Surgical Therapy for Fecal Incontinence

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Introduction

Fecal incontinence is defined as the involuntary passage or the inability to control the elimination of stool or fecal material from the anus [1]. Incontinence can be characterized as being passive—the involuntary discharge of stool or gas without awareness, urge—the discharge of stool in spite of active attempts to retain bowel contents, or seepage—the leakage of stool following an otherwise normal evacuation. In addition, symptoms can range from mild leakage to complete loss of control of both liquid and solid stool. Nevertheless, this problem can be socially devastating and can have significant emotional and psychological impact on quality of life. Fecal incontinence is one of the most common causes of institutionalization in the elderly and it accounts for significant expense. There is limited information regarding the economic burden of this disease and the total costs remain difficult to measure. In a study following 63 patients with fecal incontinence, it was estimated that the average lifetime cost associated with treatment and follow-up was $17,166 per patient in 1996 with average facility charges associated with sphincteroplasty to be $8,555 per procedure [2].

The prevalence of fecal incontinence is difficult to estimate, as it is frequently underreported due to embarrassment and reluctance of patients to discuss symptoms with their physicians. In a recent study, more than two-thirds of women with symptoms of incontinence had never discussed their condition with a physician. The lack of care-seeking for this symptom was hindered by embarrassment, perception that symptoms are a normal part of aging, development of personal coping skills, and the perception that there is no treatment available, among other reasons [3]. Nonetheless, quoted prevalence rates vary from 1.4 % to 19 % with higher rates in nursing home residents, parous females, patients with cognitive impairment or neurologic disorders, and the elderly [3–6]. Even though it is primarily a problem in the elderly population, younger groups are affected as well. Obstetric factors can be implicated in this latter group as the incidence of temporary or permanent fecal incontinence after vaginal delivery can reach 3 % or more [7]. This population, however, is complex because although we know that anal sphincter injury is an important factor, it has been shown that mode of delivery does not affect the prevalence of fecal incontinence [8].

Although it is difficult to estimate the exact incidence and prevalence of this condition, we know that the causes are many times multifactorial. Continence depends on many elements such

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as colonic transit, stool consistency, rectal reservoir function, anorectal sensation, muscle innervation, and internal and external sphincter muscle function. Interfering with one or more of these factors can lead to issues with incontinence.

Etiology

Obstetric Injury

Obstetric injury is the most commonly cited cause of incontinence in females [9]. At 3–6 months after delivery, as many as 13 to 25 % of women report fecal incontinence [10, 11]. However, the prevalence falls to 1 to 6 percent by 12 months postpartum [12, 13]. Sphincteric injury is clinically recognized in approximately 10 % of all vaginal deliveries but many other women may have unrecognized damage to the sphincter. Risk factors for sphincteric disruption include forceps delivery, occipitoposterior position, a prolonged second stage of labor, mediolateral episiotomy, and primiparity [14–16]. Additionally, as touched upon previously, women who give birth vaginally and do not suffer a sphincter laceration, and even those who undergo cesarean delivery, may also develop fecal incontinence [8, 17]. This may be related to pelvic floor denervation resulting from compression or traction injury to the pudendal nerves.

Congenital

Anorectal malformations represent a spectrum of defects that are characterized by absence of an external anal orifice. They are categorized as being low (perineal fistula, vestibular fistula) or high (rectourethral fistula, rectovesical fistula, anal atresia without fistula, rectal atresia, or persistent cloaca). Anorectal malformations occur in approximately 1 in 5,000 live births. Operative procedures depend on the type of deformity but the goal is to create a perineal opening with adequate sensory and motor control [18]. Even with adequate surgical repair, it is well known that these patients have many issues with pelvic floor dysfunction characterized by constipation and fecal incontinence as well as urinary and sexual dysfunction [19, 20]. Reported rates of incontinence vary, but in a large retrospective study from Germany, complete continence was found in only 27 % of patients and 74 % of patients had some degree of soiling. Only approximately 50 % of this cohort followed a bowel management program consisting of enemas, suppositories, and/or anal plugs and still more than 80 % of these patients had persistent soiling [20].

Iatrogenic

Fecal incontinence is a common sequelae of anorectal surgery. The most common procedures to cause symptoms of incontinence are those for anal fissure and for fistula-in-ano. Although both of these procedures involve cutting some degree of sphincter muscle, the mere use of an anal retractor can cause damage to the internal sphincter muscle with resultant postoperative seepage or leakage of stool.

The theory behind treatment for anal fissure is reduction of elevated sphincter tone. The first line of treatment is usually medical treatment such as topical nitroglycerin, topical calcium channel blocker, or botulinum toxin injection. When conservative treatment fails, surgical treatment is usually indicated. The most common surgical procedure to treat this condition is lateral transection of the internal sphincter muscle or lateral internal sphincterotomy. This procedure is highly effective for treatment of anal fissure but fecal incontinence is a reported complication. In a study from Brazil, it was noted that the rates of incontinence were decreased depending on the amount of internal sphincter muscle that was divided. When less than 25 % (<1 cm) of the sphincter muscle was divided, there were no patients that suffered from postoperative fecal incontinence [21].

Perianal infections or abscesses are one of the most common benign anorectal disorders treated by colon and rectal surgeons. Of all patients who present with an initial perianal abscess, up to one-third will develop a chronic or recurrent anal

fistula [22]. Although the principal goal is to eradicate the fistula and minimize the risk of recurrence, it is also important to preserve continence. There are many different surgical procedures available to treat anal fistulas. The most effective procedure is fistulotomy which entails division of a variable degree of anal sphincter muscle. Although the success rate for this procedure can approximate 90 %, postoperative incontinence has been noted in up to 40 % of patients. Patients who are predisposed to incontinence include those with baseline incontinence, patients with a history of anal operations, women with anterior based fistulas, and patients with high-tracts involving a significant amount of sphincter muscles [23–25].

Procedures other than anorectal surgery can result in incontinence. Although the vast majority of patients with rectal cancer can now be treated with sphincter sparing procedures, there is still frequently postoperative compromise of anorectal function. While sphincter function may be preserved, capacity of the neo-rectum, maximum tolerable volume, and rectal compliance may be reduced resulting in an increased stool frequently and episodes of incontinence. Postoperative continence is even poorer if treatment with radiation and chemotherapy is used [26].

Neurogenic

Denervation of the pelvic floor muscles, specifically the puborectalis and the external anal sphincter, has been described in up to 80 % of patients with idiopathic fecal incontinence. Descending perineal syndrome has been implicated in this denervation. Similar to the mechanism causing postpartum pudendal neuropathy, chronic straining for stool can also cause traction injury to the perineal branches of the pudendal nerve. A vicious cycle then results in further weakness of the pelvic floor and the subsequent need for more straining. This theoretically leads to denervation causing incontinence [7, 27].

Spinal cord injuries and neurologic conditions can also cause incontinence. The pathophysiology leading to incontinence in these patients is complex. Colonic transit time is prolonged leading to constipation and often fecal impaction. The ability to voluntarily contract or relax the external anal sphincter is absent or reduced while the function of the internal sphincter muscle is normal. When the rectum is full the internal sphincter will relax; however, the patient may be unable to completely relax the external anal sphincter. This may contribute to constipation and impaction. This, in combination with an intact rectoanal inhibitory reflex (RAIR) leads to leakage of liquid stool around hard impacted stool in the rectum and incontinence [28].

Rectal Prolapse

Rectal prolapse can be associated with constipation or incontinence. Approximately 50–75 % of patients with rectal prolapse report fecal incontinence [29]. The pathophysiology causing incontinence is multifactorial. The prolapsed rectum causes chronic stretching of the anal sphincter muscles, inhibition of the internal anal sphincter muscle due to constant stimulation of the RAIR, mechanical disruption of the sphincter, impairment of anorectal sensation, and denervation of the pelvic floor muscles [7]. Improvement of continence after surgical correction of prolapse occurs in approximately two-thirds of patients [29, 30].

Assessment

As with any diagnosis, a proper and complete history and physical examination is necessary. In the case of fecal incontinence, concentration is mainly toward the perineal exam. Patients are examined in the left lateral decubitus or the prone jackknife position. First external inspection is performed. Observation should be made if the patient wears a pad, what is on the pad, and if there is stool externally on the skin. Documenting the presence of previous surgical scars or evidence of a previous obstetric injury is necessary. Inspection should be made for fistulous openings or any other significant deformities.

Notation should be made if the anus is patulous or open when the buttocks are separated. With the patient bearing down, the physician should inspect for hemorrhoidal, mucosal, or full thickness rectal prolapse. While straining, if the perineum balloons down, this indicates weakness of the pelvic floor or in more severe cases descending perineum syndrome.

Digital rectal exam should assess resting anal sphincter tone which is a function of the internal sphincter. With the finger in the rectum, the patient should be asked to squeeze simulating their ability to hold in a bowel movement. Assessment can be made if the squeeze is normal, decreased, poor, or absent which will determine external sphincter function. The examiner can feel the amount and consistency of stool in the rectum or if the patient is impacted with hard stool. Digital exam may reveal a rectocele by pushing the anterior wall of the rectum anteriorly and downward into the vagina. By performing a bimanual exam with a finger in the vagina and the rectum, the thickness of rectovaginal septum can be evaluated. By asking the patient to squeeze and then bear down, one can determine for the presence of anismus or paradoxical contraction.

Anoscopy, proctoscopy, or flexible sigmoidoscopy can be performed in the office to look for inflammation or proctitis. This can explain symptoms of diarrhea or significant mucus production. Other pathologies can cause significant mucus production such as a solitary rectal ulcer which can frequently be found in patients with rectal prolapse or internal intussusception or large villous adenomas. Findings during physical examination should be described and recorded properly. Other studies can be ordered or added as adjuncts to physical examination on an as needed basis.

Physiologic Testing

Anorectal Manometry

Anorectal manometry provides an objective assessment of anal sphincter resting and squeeze pressures as well as an evaluation of rectal sensation, rectoanal reflexes, and rectal compliance. There are different types of systems available including a water-perfused probe with multiple closely spaced sensors or a solid-state probe with micro-transducers. The latter tend to be easier to calibrate and possibly more accurate [31–33]. Although manometry gives a reliable, reproducible, and objective assessment of anal sphincter function, the findings do not consistently correlate with severity of fecal incontinence. Anal pressures in normal individuals have a large range and vary with age and gender. Patients with low values may be continent whereas high pressures do not guarantee continence. Nevertheless, the test may influence management decisions, but it may not reliably predict postoperative results.

Pudendal Nerve Terminal Motor Latency

Pudendal Nerve Terminal Motor Latency (PNTML) measurement is an assessment of pudendal nerve function. This test can be performed in conjunction with anal manometry and specifically measures neuromuscular integrity between the terminal portion of the pudendal nerve and the anal sphincter (Fig. 16.1) [1].

This test employs a disposable electrode that is placed around the gloved fingertip and inserted into the rectum (Fig. 16.2). Transrectal stimulation of the pudendal nerve is performed while measuring the time from electrical stimulus of the pudendal nerve to the onset of the electrical response in the muscles of the pelvic floor (Fig. 16.3). Prolonged PNTML indicates pudendal neuropathy. Unfortunately normal latencies do not exclude nerve injury as only the fastest remaining conducting fibers are recorded [34]. In addition, there can be anatomic overlap of the pudendal innervation on both sides of the external anal sphincter [35].

Endorectal Ultrasound

In women with suspected obstetrical injury or patients who have a history of anorectal procedures, endorectal ultrasound is a simple test for

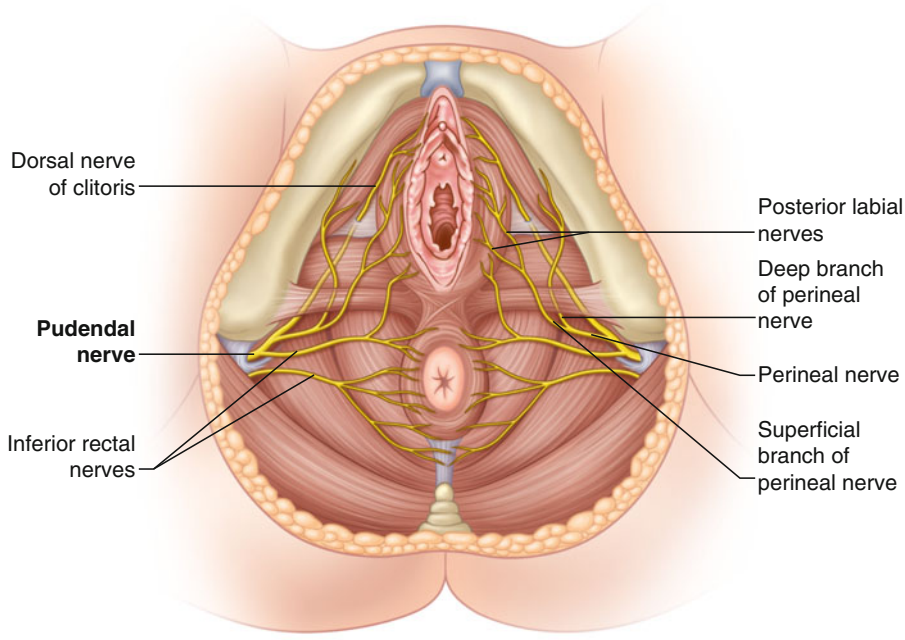

Fig. 16.1 Anatomy of pudendal nerve

defining defects in the internal and external anal sphincter muscles. The most frequently used instruments have a 360° rotating transducer and work with 7 or 10 MHz. More recently three dimensional probes have become popular. Both sphincters can be visualized and length and width can be determined. Atrophy, scar tissue, and defects in the sphincters can also be seen [18] (Fig. 16.4). This technique, similar to ultrasound in other areas of the body, is operator dependent and requires training and experience. However, when performed by an experienced clinician, this test approaches 100 % sensitivity and specificity in identifying sphincter defects [36–38].

Fig. 16.2 Probe used for pudendal nerve terminal motor latency test (*Source*: http://www.glowm.com/section_view/heading/Neurophysiologic%20Testing%20of%20the%20Pelvic%20Floor/item/57. Used with permission)

Defecography

Defecography can be performed under fluoroscopy or using Magnetic Resonance Imaging (MRI). Both techniques involve filling the rectum with either a barium paste in the case of fluoroscopic imaging or ultrasound gel in the case of MRI. Static images at rest and during squeezing and pushing allow measurement of the anorectal angle (Fig. 16.5a, b), perineal descent, and anal canal length. It has been demonstrated that the anorectal angle is increased in pelvic floor

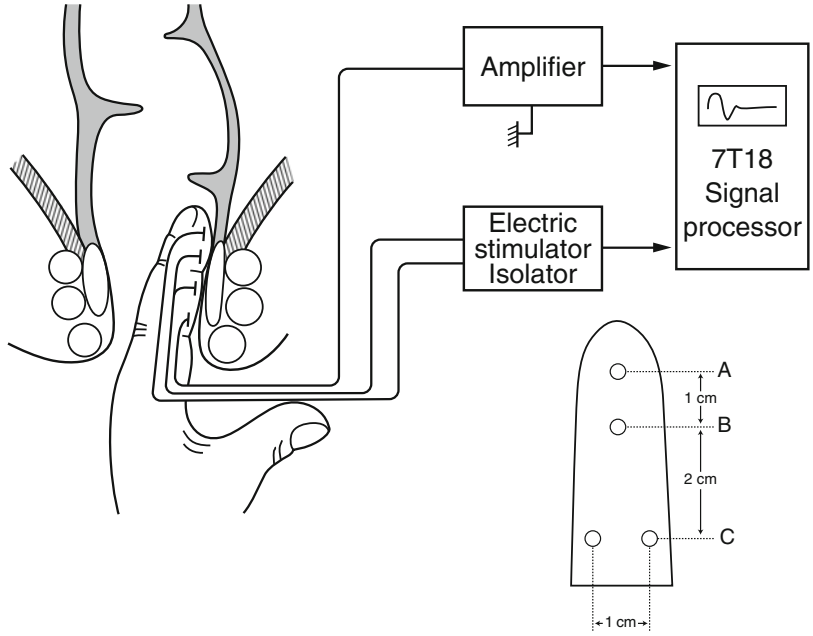

Fig. 16.3 Schematic representation of the system for measuring the pudendal nerve terminal motor latency (PNTML). Latency of the evoked muscle action responses in external anal sphincter (EAS) muscles is recorded after stimulation of both right-sided and left-sided pudendal nerve at the point of ischial spines. A. Stimulating anode. B. Stimulating cathode. C. Ground electrode. D. Recording electrodes (Used with permission from Tomita R, Igarashi S, Ikeda T, Koshinaga T, Fujisaki S, Tanjoh K. Pudendal Nerve Terminal Motor Latency in Patients with or without Soiling 5 years or more after Low Anterior Resection for Lower Rectal Cancer. World Journal of Surgery. 2007; 31(2): 403–408)

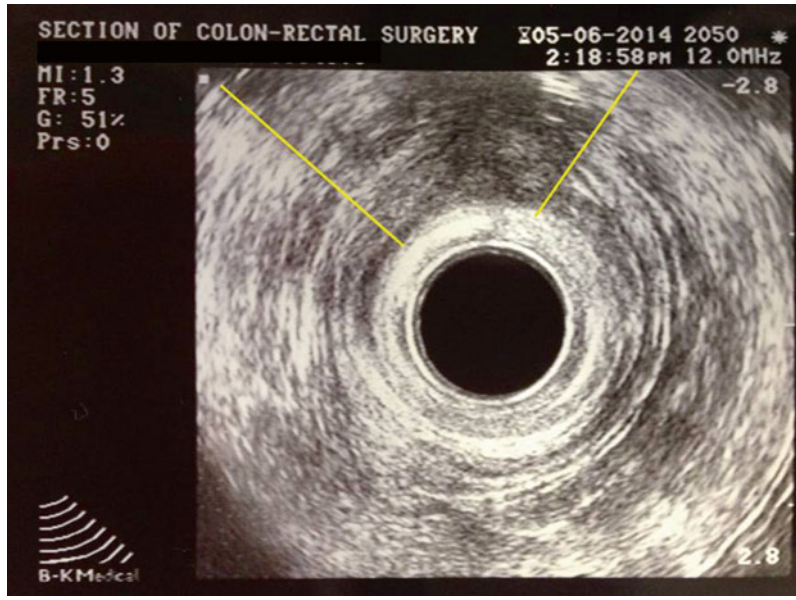

Fig. 16.4 Endorectal ultrasound demonstrating an external sphincter defect

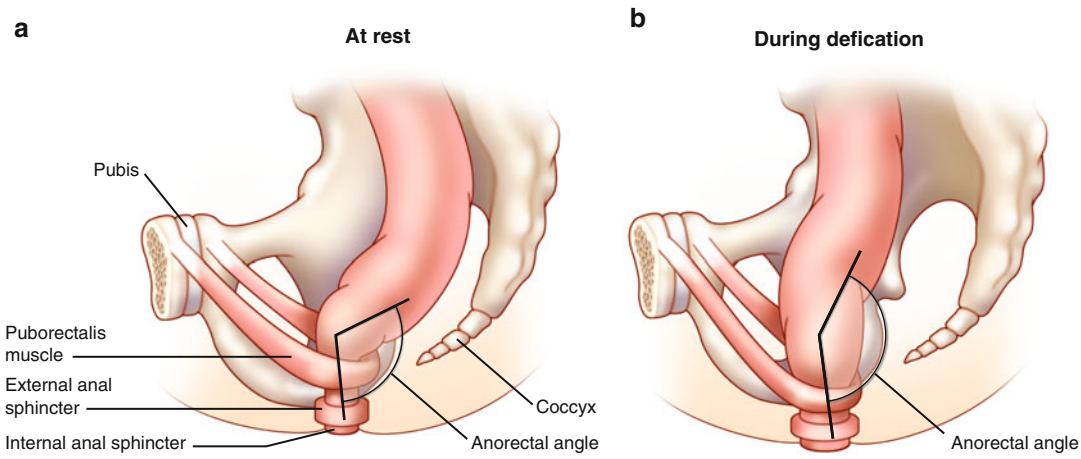

Fig. 16.5 (**a**, **b**) Normal anorectal angle at rest (**a**) and with straining (**b**)

denervation as a sign of pelvic floor weakness. However there is wide interobserver variation in the measurement of the anorectal angle which perhaps makes quantification of limited clinical value [18]. Rectal intussusception, full thickness prolapse, rectoceles, and enteroceles can also be observed. Fluoroscopic defecography tends to be a better test in some cases since the patients are sitting up in the actual position in which one normally defecates, whereas during MR defecography the patient is laying supine and it is often difficult to evacuate the gel in this non-physiologic position. In addition, although both tests can detect a number of abnormalities, these abnormalities can also be seen in otherwise asymptomatic individuals and their presence often correlates poorly with impaired evacuation [39, 40].

Treatment

Medical

After a complete history and physical examination with the addition of necessary physiologic tests, supportive measures are frequently the first approach. It is recommended for patients to keep a bowel and food diary to try and identify offending agents. For patients with diarrheal stool, one would have patients cut lactose and dairy out of the diet to evaluate for possible triggers. Trying to promote a regular ritualized bowel habit is also important. Often times, patients will not empty their rectum completely and residual stool in the rectum may seep or leak out. In these cases, bowel management programs and a regular enema may be useful to promote more complete evacuation. This type of regimen is especially helpful in patients with spinal cord injuries. In patients with loose or segmented stools, a fiber supplement is often recommended. Fiber helps to bulk the stool and promote complete emptying all at once as opposed to having to go back and forth to the bathroom several times. Unfortunately, fiber supplements can potentially worsen diarrhea by increasing colonic fermentation.

For patients with liquid or even mushy stools, Loperamide (Imodium®—McNeil Consumer & Specialty Pharmaceuticals, Fort Washington, PA) and diphenoxylate/atropine (Lomotil®—Pfizer, New York, NY) can produce modest improvement in symptoms related to fecal incontinence. A placebo controlled study of loperamide 4 mg TID has been shown to reduce the frequency of incontinence, improve stool urgency, increase colonic transit time, reduce stool weight, and interestingly, increase anal resting sphincter

Table 16.1 Classification of antidiarrheal medications

Category	Mechanism of action	Medication
Adsorbents		
Fiber supplements	Adsorb water Reduce fecal water content Increase consistency of stool	Psyllium husk (Metamucil®) Methylcellulose (Citrucel®) Guar gum Calcium polycarbophil (FiberCon®) Wheat dextrin (Benefiber®)
Bile acid sequestrant	Forms insoluble complexes with bile acid Makes bile acids osmotically inactive	Cholestyramine (Questran®)
Antispasmodics	Decreases motility Slows passage of stool Allows more time for salt and water to be absorbed	Opiods (Codeine sulfate) Diphenoxylate/atropine (Lomotil®) Diphenoxin/atropine (Motofen®) Loperamide (Imodium®)
	Inhibits hormonal secretion Decreases motility Decreases secretion	Octreotide acetate (Sandostatin®)
Anti-inflammatory	Stops expulsion of fluid into the bowel lumen by coating the mucosa Reduces inflammation/irritation of the intestinal mucosa Antibacterial	Bismuth subsalicylate (Pepto-Bismol® and Kaopectate®)

pressure [41–43]. Other medications that can be used are Codeine sulfate, which can cause drowsiness and addiction, or Cholestyramine (Questran®—Par Pharmaceuticals Inc., Spring Valley, NJ), which is a bile acid binding agent (Table 16.1).

Biofeedback

Behavioral therapy using "operant conditioning" techniques has been shown to improve bowel function and incontinence [44]. The main principle is that patients acquire new and better behaviors through a process of trial and error. The goals of biofeedback are to improve the strength of the anal sphincter muscles, improve the coordination between the abdominal, gluteal, and anal sphincter muscles, and enhance the anorectal sensory perception [1]. The benefit is variable, but improvement in as much as 64–89 % of patients has been reported [45, 46]. Careful selection of patients is crucial and includes factors such as motivation, ability to understand instruction, some rectal sensation preservation, and ability to contract the external anal sphincter voluntarily [47].

Anal Plugs

The anal plug enables controlled evacuation and helps reduce skin complications by temporarily occluding the anal canal. The plug is attached to the perineum using tape and can easily be retrieved. It is effective in controlling incontinence in a minority of patients who can tolerate its use [14] (Fig. 16.6).

Surgical Modalities

Surgery should be considered in selected highly symptomatic patients who have failed conservative measures.

Anal Encirclement Procedures

Anal encirclement was originally described by Thiersch in 1891 for the treatment of complete rectal prolapse. This was later adopted for the

Fig. 16.6 Anal plug (Courtesy of Coloplast, Minneapolis, MN)

treatment of fecal incontinence. A variety of materials have been used for this procedure including nylon, silk, strips of fascia, silver wire, silastic bands, and bioabsorbable materials [18, 48] (Fig. 16.7a–d). The goal of the procedure is to create a rigid barrier to the passage of stool. In general, the perioperative morbidity rate is high with a variety of complications described including fecal impaction, infection, breakage of the encircled material, or erosion through the skin [14, 49]. This procedure has largely been abandoned because of poor results and high postoperative complication rate.

Radiofrequency

Radiofrequency energy or the Secca® procedure (Curon Medical Inc., Sunnyvale, CA) uses heat generated by a high-frequency alternating current that flows from four electrodes causing frictional movements of ions and tissue heating. This procedure is done under sedation and local anesthetic. The device is placed under direct vision into the anal canal and needles are deployed into the tissue and into the sphincter muscles (Figs. 16.8a, b and 16.9). The generator then delivers energy (465 kHz, 2–5 W) at each needle electrode for 90 s or until the temperature reaches 85 °C. The mucosa is constantly cooled by chilled water at the base of each needle. There is constant temperature monitoring and feedback to control the amount of energy delivered to tissue. The therapeutic goal is to create thermal lesions or a controlled scar in the muscle while preserving mucosal integrity. There are variable results in the literature. In a study by Ruiz et al., of 24 patients who underwent the procedure, 16 were available for follow-up. The mean treatment time was 46 min and the number of radiofrequency lesions in the anal canal varied from 31 to 80. Four patients (25 %) experienced minor complications including bleeding, diarrhea, and constipation. Four patients (25 %) had worsening of their incontinence and 2 patients (12.5 %) had no improvement. Overall, 10 of 16 patients (62.5 %) had improvement but still had moderate incontinence at 1 year follow-up [50]. The exact mechanism of this procedure is not known. No consistent changes in anal manometry or anorectal ultrasound have been reported [51–53]. More studies are needed to determine which patients would benefit from this minimally invasive treatment.

Bulking Agents

Injection of bulking agents has emerged as a new treatment for fecal incontinence following success that has been reported in treating urinary incontinence. Many different injectable materials have been used including autologous fat, Teflon,

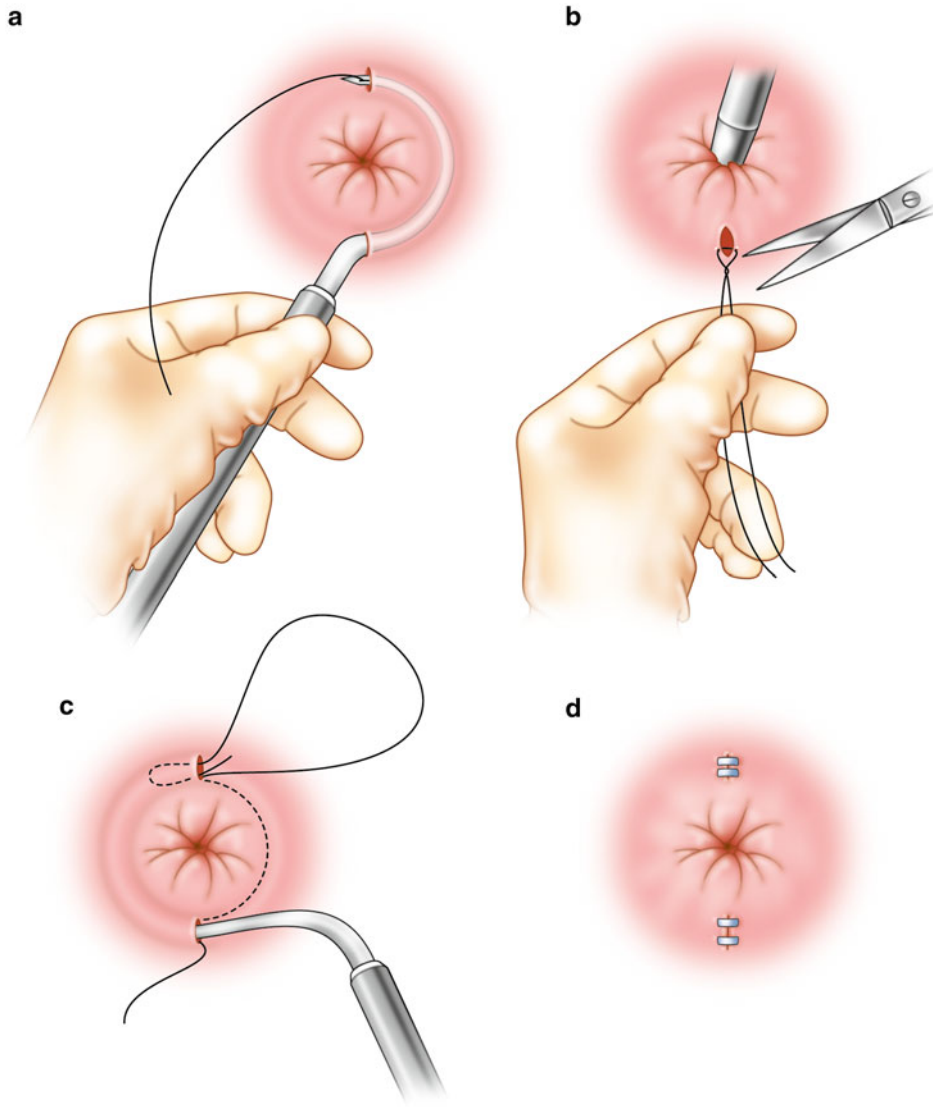

Fig. 16.7 (**a**–**d**) Anal encirclement (Thiersch) procedure

bovine glutaraldehyde cross-linked collagen, carbon-coated zirconium beads (Durasphere®), polydimethylsiloxane elastomer, dextronamer in nonanimal stabilized hyaluronic acid (NASHA™ Dx), hydrogel cross-linked with polyacrylamide (Bulkamid), porcine dermal collagen (Permacol), silicone biomateraial (PTQ™), synthetic calcium hydroxylapatite ceramic microspheres, and polyacrylonitrile in cylinder form. These materials can be injected in different ways including through the perianal skin into the intersphincteric space or through the anal mucosa into the submucosa. Injection can be guided digitally or can be done under ultrasound guidance [54].

The goal of injection is to bulk up the tissue inside the anal canal in order to approximate the anal mucosa. In doing so, this should close the anal canal or raise the pressure inside the anal

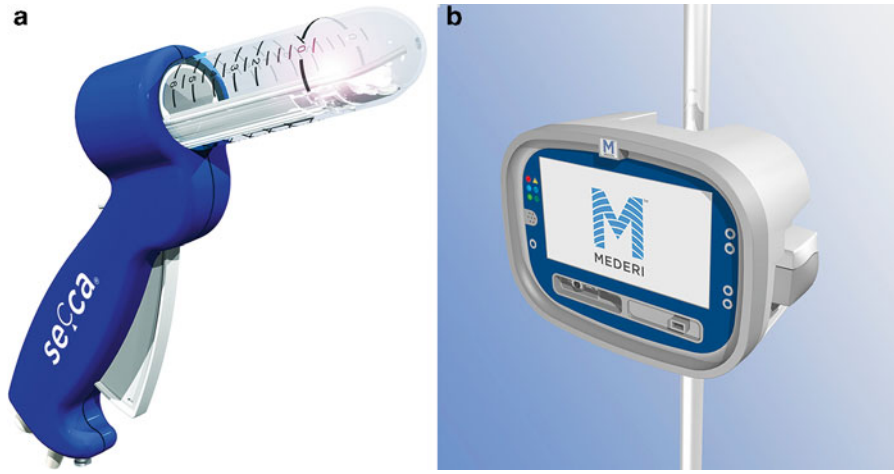

Fig. 16.8 (**a**, **b**) Secca® Radiofrequency device (Courtesy of Mederi Therapeutics, Norwalk, CT; ©2014 Mederi Therapeutics, Inc.)

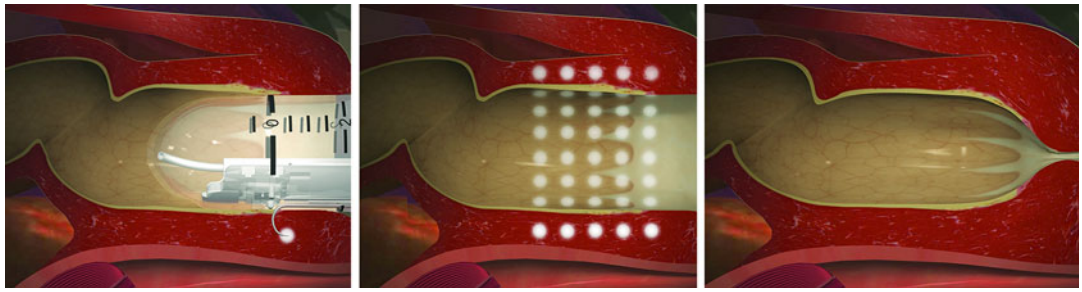

Fig. 16.9 Secca® procedure (Courtesy of Mederi Therapeutics, Norwalk, CT; ©2014 Mederi Therapeutics, Inc.)

canal to prevent leakage of stool. Studies looking at the results of this treatment are limited. There is lack of information regarding the volume of injection, ideal site of injection, and the route it should be injected. One large randomized trial comparing NASHA™ Dx to sham injections demonstrated that NASHA™ Dx is efficacious in the treatment of fecal incontinence with a follow-up of 12 months [55]. There are no studies looking at long-term benefit. In a review of all the studies published to date, the injection of bulking agents appears relatively safe; however, minor adverse events are relatively common (discomfort, pain, bleeding, abscess, and leakage of injected material) [54, 55] (Fig. 16.10).

Overlapping Sphincteroplasty

Overlapping sphincteroplasty is offered to highly symptomatic patients with an anterior external anal sphincter defect secondary to an obstetric or iatrogenic trauma. The procedure typically involves a full mechanical bowel preparation and pre-procedure intravenous antibiotics. A transverse incision is made over the perineum. Dissection is carried up to the level of anorectal ring and the anal mucosa is separated from the sphincter complex. Care is taken not to carry the dissection too far laterally as the nerve supply to the external anal sphincter enters posterolaterally. The fibrous remnant of the external anal sphincter is then divided. End-to-end repair has been

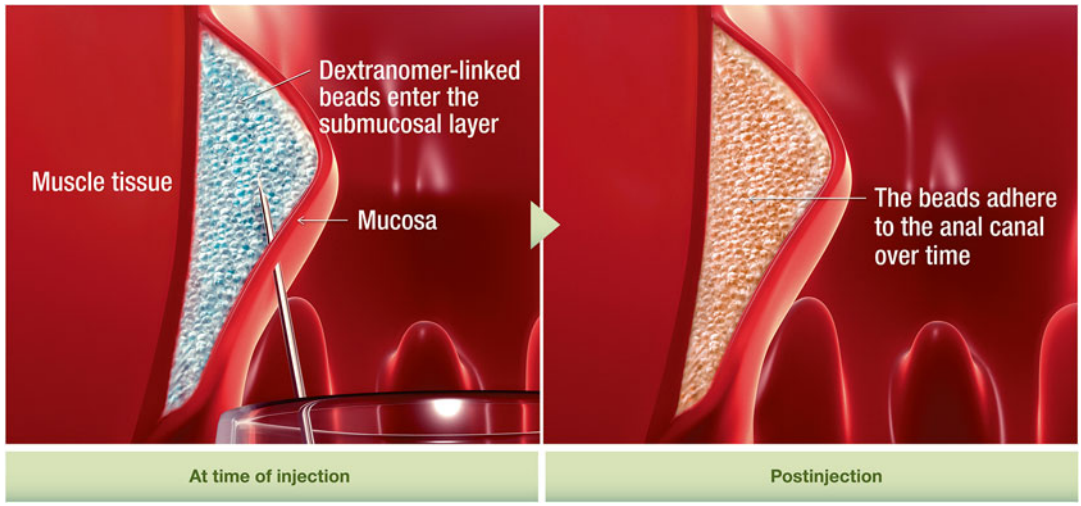

Fig. 16.10 Solesta® injection (Courtesy of Salix Pharmaceuticals, Raleigh, NC)

described but retraction of the ends of the muscle and lack of a bulking effect because of excision of the scar tissue has been implicated in the suboptimal results [56].

For overlapping repair, the scar at the ends of the sphincter is preserved to aid in anchoring the sutures. The ends of the mobilized external sphincter are overlapped and sutured together with absorbable mattress sutures. Plication of the internal anal sphincter may be concurrently performed. Anterior levatoroplasty and closure of the perineal incision in a V–Y manner can help to bulk up the perineal body and increase the anovaginal distance. Typically, the wound is left partially open to promote drainage [18] (Fig. 16.11a–d). Satisfactory results, which are defined as continence for solid and liquid stools, have been reported in 70–100 % of patients [7]. However, the majority of patients will not have perfect continence, and many patients will have residual symptoms. Some patients may even develop new evacuation problems [57]. The most important factor in the return of normal sphincter function seems to be an increase in squeeze pressures [58]. Poor outcome is usually associated with pelvic floor denervation or a residual sphincter defect [59, 60].

In a study looking at functional results of sphincter repair after a median of 10 years, zero patients were fully continent to flatus or stool [61]. Reasons for failure or decline of continence can be explained by weakening of the muscle because of normal aging, repair breakdown, or a combination of these factors [62]. Repeat sphincter repair can be performed in patients with recurrent symptoms, especially if breakdown of the repair is verified on endoanal ultrasound. It has been demonstrated that the long-term results of a repeat sphincter repair are approximately equivalent to those for primary overlapping sphincter repair [63].

Postanal Repair

Postanal repair was first described by Sir Alan G. Parks in 1975 [64]. This technique was described specifically for idiopathic or neurogenic incontinence and for incontinence following surgery for the repair of rectal prolapse. These conditions are associated with lengthening of the anorectal angle and shortening of the anal canal as a consequence of sphincter denervation [7]. The procedure is also advocated for patients with "weak" sphincters but no anatomic sphincter defect [14].

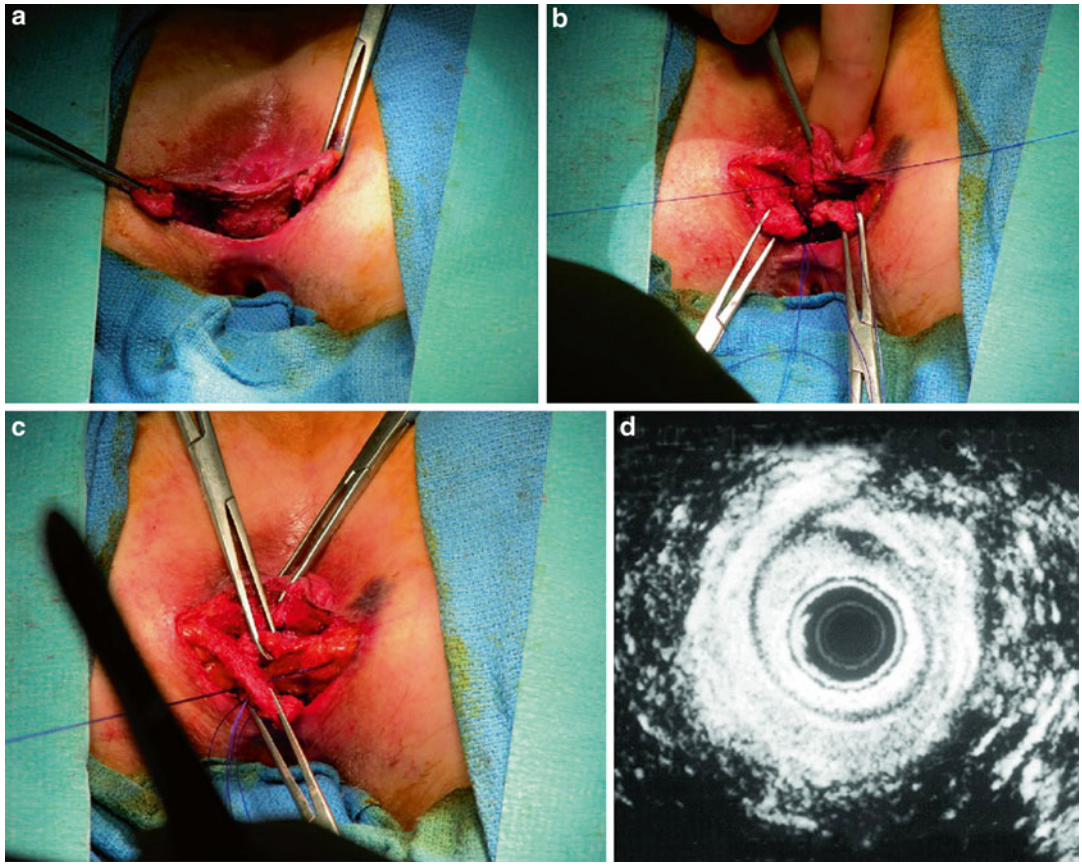

Fig. 16.11 (**a**–**d**) Overlapping sphincteroplasty (Used with permission from Seo CJ, Wexner SD, Davila GW. Reoperative Surgery for Anal Incontinence. In Billingham RP, Kobashi KC, Peters WA. Reoperative Pelvic Surgery. New York: Springer Science+Business Media: 2009)

The procedure is performed through a curved incision posterior to the anus with dissection through the intersphincteric space, through Waldeyer's fascia and into the pelvis. The ileococcygeus, pubococcygeus, and puborectalis muscles are plicated using a series of polypropylene sutures. Further plicating sutures can be placed in the deep and superficial parts of the external anal sphincter muscle using polyglactin suture [18]. The goals of the procedure are to restore the anorectal angle and to tighten the anal sphincter muscle. Although, Parks reports successful outcome in approximately 80 % of patients, these results have not been reproduced [7]. The mechanism of restoration of continence is unclear as the anorectal angle does not change significantly following this procedure and the manometric evaluation of sphincter function is variable [65, 66]. Improvement after this procedure may be caused by creation of a local stenosis or a placebo effect rather than improvement of muscle function [18].

Muscle Transposition

The most common skeletal muscle used in transposition techniques is the gracilis. Gracilis muscle transposition was first described by Pickrell in 1952 [67]. The muscle is freed from its insertion, completely mobilized, and subcutaneously tunneled to the perineum. It is then wrapped around the anus and anchored with sutures to the contralateral ischial tuberosity or the inferior ramus of

the pubic bone. The gracilis muscle is mostly composed of type two muscle fibers that are short acting and fast twitch fibers. Therefore, the muscle is fatigable and only contracts by will. Dynamic graciloplasty combines gracilis muscle transposition with an implantable electrical stimulator. This applies chronic low-frequency stimulation which functions to change the composition of the muscle to long acting, slow twitch, nonfatigable, type one muscle fibers. The procedure has a variable success rate with reports as high as 72 %. Given the steep learning curve of this technique, there is a high complication rate. Most complications are minor, but infection and rectal perforation are described [68]. Unfortunately this has not been approved for use in the United States. Other muscles that have been transposed include the gluteus maximus muscle [69], pubococcygeus [70], transverse perineal muscle [71], and even the antropylorus [72]. Free muscle transplantation has also been described [73].

Artificial Bowel Sphincter

The artificial bowel sphincter (ABS) was adapted from the artificial urinary sphincter which was introduced in 1972 by American Medical Systems (AMS). In 1987, the first description of the use of the artificial urinary sphincter was reported for fecal incontinence. The patient had an excellent result with no complications at a follow-up of 3 months [74].

Since then, modifications have been made to the artificial urinary sphincter to make it more applicable for use around the anus which culminated in the development of the Acticon Neosphincter™ (AMS, Minnetonka, Minnesota). The procedure involves encirclement of the anus with an implantable fluid-filled, silicone, elastomer cuff that is connected by tubes to a control pump and a pressure-regulating balloon. Cuff lengths range from 7 to 14 cm with three cuff widths of 2, 2.9, and 2.4 cm. The control pump is implanted in the labia or the scrotum and the balloon is implanted in the space of Retzius. The inflated cuff compresses the anus all the time. When the patient has to defecate, the fluid is manually pumped from the cuff to the balloon by using the control pump. The empty cuff allows the passage of stool and then the pressure in the balloon sends the fluid back into the cuff (Figs. 16.12 and 16.13).

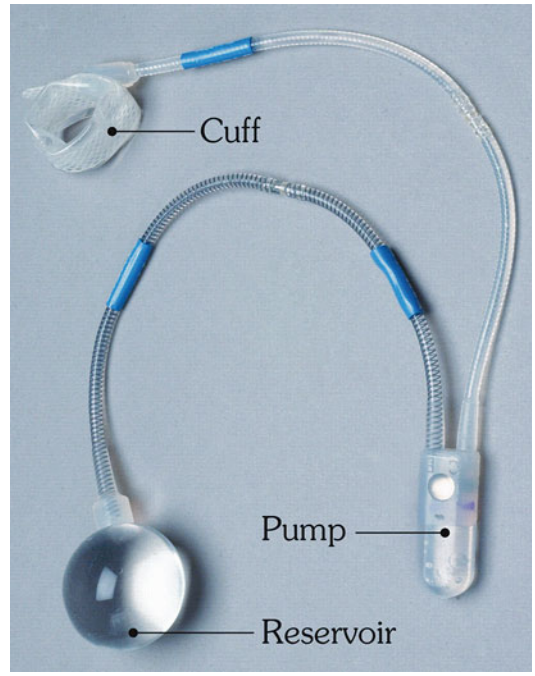

Fig. 16.12 The Acticon® artificial bowel sphincter device (American Medical Systems) (Used with permission from Goh M, Dioknow AC. Surgery for Stress Urinary Incontinence: Open Approaches. In Badlani GH, Davila GW, Michel MC, de la Rosette JJMCH, eds: Continence. London: Springer Science + Business Media, 2009)

In a multicenter, prospective, nonrandomized clinical trial looking at 115 patients, 6 patients were aborted because of perforation. Device-related complications were reported in 86 % of enrolled patients. Forty six percent of patients required device revisions to treat major adverse events including infection or erosion and 36 % required explantation. At the end of the follow-up period of 1 year, 75 of 112 patients (67 %) had functioning devices [75].

The magnetic anal sphincter (MAS) (FENIX™; Torax Medical Inc., Shoreview, MN) is a novel artificial sphincter mechanism which was recently described. This was originally used in the treatment of gastroesophageal reflux disease. This device is composed of a series of titanium beads with magnetic cores inside. The beads are interlinked with titanium wires to form

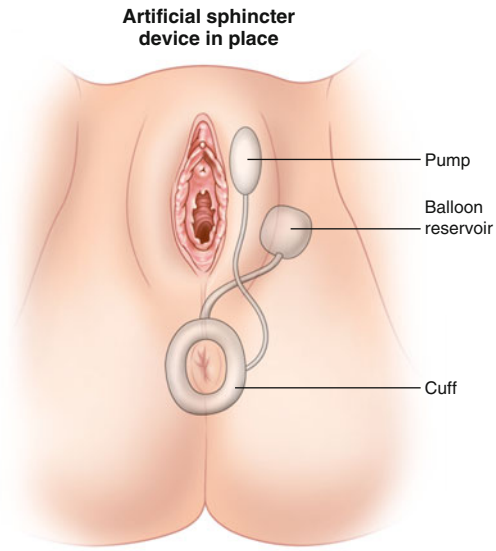

Fig. 16.13 Illustration of the implantation of the artificial bowel sphincter

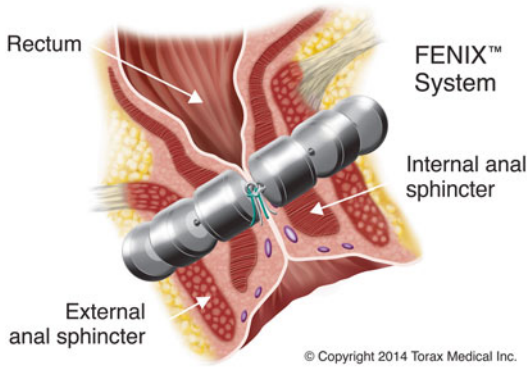

Fig. 16.14 Fenix™ magnetic anal sphincter device (Courtesy of and Copyright ©2014 Torax Medical, St. Paul, MN)

a flexible ring that is implanted around the external sphincter in a circular fashion (Fig. 16.14). The device is manufactured in different lengths based on the number of beads (14–20) [76].

One major advantage of this device in contrast to the ABS is that it works immediately once implanted without the need for further manipulation by the patient or the surgeon. The device is passively activated by the passage of stool and it automatically retracts back to its closed size after evacuation. In a study comparing 10 patients implanted with the ABS and 10 patients implanted with the MAS, there was similar 30-day complication rate but the procedure for MAS was shorter in duration with a shorter length of hospitalization [77]. Of note, this device has received European CE Mark approval for the treatment of fecal incontinence but is not available in the United States and is only limited to investigational use.

Sacral Nerve Stimulation

In 1988, Tangaho and Schmidt described the use of electrical stimulation for the treatment of neurogenic bladder [78]. Following that in 1995, Matzel et al. described its use in three patients for the treatment of fecal incontinence [79]. Since then, sacral nerve stimulation (SNS) has been advocated as a safe and effective treatment for severe fecal incontinence with minimal morbidity [80–82]. SNS has been shown to be more effective than optimal medical therapy and a placebo effect has been eliminated [83, 84]. The device has also proven to be beneficial in patients with idiopathic fecal incontinence as well as those with sphincter defects and also pudendal neuropathy [83, 85].

After a prospective multicenter study, SNS was FDA approved in the United States in 2011 for the treatment of fecal incontinence. This study looked at 120 patients that received an implant. After a mean follow-up of 28 months, 85 % of patients were improved and 40 % had perfect continence [86]. Although, no studies have been done in the United States with regards to cost, the procedure has been shown to be cost-effective in other countries [87–89].

Diversion

Although considered as the last option in the surgical strategy, construction of an end diverting colostomy may be indicated in certain patients in whom available treatments have failed, are inappropriate because of other comorbidities, or when preferred by the patient [14]. A stoma may be successful in controlling symptoms of incontinence but it may also be associated with significant psychosocial issues and stoma-related complications. As a stoma in this

instance will most likely be permanent, it is important for the patient to be marked preoperatively by an enterostomal nurse and also receive teaching and counseling prior to undergoing the procedure.

In patients with severe fecal incontinence, a stoma will improve quality of life in the majority of patients. In a survey, 83 % of patients with a permanent colostomy for incontinence reported a significant improvement in lifestyle and 84 % would choose to have the stoma again [90].

Conclusion

Fecal incontinence is an underreported condition for many reasons including embarrassment and unawareness of both physicians and patients to the available treatments. A detailed medical surgical, obstetric, and bowel history should be obtained. A thorough rectal exam combined with appropriate physiologic, endoscopic, and radiologic should be performed. Treatments are individualized to the particular patient. Emerging treatments for the treatment of fecal incontinence are promising and may avoid or even supplant traditional surgical procedures such as overlapping sphincteroplasty. The majority of patients can avoid a diverting stoma.

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