maturing the tract, making the wall more fibrotic, which results in increased healing, has been proposed by several investigators and is recommended by a recent consensus. It has also been shown to minimize sepsis and facilitate fistula closure when used in conjunction with other procedures, such as an advancement flap. O'Connor and colleagues and Champagne and colleagues found no correlation between seton placement and increasing healing rates. They stated that the presence of the seton resulted in a technically easier insertion of the plug because it helped define the anatomy of the primary and secondary opening and helped “pull” the plug through the tract.

There is little doubt that the anal fistula plug is a promising new method of treating this complex problem but with the variable success rates, more studies need to be performed to elucidate the best procedure and postoperative care to ensure the highest chance of success.

**ADVANCEMENT FLAP**

Before the advent of the collagen anal fistula plug or the use of fibrin glue, surgeons devised the endorectal/endoanal advancement flap as a sphincter-sparing method to treat complex anal fistulas. It was believed that this would preserve continence because there is no surgical division of the anal sphincter complex. There are several methods, but the technical aspects common to all methods are cleaning/debridement of the fistula tract, mobilization of a well-vascularized rectal mucosal or anodermal flap, and coverage of the internal opening of the tract with or without closure of the tract before coverage. Healing rates have been reported to be from 77% to 100% in various studies. Length of follow-up is important when evaluating the success of various methods of the surgical treatment of fistula-in-ano. Ortiz and colleagues performed a retrospective study of 91 patients who underwent flap repair of complex fistulas. The median follow-up was 42 months and there was a recurrence rate of 19%. These investigators noted that the median time to relapse was 5 months and that no recurrences were noted beyond 1 year of follow-up. Van Koperen and colleagues evaluated their long-term outcomes from flap repair of high anal fistulas and noted that after 76 months of follow-up, recurrence was seen in 21% of patients and fecal soiling was reported in 40%. This addresses an important issue and dispels the myth that incontinence is not a potential risk of flap repair.
A recent study reported a transient minor incontinence rate of 8% with complete resolution by 2 months of follow-up after advancement flap repair. Additional studies have reported minor incontinence rates of 0% to 23% associated with advancement flap procedures. Uribe and colleagues performed a prospective study of 56 patients with complex fistulas who underwent advancement flap repair. Preoperative and postoperative anal manometry were performed in all patients. A significant reduction was demonstrated in mean resting pressure and maximal squeeze pressure in the study subjects 3 months postoperatively. A 21% rate of incontinence was reported, with 9% of patients reporting major disturbances in fecal continence. Perez and colleagues performed a manometric study of patients who were randomized to undergo either advancement flap repair of complex fistulas or fistulotomy with concomitant sphincter repair. Their data revealed that mean resting pressure was significantly diminished postoperatively in both groups, but that maximal squeeze pressure was reduced only in the group undergoing flap repair. This finding did not equate to any difference in continence between the groups. The study results showed equivalent rates of healing between the 2 methods.

Various methods have been espoused to improve the success rates of flap repairs. Van der Hagen and colleagues evaluated their experience with the treatment of complex anal fistula disease and included patients with Crohn’s disease in their study group. They propose that the initial placement of a loose seton allows for resolution of sepsis and improves subsequent outcomes with advancement flap repair. They reported only 1 flap failure in 26 patients who underwent the procedure. Others have suggested that combining the use of fibrin glue obliteration of the fistula tract with endorectal advancement flap repair would potentially improve the rates of healing. Ellis and Clark and van Koperen and colleagues settled this argument with 2 studies that showed higher failure rates in patients who had fibrin glue instilled into their fistula tracts as an adjunct to flap repair. Perhaps the glue instillation prevents adequate drainage of fluid trapped under the flap through the external opening. It is easy to imagine how this might lead to flap failure.

The question of whether to use a partial or full thickness advancement flap was addressed in a study in 2008 by Dubsky and colleagues. These investigators demonstrated a higher flap failure rate in the partial thickness group (35% vs 5%). They also demonstrated a higher incontinence score in the patients treated with partial thickness flaps, although the statistical significance of this result was not reported. There were no differences in continence that correlated to flap failure. It is difficult to draw any definitive conclusion regarding incontinence from this small data set. The likely causes of incontinence after flap repair are partial division of the internal sphincter during flap mobilization, and sphincter trauma from unintentional anal dilation during retraction for operative exposure. At present these technical aspects of the procedure seem to be unavoidable and must be taken into consideration when counseling a patient preoperatively. Tyler and colleagues reported their success in treating anal fistulas using a “sphincter-sparing only” algorithm. They performed fistulotomies only when simple submucosal fistulas were present. All other fistulas were treated with loose setons followed by fibrin glue injection or advancement flaps. Glue failures went on to repeat therapy with fibrin glue or advancement flap repair. These investigators reported a 100% success rate using this algorithm with no resulting fecal incontinence. These data support the recommendation of sphincter-sparing surgery for all anal fistulas.

Anorectal Abscess and Fistula
SETONS

Setons are a viable treatment option for high trans-sphincteric fistulas, fistulas involving greater than half the bulk of the sphincter complex, and anterior trans-sphincteric fistulas in women. Setons are preferred to surgical fistulotomy because of the high incontinence rate associated with that technique in these patient populations. The risk of and concern about incontinence are not eliminated with the use of cutting/tight setons. More conservative sphincter-sparing measures that do not pose a risk of incontinence, such as fistula plugs and fibrin glue, have a higher rate of recurrence than that associated with cutting setons when used to treat these complex fistulas.

Numerous materials have been used for setons, including nonabsorbable suture, Penrose drains, rubber bands, vessel loops, silastic catheters, and ayurvedic thread (kshara sutra). Kshara sutra is the earliest known seton, and dates to 1000 BC. It is a linen thread soaked in kshara (an alkaline chemical made from plant extracts) that has caustic properties, resulting in slow cutting through tissue.

The 2 types of setons used are cutting setons (Fig. 5), which slowly incise through tissue, and noncutting setons, which are primarily for drainage. With cutting setons, the skin and anal mucosa overlying the sphincter are typically divided once the internal

![Diagram](https://via.placeholder.com/150)

Fig. 5. A cutting seton, or seton fistulotomy. (From Belliveau P. Anal fistula. In: Fazio VM, Church JM, Delaney CP, editors. Current therapy in colon and rectal surgery. 2nd edition. Philadelphia: Elsevier Mosby; 2005. p. 30; with permission.)
and external openings of the fistula are identified. The seton is then placed through the fistula tract and tightened at varying intervals (from a few days to every 2 weeks). There may be no need for further tightening if elastic materials are used and are secured tightly at the time of surgery. The time it takes to heal can range from 1 month to more than a year. These patients require numerous follow-up visits, which require tightening of the seton, examination of the fistula tract, and potentially performance of a second procedure. For this reason Mentes and colleagues used pieces of surgical gloves as cutting setons in 20 patients. These setons were secured tightly at the initial procedure and slowly cut through the sphincter mechanism without additional tightening. The average time for the seton to cut through the sphincter completely was 19 days, and a 20% rate of minor incontinence was reported. This seton has the advantages of avoiding numerous postoperative visits for adjustment, the pain associated with tightening, and the need for secondary procedures.

Noncutting (or draining) setons are typically used for patients with chronic sepsis secondary to perianal Crohn’s disease or acquired immune deficiency syndrome, and in patients with severe anorectal sepsis. They are most commonly used in patients with perianal Crohn’s disease that is symptomatic, does not respond to medical therapy, and whose fistula tracts encompass an appreciable amount of the sphincter mechanism (Fig. 6). In a study by Williams and colleagues 22 patients with Crohn’s disease who met these conditions had draining setons placed in deep fistula tracts, thus converting the tracts to simple, drained fistulas with minimal symptoms. Three of the patients healed following removal of the seton. Nine patients required further treatment, but did not require a proctectomy.

In some instances, the combination of a fistulotomy and seton has been used. The theory is that a staged fistulotomy employing the use of a seton decreases the rate of incontinence postoperatively compared with the use of a fistulotomy or a cutting seton alone. Durgan and colleagues performed a prospective study on 10 patients with high extrasphincteric fistulas using a combination approach. First a partial fistulotomy was completed, and then 4 or 5 setons were placed through the fistula tract. The setons were sequentially tightened every 10th day. By doing this it was possible to drain the tracts and cut slowly through the remaining sphincter musculature. Twenty percent of the patients were incontinent to flatus postoperatively compared with more than 60% as found in other studies. Other investigators do not believe a combination approach is beneficial. Zbar and colleagues evaluated 34 patients and compared

Fig. 6. The postoperative appearance of a draining seton using a vessel loop.
the combination approach with the use of a cutting seton alone. Eighteen patients were treated with a combined technique and 16 were treated with a cutting seton. The internal anal sphincter muscle was repaired after it was incised, and this was followed by placement of a seton through the intersphincteric space. No difference was found between the 2 groups in healing time, recurrence rates, or incontinence rates.

As mentioned earlier, incontinence is still common with the use of setons. It is rarely seen with noncutting setons because their function is primarily to drain, not to incise the anal sphincters. Incontinence has been attributed to several factors, including hard and gutter-shaped scars in the anal canal, loss of sphincter function, and loss of anal canal sensation. Patients may experience incontinence to flatus, liquid stool, or solid stool at varying levels, with different effects on their quality of life. Not all studies identify specifically the type of incontinence patients are experiencing, nor do they differentiate transient postoperative incontinence from long-term dysfunction. In addition, many studies refer simply to major and minor incontinence without defining them. Minor incontinence is defined as persistent incontinence to gas or occasionally liquid stool. Major incontinence refers to inability to control the passage of formed stool or frequently liquid stool. Isbister and Sanee performed a retrospective review of 47 patients who had cutting setons placed for complex fistulas. Their postoperative incontinence rate was 36.2% for gas, 8.5% for liquid stool, and 2.3% for solid stool. Before seton placement 14.9% of their study group were incontinent to gas or liquid stool. One fistula recurrence was reported. An additional study reported a minor incontinence rate of 63% with a 6% recurrence rate.

Although the risk of an impairment in continence is high with seton fistulotomy, this technique is used for complex, hard-to-treat fistulas that recur more frequently with sphincter-sparing methods including fibrin glue and fistula plugs.

**FISTULOTOMY**

Fistulotomy is still considered the standard by many surgeons for low, simple anal fistulas, such as submucosal, intersphincteric, and low trans-sphincteric fistulas (Fig. 7). According to ‘The practice parameters for the treatment of perianal abscess and fistula-in-ano,’ completed by Whiteford and colleagues in 2005, fistulotomies may be used to treat simple anal fistulas in cryptoglandular disease and simple, low Crohn’s fistulas that are symptomatic. Their definition of simple includes a fistula tract that crosses less than 30% to 50% of the external sphincter, is not anterior in women, has only 1 tract, is not recurrent, and is present in a patient with perfect continence. In addition, the patient should not carry a diagnosis of Crohn’s disease or have received pelvic radiation for the fistula to be considered simple. Whiteford and colleagues also recommended the use of tract debridement and fibrin glue injection for simple fistulas, because it is a benign treatment with no detrimental effects on further treatment, although the recurrence rates are higher than with fistulotomy. Fistulotomy can be used as a staged procedure for complex fistulas in conjunction with a seton according to the practice parameters.

Fistulotomy is the standard treatment for submucosal fistulas because there is no concern for incontinence and recurrence is low. Controversy arises in the treatment of fistulas that involve the sphincter mechanism because of the potential for incontinence with nonsphincter-sparing methods. Most surgeons use fistulotomies for simple intersphincteric fistulas; however, some groups such as Tyler and colleagues use fistulotomies only for submucosal fistulas. In all of their patients with sphincter involvement a seton is placed, followed by fibrin glue or a rectal advancement flap as a staged procedure.
Other surgeons use fistulotomies more frequently and apply them to complex fistulas also. Perez and colleagues have completed multiple studies looking at fistulotomies with primary sphincter reconstruction for complex fistulas. They conducted a prospective study with 16 patients who had recurrent high trans-sphincteric, suprasphincteric, or extrasphincteric fistulas. Each patient underwent a fistulotomy in which the internal and external sphincters were divided. All accessory tracts were excised. The internal and external anal sphincters were repaired using an overlapping technique. All patients who were incontinent preoperatively improved their continence score postoperatively (the Wexner grading scale was used) except for 1 female patient whose incontinence score was unchanged. Two patients (25%) developed new minor incontinence. The results were similar in a larger prospective study of 35 patients, in which 45% had recurrent disease preoperatively. Perez and colleagues also compared their method with advancement flaps. They completed a prospective randomized study of 55 patients with complex fistulas (high trans-sphincteric and suprasphincteric) and found no difference in the recurrence or incontinence rate between the 2 methods.

As mentioned earlier, the incontinence rate with fistulotomy is high and can vary greatly, with rates from 0% to 40% in low intersphincteric fistulas. As a result, not only have new methods been developed to treat fistulas, such as fibrin glue and
fistula plugs, but numerous studies have been undertaken to determine predisposing factors for incontinence. Toyonaga and colleagues\textsuperscript{83} performed a prospective randomized study with 148 patients with intersphincteric fistulas and found that age, sex, previous surgery, duration of fistula, and location and level of the internal opening did not significantly influence incontinence postoperatively in patients undergoing a fistulotomy for treatment. In addition, low anal sphincter resting pressure and short anal canal length did not predispose patients to postoperative incontinence. These investigators found that low voluntary contraction pressure and multiple previous drainage procedures predisposed patients to postoperative incontinence. They recommend preoperative manometry for all patients, and avoidance of fistulotomy if the risk factors already mentioned were identified. Koperen and colleagues\textsuperscript{59} performed a study of 179 patients in which gender, age, tertiary referral, prior fistula surgery, and smoking were not found to be risk factors. Other studies show conflicting results. Cavanaugh and colleagues\textsuperscript{82} in a study of 110 patients found trans-sphincteric tracts and the extent of external sphincter involvement to be risk factors for postoperative incontinence after fistulotomy. In addition, Garcia-Aguilar and colleagues\textsuperscript{84} determined female gender, previous surgery, high internal opening, and type of fistula surgery (procedures performed for high fistulas) were all risk factors for postoperative incontinence following a fistulotomy.

Gupta\textsuperscript{85,86} conducted fistulotomies using radiofrequency ablation in an effort to decrease complications associated with conventional fistulotomy. In a study of 100 patients with low anal fistulas he compared conventional fistulotomy to radiofrequency fistulotomy and found those in the radiofrequency group had less gas incontinence (4 vs 12%). It is speculated that the reason for decreased incontinence is that there is less damage to the surrounding tissue because radiofrequency does not heat surrounding tissue. Similar results could be expected with the use of an ultrasonic dissector, although this has not been studied.

Recurrence has been reported to be lower with fistulotomy for low intersphincteric fistulas when compared with other methods, such as fibrin glue\textsuperscript{36,59}; however, a long-term study conducted by Van der Hagen and colleagues\textsuperscript{87} suggests that the recurrence rate is higher if follow-up of the patients is performed long enough. These investigators looked at the long-term (72 months) recurrence rates of fistulotomy for low perianal fistulas. Many studies follow patients up for 12 to 24 months, which for this study had a recurrence rate of 7% and 16%, respectively. These investigators noted at 72 months of follow-up the recurrence rate was 39%. Fifty-four percent of recurrences occurred in a new location, and patients with Crohn’s disease were included in this trial. At 48 months, fistula had recurred in 60% of the patients with Crohn’s disease included in the trial. Any study that includes inflammatory bowel disease patients in long-term follow-up will have a higher rate of recurrence compared with studies that do not. Although these data are useful, the elevated long-term recurrence rate seen in this study should be considered when selecting a method of treatment.

Although incontinence may be seen with low intersphincteric fistulotomy, most cases are minor (involving gas and occasionally liquid incontinence), but may still significantly affect the patient’s lifestyle. Cavanaugh and colleagues\textsuperscript{82} conducted a study to examination how postoperative incontinence affects the quality of life for these patients. They conducted a retrospective study of 110 patients that revealed that 64% of patients had at least occasional incontinence, with 14% reporting mild lifestyle restriction, 10% reporting moderate restriction, 9% reporting mild depression, and 4% reporting moderate depression. Moderate and severe embarrassment were reported by 5% and 1%, respectively.
Fistulotomy remains a major part of fistula treatment, despite the high rate of incontinence that may be seen postoperatively. It is an effective method of dealing with the disease, with the recurrence rates being much lower than those for sphincter-sparing methods. Although many patients experience minor incontinence that does not affect their lifestyle, it can have a severe effect on others.

**NEWER METHODS OF TREATMENT**

The search for the optimal treatment of anal fistula continues because of disappointing success rates with sphincter-sparing options and high incontinence rates associated with sphincter dividing procedures. The ligation of the intersphincteric fistula tract (LIFT) procedure was first described in Thailand by Rojanasakul. This is a procedure in which a small incision is made in the intersphincteric groove (much like an open internal sphincterotomy) just over where the fistula tract crosses from the internal to the external sphincter. The intersphincteric space is opened and the fistula tract is clearly defined and ligated with suture. Short-term results in 18 patients treated by the LIFT procedure and observed prospectively showed healing in all but 1 by a mean time of 4 weeks. These results prompted the University of Minnesota Colorectal Surgery Group to adopt the technique and study it in the long term. Beals presented results with the use of the LIFT technique at the 94th annual American College of Surgeons Clinical Congress and reported a 58% success rate in 31 patients followed for a mean time of 35 weeks. Time until failure ranged from 4 to 63 weeks with a median of 19 weeks. This result has prompted further investigation of this promising technique, and a trial comparing the LIFT technique with the collagen fistula plug is currently accruing patients.

Garcia-Olmo and colleagues investigated the use of injected adipose-derived stem cells in the treatment of complex anal fistulas. Their idea was based on experience from plastic surgery of the use of these cells in tissue repair. These investigators compared the use of injected fibrin glue with glue that contained 20 million units of adipose-derived stem cells in 49 patients with complex fistulas that were either cryptoglandular or related to Crohn’s disease. Fistula healing was noted in 71% of the group treated with stem cells as opposed to only 16% healing in the group who received fibrin glue. There were no differences in adverse reactions between the groups and none appeared to be related to treatment with stem cells. A 17% recurrence rate was noted after 1 year of follow-up in the group treated with stem cells. Garcia-Olmo and colleagues concluded that fistula tract injection of adipose-derived stem cells was safe and effective in the treatment of this complex disease. Both of these techniques show promise and warrant further long-term, randomized investigation.

**SUMMARY**

The surgical management of fistula-in-ano is driven by the amount of sphincter complex that is involved with the tract, and the potential coexistence of Crohn’s disease. The preferred method of management is dictated by these factors. Sphincter-sparing methods have lower success rates than nonsphincter-sparing techniques, but come with little to no risk of fecal continence. The first line of treatment of this disease should focus on methods that do not require any sphincter division. These techniques do not prevent a more aggressive surgical approach if they fail. Submucosal fistulas can be treated by fistulotomy with little risk. Intersphincteric and low trans-sphincteric fistulas may be treated with fistulotomy as first-line management if the patient has perfect continence preoperatively, and the patient has no previous history of sphincter injury. Anterior fistulas in women must be approached
with caution. It is to be hoped continued research will lead to improved success rates in sphincter-sparing options.

REFERENCES


