13 Cryptoglandular Abscess and Fistula

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Key Concepts

- Anorectal abscess should be treated with surgical drainage, not antibiotic therapy.
- At least one-third of cryptoglandular abscesses will progress to fistula.
- Anal fistula in the typical patient should be evaluated with examination under anesthesia. Subsequent management will be dictated by anatomic findings in the operating room.
- Priorities of management are control of sepsis, maintenance of continence, and cure without recurrence, generally in that order.
- While there are many new and emerging methods of treatment, the surgeon should be critical of the published literature and base their informed consent discussion on their observed results over time. Most studies would indicate that at least 12 months of follow-up is required to determine success.

Introduction

Anorectal abscess and fistula-in-ano are commonly encountered in a colorectal surgery clinic. It is imperative for the surgeon to fully understand the pathophysiology of this disease process, the anatomy of the anal canal and pelvis with respect to cryptoglandular abscess and fistula, and how to appropriately individualize care for each patient.

As stated by Dr. Herand Abcarian, "It is difficult if not impossible to accurately assess the incidence of anorectal abscesses because they often drain spontaneously or are incised and drained in a physician's office, emergency room or surgicenter" [1]. Similarly, our estimates do not account for those treated with antibiotics alone in the primary care setting. This is further complicated by the misdiagnosis of many common anorectal pathologies as "hemorrhoids," both by patients and referring physicians.

The incidence of anorectal abscess is documented as 8.6–20 patients per 100,000 people, with males being more affected than females at an incidence of 2.4–3:1 and presentation at a mean age of 40 years [2–4]. The most common etiology is cryptoglandular, accounting for 90% of anorectal abscesses, although both abscess and fistula can arise from a multitude of etiologies, including Crohn's disease, obstetric injury, fissure, and infectious etiologies such as tuberculosis, sarcoid, and HIV. These etiologies are outside the scope of this chapter but will be discussed in further detail in subsequent chapters.

Cryptoglandular Pathophysiology

Cryptoglandular abscess and fistula-in-ano arise from glands at the dentate line, nestled between the anal papilla and the columns of Morgagni. These glands extend into the submucosal space, internal sphincter, intersphincteric space, and external sphincter to varying degrees. When bacteria and debris become inspissated in these glands, an infection develops, and this will track along the course of the gland or follow to the path of least resistance from its origin (Fig. 13.1) [5, 6]. This theory was described and popularized by Eisenhammer in the 1950s [5].

Cryptoglandular Abscess

As described above, anorectal abscesses occur in multiple spaces in the pelvis and are so classified by these locations: perianal, ischiorectal, intersphincteric, and supralevator

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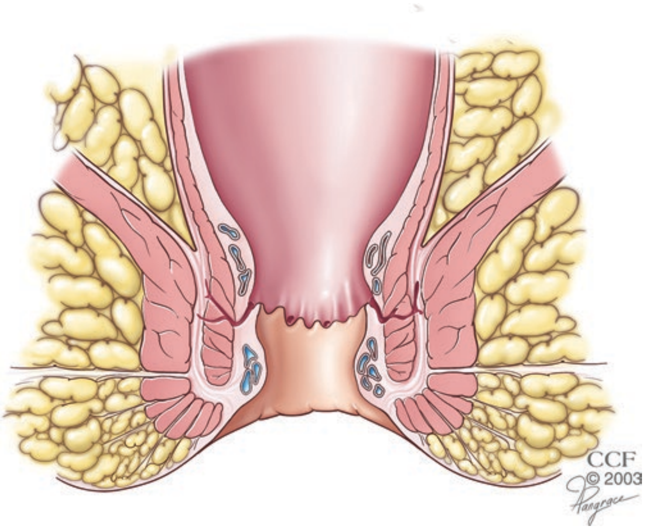

Fig. 13.1 Image depicting the anal canal with surrounding musculature and crypt glands in cross section coursing through the internal anal sphincter. (Reprinted with permission, The Cleveland Clinic Center for Medical Art & Photography © 2009–2020. All Rights Reserved)

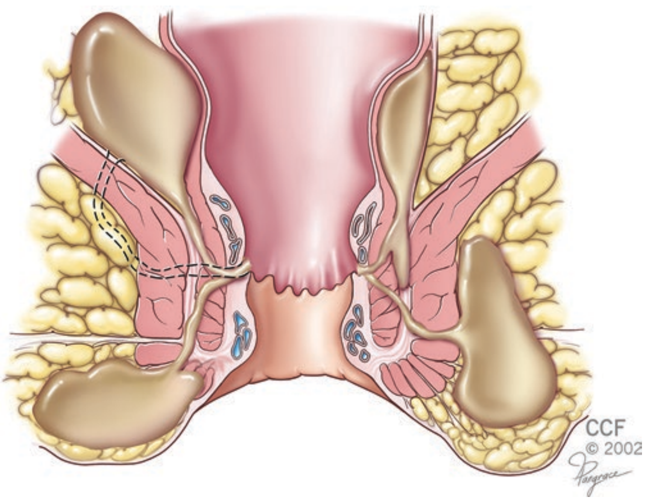

Fig. 13.2 Cross-sectional image showing abscess formation in the different potential spaces. (Reprinted with permission, The Cleveland Clinic Center for Medical Art & Photography © 2009–2020. All Rights Reserved)

(Fig. 13.2). Another classification, horseshoe abscess, describes an abscess that courses posteriorly through the deep postanal space to involve the bilateral ischiorectal spaces.

Both perianal abscesses and ischiorectal abscesses typically present with perianal pain, swelling, and fluctuance, with possible spontaneous drainage of purulent fluid. Intersphincteric abscesses typically do not have any external manifestations but rather present as intense anal pain, such that the patient will often not tolerate a digital rectal exam, without any other clear pathology to account for these symptoms such as a fissure, thrombosed hemorrhoid, sexually transmitted infection, or malignancy. Supralevator abscesses may arise from cephalad extension of a cryptoglandular origin but, however, are more commonly associated with an intraabdominal process such as diverticular disease, malignancy, or Crohn's disease. Perianal and ischiorectal abscesses represent the majority of anorectal abscess, 65–80% [7, 8]. Ramanujam et al. further described the incidence of each subtype of anorectal abscess in their evaluation of 1023 patients presenting over a 5.5-year period. In their series, perianal abscesses accounted for 42.7% of anorectal abscesses, ischiorectal for 22.7%, intersphincteric for 21.4%, and supralevator for 7.3%.

Diagnosis

History and physical examination are generally sufficient to diagnose perianal and ischiorectal abscesses. Imaging adjuncts, such as CT scan, MRI, fistulogram, and endoanal ultrasound, are not indicated for the patient with classic uncomplicated presentation, without diagnostic dilemma or comorbidity, and a fluctuant area is appreciated on examination [3, 9]. Imaging may be beneficial in the workup of those with an unclear diagnosis, such as those with isolated intersphincteric abscess or those that have other complicating factors, such as history of malignancy, radiation, Crohn's disease, prior anorectal operations, or trauma, or those with concern for complex abscesses such as horseshoe or supralevator extension. Imaging adjuncts may also be useful in select cases for management of associated fistula-in-ano, as discussed later in this chapter.

Treatment

The primary treatment for anorectal abscess is expeditious incision and drainage. Perianal and ischiorectal abscesses should be drained through the skin overlying the area of fluctuance. If the abscess cavity is large, the incision should be made over the area of the cavity that is closest to the anal verge. With this technique, if the patient develops a resultant fistula-in-ano, the tract will not be unnecessarily long. This consideration is important, as approximately one-third of acute anorectal abscesses persist as a fistula-in-ano [8, 10, 11].

Intersphincteric abscesses and supralevator abscesses require special considerations both for effective drainage and to avoid iatrogenic injury. Intersphincteric abscesses typically require internal drainage at the dentate line via sphincterotomy if there is no external area of fluctuance.

The route of drainage is of particular importance for supralevator abscesses. Those that arise from an intraabdom-

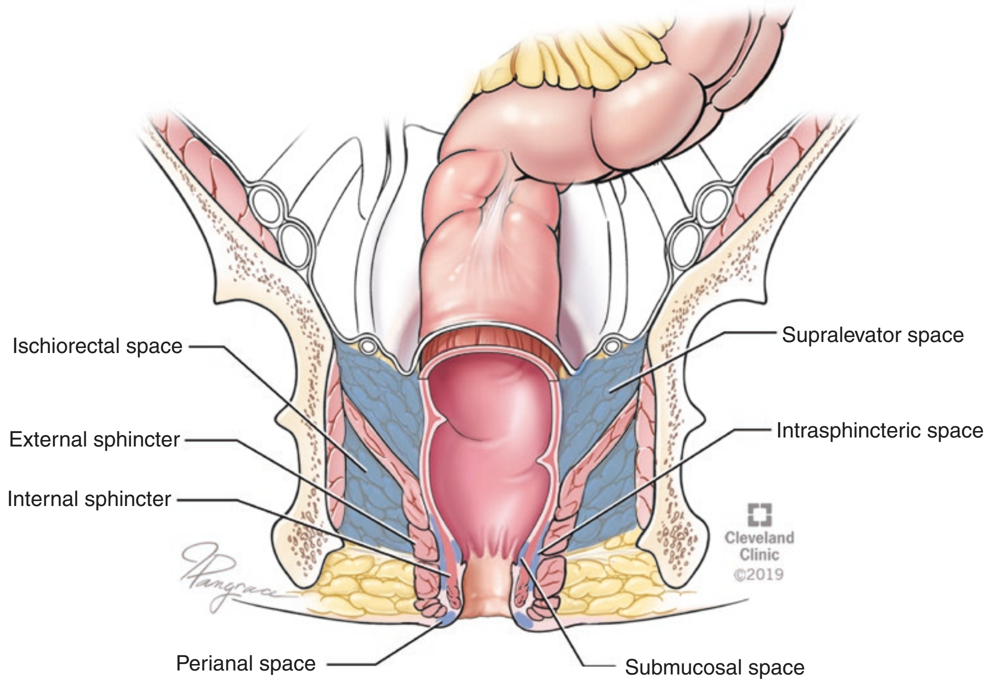

Fig. 13.3 Image showing different potential spaces for abscess formation, with emphasis on appropriate drainage route for supralevator abscess. (Reprinted with permission, The Cleveland Clinic Center for Medical Art & Photography © 2009–2020. All Rights Reserved)

inal source should be drained either transabdominally using interventional radiology assistance or transrectally, while those arising from cephalad extension of a cryptoglandular source via the intersphincteric space should be drained transrectally. Those that arise from a cephalad extension of an ischiorectal abscess should be drained transcutaneously. These principles are important in order to avoid iatrogenic creation of a suprasphincteric fistula (Fig. 13.3).

Another special case is drainage of the horseshoe abscess. As stated previously, these typically arise from extension of an ischiorectal abscess via the deep postanal space. In order to adequately drain these abscesses, there must be both bilateral transcutaneous ischiorectal drainage and posterior drainage via division of the anococcygeal ligament to access the deep postanal space. Other examples of a horseshoe abscess include those arising from a perianal abscess extending through the superficial postanal space, those extending through the anterior perianal space, or a supralevator abscesses coursing through the posterior supralevator space (Fig. 13.4).

Acute Fistula Management

By definition, 100% of anorectal abscesses of cryptoglandular etiology will have a path from the dentate line to the drained abscess cavity. At the time of acute abscess presentation, 30–70% of patients will have an identifiable tract [8, 12–14]; however, this tract is not mature and will only become a fistula tract in ~30–35% of patients. There is also a risk of creating a false passage while attempting to identify a fistula tract in the setting of acute inflammation. If a tract is identified, some advocate for primary fistulotomy at the time of abscess drainage to reduce recurrent abscess or need for second operation were a fistula to develop. And while some have shown a decrease in both abscess recurrence and fistula formation with primary fistulotomy [12], this approach results in occasionally unnecessary sphincter division in patients who would not have ultimately developed a chronic fistula. In addition, inflammation from the concomitant abscess will make it more difficult to discern the degree of muscle involvement, precluding appropriate surgical judgment, thereby potentially increasing the risk of incontinence [12, 15]. Given this controversy and potential risks, it is not generally recommended to definitively manage this tract at the time of abscess drainage.

Incision and drainage in the clinic instead of the operating room is preferred as it expedites the time to control of sepsis. In order to perform this procedure in clinic, the provider must have an adequate setup with anesthetic, instruments, patient positioning, and an amenable patient. In many cases, patients will tolerate in office drainage. This can be facilitated by injecting a wheal of anesthetic at the intended site of drainage, decompressing the cavity through the wheal with a larger needle prior to injecting additional anesthetic, and then completing drainage via a small incision. Complex perianal abscesses, such as those that are deep/nonpalpable, those that are associated with tissue necrosis, and those inpatients who are intolerant of a bedside procedure, are better managed in the operating room.

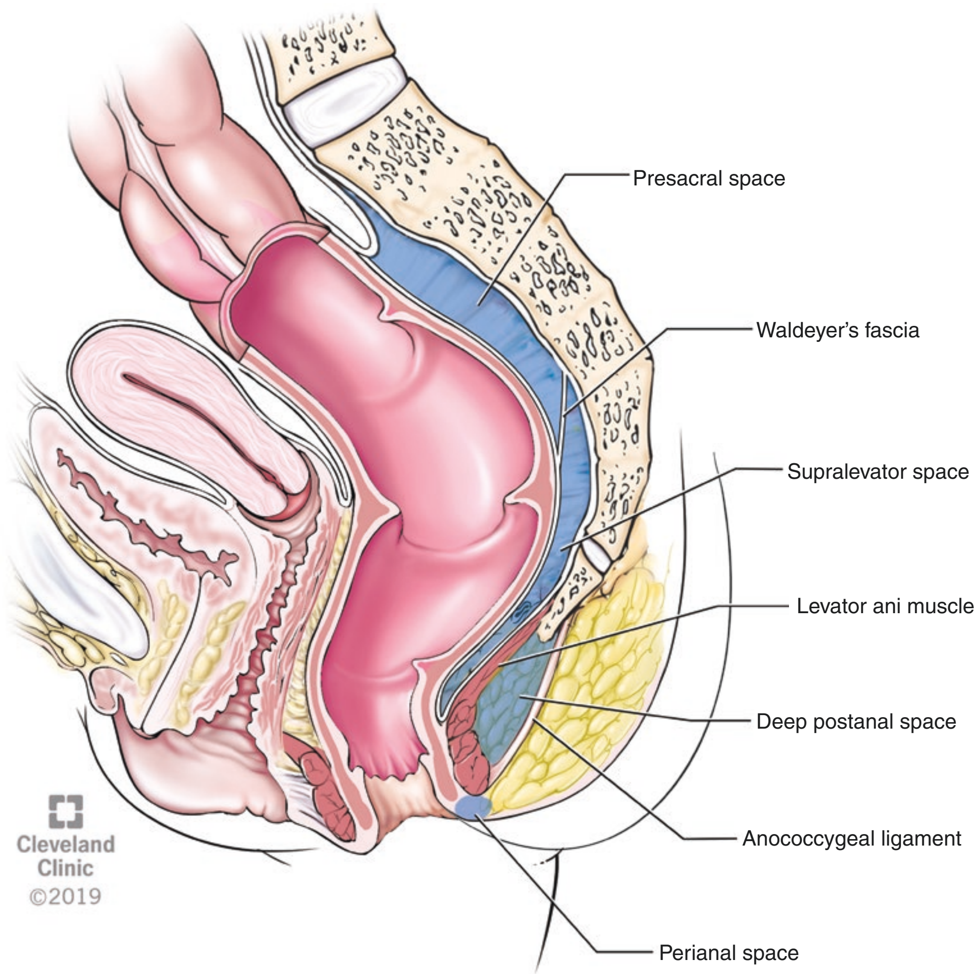

Fig. 13.4 Sagittal image showing potential abscess spaces. (Reprinted with permission, The Cleveland Clinic Center for Medical Art & Photography © 2009–2020. All Rights Reserved)

Post-drainage Care

After transcutaneous drainage, packing the abscess cavity is not recommended as wounds left unpacked are more manageable to care for with less pain and faster healing [16–18]. A catheter, such as a mushroom-tip catheter, may be placed in an abscess cavity to promote drainage and to maintain the external opening. This is of particular help in those with large or deep abscess cavities to ensure adequate drainage of the cavity and to minimize the size of external incision. Warm water soaks (i.e., sitz baths) for 10–15 minutes two to three times per day and external gauze for drainage are all that are required for wound care.

Post-drainage Antibiotics

Traditionally antibiotics were recommended only for those with extensive cellulitis, signs of sepsis, or immunocompromised state [19]. While we lack definitive evidence to direct antibiotic therapy, in general, a broad-spectrum antibiotic that offers gram-negative and anaerobic coverage while providing additional coverage of typical gram-positive skin-associated bacteria is adequate. Typical oral regimens would include augmentin alone, trimethoprim-sulfamethoxazole alone, and a quinolone combined with metronidazole. In a patient with prior history of methicillin-resistant *S. aureus* infection, use of trimethoprim-sulfamethoxazole or clindamycin will often cover a community-acquired form of the infection. This is more controversial in recent years as there is data to suggest post-drainage antibiotic treatment may decrease fistula formation. Ghahramani et al. randomized 307 patients to operative drainage with or without postoperative ciprofloxacin and metronidazole. They found a significant decrease in fistula formation from 30% in the control group to 14.1% in the antibiotic group ($P < 0.001$) [20]. Likewise, Lohsiriwat found a decrease in fistula formation from 48% to 17% in those that received antibiosis vs. those that didn't, respectively [11]. In a subsequent meta-analysis, Mocanu et al. found a 36% decreased rate of fistula formation in those with post-drainage antibiotics than those who received no antibiotics or placebo [21]. These studies are not uniformly reproducible, as there are similar studies which showed no protective effect of antibiotic treatment with fistula formation [10, 22]. Given this inconclusive evidence, guidelines still recommend against routine antibiotics [19].

Without plans for post-drainage antibiotics, it is not necessary to send a bacterial culture, as this data would not be actionable. If antibiotics are planned, then a bacterial culture at the time of drainage may help guide antimicrobial selection, in particular when treating a patient with history of drug-resistant bacteria such as MRSA.

Anal Fistula

Presentation/Symptoms

As previously discussed, anorectal abscess persists as an anal fistula in approximately 30–35% of patients. Interestingly, this rate increases in nondiabetics and those less than age 40, with no significant difference identified based on sex, smoking status, HIV status, or administration of perioperative antibiotics [10, 11]. Patients with fistula-in-ano present to the colorectal surgery clinic with a wide range of complaints, including "hemorrhoids," history of anorectal abscess with spontaneous or surgical drainage, external bump that becomes irritated and bleeds, chronic external drainage, and cyclical perianal pain and swelling that is relieved with expression of fluid. Given the variety of complaints in patients with fistula-in-ano as well as those of any anorectal patient, a good physical exam is of the utmost importance to appropriate diagnosis, medical decision-making, and patient counseling.

Classification

The most common etiology of fistula-in-ano is cryptoglandular progression. The course of the offending gland through the sphincter complex or the path the bacteria travels through the tissues as its path of least resistance determines the type of resultant fistula. Fistulas are categorized based on degree of sphincter involvement: subcutaneous/submucosal (2–3%), intersphincteric (24–45%), transsphincteric (30–60%), and suprasphincteric (2–20%) [23–25].

Subcutaneous or submucosal fistulas begin at the dentate line and course just deep to the anoderm without any sphincter involvement. Intersphincteric fistulas track through the internal sphincter alone before traveling through the intersphincteric space to reach the perianal skin. Transsphincteric fistulas travel through both the internal sphincter and external sphincter and are further subdivided based on degree of external sphincter involvement. Those fistulas involving 30% or less of the external sphincter are considered low transsphincteric fistulas, whereas those involving more than 30% of the external sphincter are termed high transsphincteric fistulas. This is of particular importance in the decision regarding sphincter-dividing vs. sphincter-sparing techniques and risk of postoperative fecal incontinence. This will be discussed in further detail in a later section. Suprasphincteric fistulas begin at the dentate line, course through the internal sphincter, travel cephalad in the intersphincteric space, and cross the skeletal muscle above the external sphincter to enter the ischiorectal space.

A fifth class of anorectal fistula is also described: the extrasphincteric fistula. These fistulas do not arise from a cryptoglandular origin and do not involve the sphincter complex. These fistulas arise from an intraabdominal source such as diverticulitis or malignancy, are associated with a separate etiology of fistulizing disease such as Crohn's disease, or may arise from iatrogenic injury or inappropriate drainage of a supralevator abscess. Extrasphincteric fistulas are mentioned here to fully understand the classification of fistula-in-ano; however, their management will be discussed in another chapter (Fig. 13.5).

Neither the location of the initial abscess cavity nor the location of external opening of a fistula tract can predict the degree of sphincter involvement. The internal opening can be somewhat reliably predicted for cryptoglandular fistulas based on the location of the external opening following Goodsall's principle. Overall this principle correctly corresponds to actual patient disease in ~80% of those with cryptoglandular fistula [26]. This is most accurate for posterior and intersphincteric fistulas, 91% and 93%, respectively, than for anterior and transsphincteric fistulas, 69% and 68%, respectively (Fig. 13.6) [27].

In this principle, any external opening involving the posterior half of the anoderm (posterior to the transverse anal line) will curve medially to involve an internal opening in the posterior midline. External openings involving the anterior half of the anal verge (anterior to the transverse anal line) will correspond to a radially located internal opening. Exceptions to this rule include posteriorly arising fistula tracts that extend anteriorly in their curved path prior to communicating with the perianal skin.

Preoperative Imaging for Fistula Characterization

As mentioned previously, there are several imaging adjuncts that may be used to define a fistula tract, such as CT scan, MRI, fistulography, and endoanal ultrasound. The majority of patients with uncomplicated cryptoglandular disease are diagnosed with fistula-in-ano based on symptoms and physical exam findings alone, and there is no additional benefit to adding imaging in the initial workup. Gonzalez-Ruiz et al. demonstrated 93% ability to identify internal fistula opening

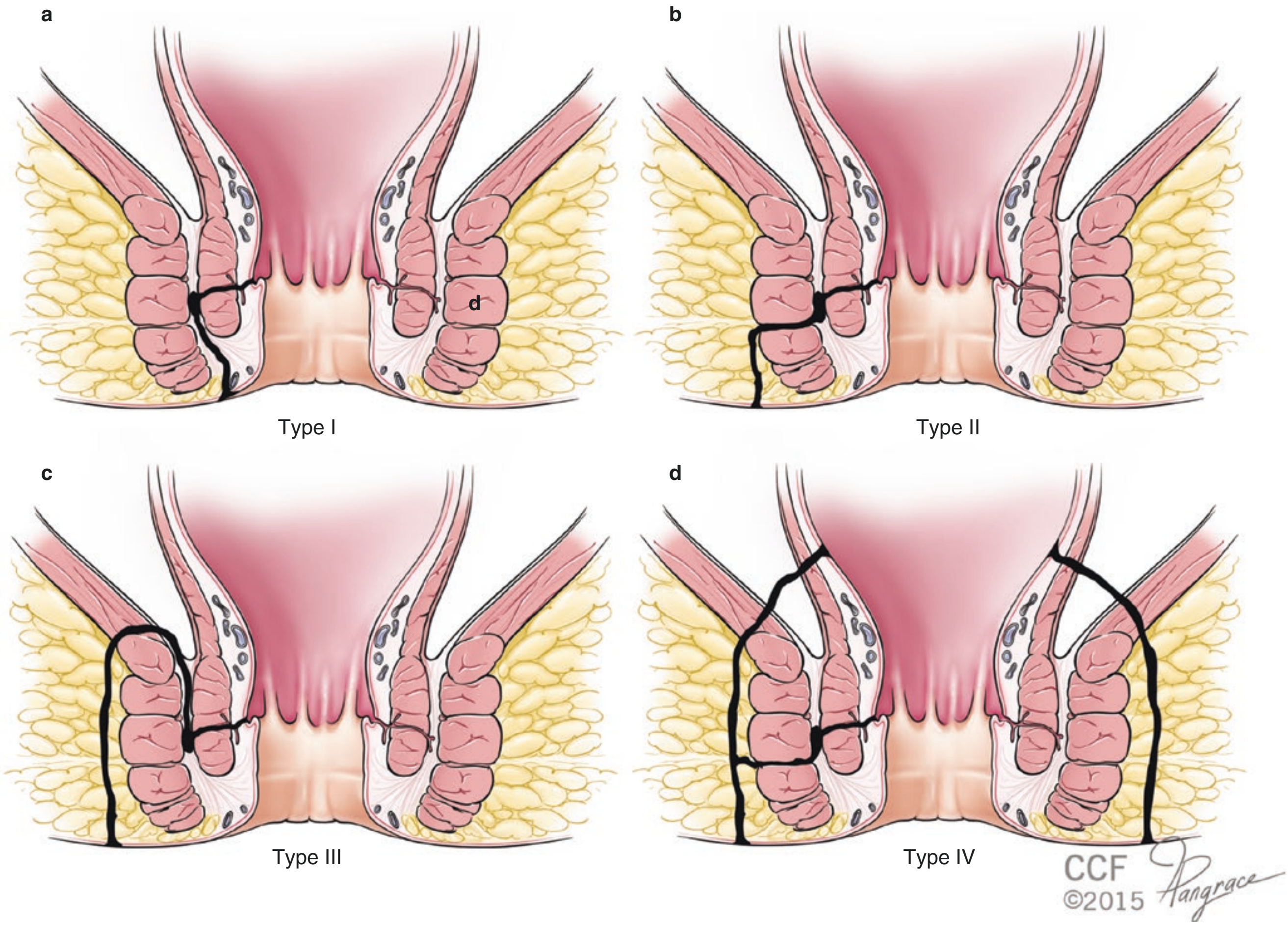

Fig. 13.5 Cross-sectional images showing the anatomy of various fistula tracts. Type 1, intersphincteric; type 2, transsphincteric; type 3, suprasphincteric; type 4, extrasphincteric, combined transsphincteric/extrasphincteric. (Reprinted with permission, The Cleveland Clinic Center for Medical Art & Photography © 2009–2020. All Rights Reserved)

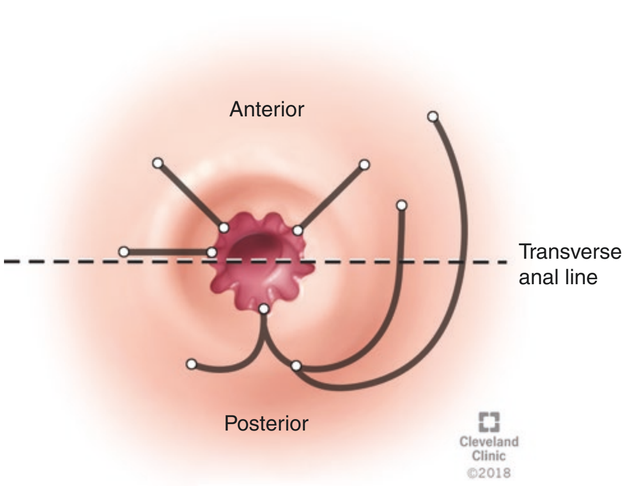

Fig. 13.6 Goodsall's rule, which has come into question more recently. It still remains a decent guideline for determining the location of an internal opening. (Reprinted with permission, The Cleveland Clinic Center for Medical Art & Photography © 2009–2020. All Rights Reserved)

with direct palpation [26]. Imaging is reasonable to consider for those with non-cryptoglandular disease, such as Crohn's, those with recurrent disease or history of prior fistula operation, and those in whom the tract was not readily identifiable on examination under anesthesia.

The imaging modality selected is highly dependent on surgeon preference, comfort with interpretation, access to certain modalities, and, in the case of ultrasound, surgeon skill.

Fistulography

Fistulography is performed by injection of water-soluble contrast into the external fistula opening followed by plain X-ray or fluoroscopy imaging. A modified technique described by Pomerri et al. may also be used during which contrast is placed into the rectum via a Foley catheter [28]. With this method, the authors were able to identify 100% of primary tracts, 74.2% of internal openings, 91.8% of secondary tracks, and 87.8% of abscesses. Despite relative accuracy, both fistulography techniques have been surpassed by other modalities, due to the lack of radiologist expertise, anatomic information provided with plain X-ray alone, and discomfort to the patient [29]. These may still have a role for those without access to more advanced 3D imaging options.

Computed Tomography (CT)

Standard computerized tomography (CT) is typically not a helpful modality to evaluate fistula characteristics [30]. CT may be helpful, as previously stated, in the evaluation of complex abscess cavities, including supralevator abscesses, or to define aberrant anatomy from prior surgery, prior infection or inflammatory disease, or congenital aberrancies. CT with fistulography, however, does have the ability to characterize a fistula tract with relatively good accuracy [31]. Proponents of this technique cite the increased availability of CT and decreased cost as compared to MRI. There is also no interobserver variability. Negatives of this modality include exposure to radiation, procedural cannulation of the fistula tract which often requires surgeon presence in radiology, and decreased accuracy as compared to MRI. CT fistulography is less accurate at fistula classification (73.1% vs. 92.7%, $p < 0.001$) and identification of internal opening (68.2% vs. 85.3%, $p < 0.001$) as compared to MRI, with similar ability to identify secondary extensions and similar correlation with intraoperative findings [31].

Magnetic Resonance Imaging (MRI)

The use of MRI to evaluate anal fistulas was first described in the 1992 by Lunniss et al. [32]. In the initial reports, MRI was highly accurate, sensitive, and concordant with operative findings [33, 34]. Many consider MRI the preferred imaging modality to characterize anal fistulas given its accuracy, reproducibility, and no need for instrumentation of the fistula tract by the radiologist or surgeon, which leads to improved patient tolerance [29]. MRI is also preferred due to its ability to both localize abscesses and characterize fistulas with depiction of the surrounding anatomy.

A more important determination may not be which modality to use, but when to use imaging. In a study of 136 patients undergoing preoperative 3T MRI, Konan et al. identified an 83.1% concordance with operative findings; however, the contribution of that finding to clinical evaluation was only significant in 33.8% of patients [35]. Applicable and treatment changing information was more common in those with complex fistulas (54.4% vs. 5.2%, $p < 0.001$) and with external opening >2 cm from the anal verge (47.1% vs. 10.2%, $p < 0.001$) and when a horseshoe fistula was present (66.7% vs. 30.6%, $p = 0.021$). This again supports the earlier assertion that imaging adjuncts are unnecessary with straightforward cryptoglandular disease.

MRI can be performed with either an endoanal coil or a body coil. There was initial support for the endoanal coil with studies showing improved accuracy as compared to an external coil [36]. This technique however is poorly tolerated by patients and has decreased ability to delineate anatomy further from the anal verge. In addition, with improvements in MRI technology with both 1.5 Tesla and 3.0 Tesla magnets, body coil MRI findings surpassed endoanal coil MRI in concordance to surgical findings [37, 38].

Endoanal Ultrasound (EAUS)

While MRI is currently considered the gold standard for fistula evaluation, cost and access are often prohibitive for patients. In these situations, endoanal ultrasound provides a reasonable alternative for preoperative evaluation. Endoanal ultrasound is similar to MRI in ability to accurately identify internal opening, each with rates of 80–90% accuracy [37, 39, 40]. Endoanal ultrasound is less accurate at identifying secondary extensions, 67–80% vs. 90% [37, 39, 40]. Notably there is no difference between these two modalities in evaluation of simple fistula tracts [40]; however, most would argue that neither adjunct is indicated for the simple fistula tract.

Injection of dilute hydrogen peroxide into the fistula tract via the external opening is often used as an ultrasonic contrast agent during endoanal ultrasound to improve visibility of fistula. Peroxide contrast enhancement increases identification of internal openings, accuracy of fistula classification, and ability to identify supralevator extension and abscess [41–44].

Endoanal ultrasound remains an accurate and cost-effective modality for fistula evaluation. However, given the poor patient tolerance, variability of accuracy based on operator skill, and limited view of anatomy further from the anal canal, MRI continues to be the standard of care for preoperative imaging assessment when available and when indicated in select patients. One advantage of ultrasound is that it can be performed as an adjunct in the OR, which may have immediate impact upon treatment.

Treatment Strategies

There are three main goals in management of fistula-in-ano: (1) control of sepsis, (2) definitive repair of fistula without recurrent disease, and (3) maintenance of continence [45, 46]. The first step in treatment is rectal exam under anesthesia, to evaluate the fistula, surrounding anatomy, and degree of ongoing infection and to classify the fistula with respect to sphincter involvement.

There is little to no role for medical management alone without surgical management in the treatment of cryptoglandular fistula-in-ano. Exceptions to this include those that are minimally symptomatic and have other comorbidities precluding surgical management. In these patients, control of sepsis remains a goal of treatment which may require placement of a draining seton as described below. They must also

Fig. 13.7 Image showing malignant degeneration/transformation in a chronic fistula tract

be monitored long term due to the rare but documented incidence of malignant degeneration of chronic anal fistula (Fig. 13.7) [47]. Medical management is well described for fistula-in-ano related to Crohn's disease, as will be discussed in the following chapter.

Intraoperative Fistula Identification

The first step in surgical management is intraoperative identification and characterization of the fistula. Even in those with preoperative imaging, these findings are merely guidance and must be confirmed with intraoperative findings. To this end, rectal examination under anesthesia is performed. The authors prefer monitored anesthesia care with sedation and prone jackknife position; however, this procedure can be performed in high lithotomy or under general anesthesia depending on surgeon preference and patient comorbidities.

The procedure begins with digital rectal exam and anoscopic exam both to palpate internal opening and rule out other anal canal pathologies previously unidentified during examination in clinic. The external opening is gently probed with a blunt-tipped fistula probe. These probes can be single or double armed, straight or curved, and malleable or non-malleable, depending on both surgeon preference and the limitations of the individual fistula tract. The probe is passed along the tract until it communicates with the internal opening. This can be facilitated by palpation of the internal opening with the opposite hand at the time of probe passage to guide direction. The probe should move smoothly and without significant force through the fistula tract, so as to avoid creation of a false passage.

A commonly encountered situation is that in which the fistula probe passes through the sphincter complex but does not pass through the mucosal opening. While tempting to "pop through" this final layer of mucosa, inaccurate identification of the internal opening leads to increased risk of recurrent fistula, and therefore this should be avoided [48].

It can be challenging to identify the internal opening in some patients. Intraoperative hydrogen peroxide or methylene blue may be injected via the external fistula opening to aid in identification of the exact site of internal opening. In a study by Gonzalez-Ruiz et al., internal openings were accurately identified in 83% of cases when methylene blue or hydrogen peroxide injections were used [26]. Even if the internal opening is identified, it may be difficult to pass the probe if there is significant angulation or branching or if you encounter unexpected complex anatomy. In these cases, the surgeon may choose to gently probe the internal opening outward to attempt to connect with the externally passed probe.

Alternatively, intraoperative ultrasound with or without hydrogen peroxide contrast enhancement may be used. Just as with preoperative endoanal ultrasound, the surgeon may choose to add hydrogen peroxide as ultrasonic contrast enhancement. Some show that the addition of hydrogen peroxide significantly increases the ability to identify internal opening (94%) and determine curvilinear vs. linear anatomy (85%) [49, 50]. Others found endoanal ultrasound with hydrogen peroxide and endoanal ultrasound alone were equivocal in identifying internal opening, primary tract and secondary tract, although both were still highly accurate at 90 and 86%, 81 and 71%, and 68 and 63%, respectively [51].

It is important to remember that, like any ultrasound, endoanal ultrasound is highly user dependent. These aforementioned degrees of accuracy are in the hands of experienced users. If a surgeon is anticipating use of this modality in the operating room, then it is advised to initially perform endoanal ultrasound intraoperatively on all fistula-in-ano patients, whether simple or complex, to improve their skill and interpretation.

Other techniques have been described to aid in internal opening identification and complete probe passage. One such technique describes partial fistulectomy or fistulotomy from the external opening to the level of the external sphincter followed by traction on the transsphincteric portion of the fistula to identify dimpling of the anal mucosa at the site of

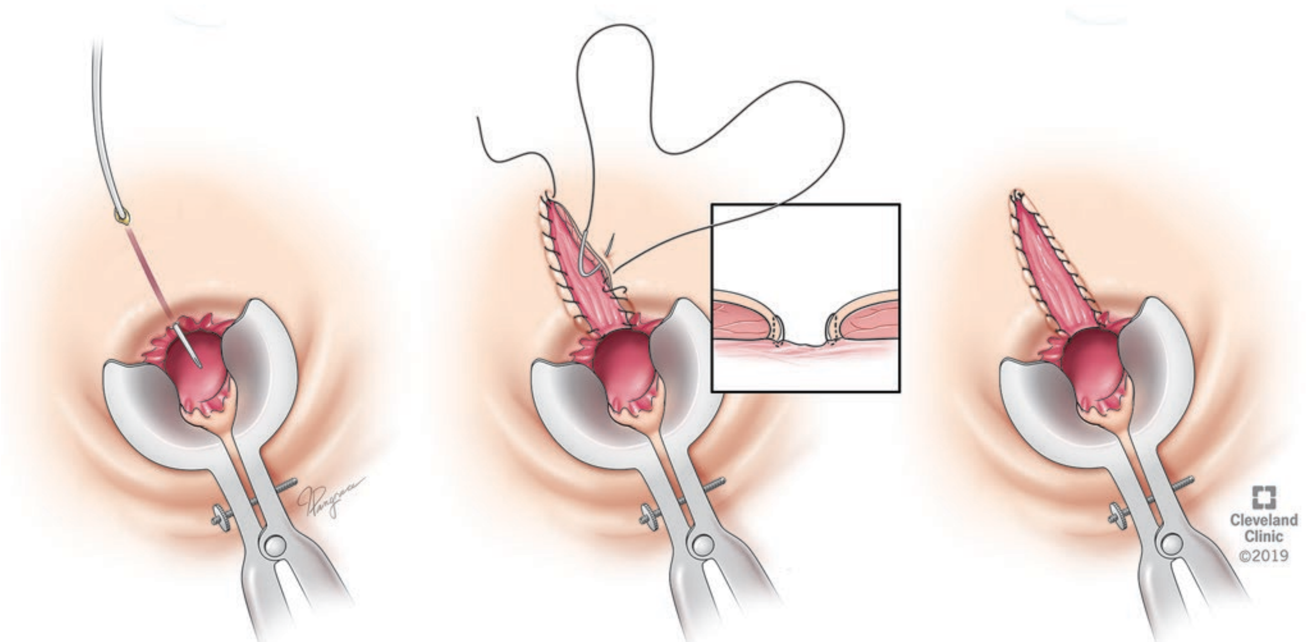

Fig. 13.8 Image showing a simple fistulotomy with marsupialization of the wound edges. (Reprinted with permission, The Cleveland Clinic Center for Medical Art & Photography © 2009–2020. All Rights Reserved)

internal opening [52]. These techniques should be used with caution as they may interfere with appropriate and definitive treatment in the future. Occasionally, one should abandon the procedure if an internal opening is not identified, preserving a future opportunity to identify the fistula tract without injury to the anal canal or sphincter complex.

Once clearly identified, fistulas are commonly classified as simple or complex based on the risk for incontinence after a sphincter-dividing operation. Complex fistulas are described by the American Society of Colon and Rectal Surgeons Standard Practice Task Force (SPTF) as involving more than 30% of external sphincter (high transsphincteric, suprasphincteric, and extrasphincteric), anterior location in a female, multiple tracts, recurrent fistula, preexisting incontinence, local irradiation, and Crohn's disease [53]. Fistulas that clearly fall in the simple classification may be treated with definitive sphincter-dividing surgery at the time of initial presentation. All others should undergo a sphincter preserving technique, typically beginning with placement of a draining seton.

Fistulotomy

Fistulotomy is generally safe in simple fistulas with recurrence rate of 0–9% and incontinence rate between 0% and 37% [24, 48, 54]. The wide range in findings is likely due to variable inclusion criteria of simple vs. complex fistula type in these studies of patients undergoing fistulotomy. Overall, in appropriately selected patients, fistulotomy is safe and has low risk of recurrence and resultant incontinence. For this reason, it is the only surgical option recommended for simple fistulas.

Fistulotomy entails laying open the fistula tract including all secondary tracts for complete and adequate drainage. In some situations, fistulotomy of the primary tract with counter-drainage of the secondary tract/s will provide a reliable result but can simplify healing and postoperative care (Fig. 13.8). This is most easily performed by dividing the tissue overlying the fistula probe with electrocautery. The underlying fistula tract is debrided with electrocautery or curetting. Marsupialization of the wound edges after fistulotomy has been shown to decrease overall resultant wound size, shorten time to healing (6 weeks vs. 10 weeks, $p < 0.001$), and reduce incidence of postoperative bleeding (36% vs. 46%, $p < 0.05$) [55, 56].

Concomitant fistulectomy was initially theorized to improve healing by removal of the dense fibrotic tissue of a chronic fistula. This technique, while having similar recurrence and incontinence rates as compared to fistulotomy, also carries with it increased wound size, increased size of postoperative sphincter defect, and increased time to healing [45, 57, 58]. Therefore, we do not recommend fistulectomy over fistulotomy for simple fistula-in-ano. Fistulectomy may have a role for chronic blind ending sinus tracts, especially one that does not cross the sphincter complex and travels cephalad into the ischiorectal space, for which fistulotomy is not feasible. A drain may be placed in this scenario to facilitate fluid drainage, in particular for tracts that are narrow and penetrate deeply into the tissues.

Fig. 13.9 Transsphincteric fistulotomy into the deep postanal space in a patient who failed sphincter-sparing management. This individual did not have any alteration in continence after healing, which is a relatively common result in this setting

While fistulotomy is typically reserved for low lying and simple fistulas, the modified Hanley procedure [59] (posterior midline fistulotomy into the deep postanal space using primary fistulotomy or a cutting seton combined with counter-drainage of bilateral horseshoe tracts) has been associated with successful treatment of deep postanal space/horseshoe fistulas that would generally be considered as complex (Fig. 13.9). It is the opinion of the authors that this procedure should be reserved for failures of sphincter-sparing approaches; however, despite the significant amount of external sphincter divided, incontinence rates are relatively low.

Setons

The word seton originates from *seta*, the Latin word for bristle. In fact, the earliest described setons were horsehair or "seta equina." These setons were used to drain infection and fell out over time. Currently there are many materials that may be used as a seton: nonabsorbable sutures, vessel loops, Penrose drains, silastic catheters, rubber bands, wire, electrical cable tie, etc. The main differentiation between setons is not the material chosen but the goal of treatment. Setons are characterized as draining setons or cutting setons.

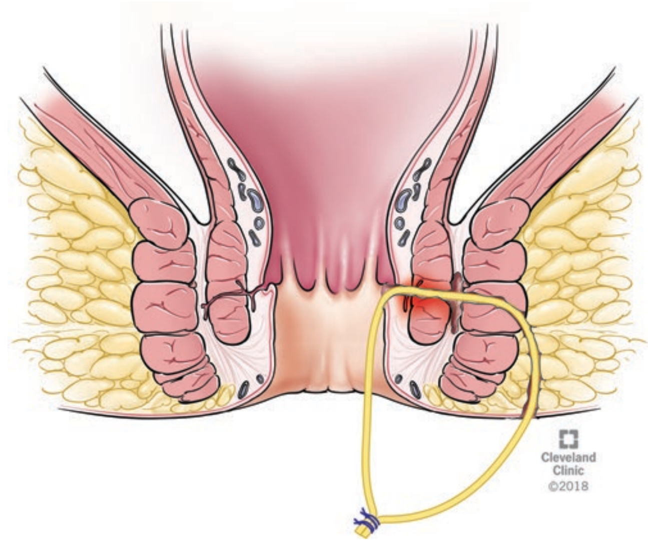

Fig. 13.10 Loose seton placed through a transsphincteric fistula. (Reprinted with permission, The Cleveland Clinic Center for Medical Art & Photography © 2009–2020. All Rights Reserved)

Draining Seton

A draining seton is secured loosely to itself (Fig. 13.10) such that there is no significant tension on the involved tissues. This type of seton is placed if there is complex disease with significant sphincter involvement or significant inflammation such that degree of sphincter involvement cannot be accurately elucidated. The goal of a draining seton is adequate drainage and sepsis management, as well as tract maturation, which is necessary for some types of complex repairs. This procedure is very well tolerated and carries with it very little risk.

Cutting Seton

A cutting seton is placed similarly to a draining seton; however, it is secured tightly to itself such that there is tension and compression on the involved tissues. Successful placement requires division of the anoderm overlying the fistula tract. The seton is then serially tightened in clinic and slowly "cuts" through the intervening tissues until it falls out, leaving intact scar behind and preventing a tissue defect from developing. The time to healing, thereby time to extrusion of seton, may last weeks to months and is dependent on the amount of tissue to be divided. Setons are tightened as frequently as every other day or as infrequent as just once postoperatively. Recurrence rates are low with this procedure (0–10%); however, there remains a significant risk of incontinence, reported between 0 and 67% [60–66]. This observed variability in incontinence rates is attributed to differing surgical techniques, duration of follow-up, and variable surveillance records in follow-up.

Ritchie et al. evaluated a large series of patients ($n = 1460$) and concluded a rate of incontinence of 12% after cutting seton [65]. This rate was based on all included manuscripts; however, one-third of manuscripts did not include a description of incontinence, and when these are excluded, average incontinence rate increases to 32%. Likewise, several large studies used only medicated cutting setons. When these studies are excluded, incontinence rate rises to 22%. Incontinence rate also increases with more proximal location of the internal opening.

In a review by Vial et al., authors compared rates of recurrence and incontinence with or without division of the internal anal sphincter [66]. They identified similar recurrence rates between preserved and divided internal anal sphincter (5% vs. 3%) and significant difference in rates of incontinence (5.6% vs. 25.2%). These authors concluded that division of internal anal sphincter was not necessary to improve recurrence rate and worsened postoperative function and should therefore be avoided when using a cutting seton.

Overall, cutting setons have high enough incontinence rates to recommend preferential use of other sphincter-sparing approaches for complex fistulas, unless in the setting of recurrent disease with exhaustion of other options or when the anatomy is not amenable to other options.

Loose Seton as Definitive Treatment and External Anal Sphincter-Sparing Seton

Loose draining setons were traditionally seen as a mechanism for sepsis control and bridge to definitive repair in cryptoglandular anal fistula; more recent studies show promising results with the use of draining seton as definitive repair. The mechanism for this treatment is not fully understood; however, proponents of this technique cite eventual erosion of the seton such that the internal opening migrates distally out of the high pressure zone, allowing ultimate healing [67]. Emile et al. reported ~10% recurrence rate with risk of incontinence of 3% [68]. Risks for recurrence include previously recurrent fistula, supralevator extension, and anterior fistula. In their multicenter review of 200 patients undergoing loose seton placement for definitive management of fistula, Kelly et al. identified 100% initial clearance of fistula, with overall 6% recurrence rate and 96% patient tolerance [69]. In their described technique, setons were changed electively every 3 months until the fistula resolved. The median number of seton replacement for each patient was 3 (range 1–8, mean 2.84).

In a recent study by Omar et al., 60 patients with complex anal fistula were randomized to conventional drainage seton or external anal sphincter-sparing seton using a rerouting technique [70]. They identified persistence or recurrence rates of 13% and 3% for conventional and external sphincter-sparing techniques, respectively ($p = 0.35$), and no difference in physical, social, or sexual activities ($p = 0.7, 0.59, 0.67$). Importantly they identified significant decrease in time to healing from 103 ± 47 days in the conventional group, as compared to 46 ± 18 days in the external sphincter-sparing group ($p < 0.0001$). These studies are promising for the use of loose draining seton as a means of definitive treatment and warrant further investigation.

Fibrin Glue

The use of fibrin glue for obliteration of an anal fistula tract was first described in the 1990s as a means to treat complex anal fistulas without impairment of incontinence [71]. In this initial series, Hjortrup et al. reported a 50% success rate, which they argued was reasonable given the procedure's repeatability, ease of performance, and minimal patient risk. With this procedure, the primary fistula tract is identified and debrided, followed by injection of fibrin glue (Fig. 13.11). While none have been associated with change in recurrence rate, variations to this procedure include the use of preoperative setons, degree of tract debridement, use of intra-adhesive antibiotics, and suture closure of internal or external openings [72]. Since this initial study, success rates remain variable at a range of 14–94% [72–76]. Healing rates decrease with increasing fistula complexity [76, 77]. Given the variable success rates, fibrin glue is not recommended as a first-line treatment for complex fistula-in-ano; however, with low risk of complication or incontinence, it is a reasonable second-line treatment or alternative when other surgical options are not feasible [19, 29].

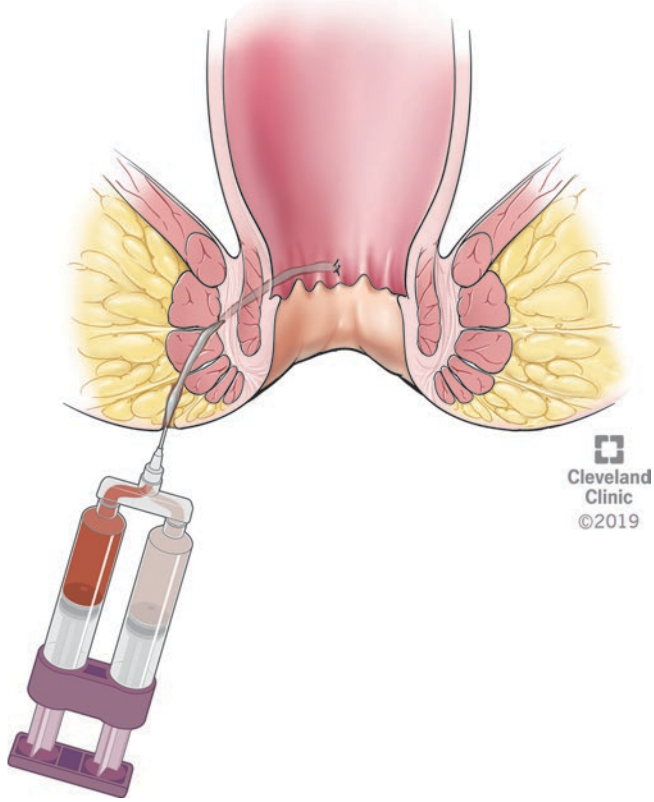

Fig. 13.11 Fibrin glue being injected into a transsphincteric fistula tract. (Reprinted with permission, The Cleveland Clinic Center for Medical Art & Photography © 2009–2020. All Rights Reserved)

Fistula Plug

The anal fistula plug was developed with similar goals to fibrin glue treatment: fistula healing by obliteration of the tract without sphincter division and resultant risk of incontinence. This procedure entails identification of primary fistula tract, passage of a biologic or synthetic plug through the fistula tract, and securement of this prosthesis to the internal opening with successful obliteration of the internal opening (Fig. 13.12a–c). The first study describing the use of graft material as an anal fistula plug, as compared to fibrin glue, occurred in 2006 by Johnson et al. [78]. In this initial series of 15 patients with bioprosthetic mesh plug, they observed an 87% closure rate. Based on this promise, commercially available plugs were created, all with the same goal: creating a scaffolding in which native tissue could grow to close a fistula tract. Subsequent studies observed widely variable success rates of 24–88% [79–82]. Decreased success was attributed to many things: inadequate tract debridement, excessive tract debridement, inadequately secured plug, and presence or lack of preoperative seton, none of which have been shown to be significant factors of success. These mixed success rates as well as increased cost have kept fistula plug from becoming a widely accepted first-line treatment for complex fistula-in-ano [19, 29].

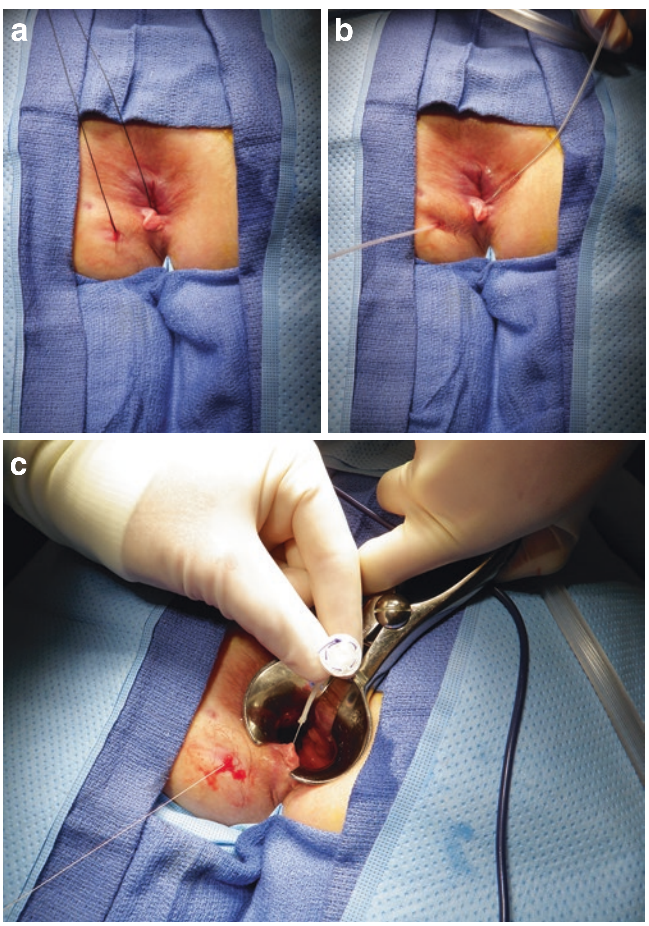

Fig. 13.12 (**a**): Transsphincteric fistula with silk suture (marker suture) placed through the tract. This will be used to pull the fistula brush through the tract. (**b**): Fistula brush being pulled through the tract to gently debride granulation tissue. (**c**): Fistula plug being pulled retrograde through the tract

While its role as a solitary treatment for complex fistula is limited, some have evaluated the role of fistula plug as an adjunct to other complex repairs, such as endorectal advancement flap (ERAF) and ligation of intersphincteric fistula tract (LIFT), as discussed below.

Endorectal Advancement Flap (ERAF)

Endorectal advancement flap entails debridement or excision of the fistula tract and mobilization of a wide-based mucosal/submucosal rectal flap, followed by coverage of the internal opening after removal of overlying tissues and suture closure of the internal opening (Fig. 13.13a–d). Based on its reproducible reasonable success rates of 60–100% [83–91], endorectal advancement flap has been accepted as a first-line treatment option for complex anal fistulas. Keys to successful flap survival include adequate blood supply, via the wide-based submucosal plexus, and lack of tension, requiring adequate length of mobilization. There is variability regarding degree of circular muscle (internal sphincter) included in the mucosal and submucosal flap, with a direct correlation between degree of muscle involvement and flap viability [92]. Importantly, however, there is an inverse relationship between degree of muscle involvement and subsequent incontinence. Recurrence is associated with smoking, recurrent disease, Crohn's disease, prior horseshoe abscess, and elevated BMI [93–97]. Contraindications include Crohn's disease, undrained sepsis, persistent secondary tracts, fistula diameter greater than 3 cm, malignancy or radiation-related etiology, and anorectal stricture [98]. Recently, Yellinek et al. evaluated flap configuration and did not show significant difference in recurrence between rhomboid designed flap (64%) and elliptical flap (62%) [99]. Likewise, there is no change in success between standard curette debridement and fistulectomy excision of fistula tract[86]. Repeat endorectal advancement flap is feasible and carries with it good success rates; however, it is also associated with a higher rate of recurrence than initial ERAF repair [100, 101].

Importantly, while this procedure does not directly divide sphincter muscle, incorporation of sphincter fibers in the advancement flap to varying degrees does lead to worsening continence in up to 35% of patients [86, 102].

Both anal fistula plug and fibrin glue have been suggested as adjuncts to endorectal advancement flap to improve success. Studies evaluating addition of fibrin glue to ERAF unfortunately revealed higher rates of failure than with flap alone [93, 103]. Likewise, advancement flap closure over a

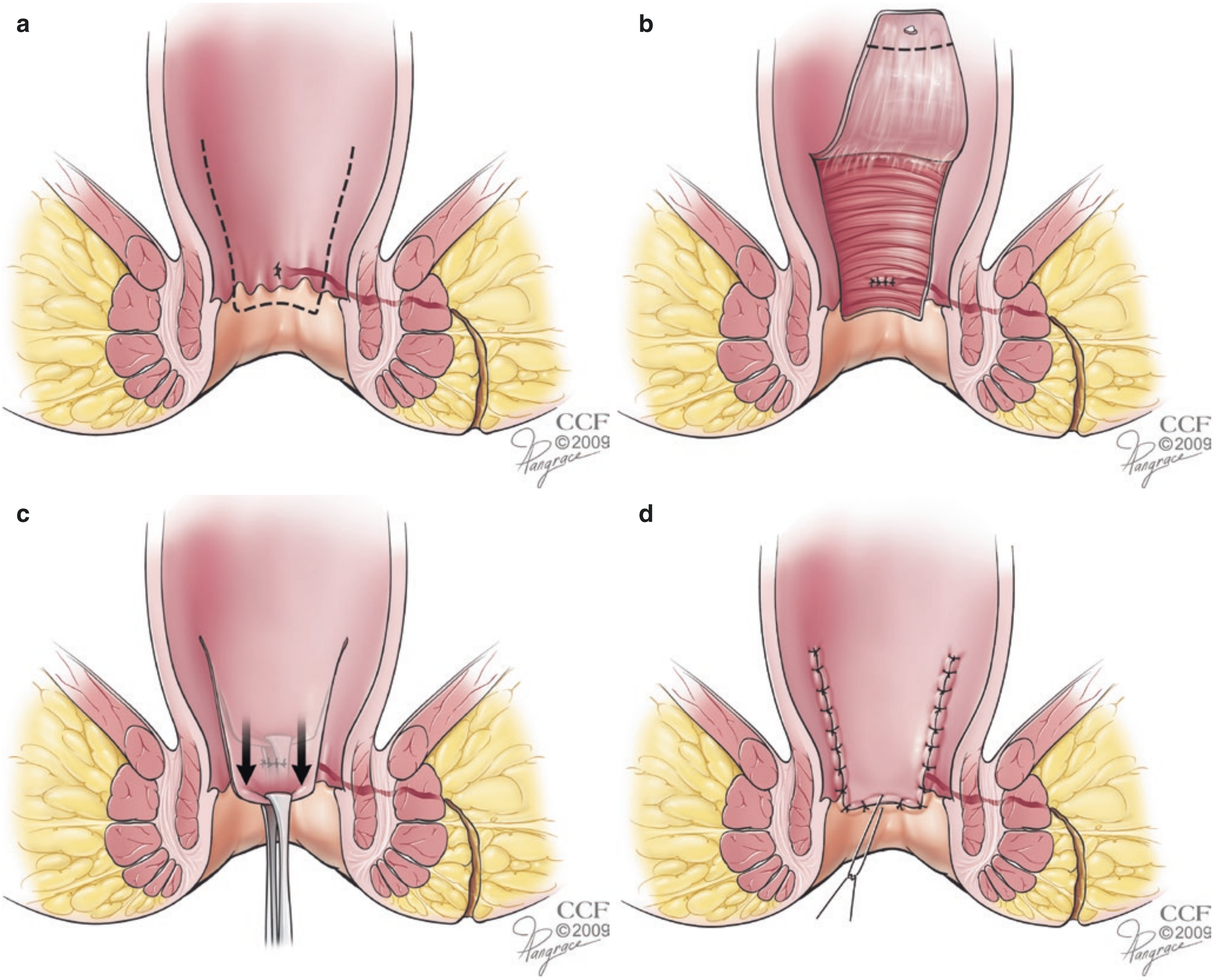

Fig. 13.13 (**a**): Dotted line represents the outline of intended tissue flap harvest. (**b**): Mucosal/submucosal flap raised with appropriate dimensions as well as area at the tip, intended for excision. (**c**): Flap being stretched into place after closing the internal opening at the muscular level. (**d**): Completed endorectal advancement flap. (Reprinted with permission, The Cleveland Clinic Center for Medical Art & Photography © 2009–2020. All Rights Reserved)

fistula plug does not confer improved healing as compared to fistula plug alone. It may be beneficial to incorporate platelet-rich plasma with ERAF [104]; however, additional studies are required.

An alternative flap design is described using a dermal advancement flap instead of a mucosal flap (Fig. 13.14), which carries with it the theoretical decreased risk of mucosal ectropion. Such flaps can be fashioned in a "house" or "diamond" configuration or as V-Y advancement of perianal skin. Studies evaluating this therapy are heterogeneous, making it difficult to make definitive recommendations. Overall, this procedure is safe and has low to moderate rates of incontinence (10–20%) [92, 105] and moderate rates of success (50–70%) [98, 106–109].

Ligation of Intersphincteric Fistula Tract (LIFT)

Similar to ERAF, ligation of intersphincteric tract (LIFT) is now widely accepted as a first-line treatment for complex fistula-in-ano due to reasonable success rates and sphincter preservation [19]. LIFT was developed as a "total sphincter preserving" technique in 2007 by Rojanasakul et al. [110]. This procedure entails dissection of intersphincteric space until the mature fistula tract is encountered and subsequently divided and doubly ligated (Fig. 13.15a–d). The internal and external wounds are debrided and left open to drain. In the initial description in 2007, authors reported 94.4% healing rate with 0% rate of incontinence [110]. A subsequent retrospective observational study of 251 patients by the initial authors reported 87.7% rate of healing [111]. Limitations include lack of reporting on complications, specifically changes to continence, and varied patient population (55.8% low transsphincteric, 10.8% intersphincteric, 6.0% high transsphincteric, 25.5% semihorseshoe ischioanal, 2.0% horseshoe ischioanal). As many studies of sphincter-sparing techniques include only complex fistula-in-ano, it is important to consider that the patient population in this review was comprised of 66.6% simple anal fistulas. Overall, rates of success range from 61% to 94% with rare instances of change in continence [112–117]. Interestingly, recurrence was associated with shorter fistula tract ($p < 0.01$) [117]. When the LIFT procedure fails, it most often results in drainage via the intersphincteric incision as a persistent intersphincteric fistula which can subsequently be managed with simple fistulotomy [118–120]. Madbouly et al. randomized 70 patients to LIFT or endorectal advancement flap (ERAF) [121]. Authors observed initial success rates of 94% and 91% for the LIFT and ERAF groups, which fell to 74% and 66% after 1 year follow-up, respectively, emphasizing the importance of length of follow-up and risk of late failure. A recent meta-analysis of the topic indicates that results from ERAF and LIFT are quite similar [122].

Fig. 13.14 Anocutaneous advancement flap (from outside to inside). Can be used when creating an endorectal advancement flap leading to a mucosal ectropion

Variations of the LIFT technique have been suggested: BioLIFT, LIFT plus, LIFT-PLUG, LIFT + ERAF. The BioLIFT incorporates a bioprosthetic graft placed in the inter-

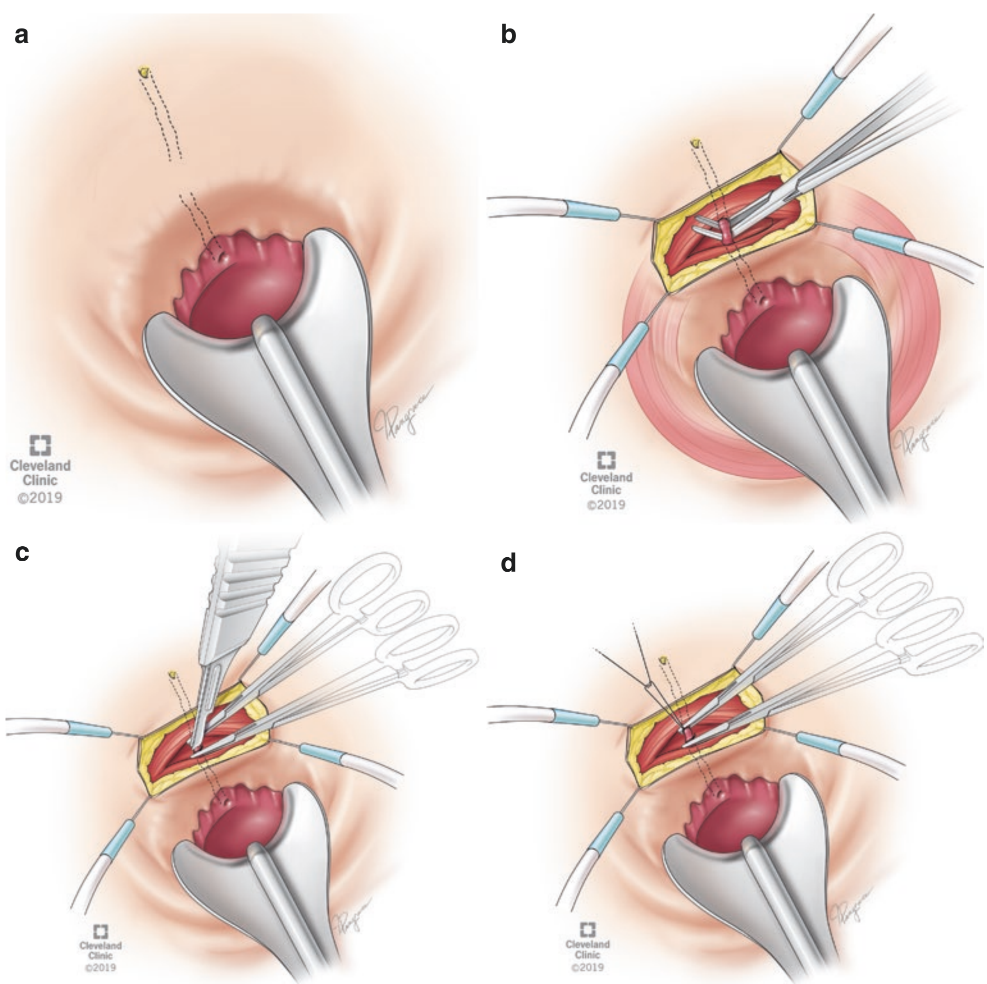

Fig. 13.15 (**a**): Transsphincteric fistula tract, illustrating the intersphincteric portion of the tract prior to incision for LIFT. (**b**): Intersphincteric incision with isolation of the intersphincteric portion of the tract. (**c**): Division of the intersphincteric portion of the tract. (**d**): Ligation of the intersphincteric portion of the fistula tract. (Reprinted with permission, The Cleveland Clinic Center for Medical Art & Photography © 2009–2020. All Rights Reserved)

sphincteric plane with the goal of decreasing communication between the two portions of the fistula tract. Concern regarding this procedure surrounds the risk of additional intersphincteric dissection to accommodate the prosthesis as well as the cost of the bioprosthetic. Lau et al. evaluated LIFT and BioLIFT and found similar success rates of 80.2 and 81.9%, respectively [123]. Thus far, BioLIFT cannot be supported as an advantage based on the cost and equivocal results.

Han et al. evaluated traditional LIFT procedure with the LIFT-PLUG procedure [124]. In this operation, a bioprosthetic plug is passed through the previously debrided external sphincter tract via the intersphincteric incision and secured in place. These authors observed shorter healing time (22 days vs. 30 days, $p < 0.001$) and higher primary healing rate (94.0% vs. 83.9%, $p < 0.001$) in the LIFT-PLUG group than the standard LIFT group, respectively.

The LIFT plus procedure incorporates a partial fistulotomy of the distal tract external to the external sphincter to promote external drainage. LIFT plus may confer an advantage over LIFT with success rates of 85% vs. 81% (0.0529) as observed by Sirikurnpiboon et al. [125]. Overall, with the current data available, none of these three techniques can be confidently recommended over standard.

Novel Surgical Therapies

Fistula Tract Laser Closure (FiLaC™)

Closure of an anal fistula tract using radially emitting laser probe was first described in 2011 and subsequently in 2014 as a novel technique to heal simple and complex anal fistulas without risk to continence [126–128]. In its initial description, the authors described mechanical tract debridement with endorectal advancement flap, followed by laser treatment of the tract with a radial fiber connected to a diode laser [126]. Subsequent descriptions did not include endorectal advancement flap. Success rates were reported at 77–82% in these initial small series with no instances of incontinence. Since then, additional studies observed a decrease in primary success rates of 33–71% [129–131]. In those with primary failure, secondary success was achieved in some with repeat-FiLaC™, fistulectomy with sphincter repair, or primary fistulotomy that was possible due to distal migration of the tract after FiLaC™. Increased success was associated with intersphincteric-type, short fistula tract (<30 mm) and history of prior seton. One study to date has described minor mucous or gas incontinence at a rate of 1.7% during their median 25.4-month follow-up [131].

Video-Assisted Anal Fistula Treatment (VAAFT)

Meinero and Mori first described the video-assisted anal fistula treatment (VAAFT) procedure in 2006, with which they observed promising success with 74% primary closure rate and 87% overall healing after 1 year of follow-up [132]. This procedure is characterized by direct visualization of the primary fistula, secondary tracts, and internal opening. A Karl Storz fistuloscope is passed through the external opening to the internal opening with continuous glycine-mannitol irrigation. Once the internal opening is identified, it is marked with a stay suture. A unipolar electrode is inserted into the fistuloscope to fulgurate the fistula walls including the openings to any secondary tracts. This is followed by debridement of necrotic material with a brush and finally closure of the internal opening, traditionally with surgical stapler, absorbable suture, or advancement flap. The closure may be further enforced by fibrin glue injection just beneath the prior internal opening. This procedure is similar in many ways to the FiLaC™ procedure but, however, has the additional benefit of direct visualization.

Garg et al. evaluated VAAFT with a meta-analysis of 8 studies including 786 patients [133]. The authors identified a 76% success rate, 16.2% complication rate, and no reports of worsening level of continence. In a subsequent meta-analysis by Emile et al. of 788 patients across 11 studies, rates of success remained high at 86.8% after medial follow-up of 9 months [134]. Complication rate remained low at 4.8% observed. Interestingly, recurrence rates varied by type of internal opening closure. Staple closure was the lowest at 15.3%, followed by suture closure 17.7%, and lastly recurrence was highest with advancement flap closure. VAAFT is a promising technique in the growing field of fistula management.

Fistulotomy with Primary Anal Sphincter Reconstruction

Fistulotomy was previously only regarded as an appropriate treatment for simple anal fistula given the increasing risk of incontinence with increasing fistula complexity. In recent years, there have been several promising studies evaluating the role of fistulotomy with primary sphincter reconstruction (Fig. 13.16a–c). These studies reveal high success rates (91–96%) and low incontinence rates (2–13%), with the post-defecation soiling being the most common type of de novo incontinence [135–138]. Risks of recurrent disease and incontinence were significantly increased in those with prior recurrent fistula, complex fistula, presence of secondary tracts, and prior seton drainage. In this technique, a primary fistulotomy is performed, with or without fistulectomy, followed by end-to-end primary sphincteroplasty with dissolvable sutures. Proponents of this technique argue its favorable success and complication profile as compared to many of the other surgical options for complex anal fistulas.

Stem Cell Therapy

There has been a lot of excitement regarding autologous stem cell therapy in the treatment of fistula-in-ano. In a phase

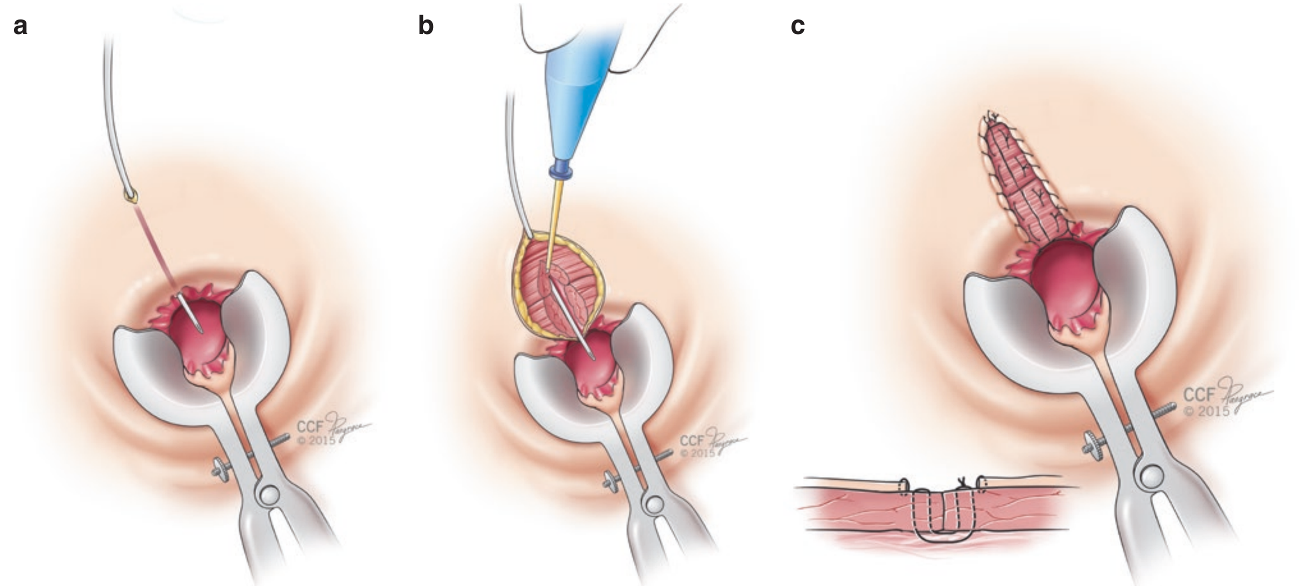

Fig. 13.16 (**a**): Transsphincteric fistula with indwelling probe prior to fistulotomy. (**b**): Fistulotomy performed over probe. There is an appreciable amount of external sphincter being divided. (**c**): Sphincter repair being performed after fistulotomy and tract debridement. (Reprinted with permission, The Cleveland Clinic Center for Medical Art & Photography © 2009–2020. All Rights Reserved)

II clinical trial, Garcia-Olmo et al. randomized 35 patients to fibrin glue alone or fibrin glue with 10 million adipose-derived stem cells [139]. Their study observed a 4.43 increased relative rate for healing (CI 1.74–11.27, $p < 0.001$) in those with adipose-derived stem cells in addition to fibrin glue (71% healing vs. 16%). Unfortunately, healing rates decreased from 71% to 62.5% in the stem cell group at 1-year follow-up. In their phase III trial, Herreros et al. on behalf of the FATT collaborative group performed a multicenter, randomized, single-blind clinical trial of 200 patients over 19 centers [140]. Participants were randomized to the following treatments after uniform closure of the internal opening: 20 million stem cells, 20 million stem cells with fibrin glue, and fibrin glue alone. There was no significant difference between groups at both 24–26-week and 1-year follow-up, ~40% and ~50%, respectively. The authors pointed out that the results were much more promising at their pioneer center, with healing rates at 24–26 weeks of 54.56%, 83.33%, and 18.18% for the stem cell alone, stem cell + fibrin glue, and fibrin glue alone groups, respectively ($p < 0.001$). Additional studies are ongoing regarding stem cell therapy including combinations with fibrin glue, plasma-rich protein, and coated fistula plugs [141–143].

Over the Scope Clip (OTSC® Proctology)

In 2012, Prosst and Ehni described the use of a clip to close the internal opening, using the OTSC® Proctology device. In this procedure, a super-elastic nitinol clip is placed with a specialized endoscope over the internal fistula opening. Initial small series observed success rates of 60–93% healing rates, with decreased healing in those with prior fistula operations. Discomfort from the clip was reported as minimal by study participants; however, the clip did require removal with the OTSC® Proctology clip cutter in the majority of cases [144–148]. This is a promising device; however, there is inadequate evidence to support its routine acceptance. Additional studies are required evaluating success, risks for failure, complication, and device cost.

Recommendation

There are a few main take-home points to consider in the management of acute anorectal abscess and anal fistula. In a patient with demonstrable abscess on physical exam, surgical drainage is the standard and can often be done in the office under local anesthesia with careful technique. Antibiotics are reserved for special circumstances including cellulitis and sepsis. Cure and preservation of continence are the overriding goals in the management of anal fistula, with continence perhaps taking precedence. A patient's quality of life would generally be better with an indwelling loose seton as opposed to living with significant incontinence. It is important to be aware of the multitude of methods that can be used to treat anal fistula. Failure rates of sphincter-sparing approaches are significant, and when one method fails, it is often useful to proceed to another. The importance of informed consent cannot be overemphasized. Failure rates should be discussed, expectations set at the onset, and patients well aware of their alternatives.

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