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Reoperative Surgery for Anal Incontinence

Christina J. Seo, Steven D. Wexner, and G. Willy Davila

The plague of fecal incontinence with its associated social and economic encumbrances has fueled a drive over the past few decades to find new innovations in its management. Numerous surgical therapies have been developed and advanced to help ameliorate this problem and improve the quality of life of the patients who suffer from it. Despite these advances, the need for reoperation exceeds 50% of patients who undergo these procedures. Therefore, the colorectal surgeon must have surgical options to restore or improve anal continence after failure of a primary, secondary, or tertiary repair. Indications include obstetric and other iatrogenic trauma, noniatrogenic trauma, imperforate anus and other congenital abnormalities, as well as neurogenic and idiopathic fecal incontinence.

After the failure of a primary operation, the patient can be evaluated and often treated in the much same manner as a patient who has not undergone surgery. The same tests, including anorectal manometry with rectal capacity and compliance testing, cinedefecography, endosonography, magnetic resonance imaging (MRI), electromyography with pudendal nerve latency assessment, and endoscopy, can still be useful in determining which secondary repair remains an option for the patient. The initial management can also begin conservatively, depending on the severity of symptoms. Medical management of diarrhea such as dietary modifications and colonic irrigation are common first-line treatments. Biofeedback therapy can often be an effective modality, improving function in up to 75% of patients, although cure has only been reported in 50%.[1] Balloon training and electrostimulation are also alternatives.

Surgical options are varied and are somewhat dictated by the etiology. An older method, the Thiersch anal encirclement procedure, is now rarely used because of problems with band erosion, though a modified version using Silastic mesh showed some efficacy.[2] While the Thiersch procedure was initially described for patients in full-thickness rectal prolapse, it has also been employed in patients with fecal incontinence, since full-thickness rectal prolapse and fecal incontinence often coexist. The encirclement operation can be effective in either scenario. Anterior sphincteroplasty is well suited for obstetric and iatrogenic disruption of sphincter defects, but is less suitable in a denervated pelvic floor. This technique can initially have good results in 50% to 80% of patients, but function may degenerate over time, resulting in a long-term success rate of only 10% to 15%.[3] Injectable bulking agents, the subject of some recent trials, show promise as a less invasive procedure.[4] The Malone antegrade continence enema (MACE) procedure has also been described for those individuals with neuropathic dysfunction, especially in children with congenital disorders of the colon and rectum.[5] Artificial bowel sphincter, both adynamic and stimulated graciloplasty, and sacral nerve stimulation are other options and are discussed in this chapter. Regardless of what method is used, each is successful to various degrees, and implementation of one or more does not preclude subsequent surgical options. The decision to use one modality over another is based mostly on surgeon training and preference, and multiple techniques may be employed to achieve the final goal of continence. The last resort after repeated treatment failures, a diverting colostomy, is still an option for those patients quality of life cannot be improved by other methods.

Redo Anterior Sphincteroplasty

The choice of procedure, contingent on findings by physical examination, physiologic testing, the history, and a fecal incontinence score such as the Wexner Fecal Incontinence Score (Table 14.1), is a redo sphincteroplasty.[6] Primary anterior overlapping sphincteroplasty is generally the standard first-line surgical therapy for the treatment of sphincter defects, particularly those from obstetric complications or iatrogenic injury from anal or low rectal surgery. The failure rate, defined as the recurrence of symptoms with or without an associated sphincter defect, is only 20% at initial operation but escalates to as high 50% at 5 years from the time of surgery and then up to 85% at 10 years.[7,8] Generally, it is advisable to wait at least 6 months, and preferably 12 months, following the initial sphincteroplasty procedure before attempting the second. Ample time is needed to allow edema and friability to subside and enhance fibrosis, especially of the divided sphincter ends.

This operation is generally undertaken with the patient in the prone-jackknife position. A transverse incision over

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TABLE 14.1. Wexner Fecal Incontinence Score.

Type of incontinence	*Never*	*Rarely (<1/mo)*	*Sometimes (<1/wk, >1/mo)*	*Usually (<1/mo, 1/day)*	*Always (>1/day)*
Solid	0	1	2	3	4
Liquid	0	1	2	3	4
Gas	0	1	2	3	4
Wears pad	0	1	2	3	4
Alters lifestyle	0	1	2	3	4

0 = perfect continence; 20 = complete incontinence.

Source: From Jorge and Wexner,[6] with kind permission of Springer Science + Business Media.

the perineal body exposes the sphincters and the scar from the prior defect. The scar is then divided and each end mobilized enough to allow overlap and be secured in the "forward 6" or "reverse 6" configuration, best seen on endoanal ultrasonography. It is important to note that great care should be taken to preserve rather than excise any scar. The incision is then closed, leaving an open area in the center for drainage and healing by secondary intention (Fig. 14.1).

Repeat overlapping sphincteroplasty is by far the most common and least morbid method of restoring anal function provided a residual or recurrent sphincter defect is present. There may be some trepidation in repeating this procedure after an initial breakdown, but the success rates after a secondary sphincteroplasty have proven to be similar to those after the initial surgery.[9,10] One study from Cleveland Clinic Florida showed that bowel function, as measured by the CCF/FISS, was equivalent in patients who underwent initial repair with those who had reoperation. However, the authors noted that success rates declined somewhat after three or more attempts (Table 14.2).[11]

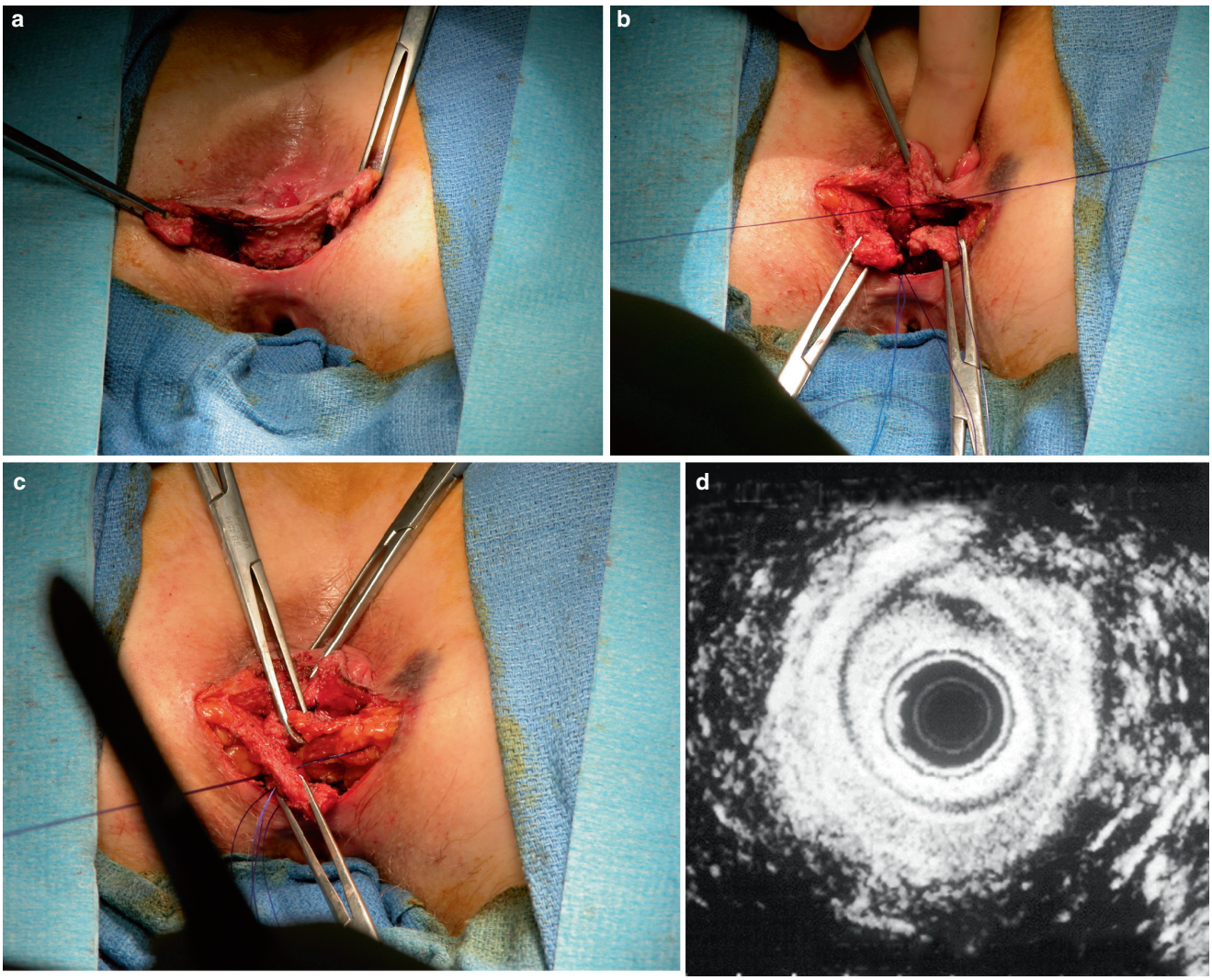

FIGURE 14.1. Overlapping sphincteroplasty. (**A**) Exposure of external anal sphincter and division of scar. (**B**) Posterior levatorplasty. (**C**) Overlapping of cut ends external anal sphincter. (**D**) Appearance of overlapping sphincteroplasty on postoperative endoanal ultrasound in a "figure-6" configuration.

TABLE 14.2. Repeat Sphincteroplasty Series.

Author	*Year*	*Patients (n)*	*Good outcome (%)*
Yoshioka[13]	1989	7	4 (57.1)
Pinedo[10]	1999	23	15 (65.2)
Giordano[11]	2002	36	18 (50)
Vaizey[9]	2004	21	13 (61.9)

Some relative contraindications do exist for a repeat sphincteroplasty operation, which are essentially the same as for the initial surgery. The lack of a clinical, radiologic, or endoscopically documented defect in the sphincter complex is predictive of poor results. Results also tend to be worse when there are sphincter defects in quadrants other than the anterior segment, which is usually where these defects are seen with obstetric injury. Preoperative defects in lateral or posterior quadrants tend to show persistent defects on postoperative ultrasonography. An overlapping repair functions by restoring the high-pressure zone of the anal canal, but deficits in the innervation to the reapproximated muscle may result in continued postoperative symptoms. The physical overlapping of the sphincters by itself may improve symptoms, however, so that even patients with significantly delayed pudendal motor latencies or undetectable electromyographies may still benefit from this procedure. Therefore, given the relatively low morbidity and technical facility of sphincteroplasty it is always offered as an option even to patients with severe pudendal neuropathy. Should this approach be selected by such patients, they are usually counseled that their prognosis is worse than if they had bilaterally normal nerve function.

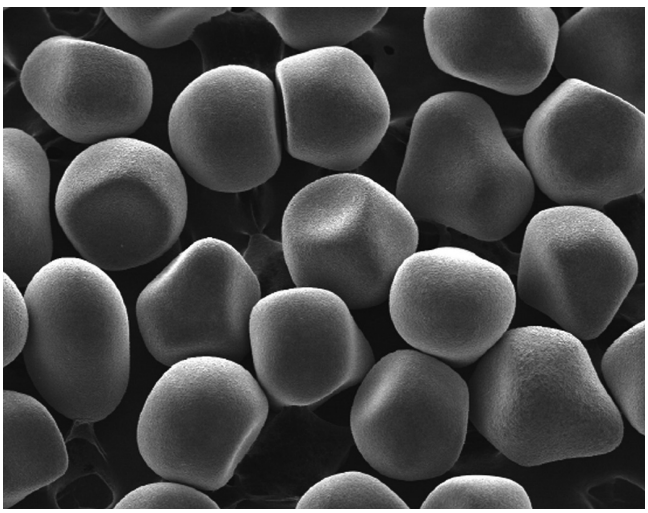

FIGURE 14.2. Injectable carbon beads.

The injection of biomaterials such as carbon or silicone has been used with varying degrees of success in the area of urinary incontinence. These materials have also been employed in institutional review board–approved trials for the treatment of fecal incontinence and can be used as an adjunct to a sphincter repair, by passively working to increase anal bulk and tone (Fig. 14.2). Studies to assess the efficacy and safety of some of these products are still underway, although initial trial results have been promising (Table 14.3).[12]

While not standard for an initial anterior sphincteroplasty, some consideration should be given to a diverting stoma with a secondary or tertiary repair. Fecal diversion may be helpful in wound healing following reoperative surgery, with the ideal goal of stoma reversal after complete healing. There is little evidence-based medicine to support this method; however, the surgeon's judgment may factor into its utility at the time of a third or more reoperation.[13–15] In general any patient with an isolated anterior defect has the potential to benefit from, and therefore should be offered, an overlapping sphincteroplasty. All of the remaining options discussed in this chapter can be potentially offered to patients who have had anatomic success but functional failure following overlapping sphincteroplasty. In addition, patients who have no defect, multifocal defects, or neuropathic or idiopathic incontinence may benefit from any of the remaining procedures.

Postanal Repair

A less often used but sometimes useful repair of posterior sphincter defects, the postanal approach, is an option for failed sphincteroplasty. Postanal repair is a useful procedure in patients without a documented sphincter defect, or ironically in those with multifocal sphincter defects, and in those individuals whose incontinence is either idiopathic or neurogenic.[16] One of the main advantages of this method is that it avoids the scar tissue created from an anterior

TABLE 14.3. Injectables.

Injectable	*Trade name*	*Author*	*Success rate (%)*
Polytetrafluoroethylene	Teflon, Polytef	Shafik[41]	7/11 (63.6)*
Autologous fat	N/A	Shafik[42]	14/14 (100)*
Collagen	Contigen	Kumar[43]	11/17 (64.7)
		Stojkovic[44]	46/73 (63.0)
Silicone	Bioplastique	Maluof[45]	2/10 (20.0)*
		Tjandra[46]	45/82 (54.9)
Carbon	Durasphere	Weiss[47]	6/10 (60)
Dextranomer/hyaluronic acid	Q-Med	Trial ongoing	N/A

*Some after multiple injections.

repair. The exposure it affords is quite extensive, as noted by surgeons who have used it for resection of rectal or presacral tumors. It has also been preferentially used after low anterior resections for patients in whom fecal incontinence was thought to be a late complication due to the transanal stapling technique.[17]

The postanal repair approach is through a transverse or U-shaped incision approximately 5 to 8 cm posterior to the anal verge with the patient in either the prone position or the high lithotomy position with steep Trendelenburg. The intersphincteric plane is entered and the Waldeyer's fascia is incised. The sphincter repair is undertaken in conjunction with the apposition of the pelvic floor muscles posterior to it, namely the ileococcygeus, pubococcygeus, and puborectalis (Fig. 14.3).[18]

Parks et al.[19,20] reported the first major series of the results from these surgeries, with a success rate of more than 80%. He attributed much of the success of this technique to the restoration of the anorectal angle, although this did not prove to be a factor in subsequent studies.[21] In 1984, Keighley's[22] series of 89 patients reported a complete success rate of 63%, with 21% claiming some improvement, while 16% had no improvement; the most common reason for lack of improvement was related to wound sepsis. Another factor seemed to be male gender; 50% of the male subjects did not report improvement after the operation at 6 months follow-up. In a subsequent study in 1999, Yoshioka and Keighley[23] evaluated 124 patients over a mean of 5 years. While overall incontinence and bowel frequency was found to be improved, manometric pressures did not change, with postoperative continued complaints of urgency and seepage, which led the authors to conclude that the long-term results of this repair were in fact poor. A more recent single-surgeon series from Cleveland Clinic Florida reported a similarly poor 3-year success rate of 35%. However, the authors also concluded that a morbidity rate of below 5% and a mortality rate of 0% made the operation an attractive option in selected patients (Table 14.4).[16] Postanal repair is a technically easy, low-risk procedure that is far less expensive and complex than are muscle transpositions, neuromodulation procedures, injectable, or the artificial bowel sphincter.

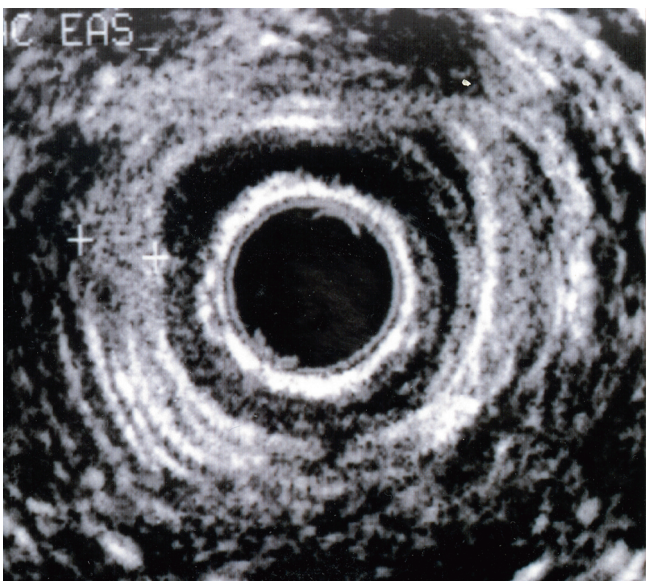

FIGURE 14.3. Endoanal ultrasound of prefecal incontinence without obvious defects.

TABLE 14.4. Postanal Repair Series.

Author	*Year*	*Patients (n)*	*Excellent/ good outcome (%)*
Parks[19]	1966	–	–
Browning and Parks[20]	1983	42	34 (81.0)
Keighley[22]	1984	105	56 (63.0)
van Vroonhaven[48]	1984	16	12 (75.0)
Ferguson[49]	1984	9	6 (66.7)
Henry and Simson[50]	1985	204	118 (57.8)
Habr-Gama[51]	1986	42	22 (52.3)
Womack[52]	1988	16	14 (87.5)
Yoshioka[23]	1989	116	94 (81.0)
Scheuer[53]	1989	39	17 (43.6)
Rainey[54]	1990	42	13 (31.0)
Orrom[55]	1991	17	10 (58.8)
Engel[56]	1994	38	19 (50.0)
Setti-Carraro[57]	1994	34	9 (26.5)
Jameson[58]	1994	36	10 (27.8)
Tsugawa[59]	2000	16	12 (75.0)
Matsuoka[16]	2000	20	7 (35.0)
Abbas[60]	2005	44	30 (68.2)
Shafik[61]	2007	19	10 (52.6)

Pediatric surgeons who perform colorectal surgery on children with congenital malformations such as imperforate anus and persistent cloaca use various approaches to repairing complex anal variations. It has been suggested that some of these techniques might be used on adults with acquired complications. The posterior sagittal approach was described in great detail by Alberto Peña in his Harry E. Bacon Lectureship published in 1994, in which the malformed rectum and anus is surgically redirected into the sphincter complex, often requiring division of the sphincters to complete the operation.[24] Interestingly, in Peña's experience of nearly 700 procedures, there was no observed decrease in fecal continence with the latter procedure. This technique and others have often been successful in the management of fecal incontinence in patients who have already undergone one or several prior attempts at repair, or who have experienced complications from prior surgeries. Candidates for this approach must have evidence of normal pelvic musculature and sacral structure. However, this technique has thus far remained the exclusive domain of pediatric surgeons. There are no criteria by which to establish inclusion or exclusion criteria or to evaluate results in adult patients.

Gluteoplasty

Several methods of reconstructing the sphincter complex with autologous muscle have been attempted, with varying popularity and success. One of the first muscle flaps used with this procedure was the gluteus maximus. Its proximity to the anus and overall strength seemed to make it an attractive choice. Different methods in creating the flaps

TABLE 14.5. Gluteoplasty Series.

Author	*Year*	*Patients* (n)	*Good results (%)*
Chetwood[26]	1902	1	1 (100)
Schoemaker[29]	1909	6	6 (100)
Bistrom[27]	1944	3	2 (66.7)
Prochiantz and Gross[62]	1982	15	9 (60.0)
Hentz[28]	1982	5	4 (80.0)
Chen and Zhang[63]	1987	6	3 (50.0)
Pearl[64]	1991	7	4 (57.1)
Christiansen[65]	1995	7	0 (0)
Devesa[30]	1997	17	9 (52.9)
Madoff[31]	1999	11	5* (45.5)
Hultman[66]	2006	25	18 (72.0)

*Gluteoplasties were electrically stimulated.

have been described, but most are adynamic and involve local transfer of the muscle around the anal canal.[25] Since Chetwood[26] first described this technique in 1902, many variations on the theme have been developed over the last century. The muscle-splitting wrap by Bistrom,[27] the keyhole by Hentz,[28] the 180-degree bilateral wrap by Schoemaker,[29] and the pantaloon by Devesa et al.[25] are possible configurations with which to surround the sphincters. Naturally, the greatest concern with these methods is suture line tension and preservation of neurovascular supply. The most common morbidity associated with this procedure, however, is wound infection (Table 14.5).[30]

The patient is placed in the prone-jackknife position and incisions are made on each side of the anus and over each gluteus incision into the sacrum. The lower 10% to 15% of each gluteus, with its intact fascia, is longitudinally split and wrapped around the anus as deeply as possible. The longitudinally split fascia is then sutured to itself on the contralateral side. All wounds are closed in layers over drains.

The gluteus muscle has fallen somewhat out of favor in recent years with the advent of the graciloplasty. Unlike the gracilis muscle, the gluteus maximus is essential to range of motion, namely in extension and abduction of the thigh. It is broad-based and is less amenable to wrapping around the anal canal than the slimmer and more mobile gracilis. Lastly, it remains a skeletal muscle and cannot maintain tonic contraction as effectively as a stimulated graciloplasty, which is described later in this chapter. The results that Madoff et al.[31] observed when using stimulated gluteoplasty were no better than those results of unstimulated gluteoplasty. However, muscle transposition gluteoplasty is still a useful modality for patients who have failed other measures.[18] Specifically, patients who have experienced anatomic success but continue to experience functional failure as well as patients with no defect or multifocal defects may be candidates. The surgeon must be careful to harvest only the lower 10% to 15% of each muscle due to its bulk. Moreover, there is little ability to gain additional length if needed.

Graciloplasty

Graciloplasty is rarely a first-line surgical treatment for fecal incontinence, but is another option for the same group of patients with end-stage fecal incontinence in whom the only remaining option would be a permanent stoma. Graciloplasty is most helpful for those patients who congenitally or iatrogenically lack a sphincter complex, those individuals who have a structurally normal but neuropathic sphincter, or those operative candidates who have a sphincter that cannot be repaired in any of the more conventional ways, such as in a case of multifocal sphincter defects.

The gracilis muscle has redundancy in function, rendering it non-essential for locomotion or stability of the lower extremity. It is also superficial in the thigh, usually has adequate length, and relies upon a single proximal neurovascular supply. The main disadvantage is that, like the gluteus, it is a skeletal, fast-twitch, easily fatigable muscle that needs to function as a chronically contracted sphincter. It was found that stimulating a skeletal muscle with a slow-twitch, fatigue-resistant muscle nerve would slowly transform the fibers of the skeletal muscle to the fatigue-resistant type. Similar results were found using electrical stimulation at a low frequency; the skeletal muscles resembled sphincter muscles after chronic inducement.[32] The results of the nonstimulated graciloplasty are detailed in Table 14.6, and of the stimulated graciloplasty in Table 14.7.

For the graciloplasty procedure, the patient is placed in the lithotomy or frog-leg position on the side of the muscle harvest. An incision is made near the insertion of the gracilis distally on the medial tibia. The tendon and muscle are identified by their superficial position and proximity to the groove posterior to the quadriceps muscles on the inner thigh. The muscle is then isolated and followed proximally, taking care to recognize and divide the perforating vessels. A midthigh counter-incision may be required to completely mobilize the muscle. The tendon is then divided from the tibial attachments and brought through the incisions to the groin. The neurovascular pedicle is identified and protected. With the legs in high lithotomy position, either a perineal incision or two incisions on either side of the sphincter complex are made. The sphincter complex is dissected away from the surrounding perineal tissue by a combination of blunt dissection and electrocautery. The tunnel should be as lateral and as cephalad to any preexisting sphincter as possible to help limit the opportunity for erosion through the perineal wound or into the anus. The gracilis muscle is then delivered and wrapped around the anal canal in the newly created tunnel and anchored into an alpha, epsilon, or gamma configuration to the contralateral

TABLE 14.6. Nonstimulated Graciloplasty Series.

Author	*Year*	*Patients* (n)	*Good results (%)*
Simonson[67]	1976	22	19 (86.4)
Leguit[68]	1985	10	9 (90.0)
Corman[69]	1985	22	18 (81.8)
Wang[70]	1988	5	4 (80.0)
Yoshioka[23]	1989	6	0 (0)
Christiansen[71]	1990	13	10 (76.9)
Faucheron[72]	1994	22	19 (86.4)
Silezneff[73]	1996	8	8 (100)

Source: Adapted from Rotholtz and Wexner;[74] with permission.

TABLE 14.7. Stimulated Graciloplasty Series.

Author	*Year*	*Patients* (n)	*Good results* (%)	*Morbidity* (%)
Kosten[75]	1993	26	17 (65.4)	11 (42.3)
Baeten[76]	1995	52	38 (73.1)	7 (13.5)
Kumar[77]	1995	10	9 (90.0)	5 (50.0)
Wexner[78]	1996	10	6 (60.0)	n/a—10 events*
Wexner[79]	1996	15	9 (60.0)	15 (100)
Mavrantonis[34]	1999	27	13 (48.1)	22 (81.5)
Mander[35]	1999	52	29 (55.8)	22 (42.3)
Madoff[31]	1999	128	85 (66.4)	n/a—138 events*
Rongen[80]	2003	200	145 (72.5)	138 (69.0)
Pennickx[33]	2004	60	47 (78.3)	44 (73.3)

*Authors list morbidity by events; multiple events may have occurred in individual patients.

ischial tuberosity; the incisions are then closed (Fig. 14.4). The insertion of the electrostimulator can be undertaken during the same surgery or at a later date.

Unfortunately, Food and Drug Administration (FDA) approval of the stimulator, leads, and electrodes was not pursued by the manufacturer (Medtronic Stimulator, Medtronic, Inc., Minneapolis, MN) (Fig. 14.5). Thus, the electrostimulator is no longer available in the United States, as the stimulator, leads, and electrodes are used to convert the fast-twitch muscle into a slow-twitch muscle by chronic stimulation. Connecting the gracilis muscle to electrodes that were tunneled through the skin and into the muscle for a time prior to repair slowly changed the nature of the skeletal muscle to that of a tonically contracted smooth muscle, making it more suitable as a substitute sphincter. Stimulation continued afterward as the source was tunneled subcutaneously, with the electrodes still in place. The main difficulty arose from the conjunction of a foreign object with a surgical field in the perianal area and the mechanical and infectious complications inherently possible.

The Belgian experience reflects the challenging nature of this procedure.[33] This study of 60 patients who underwent this surgery included 75 complications requiring 61 surgeries—on average, one extra surgery for each graciloplasty. At long-term follow-up, however, the success rate was 66%, illustrating the high morbidity rate associated

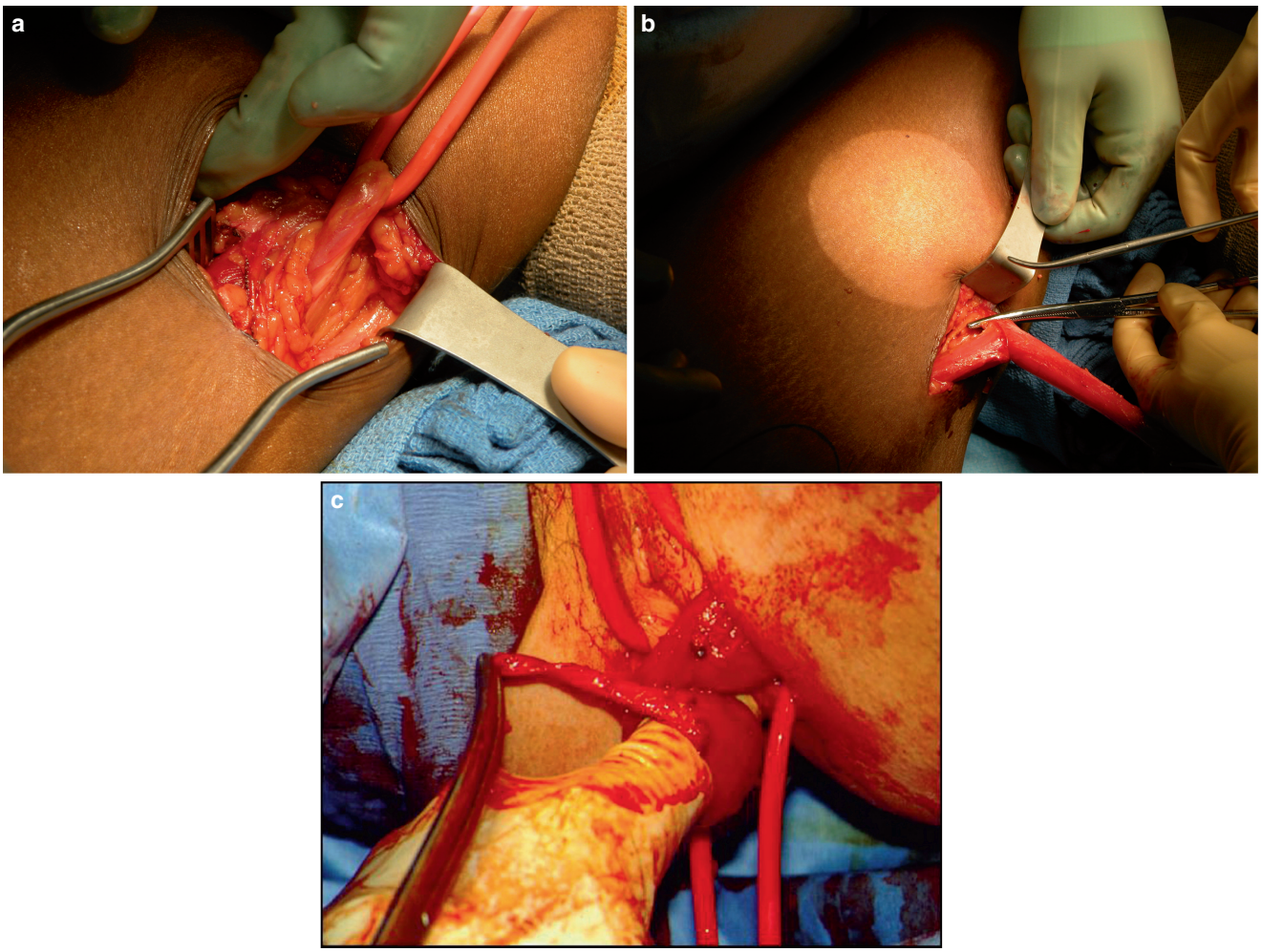

FIGURE 14.4. Gracilis interposition. (**A**) Exposure of tendinous insertion of gracilis muscle at knee. (**B**) Ligation of perforations to gracilis muscle. (**C**) Determination of configuration of gracilis wrap.

FIGURE 14.5. Electrical stimulator for gracilis transposition. (With permission of Medtronic, Inc., © 2008.)

with this procedure. Most studies describe a success rate of 42% to 85%, with morbidity rates per patient similar to those of the Belgian study. However, by some calculations, it may overall be more cost-effective than a permanent stoma, which is still remains the alternative to a failed graciloplasty.[32]

Other authors have reported similar results. Mavrantonis and colleagues[34] from Cleveland Clinic Florida found that the method of stimulation affected the success of the graciloplasty. Specifically, the direct nerve stimulation technique of Williams (NICE Technology, Inc., Fort Lauderdale, FL) was associated with increasing impedance secondary to perineural fibrosis. The indirect (intramuscular) technique of Baeten (Medtronic, Inc., Minneapolis, MN) had no such problem. Mander et al.[35] had a success rate of 56% after closure of the diverting ileostomy; however, their population experienced 16 hardware-related complications and 27 battery-related problems during follow-up.

An international forum, the Dynamic Graciloplasty Therapy Study Group, reviewed the complications associated with this surgery, and the impact of these complications on continence. Their census of 121 patients had a total of 211 adverse events in 93 patients; 89 were named severe in nature, requiring hospitalization or reoperation.[33] The consensus was that although excellent results could be achieved in some patients, a very high morbidity was expected.

Because of the surgical involvement of a lower extremity and the need for postoperative bed rest, thromboembolic events are known complications. Thus, appropriate deep venous thrombosis prophylaxis with anticoagulation or sequential pneumatic compression devices is strongly encouraged.

Dynamic graciloplasty has also been used to reconstruct the sphincter mechanism after the excision of the anal sphincters during oncologic surgery such as abdominoperineal resection. It is a necessary step in the complex creation of a neo-rectum and pelvic floor for anal defecation after total exenteration or abdominoperineal resection. Although rarely performed, it is an option for those very specific patients who are young, concerned about the aesthetic result, in good health, and willing to learn to manage the reconstructed pelvic anatomy to achieve relatively normal function. It can also be combined with a colocutaneous anastomosis.

Both the nonstimulated and the stimulated graciloplasty procedures can be performed as either unilateral or bilateral muscle transpositions. Graciloplasty may have several advantages over gluteoplasty. First, more opportunity exists to gain length both along the tendon and at the neurovascular pedicle. Second, the muscle thickness is predetermined as the entire muscle is harvested and transferred. Conversely, significant judgment must be exercised in the harvest of the appropriate amount of the gluteus muscle. Third, the gracilis is wrapped 360 degrees around the anus, which seems more physiologic than the 120-degree coverage of each gluteus muscle. Fourth, the single proximal neurovascular pedicle can be better stimulated than the gluteus.

Sacral Nerve Stimulation

A modification of a procedure done by urologists for urinary incontinence, the sacral nerve stimulator (SNS) (Medtronic, Inc., Minneapolis, MN) has been shown to simultaneously improve fecal incontinence through neuromodulation. Patients undergoing treatment for one problem often have other pelvic dysfunction, and it was noted incidentally that after SNS for urinary incontinence, there was also improved control of feces. It is thought that the stimulated pelvic floor muscles that control urinary continence also affect fecal continence**.** This stimulation works more centrally than the stimulator for a gracilis or gluteus transposition; the leads are placed at the third sacral foramina. A temporary lead is placed to evaluate its possible efficacy in the long term. Once the patient is seen to have improvement in symptoms, the leads can be exchanged for a permanent stimulator. This modality seems to improve not only the muscular function of defecation, but unlike other procedures, also rectal sensation, thereby affording even more control.[12] The improved sensory and motor function is attributable to neuromodulation.

Preliminary testing of the SNS is done to ensure that the placement of a permanent electrode will continue to function appropriately. In the operating room, the patient is placed in the prone jackknife position; no paralysis is administered by anesthesia. The second, third, and fourth sacral foramina are identified and a needle placed into each. A

FIGURE 14.6. SNS InterStim device. (With permission of Medtronic, Inc., © 2008.)

stimulator is then attached and the contraction of the perineal muscles and the ipsilateral first toe is observed. The weakest signal to elicit these reflexes is noted, as is the foramen with the best response. A lead is then passed through the needle and attached to the skin.

At a later date, once sufficient stimulation is noted with the temporary electrode, a permanent replacement is passed through the same foramen as the original lead, and then tunneled to the buttock on the same side. At that site, a pocket is created to hold the pulse generator and the lead attached. Finally, it is activated while the patient is awake postoperatively.

Variations to the above method include percutaneous placement of the leads, or placement of the permanent pulse generator at the first surgery rather than using a temporary electrode.[36]

Interestingly, in a double-blinded crossover study, the efficacy of the stimulator was tested by setting the device to "on" or "off" with each limb for 1 month. The observation of symptomatic improvement by the patients and documented by the staff correlated well with the actual status of the stimulator, thereby proving that a functional device was more effective than placebo (Fig. 14.6 and Table 14.8).[37]

The SNS method shows great promise and significant results in complete or improved continence. As with the stimulated graciloplasty, the stimulator and the electrode are currently not available in the United States. It is hoped that the very promising results of the recently updated 120-patient institutional review board–approved FDA-supervised trial will result in availability of this technique. However, even when available the cost of these devices (for both stimulated graciloplasty and SNS) may be prohibitive, and nonstimulated graciloplasty, gluteoplasty, and postanal repair still remain more cost-effective options.

TABLE 14.8. Sacral Nerve Stimulation Series.

Author	*Year*	*Patients* (n)	*Good results (%)*	*Complete continence (%)*
Matzel[81]	1995	3	3 (100)	2 (66.7)
Vaizey[82]	1999	9	8 (88.9)	7 (77.8)
Malouf[83]	2000	5	5 (100)	n/a
Matzel[84]	2001	6	6 (100)	n/a
Ganio[85]	2001	25	22 (88.0)	11 (44)
Kenefick[86]	2002	15	15 (100)	11 (73.3)
Jarrett[87]	2004	46	45 (97.8)	n/a
Kenefick[88]	2006	19	19 (100)	14 (73.7)
Hetzer[89]	2007	37	34 (91.9)	n/a
Holtzer[90]	2007	29	28 (96.6)	n/a

Artificial Bowel Sphincter

The artificial bowel sphincter (ABS) (American Medical Systems®, Minneapolis, MN) is another method for end-stage fecal incontinence. ABS is usually considered after other treatment options have failed and is especially feasible in those patients whose incontinence is due to neurologic damage or disorders.[38] In addition, it is also possible to offer the patient a repeat ABS after a failed one has been explanted.

The function of the ABS is to behave as a true, tonically contracted anal sphincter, directly controlled by the patient. Its greatest advantage is its ability to allow the patient to evacuate normally and discreetly, and thus keep some socially acceptable schedules.

There are three major parts that are pressurized by fluid and connected by plastic tubing. The first is the cuff, which is most like the native sphincter, which is wrapped around the anal canal. The balloon is a reservoir filled with radiopaque fluid buried in the subfascial plane over the bladder. The pump is connected to both the balloon and the cuff and controls the flow of fluid between them. This is placed in the scrotum or labus majorus of the patient and can be manipulated by the patient to inflate or deflate the cuff (Fig. 14.7). The results are presented in Table 14.9.

Perioperative intravenous antibiotics are continued during the hospital stay, followed by outpatient oral antibiotics. The ABS is deactivated for at least 6 weeks after implantation to promote healing and incorporation, and then activated after confirmation of wound healing.

Morbidity associated with this apparatus includes postoperative infection, constipation, pain, and cuff slippage or erosion. These problems usually require explantation or at least surgical revision of one or more components. The explantation rate can range anywhere from 16% to 41%, including those cases in which multiple ABS devices were explanted, reimplanted, and reexplanted.[39] It is not unreasonable to revise a portion of the system in cases of erosion of the tubing or cuff through the skin; however, it may ultimately require explantation of the entire ABS at a later date. Conservative measures have been successful at managing postoperative hematoma and superficial dehiscence.[40] Malfunction of the cuff is also possible, by leakage of fluid, failure to deflate, or unbuttoning; these problems generally require operative intervention. This procedure is

FIGURE 14.7. Artificial bowel sphincter.

technically much easier than either the gluteoplasty or graciloplasty but more challenging than the SNS.

Gynecologic Approaches to Fecal Incontinence

The gynecologic approach to fecal incontinence has always been focused on restoration of anatomic integrity to the external anal sphincter musculature. This is in sharp contrast to the colorectal approach, which is based on a functional assessment of the fecal continence mechanism. As such, gynecologists have traditionally addressed recurrent fecal incontinence with a repeat sphincteroplasty. Various reasons underlay this marked difference in philosophy.

TABLE 14.9. Artificial Bowel Sphincter Series.

Author	*Year*	*Patients* (n)	*Good results (%)*	*Reoperation/ explant (%)*
Christiansen[91]	1987	5	n/a	n/a
Christiansen[38]	1992	12	8 (66.7)	4 (33.3)
Lehur[92]	1996	13	9 (69.2)	4 (30.8)
Wong[93]	1996	12	9 (75.0)	4 (33.3)
Christiansen[94]	1999	17	7 (41.1)	9 (52.9)
Lehur[95]	2000	24	18 (75.0)	7 (29.2)
Savoye[96]	2000	12	12 (100)	n/a
Altomare[97]	2001	28	21 (75.0)	7 (25.0)
Lehur[98]	2002	16	11 (68.8)	4 (25.0)
Devesa[99]	2002	53	43 (81.1)	10 (18.7)
Ortiz[39]	2002	22	5 (22.7)	11 (50%)
Wong[100]	2002	112	52 (46.4)	51 (45.5)
Michot[101]	2003	37	19 (51.4)	11 (29.7)
Romano[102]	2003	8	7 (87.5)	n/a
Parker[103]	2003	45	23 (51.1)	18 (40.0)
Casal[104]	2004	10	9 (90.0)	3 (30.0)
Altomare[105]	2004	28	3 (10.7)	16 (57.1)

Bias Toward Obstetrical Surgical Experience

To most obstetricians/gynecologists, repair of a sphincter laceration at the time of the vaginal delivery is a simple procedure, commonly delegated to a lower level resident. After perineal trauma resulting from vaginal delivery, "reapproximating" the sphincter edges is deemed a very simple procedure. Fortunately, most women do well with this simple repair and the rate of postpartum fecal incontinence is much lower than one would expect after that degree of trauma. Postoperative sonographic evaluation has revealed that an obstetrical-type repair of the sphincter laceration is suboptimal. In fact, there is an underlying occult anal sphincter tear rate, which is not identified in the intrapartum process likely due to the lack of an overlying tissue tear.

Lack of Experience with Sonographic and Functional Assessment Tools

Obstetricians/gynecologists, although significantly versed in the use of ultrasound for obstetrical and gynecologic indications, do not perform endoanal ultrasound

to assess the anal sphincter. Instead, this test has been limited to the realm of colorectal surgeons. However, this expertise should require a simple training process for obstetricians/gynecologists, although this has not yet occurred to date. In addition, neurophysiologic evaluation is not typically performed by gynecologists. As such, gynecologists generally resort to a simple anatomic assessment.

Absence of Colorectal Expertise in Many Communities

As early as during residency training, most obstetricians/gynecologists are not exposed to the scope of practice of colorectal surgery, especially as it is related to fecal incontinence. These colorectal-type clinical problems are typically kept "in-house" and thus obstetricians/gynecologists are not exposed to the potential referral to another clinician with expertise in this area. In addition, many communities lack a colorectal surgeon who is well versed in the sonographic and functional evaluation of the anal sphincter mechanism. Furthermore, if indeed there is a colorectal surgeon within the community, many do not have an interest in defecatory dysfunction in women.

The advent of the subspecialty of Urogynecology and Reconstructive Pelvic Surgery has created an increased level of awareness regarding the intricacies of the fecal continence mechanism in women. As more urogynecologists are trained and practicing within a given community, it is clear that recurrent fecal incontinence will be seen in a more comprehensive manner by practicing obstetricians and gynecologists. It is likely that an obstetrician/gynecologist will need to attain subspecialty training in urogynecology in order to reach a level of comfort in the repair of a recurrent anal sphincter tear. Despite changes in practice style and greater availability of urogynecologists, it is unlikely that the practicing obstetrician/gynecologist will add the treatment of recurrent fecal incontinence to his or her clinical practice spectrum.

Reparative Surgery

The gynecologic approach to repair of an anal sphincter tear is simply a modified episiotomy with an attempt at identification of the torn sphincter ends and their reapproximation. This is typically done by clinical examination rather than sonographic evaluation; the patient is placed in a high lithotomy position, after which a small midline incision is made.

For the practicing colorectal surgeon, there are significant differences including surgical exposure due to positioning of the patient and type of incision, which can enhance the ability to reapproximate the ends of a sphincter muscle in an overlapping fashion. There is very limited literature in terms of repair of recurrent anal incontinence by gynecologists.[1,2] However, success rates are not remarkably low, and not significantly different from the long-term success rates reported by colorectal surgeons with increased preoperative evaluation, increased surgical exposure, and more robust reapproximation of the sphincter ends.

Alternate Surgical Approaches

Obstetricians/gynecologists are not typically versed in the performance of bulking agent injections, radiofrequency therapy, artificial sphincter placement, or other novel approaches to sphincter dysfunction—be it fecal or urinary. Urogynecologists do perform a large amount of bulking agent injections; however, the limited success rate with collagen bulking injections for urinary incontinence leads to a significant amount of skepticism regarding the use of bulking agents for fecal incontinence. Limited success with liquid medium continence has led to a reduced acceptance of bulking agents for urinary incontinence. An ideal bulking agent for this purpose does not exist to date.

It is expected that as Urogynecology and Reconstructive Pelvic Surgery expands its clinician base and more obstetric/gynecologic residents are exposed to the appropriate evaluation and management of female pelvic floor dysfunction, recurrent fecal incontinence may well attain a greater level of sophistication as related to obstetric/gynecologic approaches. This, however, will likely be restricted to the clinical scope of practice of trained urogynecologists.

Colostomy

Despite multiple attempts, there are cases in which restoration of complete continence cannot be achieved. Recurrent lapses into incontinence can cause skin breakdown and nonhealing wounds. Even if further repairs were to be contemplated, a period of regeneration of healthy tissue is desirable before attempting further intervention. Fecal diversion, temporary or permanent, is often a safe option for those patients who once again experience incontinence after failed surgical therapy. In these cases, laparoscopic stoma creation is often the preferred modality.

Conclusion

The best approach to addressing patients with persistent fecal incontinence after sphincter repair is to think in an algorithmic method. Figure 14.8 shows that there are fundamentally two groups of patients—one of which has a persistent or recurrent anterior sphincter defect. Generally, this group of patients can undergo repeat overlapping sphincteroplasty, although the success or failure may depend on the status of the pudendal nerves. The second group of patients is made up of individuals in whom the sphincter repair was deemed anatomically successful but who continue to have persistent incontinence. In addition, the second group can include patients with multifocal defects not amenable to sphincter repair. This second group of patients is somewhat more challenging as the options are more extensive than repeat sphincter repair when a persistent or recurrent defect is present. In this group of patients, the decision must be made among the use of injectables, sacral nerve stimulation, artificial bowel sphincter, stimulated or nonstimulated graciloplasty, gluteoplasty, or perhaps a stoma; other options such as the MACE procedure exist. By reviewing the materials

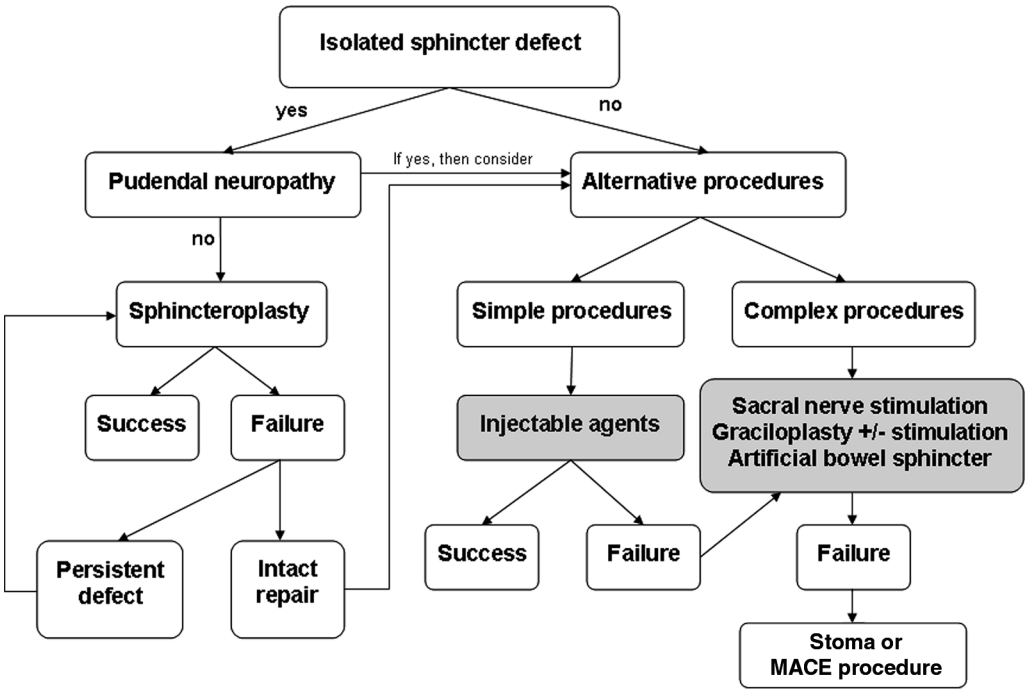

FIGURE 14.8. Algorithm for surgical management of fecal incontinence.

outlined in the tables in this chapter, as well as reviewing each individual patient's respective results of the fecal incontinence score and physiologic testing, an appropriate therapeutic choice can be made.

The number of therapeutic options is testimony to their universal efficacy. In addition, the therapy selected must be tailored not only to the individual patient but also to the individual surgeon. Training and experience in these complex procedures and availability of the resources to undertake them may be limiting steps. Therefore, an additional discussion with each patient may include disclosure that one or more viable options may exist outside of the surgeon's practice. The patient may need to decide between the convenience of a locally performed "simpler" procedure and the expense and inconvenience of a more complex procedure undertaken at a tertiary referral center.

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