Endorectal Advancement Flap

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Introduction

Treatment of anal fistula can be a delicate balance between maximizing the chances of successful healing and avoiding complications from the surgery itself, particularly incontinence from division of the anal sphincters. Many surgical procedures have been used in the treatment of anal fistula, with varying success. Endorectal advancement flap can be a useful tool in the armamentarium of the surgeon faced with an anal fistula, including in complex cases such as Crohn's disease or recurrent fistula.

First described by Noble in 1902 for rectovaginal fistulas [1], the application of this technique to anal fistulas was published soon after by Elting [2]. However, advancement flap did not gain wider popularity until much later. It was not until 1948 that Laird described modification of this to a partial-thickness flap [3], and widespread use of the technique did not follow for many decades. However, as the advantages of the operation became more apparent, endorectal advancement flap became one of the most widely used surgeries to treat fistula in ano.

The endorectal advancement flap has theoretical advantages over other strategies to treat anal fistula. By covering the internal opening of the fistula, it interrupts the course of the fistula, thus encouraging healing. The flap also avoids any full-thickness division of the anal sphincters, helping to preserve continence. The location of the flap on the high-pressure side of the fistula maintains the flap in place, rather than tending toward disruption of the flap by pressure transmitted through the fistula if the flap were to be located on the low-pressure side of the fistula. Thus, endorectal advancement flaps have great potential to effect cure in the treatment of anal fistulas.

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Technique

The patient needs no special preparation, although some surgeons may prefer enemas to clear the rectum of stool. Perioperative antibiotics are not necessary although they are used by many surgeons. The patient is placed under either regional or general anesthesia and positioned in the prone jackknife position. The buttocks are spread and taped to provide exposure. Careful attention to positioning, such that the patient's hips are at the break point in the bed, greatly facilitates good visualization during the course of the operation, and a headlight is indispensable. Although posterior fistulas can be more difficult to address in this position than anterior or lateral fistulas, the prone jackknife position is still preferable to lithotomy as it provides better exposure.

A Pratt or Hill-Ferguson retractor is used to visualize the internal opening and the fistula tract is probed to delineate the anatomy. The fistula should be characterized by type (intersphincteric, transsphincteric, extrasphincteric, or suprasphincteric), the amount of muscle involved, and the location of the internal opening. Careful attention should be paid to identifying any additional tracts, as undrained tracts will contribute to failure of the flap. Beginning distal to the internal opening, a partial-thickness flap is raised incorporating mucosa, submucosa, and some muscle fibers (Fig. 14.1). As the flap is developed, the width should gradually increase so that the base is at least twice the width of the apex of the flap to ensure adequate blood supply to the flap. Dissection of the flap continues cephalad until the flap reaches easily past the internal opening without excessive tension. At this point many surgeons perform a partial fistulectomy, coring out the fistula tract beginning at the external opening until the sphincter muscles are reached. If a fistulectomy is not performed, the fistula tract should be curetted to remove granulation tissue and debris.

The internal opening should be closed using interrupted absorbable sutures such as 2-0 polyglactin. The tip of the flap, containing the internal opening, is excised. The flap is then

H. Abcarian (ed.), *Anal Fistula: Principles and Management*, DOI 10.1007/978-1-4614-9014-2_14,

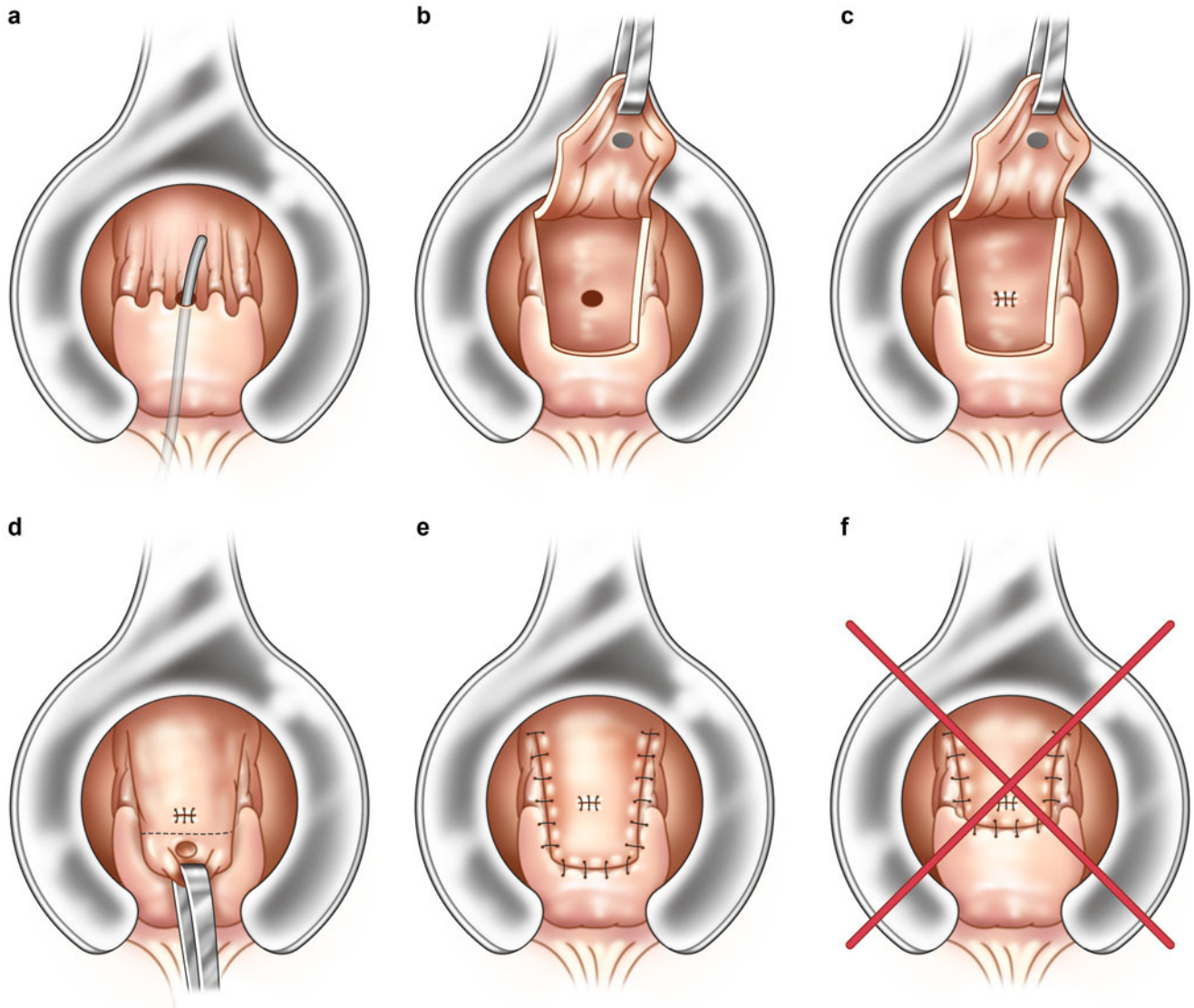

Fig. 14.1 Rectal advancement flap. (**a**) Fistula in ano, with internal opening at the dentate line. (**b**) Elevation of partial-thickness flap, exposing internal opening. (**c**) Closure of internal opening. (**d**) Advancement of flap with excision of portion containing internal opening. (**e**) Completed flap covering internal opening. Note this advances mucosa distal to dentate line. (**f**) Incorrectly illustrated flap, showing internal opening above dentate line and flap advancing only to dentate line

sewn into place using interrupted absorbable sutures, again such as 2-0 polyglactin. While doing this, the sutures should be spaced more closely together on the flap than on the rectal defect so that the flap is gradually advanced to cover the internal opening without excessive tension. When properly performed, the flap should extend distal to the dentate line if the internal opening was at the dentate line (Fig. 14.1, panel e). However, many publications regarding endorectal advancement flap erroneously illustrate the internal opening above the dentate line with the finished flap extending to the dentate line (Fig. 14.1, panel f); when properly performed an advancement flap for a fistula with the internal opening at the dentate line results in a slight degree of ectropion. The area is then inspected for hemostasis; rectal packing is not necessary. Many publications report an inpatient stay after surgery of up to 3–4 or even 6 days [4–9], but the patient can be discharged the same day in the majority of cases. Pain medication, sitz baths, and bulk laxatives should be prescribed; no restricted diet or other laxatives are necessary.

Results

Healing of Fistula

The reported success rates for primary healing of cryptoglandular fistulas after endorectal advancement flap vary widely from 59 to 97 % (Table 14.1), but are generally in the

Table 14.1 Results of endorectal flap repair of cryptoglandular fistulas. Primary success rate is the percentage healed after first attempt at repair with advancement flap; ultimate success rate is percentage healed after additional intervention for initial failures

Authors	Number of patients	Fistula type	Primary success rate (%)	Ultimate success rate (%)	Comments
Christoforidis et al. [19][a]	43	TS	63	–	14 patients had fistulectomy and 7 had fibrin glue in addition to flap
Chung et al. [57][a]	96	TS	60	–	Mucosal rather than partial-thickness flaps
Dubsky et al. [41]	54	High TS or SS	76	–	
Golub et al. [20]	164	115 (70 %) TS, SS, ES 15 (9 %) IS 34 (21 %) not recorded	97	–	Success rate based on long-term follow-up in 61 patients; 10 patients had fistulas in the immediate postoperative period requiring additional intervention but were not considered recurrences
Koehler et al. [52][a]	15 mucosal 18 partial- or full-thickness	Dorsal horseshoe	73	88	Ultimate success rate includes patients who had anocutaneous flaps ($n=8$) or suture closure of internal opening ($n=11$)
Mitalas et al. [34][b]	162	TS	59	–	
Mitalas et al. [16][b]	80	TS	68	–	
Mitalas et al. [31][b]	54	TS	63	–	
Mitalas et al. [18][b]	26	TS	69	90	All of these patients were having repeat flap surgery, with a success rate of 69 %; in combination with the first surgery this leads to an ultimate success rate of 90 %
Mitalas et al. [39][b]	278	TS	64	–	
Ortiz and Marzo [49]	103	91 (88 %) TS 12 (12 %) SS	93	–	All patients also had fistulectomy
Ortiz et al. [17][a]	91	High TS or SS	82	–	
Ortiz et al. [14][a]	16	TS	88	–	
Perez et al. [8][a]	30	High TS or SS	93	–	
Schouten et al. [36]	44	TS	75	–	
van Koperen et al. [42][a]	54	TS	83	–	
Wang et al. [56][a]	26	TS	64	–	

TS transsphincteric, *SS* suprasphincteric, *ES* extrasphincteric, *IS* intersphincteric
[a]Study included other interventions (e.g., anal fistula plug, fibrin glue) but reported results are only for patients who had endorectal flap
[b]These studies include many of the same patients

70–80 % range. Some of this variation in success rates may be due to the duration of follow-up and the means of defining and detecting recurrence. The mean time to recurrence has been found to range widely from a median of 8 weeks to 9 months [10–12]. Some studies show the majority of recurrences occurring within the first year [13], or even all recurrences occurring within the first 3 months [14], while other studies have shown recurrences up to 55 months after surgery [7, 15].

Studies designed specifically to examine the length of follow-up needed to capture all recurrences demonstrate that the majority of recurrences occur early. Mitalas et al. [16] attempted to define the duration of follow-up required by following 80 patients who had an endorectal advancement flap for a median of 92 months. They found a median healing time of 3.6 months and one patient presenting with a recurrence at 28 months. However, in this study the long-term follow-up was performed by having patients fill out a questionnaire rather than by an office visit with examination, so some recurrent fistulas may not have been detected. Ortiz et al. [17] conducted follow-up of 91 patients with examinations monthly until the wound healed and annually after healing. Their results, over a median follow-up of 42 months, did not differ significantly from those of Mitalas, showing a mean time to recurrence of 5 months and no recurrences after 1 year. Thus, it appears the majority of recurrences will become clinically apparent within the first year, but a small minority of patients may experience late recurrence after initial healing.

Healing Rates After Repeat Flap

If endorectal advancement flap fails and the patient has a recurrence, repeat flap is an option for treatment. Mitalas et al. performed a second advancement flap in 26 patients with transsphincteric cryptoglandular fistulas who had recurrence after an initial rectal advancement flap [18]. The healing rate after the second flap was 69 %. In combination with the patients with successful fistula healing after the first flap,

endorectal advancement flap was successful in 90 % of patients after a maximum of two attempts. In addition, patients undergoing repeat flap had no change in fecal incontinence scores, suggesting that repeat flap carries a low risk of incontinence.

Complications

Endorectal advancement flap is generally associated with a low risk of complications; many case series do not report complications. The most common complication appears to be bleeding. In a case series of 189 patients with mucosal flaps by Aguilar et al. [4], there were two cases of delayed bleeding; bleeding was also reported in 2 of 43 patients by Christoforidis et al. [19], 1 of 167 patients by Golub et al. [20], 1 of 48 patients by Muhlmann et al. [12], and 1 of 31 patients by Joo et al. [6].

There are also reports of urinary retention [21], including a 7.8 % rate of postoperative urinary retention by Golub et al. [20]. For this reason it is reasonable to ensure patients can void before they are discharged from the recovery area, in order to avoid emergency room visits for urinary retention. In the Aguilar study [4] there were two cases of anal stenosis; however, 80 % of these patients also had a hemorrhoidectomy, so it is unclear whether these complications arose as a result of the advancement flap or the hemorrhoidectomy.

Effect of Other Factors on Healing Rates

Patient Characteristics

In general there is no effect of age on healing rates in multiple studies [22–27]. In studies that have shown a difference in healing rates with age, increased age is associated with a higher likelihood of healing. Gustafsson et al. found a trend toward a higher likelihood of healing with age greater than 50 [28]. Similarly, healing rates were 45.7 % for age less than 40, 67.9 % for those aged 40–60, and 100 % for those older than 60 in a paper by Sonoda et al. [29]. One confounding factor may be the prevalence of Crohn's; in the Sonoda paper a higher proportion of the younger patients had Crohn's disease while the older patients were more likely to have cryptoglandular fistulas. However, some of the studies demonstrating no effect of age on healing rates included significant numbers of patients with Crohn's disease [22, 26]. Thus, it is unclear whether the decreased healing at younger ages found in some studies is due to a differential prevalence of Crohn's among the study patients at different ages.

The majority of studies have found that gender does not affect fistula healing rates [28], including in multiple logistic regression analyses after controlling for other factors [24, 25, 27]. However, one study did find a significantly greater proportion of men had primary healing of their fistula [30]. Seventeen of 24 males vs. 6 of 18 women in this study had primary healing of their fistula after closure of the internal opening was performed; in the majority of cases this closure was done with a partial-thickness endorectal advancement flap.

The data on the effect of obesity on healing rates is mixed. Schwandner et al. found that obesity, defined as a body mass index (BMI) greater than 30 kg/m^2, was associated with a decreased success rate for full-thickness flaps [23]. In this study, the recurrence rate was 14 % for non-obese patients vs. 28 % for obese patients, and this association continued after adjustment for other factors. Among the patients with recurrence of their fistula, there was also a higher need for reoperation for abscess among obese patients vs. non-obese patients. However, other studies have found no difference in recurrence with obesity [24, 26, 28], or even increased healing with greater body surface area [29]. Many studies have found no effect of smoking on flap success [23, 25, 28, 31].

However, smoking is associated with a higher recurrence rate in other studies [22, 24, 27], which may be plausible due to the possibility of decreased blood flow to the rectal mucosa as a result of smoking [31]. All of these studies performed multivariate analyses which demonstrated that smoking was independently associated with fistula recurrence after endorectal advancement flap. Ellis and Clark [27] found a 51 % recurrence rate for smokers vs. 19 % for nonsmokers undergoing endorectal advancement flap. Similarly, Zimmerman et al. [24] found a 40 % recurrence rate among smokers vs. a 21 % recurrence rate among nonsmokers; in this study the healing rate was significantly less if the patient smoked more than ten cigarettes per day. It may therefore be prudent to encourage patients to quit smoking prior to endorectal advancement flap.

The use of systemic medications in Crohn's disease also has the potential to affect success rates. Steroid use has not been found to affect healing rates in some studies [10, 22], with other studies showing a trend toward an increased likelihood of failure with steroid use [26, 29]. This may be due to steroid use serving as a proxy for a greater severity of Crohn's disease, which would predispose patients to recurrence or persistence of their fistulas. In contrast, there is evidence that biologic immunomodulators may contribute to the success of endorectal advancement flaps in patients with Crohn's disease. In a case series of 19 patients with Crohn's disease who were treated with preoperative infliximab, eight healed and did not require surgery. The remaining 11 underwent endorectal advancement flaps with an 82 % success rate [32]. Similarly, in a retrospective review of 218 patients with Crohn's undergoing a variety of surgical interventions

for anal fistulas, there was improvement or healing in 71.3 % of those receiving biologic immunomodulators vs. 35.9 % of those not receiving biologics, although the overall healing rate was low at 26.5 % for surgery alone and 36.6 % for surgery plus biologic immunomodulators [33]. Biologics thus show some promise as an adjunct to endorectal advancement flaps in patients with Crohn's disease.

Fistula Characteristics

Although there have been some studies that show no difference in recurrence rates based on etiology of the fistula [7], the preponderance of evidence suggests that fistulas associated with Crohn's disease tend to have a higher recurrence rate than fistulas of other etiologies [5, 10, 22, 29]. For example, Sonoda et al. [29] found a healing rate of 50 % for Crohn's fistulas vs. 77 % for cryptoglandular fistulas, and Mizrahi et al. found rates of 43 and 67 %, respectively [10]. There is some evidence that the activity of Crohn's disease, not just the presence of Crohn's, can affect recurrence rate also. A success rate of 25 % has been found in the presence of small bowel Crohn's, vs. 87 % in the absence of small bowel Crohn's [6]. In contrast, though, Crohn's activity was not found to affect the healing rate after rectovaginal fistula repair (done in most cases with a mucosal advancement flap although a significant minority of patients had other procedures performed) [26]. Patients with Crohn's disease should therefore be counseled that they may experience a higher rate of recurrence after endorectal advancement flap than patients with fistulas due to cryptoglandular or other causes.

Location of the fistula does not appear to affect healing rates, with anterior, posterior, and lateral fistulas having similar healing rates [23, 24, 34]. Data are mixed as to whether different types of fistulas have differential healing rates. Mizrahi et al. found no difference in healing rates between anorectal, rectovaginal, pouch-perineal, and rectourethral fistulas in a case series of 106 flaps in 94 patients [10], although there were necessarily small numbers of some of these types of fistulas. A number of studies have compared rectovaginal fistulas to other fistulas, with a higher healing rate [6, 35], lower healing rate [5], and no difference [27] all having been found.

Data are similarly mixed as to the effect of fistula complexity on healing rates. "Complex" fistulas (horseshoe, suprasphincteric, or anovaginal fistulas or those with other extensions) have not been found to have lower healing rates than more straightforward fistulas [28, 30]. Fistulas with a horseshoe component have been found to have higher [34], lower [13], and similar [24] healing rates when compared to fistulas without a horseshoe component. The healing rate for rectovaginal fistulas was not found to vary by the location of the fistula (high vs. low) or size of the fistula opening by Pinto et al. [22]. Referral to a tertiary institution may also serve as a proxy for fistula complexity, but has not been found to affect success rates in the studies that have examined this factor [23, 25]. Thus, surprisingly, the majority of studies show no effect of complexity on healing rates.

Prior surgical attempts to repair the fistula are another factor that may serve as a proxy for fistula complexity. Schouten et al. found a success rate of 87 % for transsphincteric cryptoglandular fistulas treated with endorectal advancement flaps if there had been only one or no prior attempts at repair vs. a success rate of 50 % if there had been two or more attempts at repair [36]. Lowry et al. found similar results for among a group of patients treated for rectovaginal fistulas with endorectal advancement flaps (of note, 31 % of these patients had concomitant overlapping sphincteroplasties). Success rates were 88% among those with no prior repairs, 85 % with one repair, 55 % with two repairs, and 100 % with three repairs, with the relative risk of failure for those with two prior attempts vs. none being 3.71 [37]. Additional studies have found a decreased success rate [7, 27] or trend toward this [38] with prior attempts at repair. However, many other studies have found no difference in the recurrence rate in the presence of prior attempts at repair [6, 10, 25, 28] or any relationship to the number of prior attempts at repair [23, 24, 26]. Thus, while patients with a history of multiple prior attempts at repair should be cautioned about the risk of failure, there is evidence that they can expect a success rate which may not be markedly different than patients who have not had prior attempts at repair.

Operative Technique

A seton is often placed prior to surgery to allow maturation of the fistula tract prior to endorectal advancement flap. There is some evidence that this may contribute to a greater likelihood of healing. A greater success rate for endorectal flap after seton placement [29], or a trend toward this, [26] has been found in some case series but not in others [24, 25, 39]. However, in all of these studies the choice of a preoperative seton was not random, suggesting that these were likely placed in situations where the surgeon anticipated a lower likelihood of healing. The finding of no difference or an increase in healing in these presumably more difficult fistulas suggests that setons are of benefit. Seton placement for a minimum of 6 weeks prior to flap should therefore be strongly considered.

Reports vary widely on the use of antibiotics and constipating medications. While the majority of centers administer a dose of perioperative antibiotics, some centers also continue antibiotics postoperatively for variable durations. Some centers limit patients to a clear liquid diet for a period of time and/or place them on constipating medications, while others have no particular restrictions. Studies in general do not show a benefit of postoperative antibiotics [7, 29] or a postoperative regimen including clear liquid diet, immobilization, and antibiotics [39]. Only one report demonstrates

increased healing with postoperative antibiotics [30]. Not all of the patients in this study had flaps performed, and all had fistulectomy performed in addition, so the generalizability to patients undergoing endorectal advancement flap is limited. In terms of postoperative bowel regimen to promote constipation, no difference in healing rates has been found between a constipating regimen and no regimen [7, 10]. Thus, perioperative antibiotics may be used, but postoperative antibiotics and a restricted bowel regimen are not necessary.

Partial-thickness flaps are likely more successful than full-thickness flaps. In a review of the literature incorporating a total of 1,654 patients, Soltani and Kaiser examined the effect of flap type on healing rates [40]. They found that partial-thickness flaps were used more often in the studies reporting above-average success rates, while full-thickness flaps were associated with below-average success rates except in one study [41]. Mucosal flaps were represented equally in studies reporting above- and below-average success rates. Partial-thickness flaps, incorporating mucosa, submucosa, and some muscle fibers, should be preferred.

The presence of a diverting stoma has not been found to have an effect on fistula healing after endorectal advancement flap [10, 26, 29]. However, all of these studies were case series in which the choice of whether to perform a stoma was nonrandom. Most likely the patients selected to have a stoma had fistulas that were thought to have a low likelihood of healing, and as such it is unclear whether the stomas performed in these cases contributed to a higher healing rate than would otherwise have been found for these difficult fistulas. Diverting stoma may be a good option in selected cases.

Modifications to the Endorectal Advancement Flap

A number of modifications to the endorectal advancement flap technique have been attempted, but generally have not led to increased success rates. Perhaps the most enthusiasm surrounded the injection of fibrin glue into the fistula tract in addition to performing the flap. Although one study found no effect of glue injection on healing, there were only 12 patients who had glue injected. Instead, there is good evidence to suggest that fibrin glue decreases the chance of successful healing. Both a case–control study [42] and a randomized controlled trial [43] have demonstrated a decreased success rate with glue. In the case–control study, 26 patients who had fibrin glue and advancement flap were matched to 54 who had advancement flap only. The recurrence rate was 17 % for advancement flap alone vs. 46 % for flap and fibrin glue. Similarly, in the randomized controlled trial there was a recurrence rate of 20 % for flap alone vs. 46 % for flap and fibrin glue (but these patients had either mucosal advancement flaps or anodermal flaps rather than partial-thickness rectal flaps). Fibrin glue should not be used in conjunction with advancement flap. Sileri et al. performed a similar injection with porcine dermal collagen matrix, achieving success in 10 of 11 patients [44], but experience with this material is limited.

Gustafsson and Graf did a randomized controlled trial comparing flap alone to flap with a gentamicin-collagen sponge implanted underneath and found no difference in healing rates between the two groups [28]. Similarly, van Onkelen et al. found a healing rate of only 51 % when performing the LIFT (ligation of intersphincteric fistula tract) procedure in addition to endorectal advancement flap [45]. Thus, there are no modifications to the endorectal advancement flap that have been found to consistently improve outcomes over flap alone.

Continence

Although endorectal advancement flaps do not divide full-thickness muscle, there are a number of reasons why they may negatively affect continence. A partial-thickness flap does take some muscle fibers, including some of the internal sphincter fibers if the flap extends distal to the dentate line as it does in most cases. If the internal opening is at the dentate line, flaps also cause the rectal mucosa to extend past the dentate line, creating some degree of ectropion. Finally, the amount of stretch that must be put on the sphincter muscles intraoperatively could cause some temporary or even permanent incontinence.

Clinical Results

Studies have come to a wide range of conclusions regarding continence after endorectal advancement flap. Encouraging findings regarding continence have been found by a number of studies, which have found no change in continence after flap [46, 47] or only transient changes in continence [15]. Similarly, when the Rockwood Fecal Incontinence Severity Index was measured preoperatively and postoperatively after initial and even repeat flaps, no change in scores was found [18]. Some studies even report improved continence after flap, perhaps because there is no longer drainage through the fistula tract [5, 35]. However, in one of these studies, which exclusively included patients with rectovaginal as opposed to anoperineal fistulas, some of the patients had sphincteroplasties in addition to advancement flaps, which may partially explain the improvement in continence [35].

The preponderance of studies indicates a decrement in continence in a minority of patients. Van der Hagen et al. found a decrease in continence postoperatively in 10 % of patients [48], and Mizrahi et al. similarly found 9% of patients to have a decrease in continence [10]. The reported postoperative prevalence of mild soiling or incontinence to flatus ranges from 8 to 15 % postoperatively [4, 11, 20, 49], although

it is unclear what the preoperative prevalence of incontinence was in these populations.

When continence has been assessed more formally using incontinence scoring systems, there continues to be evidence for a moderate decrement in continence in a subset of patients. Ortiz et al. measured the Cleveland Clinic Florida Fecal Incontinence (CCF-FI) score preoperatively and postoperatively, and found that the proportion reporting a score of zero (perfect continence) decreased significantly from 89 % preoperatively to 77 % postoperatively [17]. When Christoforidis et al. used the CCF-FI score to assess continence after advancement flap, 48 % reported perfect continence, while 35 % reported scores of 3 or 4, representing occasional incontinence to flatus with rare incontinence to liquid stool. Seventeen percent reported scores of 7–12, representing frequent liquid or occasional solid incontinence, but this group comprised four patients, two of whom were incontinent preoperatively and one of whom could not recall what his continence status was preoperatively [19].

There are also studies that would support a substantial negative effect of endorectal advancement flaps on continence. Postoperatively, Joy and Williams found 50 % of patients were incontinent to flatus, 21 % to liquid, and no patients to solids (patients who were incontinent to flatus and liquid were counted in both groups) [50]. One report found a 43 % prevalence of postoperative soiling [25] and another a 38 % incidence of soiling or incontinence to flatus among patients who had reported normal continence preoperatively [36]. At 1 year after surgery, 31 % of patients reported a slight decrease and 11 % a major decrease in continence in another study, although some of these patients had additional surgery with division of the internal sphincter before their 1-year follow-up [30].

Thus, the data on postoperative continence are mixed, but most studies seem to support a decrement in continence in a subset of patients. This is supported by a meta-analysis by Soltani and Kaiser which found a prevalence of incontinence after advancement flap of 13.2 % in cryptoglandular disease and 9.4 % in Crohn's (although it was not specified whether this was incontinence to flatus, liquid, and/or solid stool) [40]. Most likely a minority of patients will experience impaired continence postoperatively, although in many cases this will be soiling or incontinence to gas rather than incontinence to solid stool. Informing patients of this risk is an important part of the preoperative counseling process.

Manometric Results

Several studies have used anal manometry to quantify any changes associated with endorectal advancement flap, and the findings have been mixed. Some have found no difference in resting or squeeze pressures when comparing preoperative to postoperative values, although one of these studies included only nine patients [11, 47]. Many other studies have found manometric changes after endorectal advancement flap. Among 56 patients treated with advancement flap for mid to high transsphincteric fistulas, Uribe et al. found a significant decrease in resting pressure from a mean of 83.6 mmHg preoperatively to 45.6 mmHg postoperatively and in squeeze pressure from a mean of 208.8–169.5 mmHg, respectively [9]. Other studies, although also examining patients who had other procedures to treat anal fistulas, found decreases in resting [30, 51–53] and squeeze pressures [30, 52, 53] among the patients who had endorectal advancement flaps. These findings suggest that the incontinence reported by some patients after advancement flap is not due solely to ectropion causing fecal seepage, but results from decreases in the resting and squeeze pressures. Whether these decreases in resting and squeeze pressures are due to taking some internal sphincter fibers, stretching of the sphincter muscles during surgery or some other cause remains to be seen.

Risk Factors for Incontinence

Knowledge of factors associated with an increased risk of incontinence after endorectal advancement flap would be useful in counseling patients who may be at particularly high risk of incontinence. However, few studies have identified risk factors for incontinence. Schouten et al. found no difference in risk of incontinence based on age, sex, or the number of prior repairs [36]. Mizrahi et al. found an increased risk in the presence of prior attempts at repair [10]. Abbas et al. found an increased risk of incontinence with older age and high transsphincteric fistulas, but the majority of the patients in this study had fistulotomies, with only 10.6 % of patients having advancement flaps [13]. Although there is little data with which to counsel patients, the patients at higher risk for incontinence after advancement flap are likely those who are at higher risk with any procedure—those with baseline disturbances in continence, prior repairs, women, and older individuals.

Comparison with Other Surgeries for Fistula

Anal Fistula Plug

A number of studies have compared endorectal advancement flap to anal fistula plug, as both operations do not involve full-thickness division of the anal sphincter muscles. Two randomized controlled trials comparing plugs and advancement flaps have been conducted. In the first, by Ortiz et al., 43 patients with high transsphincteric fistulas of cryptoglandular origin were randomized to plug or flap and followed

for up to 1 year [14]. This study was closed prematurely due to a significantly higher rate of recurrence in the plug arm, with recurrences in 12 of 15 plug patients vs. 2 of 16 flap patients (relative risk for recurrence for plug vs. flap, 6.40, $p<0.001$). Van Koperen et al. similarly performed a randomized controlled trial of plug vs. advancement flap in high transsphincteric cryptoglandular fistulas [54]. This study found a 71 % recurrence in the plug arm vs. 52 % in the flap arm, which was not significant. However, this study was likely underpowered, as their power calculation assumed a 40 % difference in recurrence rate between the two arms. Conversely, a randomized controlled trial of acellular dermal matrix used in a manner similar to a plug found recurrence of only 4.5 % with acellular dermal matrix vs. 28.9 % with flap [55].

There are also a number of case series comparing success rates with plugs vs. flaps. Some have shown greater success rates with flap than plug [13, 19, 56], often despite longer follow-up in the flap group which would tend to predispose to a higher recurrence rate in the group with longer follow-up [19, 56]. Other studies demonstrated no difference in success rates between the two operations [12, 57]. However, in one of these studies the flaps were mucosal, rather than the more commonly performed partial-thickness flap, so it is unclear whether this would have affected the observed success rate [57]. Thus, the preponderance of evidence would suggest that the endorectal advancement flap has a higher success rate than the anal fistula plug, as many studies demonstrate this, and some of the studies demonstrating no difference in success rates between the two methods have methodologic concerns. In addition, there is an absence of any studies demonstrating the flap is inferior to the plug.

Fistulotomy

A number of retrospective reviews have compared fistulotomy and endorectal advancement flap. A higher recurrence rate has been found with flap as compared to fistulotomy [25, 48, 51], although one study found no difference in recurrence rate [13]. However, the problem with comparing these two methods, as acknowledged by many of the authors of these studies, is that endorectal advancement flap is generally used in situations where a fistulotomy would be associated with an unacceptably high risk of incontinence, either due to the high location of the fistula or due to preexisting impaired continence. Therefore, it is of little use to compare these two methods, particularly in retrospective reviews, as patients who underwent a flap were likely not candidates for fistulotomy. One randomized controlled trial comparing endorectal advancement flap vs. fistulotomy with concomitant sphincter repair has been conducted [8]. This study showed a 7.4 % recurrence rate in the flap group vs. 7.1 % in the fistulotomy group, with no difference in continence between the two groups. However, as the majority of surgeons do not perform sphincter repair at the time of fistulotomy or perform fistulotomy for high fistulas, this comparison cannot be generalized. Fistulotomies are appropriate for low fistulas in the absence of impaired continence, while endorectal advancement flaps are used for situations where fistulotomy is not an option.

Fibrin Glue

Two retrospective reviews by Chung et al. have examined the success rates with fibrin glue instillation vs. endorectal advancement flap. In one, fistula plug and endorectal flap were found to have superior healing rates compared to seton and fibrin glue [57]. In another study among 51 patients with inflammatory bowel disease, a 20 % success rate was found with the flap and 0 % success with glue; however, this study included only five patients with flaps and two with fibrin glue, so conclusions regarding the relative efficacy of these two procedures cannot be drawn from this study [58]. Flap may thus be more effective than glue, but there is very limited evidence upon which to base a conclusion.

Seton

While a seton is rarely used as a primary strategy to effect fistula healing, there are some studies that have compared endorectal advancement flap to setons. One found a high healing rate for flaps, loose setons, and cutting setons with no difference between groups [50], while another study that compared anal fistula plug, fibrin glue, endorectal advancement flap, and setons found plugs and flaps to be superior to glue and setons [57].

Special Situations

Endorectal advancement flap can also be useful in situations where the fistula may be especially complex or difficult to heal, such as rectovaginal fistulas, rectourethral fistulas, and Crohn's-associated fistulas.

Rectovaginal Fistula

Rectovaginal fistulas can pose particular challenges to the surgeon. Endorectal advancement flaps can play a role in the treatment of rectovaginal fistulas, whether alone or in conjunction with sphincteroplasty. For a discussion of the treatment of rectovaginal fistula in the setting of Crohn's

disease, please see the later section on this topic; this section will deal exclusively with rectovaginal fistulas not due to Crohn's disease.

A wide range of results have been reported for endorectal advancement flap alone for rectovaginal fistulas associated with cryptoglandular disease or obstetric injury. Hoexter et al. reported no recurrences over a mean follow-up of 4 years in a group of 15 patients treated with advancement flaps for low rectovaginal fistulas [59], as did Hilsabeck in a group of nine patients followed for as long as 20 years [60]. Success rates were lower in a report by Russell and Gallagher, with healing in all six flaps performed for fistulas arising from obstetric injury, but just 12 of 15 flaps performed for fistulas arising from cryptoglandular disease [61]. Watson and Phillips also reported a lower initial success rate, with success in 7 of 12 patients with fistulas arising from a mix of obstetric injury and cryptoglandular disease [62]. Tsang reported an even lower success rate of just 41 % among 27 flaps performed for fistulas arising from obstetric injury [38]. In terms of functional results, flaps improve continence in this group because there is no longer gas and stool passing into the vagina. Among the 19 patients with anovaginal fistulas who had an endorectal advancement flap in the study by Mazier et al., only one was incontinent to flatus postoperatively, while preoperatively 14 were incontinent to flatus, four to liquid stool, and one to solid stool [63].

Advancement flap can also be performed in conjunction with sphincteroplasty to treat fistulas due to obstetric injury, and this may be associated with a greater success rate in healing the fistula than flap alone. A number of studies have reported success rates among groups of patients with rectovaginal fistulas in which a significant portion of the patients underwent sphincteroplasty in addition to flap. Success rates have ranged from 74 to 95 % [37, 64–66]. In a series where all 20 patients had mucosal flaps in addition to sphincteroplasties, Khanduja et al. reported that drainage of stool and flatus stopped in all, and 14 had perfect continence while six reported their continence was improved [67].

Rectourethral Fistula

There are some reports of using endorectal advancement flaps for rectourethral fistulas. Parks and Motson described this in 1983 using a full-thickness flap in five patients with rectoprostatic fistulas [68]. All of these were done under the protection of a sigmoid colostomy, and all healed. Garofalo et al. treated 23 patients for rectourethral fistula, 12 of whom were treated with endorectal advancement flap [69]. They achieved initial success in 8 of the 12 patients, and two of the failures healed after repeat flap. Most of these patients had stomas, and the authors advocated for both fecal and urinary diversion prior to flap repair. Advancement flap may thus be an option for rectourethral fistulas, and avoids some of the morbidity associated with procedures such as gracilis muscle flaps.

Table 14.2 Results of endorectal advancement flap in Crohn's-associated rectovaginal fistulas

Authors	Number of patients	Success rate (%)
El-Gazzaz et al. [26]	47	43
Hull and Fazio [74]	24	67
Penninckx et al. [73]	11	55
MacRae et al. [75]	8	0
Athanasiadis et al. [53]	7	29
O'Leary et al. [76]	6	50
Morrison et al. [77]	2	100

Crohn's Disease

Advancement flap is an attractive option in Crohn's disease because full-thickness sphincter division is avoided, which is of particularly great importance in these patients as they will be at greater risk for future fistulas. However, results have not been particularly promising. Among the nine patients with Crohn's disease who underwent flaps, five recurred in one study [70]. In a larger study of 32 patients with Crohn's undergoing a total of 36 flaps, four did not heal in the immediate postoperative period and the same fistula recurred after healing in an additional 11 patients [71]. The risk of recurrence of the operated fistula (as opposed to a new fistula in another location) was 46 % at 2 years, despite 18 of the 36 flaps being done under the protection of a diverting stoma. Thus, endorectal advancement flap may result in healing in some patients with Crohn's disease, but the risk of recurrence is high.

Rectovaginal Fistula Associated with Crohn's Disease

As difficult as it is to treat fistulas in the setting of Crohn's disease, rectovaginal fistulas in the setting of Crohn's disease present even greater challenges, and as a result there is rather extensive literature on the subject. The majority of studies, however, include only a small number of patients with Crohn's-associated rectovaginal fistulas undergoing flap procedures. Reported success rates after initial flap tend to be quite low (Table 14.2). Rectovaginal fistulas associated with Crohn's disease tend to have higher recurrence rates than those due to other etiologies [22, 72]. Among those with Crohn's, the number of sites involved with Crohn's has also been found to be associated with outcome [73], although another study found no association between Crohn's activity

and failure [26]. Thus, endorectal advancement flap can certainly be used in an attempt to heal rectovaginal fistulas associated with Crohn's disease, but success rates are low. It may be that increased success rates are seen as the use of biologic immunomodulators becomes more prevalent.

Conclusion

Endorectal advancement flaps are a useful technique in the treatment of anal fistula. Advancement flaps are associated with a success rate that compares favorably to other surgeries for anal fistula. Flaps are associated with only a small risk of a decrement in continence, as they avoid full-thickness division of the anal sphincters. They can also be used in special situations such as Crohn's disease and rectovaginal fistulas. Surgeons treating anal fistulas should be well-versed in the technique of endorectal advancement flap.

Summary

- Endorectal advancement flap for anal fistula is successful in many patients and is a valuable tool for treating anal fistulas.
- Endorectal advancement flap avoids division of the anal sphincter muscles, but may still have deleterious effects on continence.
- Complex fistulas such as those arising from Crohn's disease or persisting after prior attempts at repair can be successfully addressed with endorectal advancement flaps.
- In general, modifications of the endorectal flap technique have not led to increased success rates.

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