

Management of patients with faecal incontinence

Jakob Duelund-Jakobsen, Jonas Worsoe, Lilli Lundby, Peter Christensen and Klaus Krogh

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Abstract: Faecal incontinence, defined as the involuntary loss of solid or liquid stool, is a common problem affecting 0.8–8.3% of the adult population. Individuals suffering from faecal incontinence often live a restricted life with reduced quality of life. The present paper is a clinically oriented review of the pathophysiology, evaluation and treatment of faecal incontinence.

First-line therapy should be conservative and usually include dietary adjustments, fibre supplement, constipating agents or mini enemas. Biofeedback therapy to improve external anal sphincter function can be offered but the evidence for long-term effect is poor. There is good evidence that colonic irrigation can reduce symptoms and improve quality of life, especially in patients with neurogenic faecal incontinence. Surgical interventions should only be considered if conservative measures fail. Sacral nerve stimulation is a minimally invasive procedure with high rate of success. Advanced surgical procedures should be restricted to highly selected patients and only performed at specialist centres. A stoma should be considered if other treatment modalities fail.

Keywords: faecal incontinence, conservative treatment, quality of life

Introduction

Epidemiology of faecal incontinence

Faecal incontinence (FI) can be defined as the recurrent uncontrolled passage of faecal material in a person with a developmental age of at least 4 years. The prevalence of FI in the adult population has been estimated at 0.8–6.2% [Pretlove *et al.* 2006; Damon *et al.* 2006]. Recent data from the North America, however, indicate a much higher prevalence of 8.3% even in noninstitutionalized adults [Ditah *et al.* 2014]. The prevalence of FI increases with age from approximately 3% in the age group from 20 to 29 years to 16% in people aged 70 or over [Ditah *et al.* 2014]. In nursing home residents the prevalence of FI may be as high as 47% [Nelson *et al.* 1998]. The risk of FI is independently associated with older age, diabetes, loose stools and three or more bowel movements per day [Ditah *et al.* 2014]. It is controversial whether FI is associated with female sex or not [Ditah *et al.* 2014; Nelson *et al.* 1998].

FI has serious consequences for social activities and quality of life [Drossman *et al.* 1993; Crowell

et al. 2007]. Furthermore, FI is a cause of significant cost due to diagnostics, treatment, care and reduced ability to work [Bharucha *et al.* 2005; Xu *et al.* 2012].

The literature on FI is extensive and multiple treatment modalities exist. The present paper is a clinically oriented review of the pathophysiology, evaluation and treatment of FI.

Physiology of anal continence

Anal continence depends on complex interactions among a number of factors. The internal anal sphincter muscle (IAS) is a continuation of the circular rectal smooth muscle layer. Its main function is to generate most of the anal resting pressure, thereby preventing FI at rest [Lestar *et al.* 1989]. The IAS is under reflex control. The external anal sphincter muscle (EAS) is composed of striated muscle cells and is partially under voluntary control. The EAS contributes to the anal resting pressure but its main function is to generate the anal squeeze pressure [Lestar *et al.* 1989]. The puborectalis muscle forms a sling around the

Correspondence to:
Jakob Duelund-Jakobsen, MD, PhD
Pelvic Floor Unit,
Department of Surgery
P, Aarhus University
Hospital, Tage-Hansens
Gade 2, 8000 Aarhus C,
Denmark
jakob_jakobsen@hotmail.com

Jonas Worsoe, MD, PhD
Lilli Lundby, MD, PhD
Peter Christensen, MD, DMSc
Pelvic Floor Unit,
Department of Surgery
P, Aarhus University
Hospital, Denmark

Klaus Krogh, MD, DMSc
Neurogastroenterology
Unit, Department
of Hepatology and
Gastroenterology, Aarhus
University Hospital,
Denmark

Table 1. Common causes of faecal incontinence.

Anal sphincter dysfunction	Congenital anorectal malformations Radiation therapy Obstetric anal sphincter injury Anal surgery Perianal fistulas Sexual abuse
Rectal disorders	Inflammatory bowel disease Radiation therapy Rectocele Rectal intersusception Rectal prolapse Faecal impaction
Neurological disorders	Spinal cord lesions Stroke Multiple sclerosis Spina bifida Diabetic neuropathy Obstetric nerve damage
Myopathy	Systemic scleroderma
Fast colorectal transit time	Chronic diarrhoea Irritable bowel syndrome
Psychological	Encopresis Dementia

upper part of the anal canal. The tone of the puborectalis muscle creates the anorectal angle, which prevents movement of faeces from the rectum to the anal canal between defecations. In contrast to the rectum, the anal canal is densely innervated by sensory nerve cells. Anal sensibility is necessary for the person to contract the EAS if defecation is to be postponed. The anal sampling reflex, including short-lasting rectal contraction and relaxation of the upper part of the anal canal, allows the subject to sense the content of the rectum [Duthie and Bennett, 1963].

Normal compliance of the rectal wall is necessary for the rectum to function as a reservoir. Impaired rectal sensation may cause faecal retention and thereby FI while a hypersensate or hyperreactive rectum may cause urge symptoms and FI. Colorectal transit time may be used to determine the transport time to the different segments of the colon [Abrahamsson *et al.* 1988]. If transit is fast, stools may become loose or liquid and difficult to retain.

Any factor described above may be disturbed and thereby make the subject incontinent. If no major structural or neurological abnormalities are

found, FI is defined as primary or functional/idiopathic [Bharucha *et al.* 2006]. If the underlying pathology can be identified, FI is defined as secondary to the specific condition.

FI secondary to other disorders

FI is a common consequence of a number of conditions and diseases, some of which are shown in Table 1. Congenital, traumatic or iatrogenic defects of the anal canal are well known causes of FI. Especially, sphincter lesions resulting from vaginal delivery may result in FI. Many patients with neurological disorders affecting the brain, spinal cord or peripheral nervous system have FI because of impaired anal sphincter control, reduced or absent anorectal sensibility or abnormal anorectal reflexes. Patients with diabetes may have neuropathy of the anal canal and some have chronic diarrhoea. In patients with various connective diseases, notable scleroderma, there is myopathy and atrophy of the IAS. Rectal surgery may compromise the reservoir function of the rectum as seen in patients with low anterior resection syndrome. The same can be seen after radiotherapy towards the pelvic organs and in some patients with inflammatory bowel disease or

irritable bowel syndrome. A large rectocele or rectal intersuption may cause FI or soiling, as stool can be retained (stool trapping) and later leak through the anal canal [Melchior *et al.* 2015]. Usually, a full-wall rectal prolapse will compromise the IAS and EAS and cause FI [Faucheron *et al.* 2015].

If FI is secondary to other disorders, the underlying disorder should be treated if possible. In many cases this is, however, not possible and specific treatment should be attempted as described later in this paper.

Idiopathic (functional) FI

According to the ROME III criteria, functional FI is defined as the recurrent uncontrolled passage of faecal material in a person with a developmental age of at least 4 years and one of the following: abnormal functioning of normally innervated intact muscles; minor abnormalities of sphincter structure or innervation; normal or disordered bowel habits (i.e. faecal retention or diarrhoea); and psychological causes [Bharucha *et al.* 2006]. Also according to the ROME criteria, the following have to be excluded: abnormal innervation caused by lesions within the brain, spinal cord, sacral nerve roots, or generalized peripheral or autonomic neuropathy; anal sphincter abnormalities associated with a multisystem disease; and structural or neurological causes believed to be the primary cause of FI.

Idiopathic FI is associated with a weakened pelvic floor as indicated by reduced anal pressures and increased distensibility of the anal canal [Sorensen *et al.* 2014]. Damage to the pudendal nerve during childbirth is considered an important aetiological factor for idiopathic FI [Kiff and Swash 1984].

Evaluation of FI

Patient history

A careful patient history is essential in the evaluation of FI. The nature and type of FI should be characterized and include onset, frequency, duration, diurnal variation, stool consistency, previous management, coexisting urinary incontinence, relation to food intake and physical activity, and the impact on social activities and quality of life. It is important to describe whether the patient has urge FI (FI preceded by a strong desire to defecate) or passive FI (FI not preceded by desire to defecate).

It is also of clinical relevance to determine whether the patient has incontinence to substantial amounts of solid or liquid stools or whether it is soiling/seepage of small amounts of liquid stools.

The number of childbirths, any history of obstetric anal sphincter injuries, previous anorectal surgery, and other anal or perianal trauma must be elucidated. As neurological disorders and systemic disorders such as diabetes mellitus and connective tissue disorders often cause FI, these should be mentioned if present. Recent onset of FI can be the first sign of neoplasia or inflammation and therefore requires further endoscopic evaluation according to national recommendations.

The patient history should be supported by patient-reported outcome measures (PROMs) to quantify patient symptoms and convert individual experiences into data. Thereby, grading of the severity of FI is possible and treatment can be monitored for quality control and for scientific purposes. Several different PROMs for FI exist. Most of the scores have been subjected to limited validation. The most widely used scoring tools are the Wexner incontinence score [Jorge and Wexner, 1993], the St Marks FI grading system [Vaizey *et al.* 1999], the Fecal Incontinence Quality of Life Scale [Rockwood *et al.* 2000] and the International Consultation on Incontinence Questionnaire – Bowel Symptoms (ICIQ-B) [Cotterill *et al.* 2011].

The Wexner incontinence score is probably the most widely used to assess the severity of FI. The score consist of five items (incontinence of solid stool, liquid stool, and flatus, the need to wear a pad and lifestyle alterations), which are summarized over 4 weeks. For each item, a score from 0 to 4 is assigned, depending on the frequency from always/daily (4) to never (0). The sum of the five items gives the total score, which ranges from 0 indicating full continence, to 20 indicating complete incontinence.

A bowel habit diary can be used for daily registration of bowel habits. Traditionally this has been done on paper forms, but current initiatives are undertaken to convert bowel habit diaries in to smartphone apps.

Physical examination

Physical examination of the perineum and the anal canal is mandatory [Dobben *et al.* 2007]. The passive closure of the anal canal and perianal

skin erosions can be assessed with inspection. With digital rectal examination ‘the educated finger’ provides a rough impression of the anal resting and squeeze pressures [Hallan *et al.* 1989; Mimura *et al.* 2004; Eckardt and Kanzler, 1993]. Furthermore, coordinated relaxation of the pelvic floor muscles at straining can be accessed digitally. In patients with coexisting symptoms of difficult rectal evacuation the patient should be asked to sit on a commode and perform a Valsalva manoeuvre in order to reveal a rectal prolapse.

Endoanal ultrasonography and anorectal physiology tests

The integrity of the anal sphincter can be examined in detail with endoanal ultrasonography [Sultan *et al.* 1994; Law *et al.* 1991]. This provides a clear presentation of the IAS and EAS which can reveal structural causes of anal sphincter dysfunction [Felt-Bersma and Cazemier, 2006]. Endoanal ultrasonography has a high degree of sensitivity and specificity and it correlates well with manometric findings [Bordeianou *et al.* 2008]. The examination is easy to perform and 3D images can be saved for training and supervision.

Anal physiology testing often done in severe FI and before sophisticated treatment modalities are introduced. However, the prognostic value of each test has been questioned and it should be emphasized that an anal physiology test cannot stand alone in the clinical decision making [Hill *et al.* 2006].

Anal manometry determines the anal resting pressure and anal squeeze pressure. It can either be done by water perfused [McHugh and Diamant, 1987] or solid state catheters.

High-resolution manometry of the anal canal provides detailed spatial information about anal pressures. The technique is increasingly used but it remains to be established whether the rather expensive equipment provides better guidance towards therapy than standard manometry. Rectal capacity and compliance can be tested with a rectal balloon gradually filled with either air or water. Rectal sensibility is also assessed during balloon filling as the patient reports ‘first detectable sensation’, ‘sensation of urge to defecate’ and ‘maximum tolerable rectal volume’. The barostat is considered the golden standard for assessment of rectal compliance, but the procedure is very time consuming [Vanhoutvin *et al.*

2009]. A new ‘quick-barostat’ may solve this problem [Sauter *et al.* 2014].

The threshold for anal mucosal sensation can be determined with neurophysiology tests [Felt-Bersma *et al.* 1997] and the pudendal nerve terminal motor latency time can reveal possible traction neuropathy [Kiff and Swash, 1984]. Colonic transit times by use of radiopaque markers and a single abdominal X-ray can reveal coexisting constipation [Abrahamsson *et al.* 1988]. Dynamic magnetic resonance imaging [Melchior *et al.* 2015], conventional defaecography or a transperineal ultrasonography is indicated if a large rectocele or rectal intussusception is suspected.

Conservative treatment of FI

Conservative therapy is first-line treatment for patients with FI. Conservative therapy is defined as any nonsurgical, noninvasive intervention improving faecal continence or as a treatment to prevent further deterioration over time. Several conservative treatment options are available, but the durability over time is often poor and a more invasive approach can be necessary [Tjandra *et al.* 2008]. A treatment algorithm for FI has been proposed by the International Consultation on Incontinence [Abrams *et al.* 2010]. Recently, we have published that conservative management of FI in a specialist nurse-led programme is effective and appreciated by the patients [Duelund-Jakobsen *et al.* 2015]

Behavioural and medical therapy

The first step in the treatment of FI is usually regulation of diet, fluid intake and bowel habits. Patients must be advised to avoid food or drinks that cause loose stool and frequent bowel movements. Fibre and bulking agents, such as natural psyllium, methyl cellulose or synthetic polycarboxophil, may augment stool consistency and have documented effect against FI [Bliss *et al.* 2001; Sze and Hobbs, 2009].

An anal plug can be attempted in patients with passive FI, especially those with soiling of small amounts of liquid stools. Even though most patients cannot tolerate the use of anal plugs on a permanent basis, they may be useful for occasional use [Deutekom and Dobben, 2012].

Constipating agents, such as loperamide, are frequently used and the efficacy has been documented

against FI associated with loose stool [Lauti *et al.* 2008]. Loperamide is an opiate derivative that acts by increasing transit time through the small intestine and the proximal colon, thereby promoting absorption and improving stool consistency [Ooms *et al.* 1984; Ruppin, 1987]. Furthermore, loperamide impairs the rectoanal inhibitory reflex and increases the anal resting pressure [Hanauer, 2008; Musial *et al.* 1992; Ruppin, 1987; Read *et al.* 1982].

Laxatives, mini enemas and suppositories can be useful, especially in those with coexisting evacuation disorders.

Biofeedback therapy assists the patient in learning to improve contraction of the EAS. The exercises are performed with a manometric probe in the anal canal. The probe is attached to a visual or verbal amplifier that gives response proportional to the pressure delivered during squeeze. Individualized training programmes lasting 6–8 weeks with twice-daily exercises at home followed by an evaluation is common practice. Patients are encouraged to continue the strengthening exercises lifelong. The mechanism of action for biofeedback therapy is still not fully understood [Papachrysostomou and Smith, 1994]. A recent Cochrane review concluded that the current literature does not allow a definitive assessment of the possible role of biofeedback therapy in the management of FI [Norton and Cody, 2012].

Transanal irrigation

Transanal irrigation can reduce episodes of FI. The patient usually administers the enema daily or every other day thereby obtaining a state of 'pseudo-continenence' because the distal colon and the rectum are without stools. A number of specialized catheters can be used. Usually, body-tempered water is used. The procedure is simple and safe for long-term treatment [Christensen *et al.* 2009]. A study using a scintigraphy model demonstrated that in patients with idiopathic FI, transanal irrigation results in almost complete emptying of the rectosigmoid and descending colon [Christensen *et al.* 2003]. Medium-term follow up has shown that 51% of patients have a successful outcome after 21 months [Christensen *et al.* 2009]. The most firm evidence for transanal irrigation is, however, among patients with FI and evacuation disorder as a consequence of spinal cord injury [Christensen *et al.* 2006].

Surgical treatment of FI

Injectable bulking agents

Patients with passive incontinence such as seepage and soiling or mild FI without significant EAS defects are candidates for treatment with bulking agents. A number of different biomaterials including autologous fat, silicone, cross-linked collagen, dextranomer in hyaluronic acid gel, carbon coated beads and others have been used for injection into the submucosa or the intersphincteric space to augment the anal sphincter and improve continence.

A systematic review of efficacy and safety of injectables was published in 2011 [Hussain *et al.* 2011]. A pooled analysis on a total of 1070 patients concluded that continence improved in 70% during the early postoperative period but in only 42% at 12-month follow up. A Cochrane review from 2013 identified five randomized studies and concluded that no evidence of long-term outcome was available [Maeda *et al.* 2013]. A multicentre trial randomized 206 patients in a 2:1 ratio to receive either submucosal injections of dextranomer in stabilized hyaluronic acid gel or sham injections. At 6 months, 52% of the patients in the treatment arm reached the primary endpoint of 50% reduction in FI episodes. Surprisingly, 31% of the patients in the sham injection group also responded to treatment [Graf *et al.* 2011]. In 2014 the results from 83 out of 115 patients in the treatment arm were updated and the success rate was 63% [La Torre and de la Portilla, 2013].

In 2011, Ratto and colleagues introduced a new procedure with implant of Gatekeeper. This is a self-expandable prosthesis placed in the intersphincteric space of the anal canal. Preliminary results from 14 patients showed a significant decrease in episodes of major FI while quality of life significantly improved. No complications were reported [Ratto *et al.* 2011] but long-term results are needed.

Neuromodulation

Neuromodulation is an attractive therapeutic option when conservative measures fail. Neuromodulation has to some extent obviated the use of overlapping sphincter repair and more extensive surgical procedures which had high morbidity and poor long-term efficacy [Rongen *et al.* 2003; Glasgow and Lowry, 2012]. Treatment of FI by neuromodulation is mainly conducted by

sacral nerve stimulation (SNS) using the implantable Interstim therapy system (Medtronic, Minneapolis, MN, USA) or lately tibial neuromodulation using a peripheral electrode with the Urgent PC neuromodulation system (Uroplasty Ltd, Manchester, UK). Both modalities are adopted from treatment of urinary incontinence [McGuire *et al.* 1983; Stoller, 1999]. SNS was introduced for idiopathic FI in 1995 [Matzel *et al.* 1995]. Tibial neuromodulation was first applied for treatment of FI in 2003 [Shafik *et al.* 2003]. The mechanism of action remains to be established, but direct or peripheral stimulation of sacral roots modulating afferent or efferent central pathways controlling colorectal motility and perception is proposed [Gourcerol *et al.* 2011].

Sacral nerve stimulation. The procedure is done under local or general anaesthesia. An electrode is placed through a sacral foramen S2–S4 (preferably S3) to stimulate the sacral nerve roots. The procedure is composed of two stages; first, a percutaneous nerve evaluation (PNE) test that is performed with one or more test leads. Alternatively, a permanent lead with an extension cable is used and connected to an external pulse generator. If FI is significantly reduced during the PNE test, usually by at least 50% [Duelund-Jakobsen *et al.* 2012], a permanent electrode is implanted and a pulse generator is placed in a gluteal pocket. The pulse generator is accessible for programming by external telemetry.

The result of the test period has a high predictive value for subsequent successful permanent implantation. Whereas no demographic data predicted a positive PNE test, the results of external sphincter evaluation appear to be a predictor [Maeda *et al.* 2010; Hornung *et al.* 2014]. Normal pudendal terminal motor latency and low stimulation amplitude have been identified as predictors for successful SNS [Duelund-Jakobsen *et al.* 2014; Gallas *et al.* 2011].

Several studies have documented that SNS effectively reduces episodes of FI and improves quality of life in the short term [Hollingshead *et al.* 2011; Wexner *et al.* 2010; Tjandra *et al.* 2008]. Even though the effect appears to be maintained at medium- and long-term follow up [Duelund-Jakobsen *et al.* 2012; Altomare *et al.* 2015; Michelsen *et al.* 2010; Mellgren *et al.* 2011], some loss of efficacy and adverse events (pain/discomfort) have been reported [Maeda *et al.* 2011].

Posterior tibial nerve modulation. The posterior tibial nerve is a mixed sensory motor nerve with afferent

fibres originating from the lumbosacral dorsal roots (L4–S3). Stimulation is delivered transcutaneously using a plaster electrode (TTNS) or percutaneously using a needle electrode (PTNS). The electrode is placed above the medial malleolus, and a ground surface electrode placed on the ipsilateral leg. Various treatment protocols have been applied ranging from 4 weeks to 12 weeks, with scheduled stimulation sessions from daily to once per week. A comparison between stimulation regimes showed significantly better efficacy with more frequent stimulation sessions [Thomas *et al.* 2013].

The main indication is urge FI but treatment has often been offered quite liberally on a trial and error basis. Two randomized controlled trials have evaluated the effects of peripheral neuromodulation *versus* sham but results were conflicting [George *et al.* 2013; Leroi *et al.* 2012].

Only uncontrolled data are available from TTNS and generally the effect was smaller than reported for PTNS and perhaps not clinically relevant [Leroi *et al.* 2012; Eleouet *et al.* 2010; Queralto *et al.* 2006]. Accordingly, a randomized controlled trial did not show significant reduction in incontinence episodes with TTNS compared with sham [Leroi *et al.* 2012].

In a randomized trial, results from SNS and PTNS did not differ significantly [Thin *et al.* 2015]. Thus, the role of posterior tibial nerve modulation is unclear, but an ongoing large British randomized study of PTNS *versus* sham may help define it.

Sphincteroplasty

Sphincteroplasty to reconstruct defects in the EAS has been the standard treatment of FI after documented external sphincter defects. Short-term improvement in FI has been reported in up to 86% of patients [Cheung and Wald, 2004; Barisic *et al.* 2006]. After 3 months, almost two-thirds of the patients reported excellent or good results with improved quality of life. However, several retrospective studies show a deterioration of the functional outcome in the long term. After 5–10 years, only 25–40% of the patients are continent [Lehto *et al.* 2013; Bravo Gutierrez *et al.* 2004].

Antegrade continence enema

Antegrade colonic irrigation through an appendicostomy was first described in children with FI

by Malone and colleagues in 1990 [Malone *et al.* 1990]. The method aims at avoiding FI by scheduled controlled emptying of the colon. Antegrade irrigation is well established for FI in children with anorectal malformations or neurological disorders [Levitt *et al.* 1997]. Data on adults are fewer but long-term results appear to be good with a rate of success around 75% [Lefevre *et al.* 2006; Poirier *et al.* 2007]. Appendicostomy stenosis, leakage of mucus or intestinal content from the stoma and surgical site infections are common complications, which may require surgical revision.

Laparoscopic ventral rectopexy

Laparoscopic ventral rectopexy has been introduced against high-grade rectal intussusception with outcomes comparable to those for full thickness rectal prolapse [Gosselink *et al.* 2015]. Studies are still few, observational in design and with 1-year follow up only. Complications include comparable chronic pelvic pain and mesh erosion as reported from treatment of full thickness rectal prolapse [Evans *et al.* 2015; Faucheron *et al.* 2015].

Radiofrequency energy

Treatment of FI by means of temperature-controlled radiofrequency energy administered to the anal canal was first described in 2002 and named the SECCA procedure [Takahashi *et al.* 2002]. The technique is simple and the radiofrequency energy is delivered to the sphincters with an anoscope. A recent review concluded that with appropriate patient selection improvement of FI symptoms and quality of life persist for at least 6 months and seems to continue for a further 5 years [Frascio *et al.* 2014]. However, the number of patients treated is small and only 39 patients were followed for 5 years. A recently published animal study found that SECCA caused restructuring of the IAS and EAS rather than fibrosis and scarring [Herman *et al.* 2015].

Neosphincter procedures

Patients with severe FI who do not achieve satisfactory results on any of the treatment regimens described above can be considered for neosphincter procedures such as the gracilis muscle transposition (dynamic graciloplasty), implantation of an artificial bowel sphincter or the magnetic anal sphincter. The surgical techniques for these

procedures are complex and should only be carried out in selected centres.

Graciloplasty is performed with the patient's gracilis muscle to create a new sphincter around the anus. To sustain muscle tone, an electrode is placed in the gracilis muscle and connected to a stimulator implanted in the abdominal wall. In a systematic review the success rate of graciloplasty ranged from 42% to 85% [Chapman *et al.* 2002]. Complications are common and include pain, surgical site infections, and problems related to the electronic device. Hospitalization or surgery were required in 42% of the patients [Matzel *et al.* 2001].

The artificial bowel sphincter consists of an inflatable cuff placed around the anal canal, a reservoir balloon and a pump positioned in the labia or scrotum connecting the cuff and the balloon. The cuff is filled with fluid to maintain continence and emptied when there is a need to defecate. The rate of success is very variable and adverse events are common. A single centre study from 2011 included 52 patients and the follow up was over 5 years. Fifty percent of the patients required revision, mainly due to a leaking cuff, and 27% were definitively explanted, mainly due to device-related infection.

At the end of follow up, 67.3% had an active device and there were significant improvements in both Wexner incontinence and quality of life scores. The authors concluded that with careful patient selection and meticulous surgical technique this method may still be considered an option for patients with severe FI [Wong *et al.* 2011b].

The magnetic anal sphincter consists of a ring of titanium beads with internal magnetic cores. It is placed around the EAS. During defecation the beads separate to allow stool passing. Data on the method are very few. The artificial bowel sphincter and the magnetic anal sphincter were compared in a prospective but nonrandomized study with only 10 patients included in each group. Both groups obtained a significant improvement in Wexner incontinence score and quality of life. There were no significant differences in postoperative complications and revision/explanation rates [Lehur *et al.* 2010; Wong *et al.* 2011a].

Colostomy

Colostomy is the final option to treat FI, if other therapies fail or if the patient is not suitable for

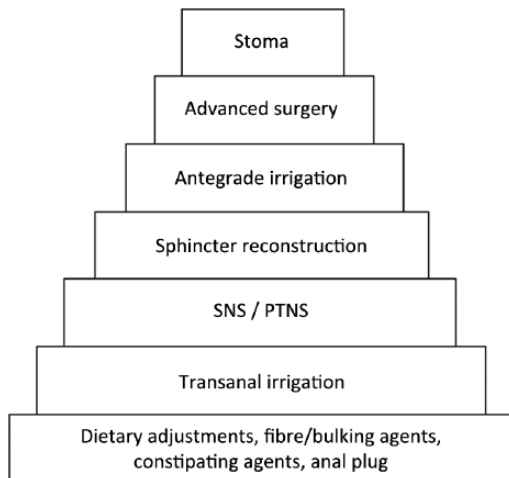


Figure 1. Management algorithm of faecal incontinence. SNS, sacral nerve stimulation; PTNS, percutaneously using a needle electrode.

the previously described conservative or surgical procedures. Patients are often reluctant to have a colostomy, assuming that quality of life with a stoma is poor. Several studies show that colostomy formation actually improves quality of life in most. A cross-sectional survey showed that general quality of life and FI-related quality of life scores were significantly improved in patients who had received a stoma due to FI compared with other patients with FI [Colquhoun *et al.* 2006]. In another retrospective study, 80% of patients with FI stated that they would choose to have the stoma again [Norton *et al.* 2005].

Treatment algorithm for management of FI

Standard management of FI follows a stepwise approach to achieve patient satisfaction with the most minimal therapeutic intervention (Figure 1). Detailed history and physical examination are mandatory and in most patients treatment should be preceded by endoscopy.

In 2010 we implemented a specialist nurse-led programme for the treatment of FI. A colorectal specialist performed a preadmission assessment of referrals and nearly 80% were seen and managed by the specialist nurses without consulting a doctor. Treatment efficacy and patient satisfaction were high. The concept of specialist nurse-led clinics reduced the number of patients requiring evaluation by a colorectal surgeon. We recommend that standard conservative treatment should have been attempted before patients are

referred to consult a colorectal specialist [Duelund-Jakobsen *et al.* 2015]. Anorectal physiology tests and endoanal ultrasound should be reserved for patients not responding to initial conservative treatment.

Dietary advice, dietary fibre supplement and constipating agents are usually tried as first-line therapy. Some patients may benefit from an anal plug, mini enema or biofeedback. Colonic irrigation is especially effective in patients with neurological disorders causing FI but can be attempted in other cases too. Injections of bulging agents can be offered to selected patients with passive incontinence but long-term results are not convincing. SNS is a well documented treatment for FI with good long-term results and complications are at an acceptable level. The role of posterior tibial nerve modulation is unresolved. The SECCA procedure is not a standard procedure in many centres and further research is needed before its place in the treatment algorithm can be established. Complex surgical interventions such as gracilis muscle transposition or artificial sphincter implantation should only be considered in highly selected patients and they are only offered at a few centres internationally. Finally, a colostomy should be considered in patients with severe FI not responding to continence regimes described above (Figure 1).

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Conflict of interest statement

The authors declare that there is no conflict of interest.

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