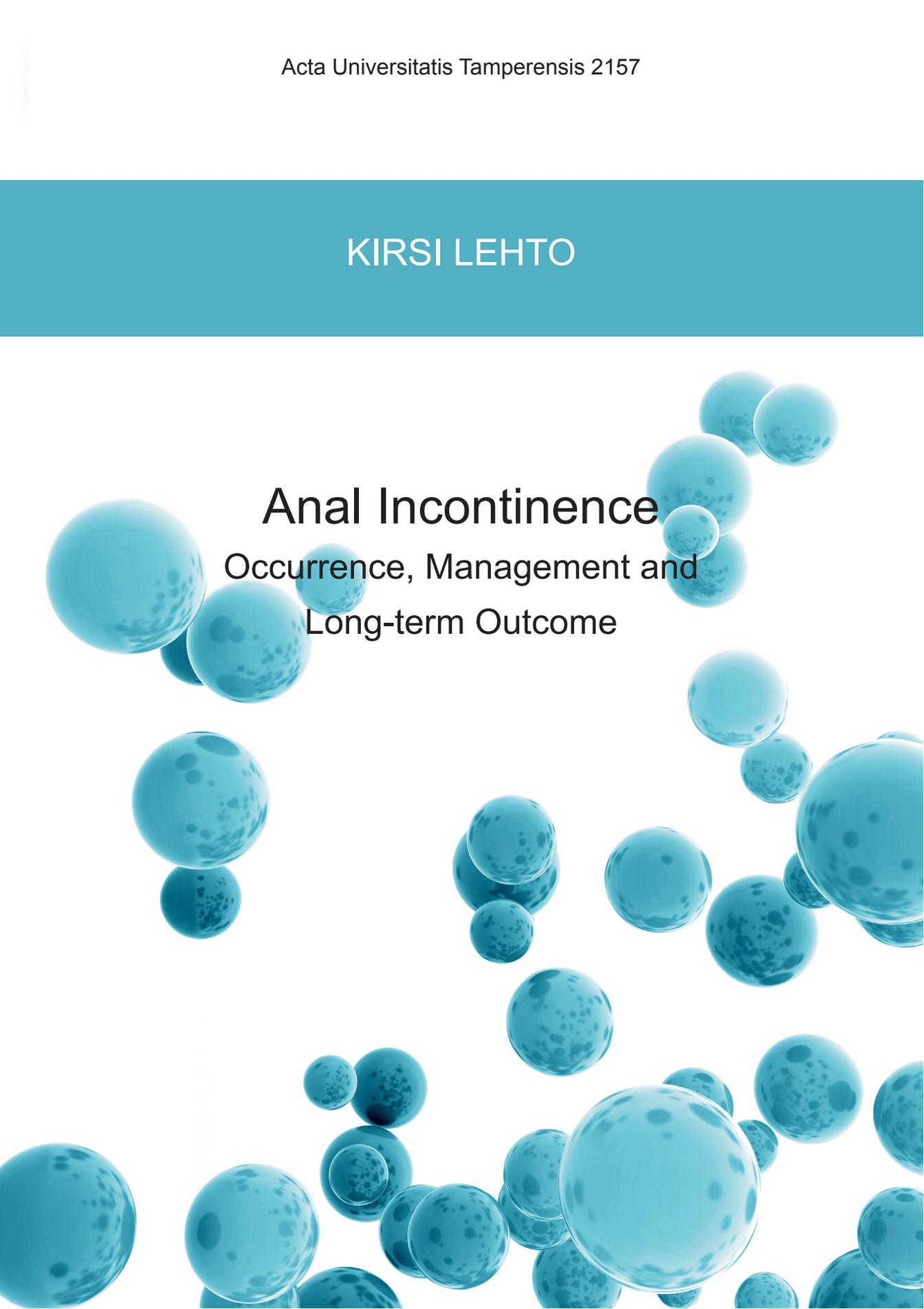


KIRSI LEHTO

The background of the cover is white, featuring a decorative pattern of numerous translucent blue spheres of varying sizes. These spheres are scattered across the page, with some appearing larger and more prominent than others, creating a sense of depth and movement. The spheres have a slightly textured surface, resembling marbles or bubbles.

Anal Incontinence

Occurrence, Management and
Long-term Outcome



KIRSI LEHTO

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Occurrence, Management and
Long-term Outcome



ACADEMIC DISSERTATION

To be presented, with the permission of
the Board of the School of Medicine of the University of Tampere,
for public discussion in the small auditorium of building M,
Pirkanmaa Hospital District, Teiskontie 35, Tampere,
on 6 May 2016, at 12 o'clock.

UNIVERSITY OF TAMPERE

KIRSI LEHTO

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Long-term Outcome

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*To my late parents
Tuulikki and Usko Lehto*

ABSTRACT

Anal incontinence (AI) is a disorder in which the individual cannot control the passage of gas, fluid or solid stool. Operations to the anorectal area, a traumatic delivery and neurological disorders are the most common reasons for AI. In case of idiopathic faecal incontinence (FI), rectal prolapse and intussusception often associate with it. The initial treatment of AI is always conservative. If it does not relieve symptoms sufficiently, surgical treatment is considered.

This study aimed to evaluate the occurrence of AI and to estimate the effect of its management, with a special focus on anterior sphincter repair and the left-sided PEG colostomy tube. The special aim was to find out the long-term outcome, including quality of life (QoL). The results were based on questionnaires or phone calls to the subjects.

The occurrence of FI in this cross-sectional study was 10.6%, and 5.2% suffered from it at least twice a month. Women suffered significantly more than men did. The occurrence of urinary incontinence (UI) and FI were strongly correlated with each other. After a long-term follow-up, 58% of the individuals remained incontinent and 83% of them were women. UI was present in 63% of subjects suffering also from FI and in 20% of subjects who did not suffer from FI.

It is notable that in this cross-sectional study, only 27.2% had discussed the FI with their physician. However, 66% felt that they needed treatment but only 10% had received it. After 10 years of follow-up, as many as 57% of the subjects suffering from incontinence felt that they needed help for the disorder but only 46% had received it.

Operative management, that is, anterior sphincteroplasty, was rather disappointing in the long term, as fewer than 30% of the patients in both age groups got any benefit from it. Elderly people are not likely to have any long-term value out of it. In the future, it is important to detect those patients more exactly for whom operative treatment is an alternative. Failures in the PEG tube colostomy are common, but 33% got benefit from it.

AI is a common disorder, but the subjects are reluctant to discuss their problems with the physicians. The health care staff should be more aware of the problem and encourage their patients to talk about AI. The detection and management of AI should be improved, especially in primary health care. In specialised centres more attention should be paid to the selection of the treatment for each individual suffering from AI, and the decision should be based on improving QoL.

TIIVISTELMÄ

Anaali-inkontinenssilla tarkoitetaan vaivaa, jossa ihminen ei pysty tahdonalaisesti pidättelemaan suolikaasua tai ulostetta. Anorektumin alueelle tehdyt kirurgiset toimenpiteet, synnytykseen liittyvä sulkijalihhasvaurio ja neurologiset sairaudet ovat anaali-inkontinenssin tavallisimpia aiheuttajia. Idiopaattisen ulosteinkontinenssin taustalta löytyy usein rektumprolapsi tai tuppeuma. Kaasun ja ulosteen pidätyskyvyttömyyden ensisijainen hoito on aina konservatiivinen. Mikäli se ei helpota riittävästi oireita, harkitaan kirurgisia hoitomuotoja.

Tämän väitöskirjan tarkoituksena oli selvittää anaali-inkontinenssin esiintyvyyttä ja arvioida kirurgisista hoitomuodoista sulkijalihhasrekonstruktion ja paksusuolen loppuosaan laitettavan huuhtelukatetrin tuloksia. Erityisesti tarkoitus oli selvittää pitkäaikaistuloksia ja elämänlaatua. Tulokset perustuivat kyselykaavakkeisiin tai puhelinhaastatteluun.

Ulosteen pidätyskyvyttömyyden esiintyvyys yleensä oli 10,2 % ja kahdesti kuukaudesta sitä esiintyi 5,2 %:lla. Naisilla vaivaa esiintyi miehiä merkitsevästi enemmän. Virtsan pidätyskyvyttömyys ja ulosteen pidätyskyvyttömyys liittyivät vahvasti toisiinsa. Pitkäaikaiseurannassa 58 % henkilöistä kärsi edelleen ulosteen pidätyskyvyttömyydestä ja 83 % heistä oli naisia. Virtsan pidätyskyvyttömyydestä kärsi 63 % henkilöistä, joilla oli myös ulosteen pidätyskyvyttömyyttä ja 20 % niistä, joilla ulosteen pidätyskyky oli normaali.

On huomionarvoista, että vain 27 % ulosteen pidätyskyvyttömyydestä kärsivistä potilaista oli keskustellut asiasta lääkärin kanssa. Kuitenkin 66 % heistä koki tarvitsevansa siihen apua ja vain 10 % oli sitä saanut. Kymmenen vuoden seurannan jälkeen edelleen 57 % ulosteen pidätyskyvyttömyydestä kärsivistä henkilöistä koki tarvitsevansa apua, mutta vain 46 % oli sitä saanut.

Sulkijalihhasvaurion kirurgisen hoidon pitkäaikaistulokset olivat huonoja; alle 30 % molemmista ikäryhmistä kokivat siitä hyötyä. Erityisesti iäkkäillä ihmisillä pitkäaikaistulokset olivat huonoja. Tulevaisuudessa on tärkeä kiinnittää huomio siihen, kenelle kirurginen hoito on hyvä vaihtoehto. Paksusuolen loppuosaan laitettavan huuhtelukatetrin hoidon epäonnistuminen oli yleistä, mutta 33 % potilaista hyötyi siitä.

Anaali-inkontinenssi on yleinen vaiva, mutta potilaat ovat haluttomia keskustelemaan asiasta lääkärin kanssa. Terveydenhuoltohenkilöstön tulisi olla tietoisempia inkontinenssi-vaivasta ja heidän tulisi rohkaista potilaita puhumaan siitä. Erityisesti perusterveydenhuollossa on tärkeä löytää ja tunnistaa pidätyskyvyttömyydestä kärsivät potilaat sekä tuntea eri hoitomuodot. Erikoissairaanhoidossa puolestaan on tärkeä osata valita oikein potilaat, jotka voisivat hyötyä kirurgisesta hoidosta, ja valinnan tulee perustua potilaan elämänlaadun parantamiseen.

LIST OF ORIGINAL PUBLICATIONS

- I Prevalence of faecal incontinence in adults aged 30 years or more in general population. Aitola P, Lehto K, Fonsell R, Huhtala H. *Colorectal Dis.* 2010 Jul; 12(7):687–91.
- II Seven-year follow-up after anterior sphincter reconstruction for faecal incontinence. Lehto K, Hyöty M, Collin P, Huhtala H, Aitola P. *Int J Colorectal Dis.* 2013 May; 28(5):653–8.
- III Anal incontinence: long-term alterations in the incidence and healthcare usage. Lehto K, Ylönen K, Hyöty M, Collin P, Huhtala H, Aitola P. *Scand J Gastroenterol.* 2014 Jul; 49(7):790–3.
- IV Antegrade transverse or sigmoid colonic enema through a percutaneous endoscopic gastrostomy tube is an option in the treatment of colorectal dysfunction. Lehto K, Hyöty M, Collin P, Janhunen J, Aitola P. *Tech Coloproctol* 2015 Oct 30. [Epub ahead of print]

ABBREVIATIONS

ABS	Artificial bowel sphincter
AI	Anal incontinence
BA	Bulking agents
EAS	External anal sphincter
EAUS	Endoanal ultrasonography
ER	External rectal prolapse
EVMRI	Endovaginal MRI
FI	Faecal incontinence
FIQLS	Faecal Incontinence Quality of life Scale
IAS	Internal anal sphincter
IRP	Internal rectal prolapse
LAR	Low anterior resection
MRI	Magnetic resonance imaging
PEG	Percutaneous endoscopic gastrostomy
PFD	Pelvic floor disorders
POP	Pelvic organ prolapse
PNTML	Pudendal nerve terminal motor latency
QoL	Quality of life
TNS	Tibial nerve stimulation
SNS	Sacral nerve stimulation
UI	Urinary incontinence

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Tiivistelmä

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1 INTRODUCTION

Anal incontinence

AI is a disorder in which a person cannot control the passage of gas, fluid or solid stool. Operations to the anorectal area, a traumatic delivery and neurological diseases are the most common reasons for the disorder. In idiopathic FI, rectal intussusception and rectal prolapse are associated with increasing FI. AI may manifest itself after many decades from the initiating event. The disorder is known to have deleterious effects on the individual's social life, and it is often considered shameful. The patient does not always find it easy to tell about the symptoms to the physician, who again may underestimate the severity of the symptoms. The harmfulness of the disorder depends on the person's social activities and way of living. AI may considerably restrict the social life, and it obliges the person suffering from it to plan every movement carefully to get a rapid access to the toilet whenever needed. All this is likely to have a significantly harmful effect on quality of life (QoL).

The prevalence of AI is not known, and its frequency varies considerably in different studies. Nevertheless, AI is doubtless more common than previously thought. Contacts to physicians may be only the tip of the iceberg. Community-based studies are needed to explore the prevalence of AI, its long-term outcome and the effect on QoL.

Maintaining the continence depends on the condition of pelvic floor muscles, sphincters, nervous system and the patient's capability to co-operate when treating possible incontinence. This complex system makes it a challenge to manage AI. Because of the intimate nature of the disorder, it is difficult but also important to detect patients who would need the treatment.

The treatment of AI depends on its aetiology. In all the cases, the conservative method is the first choice, and these are also used beside operative treatment. The long-term results of operative methods are not well understood. Sphincter reconstruction is the choice in case of a defect in the sphincter after a sphincter rupture. Sacral nerve stimulation (SNS) can be considered if the incontinence is of neurologic origin or if sphincter reconstruction does not help, and it can be the first choice after conservative treatment. Laparoscopic ventral rectopexy has become the choice of treatment for external rectal prolapse (ERP) and internal rectal prolapse (IRP) (Mercer-Jones et al., 2014). There are a few other choices for operative treatment, such as bulking agents (BA) or a more uncommon treatment, the artificial sphincter. BAs are used to augment the walls of the internal anal sphincter (IAS)

to raise the pressure in the anal canal in order to prevent AI. A special but not widely used method of operative management is a PEG tube inserted in the distal colon. Its long-term benefits in adults have not been evaluated, and it is debatable whether it is still a proper treatment option.

The anatomy and physiology of pelvic floor and anorectum

The rectum is a 15–20 cm long segment of the terminal large intestine beginning where the taenias of the colon end at the level of promontorium. It works as a reservoir of the stool before the voluntary defecation. The functional anal canal is 3–6 cm long, extending from the levator ani muscle to the anal verge. There is a transition in the blood supply and innervation of the anal canal in the dentate line. Both parasympathetic and sympathetic innervation are proximal to the dentate line. Somatic innervation in the anal canal exists distal to the dentate line. Classically the pelvis is divided into three compartments: anterior (containing the urethra and bladder), middle (vagina and uterus) and posterior (rectum). Additionally, there are supporting structures, a complex network of fascia, ligaments and muscles attached to the pelvic bone (Weber et al., 2001).

The superior haemorrhoidal artery initiates from the inferior mesenteric artery and supplies mainly blood to the rectum. The middle haemorrhoidal artery gives blood to the lower one third of the rectum and the inferior haemorrhoidal artery mainly to the anal canal, but it also perfuses the rectum, making a network of vessels to the submucosa (Michels et al., 1965). The veins from the upper part of the rectum drain to the inferior mesenteric artery, and the veins from the lower part drain via the internal iliac vein to the inferior vena cava. The lymphatic drainage arises from the upper part of the rectum via inferior mesenteric nodes to para-aortic nodes; from the lower part to the nodes along the internal iliac artery (Heald et al., 1998).

The anal canal is surrounded by the IAS and the external anal sphincter (EAS), and it contains the dentate line (Thompson-Fawcett et al., 1998). Both sphincters provide for continence together with the pelvic floor muscles. The IAS is an extension of the inner muscle layer of the rectum, extending approximately 1 cm beyond the dentate line and just beyond the EAS. There is an intersphincteric groove between the IAS and EAS.

The IAS is innervated with sympathetic nerves from the L5 and parasympathetic nerves from S2–S4. The IAS contributes to baseline continence by tonic contraction (Frenckner et al., 1976). The IAS transiently relaxes because of rectal distension. This is known as the anorectal inhibitory reflex, which helps to distinguish liquid stool from solid stool or from gas (Taylor et al., 1984).

The EAS has a tonic contraction, but contrary to the IAS, voluntary contraction is possible. Branches of pudendal nerve and a branch of S4 innervate the EAS. When intra-abdominal pressure suddenly increases, the spinal reflex causes the EAS to contract (Sun et al., 1990). Broens and colleagues (2013) demonstrated rather recently that there is an

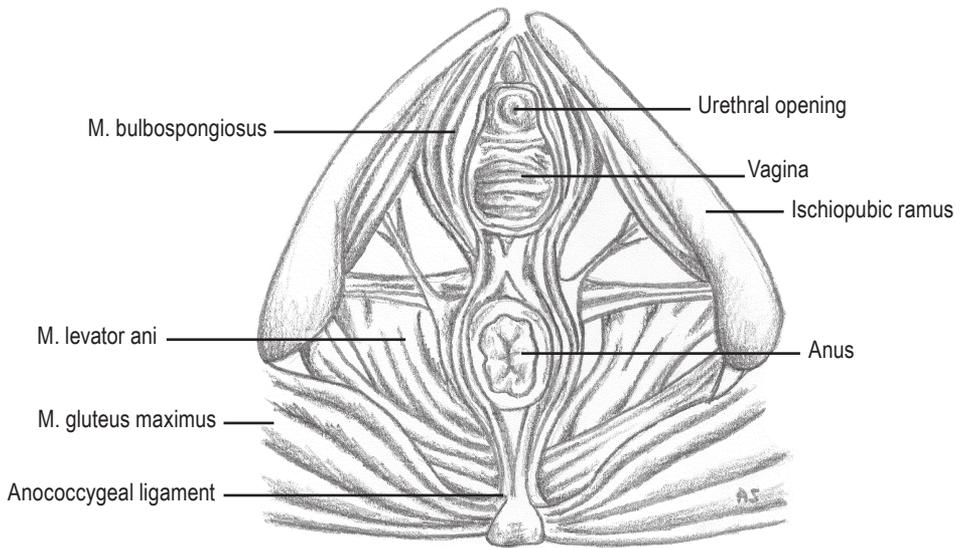


Figure 1. Pelvic floor

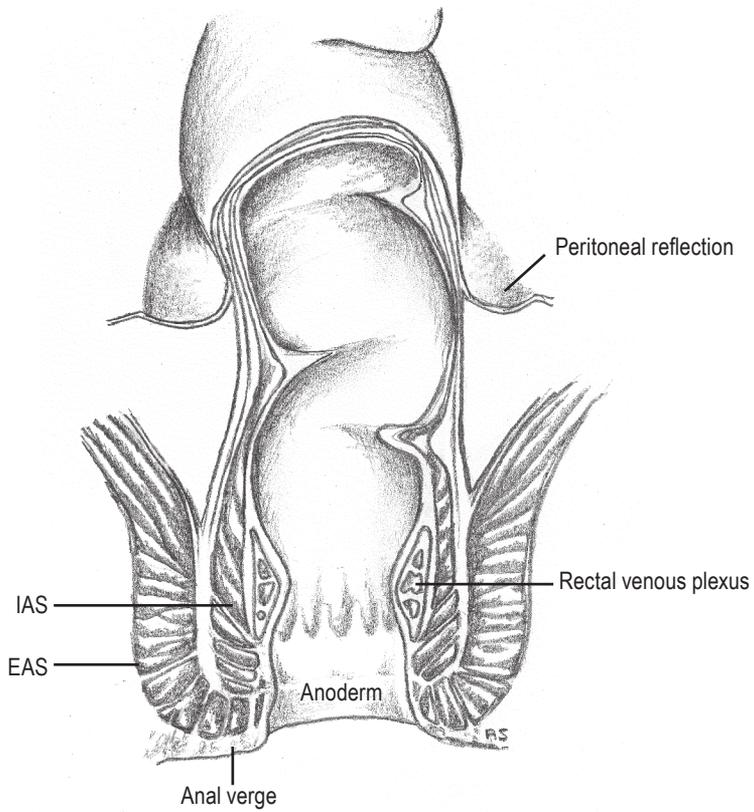


Figure 2. Anorectum

anal-EAS continence reflex, which maintains unconscious contractions of EAS until urge sensation follows. The way the nervous system controls the unconscious contraction remains unknown (Stefanski et al., 2008). Unconscious contraction is known to decrease with age (Broens et al., 2005).

Both involuntary and voluntary muscular activities are required to maintain the anal continence. The anorectal angle is an important anatomical feature in maintaining anal continence (Ayoub SF, 1979). Complex anorectal physiology needs pelvic musculature and neural pathways to work together and to receive signals about stool consistency and bowel motility.

2 REVIEW OF THE LITERATURE

2.1 Definition of AI

In AI, voluntary control of the passage of gas and stool is disturbed. FI encompasses the incontinence of stool only. FI can be further allocated into three categories: a small amount of faecal leakage after a normal evacuation, passive incontinence when the individual does not remark the stool leakage and urge incontinence when he or she is not capable of reacting to bowel movement (Rao, 2004). Table 1 shows that the definitions of AI have been highly variable in different studies, ranging from incontinence once a week to once a month or even to once a year.

2.2 Aetiology of anal incontinence

AI may be primary, resulting from congenital malformations such as spinal cord defects or anorectal malformations, or it can be secondary. Denervation of the sphincter musculature follows obstetric tears of the anal sphincters in 60% of patients with FI (Ooi et al., 2000). Loosening of pelvic ligaments causes an apical defect and rectocele. Pushing up makes the rectum separate from the vagina, resulting in rectal intussusception and prolapse. They may cause AI by activating the rectoanal inhibitory reflex (RAIR), which results in the relaxation of the IAS (Abendstein et al., 2008). Prior hysterectomy is found to be a risk factor both for dual incontinence, which consists of UI and FI (Wu et al., 2015), and for FI alone, and it impairs the QoL (Smith et al., 2013). Other secondary causes are low anastomosis after anterior resection, rectal prolapse or proctitis, which may worsen the compliance or reservoir function of the rectal ampulla (Alavi et al., 2015). Rectal intussusception, also referred to as IRP, has been found to worsen the symptoms of FI when the grade of rectal intussusception increases (Hawkings et al., 2016). Urge incontinence has been found to be more common in patients with high-grade IRP compared to patients with low-grade IRP, while passive incontinence was more common in patients with low-grade IRP than in patients with high-grade IRP (Bloemendaal et al., 2016). In more than 50% of the cases, ERP is associated with FI (Parks, 1975). Burnett and colleagues (1991) found an anal sphincter defect with endoanal ultrasonography (EAUS) from 35% of the women after a vaginal delivery. The causes of AI are summarised in Table 2.

Table 1. Studies of prevalence of anal incontinence

	Country	Instrument	Age range	Respondents (female %)	Response rate %	Definition of FI	Prevalence of FI %
Talley et al. 1992.	USA	Postal questionnaire	65–93		77	More than once a week	3.7
Perry et al. 2002.	UK	Postal questionnaire	40–80+	10116 (54.2)	70	Leakage monthly or more.	3.3
Bharucha et al. 2005	USA	Postal questionnaire	20–80+	2800 (100)	53	In the past 12 months accidental leakage of stool and frequency	12.1
Varma et al. 2006	USA	Self-report questionnaire	40–69	2106 (100)	21	Monthly	3
Whitehead et al. 2009	USA	Questionnaire	20–70+	4308 (51.7)	71	Accidental leakage at least once in the preceding month	8.3
Markland et al. 2010	USA	In-home assessment in 4 years	>65	557 (53.3)	55.7	Any loss of control of bowel during the previous year	17
Pares et al. 2011	Spain	face-to-face interview	>18	518 (64.1)	67.2	At least one leakage in the previous 4 weeks	10.8
Jerez-Roig J et al. 2015	Brazil	face-to-face interview	Mean age 81.5	321 (75.4)	100	FI during previous 5 days	42.7
Tamanini et al. 2015	Brazil	Home interview and follow-up visits	>60	1345 (64.3) (For FI study data from 986 subjects were available)	100	In the last 12 months any lost control of bowel movements or stool	11.7

Smoking, low dietary fibre consumption, chronic diarrhoea and irritable bowel syndrome, high body mass index and several medications are known risk factors for FI (Whitehead et al., 2009). In male, malnutrition associates with FI, and in female, FI associates with depression, heart disease and polypharmacy (Tamanini et al., 2015).

Specific age-related anatomic changes appear in the anal sphincter of healthy adults older than 60 years compared to younger adults. The endovascular cushion of the sphincter disappears, squeeze and resting pressures become reduced, the EAS and IAS thicken, and rectal sensation is lost (Shah et al., 2012). The menopause is found to be a risk for FI. Although the effect of changes in hormonal activity is unclear, women with asymptomatic sphincter lesions are found to become incontinent when reaching the menopause (Bohle et al., 2011). The effect of the reduction of hormone receptors in target organs has been proposed to be a reason for the impairment of tissues maintaining incontinence (Lacima et al., 2006).

UI and FI are often related: almost 25% of all women suffering from UI also have FI to some degree (Bezerra et al., 2014), and FI has been detected in 21% of patients suffering from UI or prolapse (Jackson et al., 1997). Boirdeianou and colleagues (2015) showed that patients with severe FI had also suffered from urinary symptoms.

Table 2. Aetiology of anal incontinence

Normal pelvic floor	Abnormal pelvic floor
Spinal cord defects	Anorectal malformation
Neurological disorders	Trauma
– multiple sclerosis	– obstetric
– dementia	– anorectal surgery
– neuropathy	– accident
Diarrhoea	Structural causes
– IBD	– rectal intussusception
– short-gut syndrome	– external rectal prolapse
– laxative abuse	– rectal neoplasm
	– LAR syndrome
	Ageing

2.3 Prevalence of anal incontinence

The true prevalence of AI is not easy to estimate partly because, due to its intimate and shameful nature, people are reluctant to tell about their complaints. Different questionnaires help to find out the symptoms and the severity. In women, the more vaginal deliveries they have had, the more common FI is (Whitehead et al., 2009).

The reported prevalence of FI varies widely, ranging from 2.2% to over 40% in the population aged 20 and more, as depicted in Table 1. The prevalence depends on the definition of incontinence used. FI is unrelated to race or ethnicity, education, marital

status or income after adjusting for age. Studies of long-term alterations in FI are by and large lacking. Kyrklund et al. (2012) investigated 594 Finnish individuals aged 4–26 years in a cross-sectional cohort study. Faecal accidents decreased with age and $\leq 5\%$ of the respondents between ages 8 and 26 years reported any faecal accidents, whereas weekly or daily stool incontinence was reported by $\leq 0.5\%$ of the respondents.

2.4 Evaluation of anal incontinence

2.4.1 Evaluation of the symptoms

When evaluating the symptoms, the medical history comprising the following should be recorded: bowel habits and the consistency of stool, operations to the anorectal area (Garcia-Aquilar et al., 1998), deliveries and possible traumas relating to them (Sultan et al., 1993), pelvic radiation (Montana et al., 1989; Kimose et al., 1989), medication and other disorders besides AI.

The Fecal Incontinence Severity Score (Wexner Score) is widely used in evaluating how often the individual experiences the leakage of gas, liquid or solid stool, and whether there is a need to use pads, and how often the disorder restricts everyday life. Score 0 implies normal continence and score 20 full FI with the need to use pads daily (Jorge JM, 1993). The Faecal incontinence severity index (FISI) is a score derived from different studies in which patients and surgeons have graded the leakage of gas, mucus, liquid or solid stool at various frequencies (Rockwood et al., 1999). Reilly et al. (2000) designed and validated a self-report questionnaire to determine FI, to assess symptoms and bowel habits, to find out symptoms associated with pelvic floor dysfunction, to assess risk factors for developing FI and to assess the association between FI and UI. The Birmingham Bowel and Urinary Symptom Questionnaire (BBUSQ-22) was designed to measure FI and urinary symptoms in women. Fifteen of the 22 items focus on FI and bowel symptoms (Hiller et al., 2002). RAFIS is a new quick and simple validated test that comprises the feeling of the patient because of the leaks and the frequency of leaks (Portilla et al., 2015). The different questionnaires are depicted in Table 3.

2.4.2 Clinical examination

The clinical evaluation of the patient suffering from AI begins with the inspection of the perianal area and anal aperture. Possible perianal scars, fissures, skin changes and infections should be observed. Touching the perianal skin should make an involuntary reflex seen in the perianal skin (Zuidema et al., 2002).

A digital examination helps to find possible mass or a stricture in the rectum. The patient is asked to squeeze and relax the anal sphincters so that the resting and squeezing

Table 3. Questionnaires about anal incontinence.

First author	Year	Design	Objective	Name	Abbreviation
Jorge	1993	Questionnaire	The frequency and quality of leakage or use of pads and restriction of life	Wexner score	
Rockwood	1999	Matrix including four types of leakage and five frequencies	Create and test a severity rating score for FI	Fecal incontinence severity index	FISI
Reilly	2000	Self-report questionnaire	Evaluate FI and its risk factors	Birmingham bowel and urinary symptom questionnaire	BBUSQ-22
Hiller	2002	22-item questionnaire	Evaluate and document symptoms of bowel and urinary dysfunction in women	The faecal incontinence and constipation assessment	FICA
Bharucha	2004	Self-report questionnaire of FI (frequency and type, urgency) and constipation	Develop and validate a self-report questionnaire	Rapid assessment faecal incontinence score	RAFIS
Portilla	2015	Visual-descriptive ordinal to define patient's feelings and scale of frequency of leaks	Create simple and quick test for FI		

pressure can be appraised. In the case of constipation or incomplete evacuation, a clinical examination with a digital rectal examination reveals rectoceles or hypertonic sphincters in almost half (40%) of the cases (Lam TJ et al., 2013). The overall specificity and sensitivity of the digital rectal examination when evaluating the squeezing and resting tone of the sphincter has been shown to be more than 75% (Tantiphlachiva K et al., 2007). The digital rectal examination should not be used as the only method when diagnosing sphincter defects (Dobben AC et al., 2007). The degree of possible perineal descent should be estimated. The patient should be capable of contracting the abdominal muscles and relaxing the EAS and the puborectalis muscle, and the perineum should descend adequately (Tantiphlachiva et al., 2010).

In case of trauma during a vaginal delivery, perineal tears are classified into four degrees: the first degree extends to the perineal skin, the second degree involves also the perineal muscles but not sphincters, the third degree involves injuries of anal sphincters (3a less than 50% of the thickness of the EAS, 3b more than 50% of the thickness of the EAS, 3c involves both the EAS and IAS) and the fourth degree extends to the anorectal mucosa (Tiagamoorthy et al., 2014).

2.4.3 Endoanal ultrasonography

Endoanal ultrasonography (EAUS) is an anatomic test visualising the anal canal and its surroundings, mainly the IAS and EAS. EAUS is nowadays the golden standard technique when evaluating the sphincters in FI (Tjandra et al., 2007). EAUS proved to be a useful technique for assessing defects of the IAS and EAS (Law et al., 1990; Law et al., 1991). 3-dimensional imaging enables the examination of the anal canal for different cross sections, and it has been used for the evaluation of the anal canal since the late 1990s (Gold et al., 1999).

Sphincter defects are detected by EAUS as segmental defects in the IAS or EAS, or in both. In the upper part of the anal canal, the puborectalis muscle is visible laterally and posteriorly. With ultrasound, it is possible to find a defect in the sphincter that has been missed in the clinical examination (Stoker J et al., 2001). There was a good correlation between histologic findings and ultrasonography when the pathologist examined the sample of the suspected defect of the sphincter (Sultan AH et al., 1993 and 1994). In investigating sphincter defects, the specificity and sensitivity of EAUS come close to 100% (Sultan et al., 1994; Deen et al., 1993).

2.4.4 Defecography

X-ray defecography with the opacification of the vagina and the small bowel is considered as the gold standard diagnostic procedure for posterior compartment disorders (Felt-Bersma et al., 1990). It assesses both the anorectal anatomy and function. The contrast is installed in the rectum and the images are attained in a sitting position.

Various anatomic lines and angles are required in the interpretation of the defecography images and fluoroscopy video. Many functional and anatomic anorectal disorders, such as perineal descending, rectocele, intussusception, prolapse and rectal emptying can be detected by defecography (Sands et al., 2013). The results may guide the treatment when conservative treatment or surgical intervention is considered (Yang A et al., 1991).

2.4.5 Magnetic resonance imaging

More than two decades ago, Yang et al. (1991) described the use of dynamic magnetic resonance imaging (MRI) for the evaluation of pelvic organ prolapse (POP). MRI makes it possible to evaluate non-invasively and dynamically all the pelvic organs in multiple plains, with high resolution of the soft tissues and without radiation (Law et al., 2008). Endovaginal magnetic resonance imaging (EVMRI) can be used in diagnosing anal sphincter defects as the cause of AI. Pinta et al. (2003) compared preoperative EAUS and EVMRI at surgery. Both detected EAS and IAS defects as effectively, but EVMRI results varied considerably among radiologists.

MRI defecography is usually performed to evaluate the posterior pelvic compartment when rectocele, invagination or anismus are suspected. MRI defecography enhances the evaluation of the posterior compartment and increases the detection of prolapse in other compartments (Flushberg et al., 2011; Foti et al., 2013). Performing MRI while the patient is sitting allows a more functional position matching that at conventional defecography (Hetzer et al., 2006).

2.4.6 Anal manometry

Anal manometry measures the effectiveness of the anorectal musculature, compliance of the rectum, sensation and the rectoanal inhibitory reflex. It is used in the assessment of FI but also in the assessment of constipation (Van Koughnett et al., 2013). Normal values in anal manometry vary among patients. In general, women have lower resting and squeezing pressure than men, but especially nulliparous young women may have equal resting and squeezing pressure as men (Schuld et al., 2012).

When anal manometry is performed, the patient is lying in the left decubitus position. A manometry probe with a deflated latex balloon at the tip of it is inserted into the rectum

to a distance of 6 to 10 cm, and the measurement is performed at different levels in the anal canal. The mean pressure of three measurements of resting and squeezing pressure is calculated. The rectoanal inhibitory reflex (rectal distension causes IAS relaxation) and the compliance of the rectum can also be evaluated with anal manometry. The balloon is inflated with water to elicit it (Van Koughnett et al., 2013).

The results of anal manometry may show the need for other tests or treatment. The isolated absence of the rectoanal inhibitory reflex may indicate Hirschsprung's disease, low resting tone, possible internal sphincter damage or defect. If the resting and squeezing tones are both weak, the incontinent patient may get help from biofeedback treatment (Van Koughnett et al., 2013).

2.4.7 Pudendal nerve terminal motor latency

Pudendal nerve terminal motor latency (PNTML) measures pudendal nerve function. PNTML refers to the time an electric stimulus travels along a pudendal nerve from the ischial spine to the anal verge. Normally it takes approximately two milliseconds. Idiopathic FI may be due to the deceleration of motor nerve conduction distally in the pudendal nerves (Kiff and Swash, 1984) and thus, the prolongation of PNTML may be a sign of idiopathic FI. Hill et al. (2002) found out that one third of the patients with prolonged bilateral PNTML had normal squeezing pressure and almost half of the patients with normal PNTML had squeezing pressure below normal standing. Thus, the test is limited, and it works only as a part of the examinations. Prolonged PNTML may have prognostic value when evaluating poor long-term results after surgery (Laurberg et al., 1988).

2.5 Anal incontinence and quality of life

Pelvic floor disorders (PFD) containing AI, POP, UI, voiding and defecation problems and sexual dysfunction may cause many symptoms, but the patient may also be asymptomatic (Lawrence JM et al., 2008). Symptoms of PFD may have a remarkable effect on the patient's QoL. AI and UI are often associated with each other, and patients with both disorders report worse scores in QoL questionnaires (Bezerra et al., 2014). Mundet and colleagues (2015) recently found out different pathophysiology between women and men, and the impact on QoL was higher in women with similar severity scores.

There are instruments for measuring the QoL of the patients. SF-36 is a Short-Form Health Survey that can be used to measure the general overall quality of life. It consists of 36 items and generates scores from 1 to 100 in eight different areas of health. It concerns limitations in physical and social activities, limitations in usual role activities because of physical or emotional problems, pain, general mental health, vitality and general health perception. It is used in assessing QoL in various gastrointestinal conditions (Warc and

Shcrbournc, 1992). The Faecal Incontinence Quality of life Scale (FIQLS) is a disease-specific questionnaire related to FI. It is composed of 29 items that form four scales: Lifestyle (10 items), Coping/Behavior (9 items), Depression/Self-Perception (7 items) and Embarrassment (3 items). The questionnaire has been shown to be reliable and valid (Rockwood TH et al., 2000). The Manchester Health Questionnaire (MHQ) comprises 31 items, which measure health-related quality of life in women suffering from AI or FI (Bugg et al., 2001). The International Consultation on Incontinence Questionnaire-Bowel Symptoms (ICIQ-B) has 21 items to evaluate the symptoms of AI and FI and the impact on health-related quality of life (Cotteril et al., 2007).

Studies about QoL are summarised in Table 4.

Table 4. Studies about QoL

Author	Year	n	Disorder	QoL Scale	Prevalence of AI (FI) %	QoL
Boreham	2005	457	AI	FIQLS	28.4	Women incontinent for liquid reported more impact on QoL in all subscores than women reporting isolated flatal incontinence did.
Bharucha	2006	2800	FI	FIQLS	(18.1)	Moderate or severe impact in 23% of the women with FI.
Bartlett	2009	675	FI	FIQLS	(22.8)	Subjects reporting both solid and liquid leakage had poorer QoL than those reporting either alone.
Johannessen	2014	1571	AI during late pregnancy	FIQLS	36.5	In 25% AI affected in domain "coping" and in 20% in "embarrassment".
Bezerra	2014	172	PFD	SF-36, ICIQ-SF	41.4 (34.0*)	Women with bowel syndromes scored worse in 5/8 domains on SF-36.
Visser	2015	116	Cryptoglandular fistula and FI	FIQLS	(34)	In 18% FI affected in domain "lifestyle", in 23% in "depression", in 25% in "embarrassment". All 4 subscales were lower with patients suffering from FI.
Bordeianou	2015	585	PFD with severe FI	FIQLS	(32.6)	Severe FI indicated worsened scores in all the subscores.

*Faecal urgency

2.6 Treatment of anal incontinence

2.6.1 Conservative treatment

2.6.1.1 Medical treatment

Sufficient daily fibre supplement is important in FI. It acts as a bulking agent to make stool more solid. Fibre improved FI and stool consistency within one month in a study by Bliss et al. (2001). Apart from fibre, medications with a constipating effect may be useful in making loose stools more solid. Such drugs are loperamide, diphenoxylate and atropine, and codeine. Loperamide is most commonly used. It may also have beneficial effects on the anal sphincter resting tone (Hallgren et al., 1994).

2.6.1.2 Biofeedback

Biofeedback is a form of physical therapy. It is used to increase the patient's awareness of physiological processes that are not normally under voluntary control. There are different methods providing biofeedback treatment such as peri- or intra-anal electromyographic sensors (Patankar et al., 1997), intrarectal balloon systems (Miner et al., 1990) and a technique utilising real-time ultrasonography and manometry (Solomon et al., 2000). As a conservative method, biofeedback is a first-line treatment for AI (Norton and Kamm, 2001). Pelvic floor exercises and biofeedback treatment provide a better outcome than any other conservative treatment method alone (Norton et al., 2006). Anorectal physiology tests such as anomanometry, PTNML, defecography and MRI do not seem to predict who will best respond to biofeedback (Terra et al., 2008). Patients with mild or moderate AI with failed medical treatment are the best candidates for biofeedback treatment (Boselli et al., 2010). Kairaluoma et al. (2004) found that biofeedback therapy improves incontinence after sphincter repairs and in patients with partial external sphincter defects, but that it does not improve incontinence of idiopathic origin.

The combination of biofeedback and medication is effective treatment for FI. It is associated with improved faecal consistency, reduced urgency, and increased rectal sensory thresholds (Sjödahl et al., 2015).

2.6.1.3 Retrograde colonic enema

Retrograde colonic irrigation is a way to evacuate faeces by installing water via the anus. It enables the patient to choose the place and time of evacuation. It takes an average of two days for faeces to reach the rectum again after efficient emptying of the rectum and the distal colon (Christensen et al., 2003). In patients with FI, the method prevents leakages

between washouts. A regular evacuation of the rectosigmoid may reduce the transit time of the entire colon in patients with constipation (Bazzocchi et al., 2006). A retrograde colonic washout is used in different bowel dysfunction disorders. In more than 50% of patients with multiple sclerosis, the retrograde colonic washout improved constipation and FI (Preziosi et al., 2012). FI resulting from a low anterior resection of the rectum is difficult to treat because of its multifactorial origin (Ratto et al., 2005). Retrograde colonic irrigation is a non-invasive treatment with mild side effects, and it is suitable for treating patients with FI after a low anterior resection of the rectum (Koch et al., 2009). A specially designed catheter for enemas, Enema Continence Catheter, has a balloon inflated when the enema is put in. Deflating the balloon and removing the catheter allows the bowel to empty (Shandling et al., 1987). The Enema Continence Catheter provides a successful treatment and an improvement of QoL for 73% of the patients with FI resulting from a neurogenic origin (Christensen et al., 2000).

2.6.2 Operative treatment

2.6.2.1 Bulking agents

BAs are used to augment the walls of the IAS to raise pressure in the anal canal or to close the anal canal to prevent AI. Different bulking materials have been employed including autologous fat, Teflon, silicone, different collagens, carbon-coated zirconium beads, hyaluronic acid, hydrogel cross-linked with polyacrylamide, synthetic calcium hydroxyapatite ceramic microspheres and polyacrylonitrile in a cylinder form (Maeda et al., 2013). The injection of BA is a mini-invasive procedure and it is suitable for patients with mild to moderate AI, for those whose conservative treatment had failed, and for those who cannot or are not willing to undergo surgical treatment. Danielson and colleagues (2012) found that the injection of BA (here hyaluronic acid/dextranomer gel) improved the symptoms of incontinence for at least two years by decreasing incontinence episodes by 75%. They found that the treatment potentially improves QoL. In a randomised, double-blind, sham-controlled trial Graf and colleagues (2011) investigated 206 patients with FI, and the primary target end point was to evaluate how patients responded to treatment when the number of incontinence episodes was estimated. Patients who received active treatment had a reduction of at least 50% in the number of incontinence episodes, compared to patients receiving sham treatment. However, in the long term BAs seem to resorb and lose the effectiveness with any type of implanted material (Guerra, 2014).

2.6.2.2 Antegrade colonic enema

Malone et al. (1990) were the first to describe the antegrade colonic enema that is used to control faecal soiling most commonly in paediatric patients with neurogenic conditions resulting in neurogenic bowel and urinary symptoms. The appendix is usually fixated to the skin in the umbilicus creating a channel to be catheterised. Other places of the bowel (ileum, caecum, left colon) have also been used, and the procedure can be performed either openly or laparoscopically (Ellison et al., 2013; Karpman E et al., 2002; Tackett et al., 2002). Urological procedures are usually carried out at the same time and with good results (Teichman et al., 1998). In the left Monti-Malone procedure, the tube is inserted into the left colon in order to shorten the enema time (Liloku et al., 2002). Of the adults, 75% achieve continence and the QoL improves after the procedure (Lefevre et al., 2006; Teichman et al., 2003). Velde and colleagues (2012) investigated 40 patients with FI because of spina bifida. Of the children, 76% and of the adults, 60% achieved faecal continence, and 88% and 67% achieved social continence, respectively. A retrograde enema was applied in children and an antegrade enema in adults. In children, ACE conduits form an important part of the modern management of patients with a recto-urethral fistula. With systematic aftercare, a significant decline in the prevalence of soiling and faecal accidents can be reached with time (Kyrklund et al., 2014).

2.6.2.3 Sphincter reconstruction

Sphincter reconstruction is the golden standard of managing FI due to anal sphincter injury (Goetz and Lowry, 2005). The majority of the patients are female who have experienced a traumatic vaginal delivery (Oliveira et al., 1996). There are two techniques to repair the tear surgically. Parks and Partlin (1971) introduced the overlapping technique, in which a curvilinear incision is made, and the edges of the EAS are identified and isolated. After that the ends are overlapped and saturated to make the EAS a circumferential ring. In another technique, the ends of the EAS are brought together and sutured (Brown et al., 2013).

In a delayed sphincter repair, Tjandra et al. (2003) found in a randomised, controlled trial a similar outcome with the end-to-end and overlapping techniques, although the overlapping repair may embrace more difficulties with faecal evacuation. Malouf et al. (2000) have also found evacuation disorders among some patients after a primary overlapping sphincter repair. In a prospective randomised clinical trial, Fitzpatrick and colleagues (2000) found no differences in the results of primary sphincter repair between the overlapping and approximation techniques. Later the overlap technique was found to be a better choice of method for primary sphincter repair after a sphincter rupture. The patients whose obstetric tear had been primarily repaired with the overlapping technique suffered significantly less from symptoms of incontinence than those whose tear had been repaired with the end-to-end technique (Lepistö et al., 2008).

The overlapping technique is usually chosen for delayed treatment of obstetric sphincter damage regardless of the duration of incontinence or the patient's age. It is an operation with low costs, short hospitalisation and time of recovery (Pinta et al., 2003). The short-term outcome of delayed overlapping sphincteroplasty is known to be good, resulting in a 70–86% rate of success (Halverson et al., 2002; Young et al., 1998). Long-term results may deteriorate over time in spite of the repair technique (Glasgow et al., 2012). After 22 months of a median follow-up, in postoperative control, EAUS has shown sphincter overlap in 72% of the patients but a defect was still shown in 28% of the patients (Pinta et al., 2003). A summary of studies about the long-term outcome of anterior sphincter repair is depicted in Table 5.

2.6.2.4 Laparoscopic ventral rectopexy

Laparoscopic ventral rectopexy corrects the descent of the middle and posterior pelvic compartments, and it has achieved acceptance as a treatment of IRP and ERP (Mercer-Jones et al., 2014). For the treatment of FI in cases of rectal prolapse, ventral rectopexy achieves equivalent outcomes in patients both with ERP and with high-grade IRP (Gosselink et al., 2015). It has been found to be effective treatment for men as well (Owais et al., 2014). Laparoscopic ventral rectopexy has been found to improve the symptoms of FI especially in patients with high-grade IRP (Gosselink et al., 2013). It has been shown that the operative treatment of rectal prolapse leading to the improvement of FI is associated with a lower post-operative recto-anal inhibitory reflex than it was pre-operatively (Bloemendaal et al., 2016), which may be one reason for the improvement in FI symptoms. Laparoscopic ventral rectopexy results in acceptable rates in the long term, and mesh-related problems are rare (Consten E et al., 2015).

2.6.2.5 Neuromodulation

SNS was first developed to treat urinary disorders (Oerleman and van Kerrebroek, 2008). It is a minimally invasive technique in which an electrode is inserted through a sacral foramen to apply an electrical current to sacral nerve roots. It makes it possible to modulate the nerves and therefore muscles (Mowatt et al., 2007). A permanent electrode is inserted in patients who have a positive response with a temporary electrode (Tjandra et al., 2004). SNS may stimulate both somatic and autonomic afferent and efferent fibres, but the afferent sensory fibres are mainly the target because the stimulation can be performed at a level under the motor or sensory threshold to elicit the beneficial effects (Koch et al., 2005). The mechanism of action in SNS is unclear and it is thought to be multifactorial. It probably stimulates the somato-visceral reflex, affects the anal sphincter complex directly and modulates afferent nerves (Gourcerol et al., 2011). Its effect on anorectal physiology

Table 5. Long-term results of anterior sphincter repair. (*Primary repair, ** delayed repair, FU=follow-up)

Author	Year	Country	n	Mean age in time of FU	Technique	Mean FU time (months)	AI after FU (%)	FI after FU (%)
Fallin	2006	Switzerland	259	47	Not reported *	216	12	1
Starck	2006	Sweden	41	28	End-to-end *	48	37	0
Maslekar	2007	USA	64	Not reported	Overlapping **	84	40	69
Tjandra	2008	Australia	114	29.9	End-to-end *	19	22	1
Samarasekera	2008	UK	53	120	Not reported *	120	53	26
Soerensen	2008	Denmark	22	31	Overlapping **	50	67	24
Salim	2014	Israel	36		End-to-end *	>48	14	28
Lamblin	2014	France	23	52	Overlapping **	87	52	NR

appears as improved rectal sensations and an improvement in anal pressures (Tan et al., 2011).

Since 1995, SNS has been used to treat patients with FI (Matzel et al., 1995) and since then its use has greatly grown in number. The disadvantages of using SNS have been a high cost of the equipment and the fact that the outcome has a tendency to deteriorate over time (Malouf et al., 2000). Altomare and colleagues (2015) investigated more than 400 patients to find out the long-term outcome of SNS in the treatment of FI. They found out that half of the patients (50%) with the final implant achieved full continence. In a former study of 52 patients, more than 70% achieved an improvement of at least 50% in the continence, and QoL improved in all domains (Altomare et al., 2009). SNS is known to improve QoL (Damon et al., 2013; Devreode et al., 2012). Initially it was thought that SNS could only be used in patients with an intact EAS (Matzel et al., 2004). Later it has been found to be effective in patients with a defect in EAS as well (Chan et al., 2008; Melenhorst et al., 2008; Ratto et al., 2010).

Tibial posterior nerve stimulation (TNS) was described for FI in 2003 (Shafik et al., 2003). It is a minimally invasive procedure which is thought to cause similar effects to the anorectal neuromuscular function as SNS but does not need a permanent surgically implanted device. It can be performed either percutaneously or transcutaneously. Percutaneously the needle is placed close to the tibial nerve above the ankle. Transcutaneous tibial nerve stimulation (TNS) is delivered via electrodes placed over the tibial nerve above the ankle. The percutaneous procedure enables a higher treatment amplitude and yet with this procedure it is possible to avoid pain in the skin (Horrocks et al., 2015). TNS can be delivered with varying intervals, and there is no consensus on the optimal treatment regimen. Thomas and colleagues (2013) found daily treatment more effective than treatment twice a week, but they suggest further studies to investigate the subject.

2.6.2.6 Graciloplasty

Muscle transposition for FI was started by transposing the gluteus maximus in the first half of the 1900s (Chetwood, 1902), but it was replaced by graciloplasty initiated by Pickrell and colleagues (1952). The gracilis muscle is more superficially located and it is easier to mobilise. In graciloplasty, the patient's gracilis muscle is mobilised and wrapped around the anus. The tendon is anchored with non-absorbable suture to the ischial tuberosity. The muscle is assumed to contract when standing and abducting the leg (Cera et al., 2005). Long-time results are poor, however, probably because of the inability to maintain the sustained contraction without electrical stimulation (Faucheron et al., 1994).

Dynamic graciloplasty refers to a procedure in which an electrical device is implanted after forming the gracilis muscle ring around the anus to maintain tone and continence (Edden and Wexner, 2009). A half of the patients do not benefit from electrostimulation a year after the operation (Rosen et al., 1998). Walega et al. (2015) compared the functional

results of twenty patients who were treated either with dynamic graciloplasty or with unstimulated graciloplasty. They found no differences between the groups after a twelve-month follow-up. Beaten and colleagues (2000) showed that more than 60% of the patients maintained improvement of incontinence symptoms and an increase in QoL after two years. Thornton et al. (2004) found that only 16% of the patients maintain good continence after five years and that the complication rate is high.

2.6.2.7 Artificial bowel sphincter

An artificial bowel sphincter (ABS) consists of an inflatable cuff surgically implanted to encircle the anal canal and to act as a new sphincter, a balloon regulating the pressure and acting as a fluid reservoir and a control pump typically implanted into the labia or scrotum (Wong et al., 2011). The ABS maintains continence when the cuff is inflated. The patient lets the cuff empty when they want to defecate (Wong et al., 2002). Some health care providers have switched to use the ABS instead of graciloplasty (Darnis et al., 2013). ABS implantation is known to have a high complication rate. Wong et al. (2011) found that 50% of the patients required revision and 27% required explantation. Wexner et al. (2009) investigated factors associated with failure and complications in patients who received an ABS during a period of more than nine years; 38% of the patients had early-stage (time before artificial sphincter activation) device infections and 11% had late-stage infections. The history of perineal infection and the time between the implantation and the first bowel movement were risk factors for early-stage infection and failure. The ABS has not been used in Finland.

2.6.2.8 Colostomy

Colostomy is the definitive treatment for FI. It is typically a surgical option when other treatment options of FI have failed or they are not thinkable (Van Koughnet et al., 2013). Laparoscopic colostomy shortens the recovery time, but the most important issue is to close the rectum as distally as possible to minimize the leakage of the mucus. Patients are usually not willing to have a permanent stoma, but in a survey of Colquhoun et al. (2006), patients with FI and colostomy scored better in a general QoL scale and in the FIQLS than those with FI. Colostomy is also considered the most cost-effective treatment for severe FI when considering quality-adjusted life years (Tan et al., 2008).

3 AIMS OF THE STUDY

The aim of this study was to find out the occurrence of AI in the population and to evaluate clinical features, the conservative and operative management and the long-term outcome of the disorder.

The specified aims were as follows:

- 1) to find out the prevalence and risk factors of AI and to disclose the alterations in the occurrence of incontinence over time (I, III),
- 2) to assess the effects of anterior sphincter repair in FI and its impact on QoL (II) and
- 3) to evaluate the long-term utility of the left-sided PEG colostomy tube method in adults (IV).

4 PATIENTS AND METHODS

4.1 Patients

The patients in the study are depicted in Table 6. In study I, 8000 people living in the Tampere region in Finland were randomly gathered from the national population registry. Study III was a long-term follow-up in which questionnaires were sent to patients who participated in study I.

In 2011, it was possible to identify 155 out of the 162 incontinent subjects. Study III included two continent control subjects for each incontinent subject in study I. They were gender-matched and age-matched, being less than two years younger or older than the incontinent subjects were. Finally, there were 138 subjects in the study group and 276 in the control group.

Study II comprised 56 patients with FI who underwent anterior anal sphincteroplasty in Tampere University Hospital between the years 2003–2005.

In study IV, 21 adult patients with troublesome incontinence who had undergone unsuccessful conservative treatment were treated with the PEG tube inserted into the distal colon and the results were analysed.

Table 6. Patients and methods in this thesis

Study	Methods	Sample n	Responded (%)	Female (%)	Median FU time Months (range)	Median age (range)
I	Questionnaires	8000	3163 (39.5)	1845 (58.3)		56 (30–81)
II	Questionnaires	56	39 (69.6) ¹ 37 (66.1) ²	39 (100) ¹ 37 (100) ²	89.3 (74.6–104.2)	50 (30–79)
III	Questionnaires	414 138 ³ 276 ⁴	233 (56.3)	163 (70)	108	69 (40–90)
IV	Interview by telephone, case records	21	5 (23.8)	18 (85.7)	168 (132–204)	53 (29–79)

¹ Preoperatively and in 2006

² In 2011

³ Final number of persons in study group

⁴ Final number of patients in control group

4.2 Methods

4.2.1 Statistical methods

In study I, statistical analyses were performed with SPSS 12.0 (SPSS Inc., Chicago, Illinois, USA) for Windows. Comparisons of variables by the faecal incontinence status were made using chi-square tests for categorical variables. Multivariate logistic regression analyses were used to find risk factors for the prevalence of faecal incontinence.

In study II, the changes in Wexner's faecal incontinence score were assessed by subtracting the post-operative values from the corresponding preoperative values. The difference was classified as improvement or deterioration, separately on each scale if the change was at least one unit. Those with no change were classified into their own group. The mean differences in the quality of life scales in different faecal incontinence severity groups were analysed with ANOVA. The Wilcoxon signed rank test was used to compare the faecal incontinence quality of life scales before and after the anterior sphincter repair. The results were analysed separately for subjects who were more than 50 years of age and for those aged 50 years or less.

In study III, the descriptive results are presented as percentages or medians followed with the minimum and maximum values or quartiles. The Wexner Score and the QoL in all different QoL scales between the subgroups were compared using the Kruskal–Wallis test. SPSS for Windows (IBM SPSS Statistics for Windows, Version 19.0; Armonk, NY: IBM Corp., USA) was used for the data analysis.

4.2.2 Occurrence of faecal incontinence in adults (I and III)

In study I, a questionnaire was mailed to the study population. It included questions about general health and medication, gastrointestinal symptoms, UI, previous anorectal and gynaecological operations, deliveries and possible traumas associated with the delivery. The second questionnaire inquired about the symptoms of AI; questions were adopted from a validated questionnaire about FI (Reilly et al., 1999). Thirdly, self-made questions about AI and the rate of the symptoms were added. The impact of the symptoms on QoL and the question of whether the subjects had discussed the symptoms with a physician were further assessed with focused questions.

In study III, the Wexner Incontinence Score and FIQLS were sent to individuals who had complained of incontinence in study I. In addition, a questionnaire was sent about the frequency of UI, the use of healthcare resources because of AI, any management for AI and its possible benefits. The subjects were divided into four groups: incontinent both in 2003 and in 2012 (II), incontinent–continent (IC), continent–incontinent (CI) and continent–continent (CC).

In study I, incontinence was classified as occurring *rarely* when it occurred at most once a month, *sometimes* when it occurred at least twice a month but less than once a week, *often* when it took place at least once a week but not daily and *regularly* when it occurred at least once a day. Incontinence occurring sometimes i.e. twice a month or more frequently was chosen for analyses because FI occurring at least at that frequency is considered to be significant. On the other hand, FI occurring rarely can be considered as an occasional episode. Study III comprised all the individuals who reported AI in any frequency in study I.

Questionnaires used in this thesis are seen in the Appendix.

4.2.3 Anterior sphincter reconstruction (II)

Study II comprised patients who underwent secondary anterior anal sphincteroplasty between years 2003–2005, because the conservative management had failed. The sphincter repair was primarily performed using the overlapping technique, originally described by Parks and McPartlin (1971). The end-to-end technique (Pinta et al., 2004) was the other choice if it was not possible to use the overlapping technique. Antibiotic prophylaxis (usually ceftriaxon and metronidazole) was given at the induction of anaesthesia and additional antibiotics were given on clinical indications. All the patients were told to go on a normal diet immediately, and all received stool softeners. The Wexner Incontinence Score (Jorge and Wexner, 1993) and FIQLS (Rockwood et al., 2000) were applied before the operation (2003–2005) and again in 2006 and 2011. EAUS was performed preoperatively to all and anomanometry to 38 (68%) patients. PNTML was performed selectively to rule out a neurogenic disorder. Thirty-nine (70%) out of the 56 patients completed the questionnaires before the operation in 2006, and 37 (66%) patients completed them in 2011. Thirty-six out of the 39 respondents had undergone overlapping sphincteroplasty at least once after the operation, three had undergone end-to-end sphincteroplasty; whereas additional levatorplasty had been performed for five respondents.

4.2.4 PEG tube colostomy in the treatment of colorectal dysfunction (IV)

In 1997–2006, the PEG tube was inserted in 21 patients suffering from colorectal dysfunction. Six patients suffered from incontinence, 7 from constipation or outlet obstruction with incontinence, 7 from constipation or outlet obstruction alone and 1 from slow-transit constipation. The PEG tube insertion was carried out using laparotomy in all cases except in one using laparoscopy. The best place for the tube was marked preoperatively by stomatherapist, and she guided the patients to start the therapeutic enemas after three weeks of the application. She also taught the patients to check the fluid volume of the retention balloon and the position of the tube once a month. After three months, the

tube was changed into a skin level “button” PEG tube, in case the patient preferred a less prominent tube. In 2014, the clinical condition was evaluated by a phone interview and by investigating the patient records; it was investigated how many of the patients had the tube still in use, how they coped with it, and what the reasons for the possible removal were.

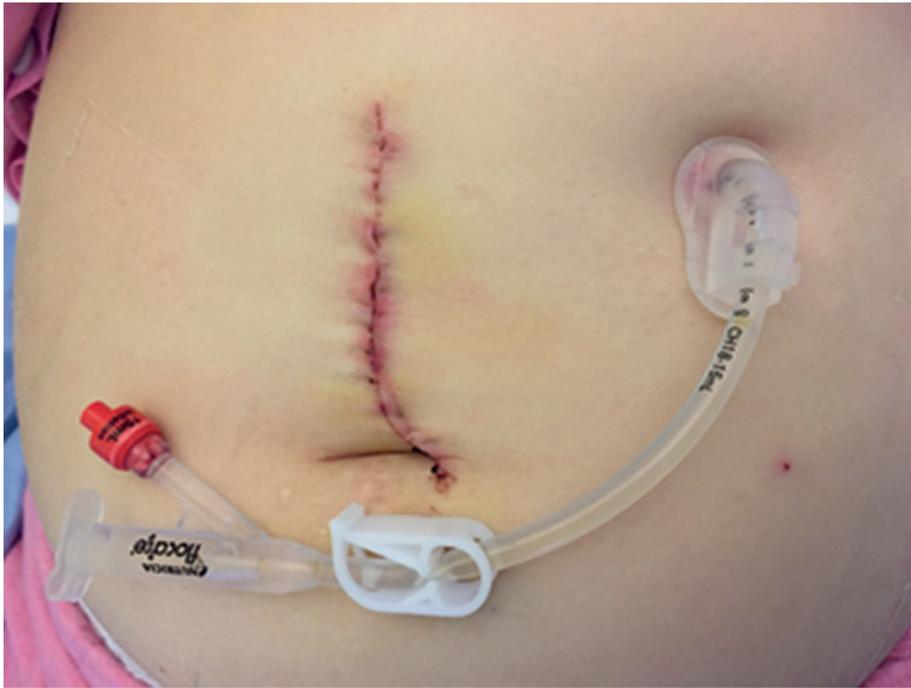


Figure 3. PEG tube colostomy applicated in laparotomy two days earlier.

5 RESULTS

5.1 Prevalence of faecal incontinence. Quality of life related to incontinence (I and III)

In study I, 3163 (40%) out of the 8000 individuals responded. The overall prevalence of FI, occurring at any frequency within the last year, was 10.6%; 11.9% among women and 8.7% among men ($P<0.005$). The incontinence for flatus only was more common among women (23.2%) than among men (14.3%; $P<0.001$). The prevalence of FI occurring at least twice a month was 5%; 61% of these had to use pads and approximately one fourth of them daily.

In study III, after 9 years of follow-up, 47 (58%) of the incontinent subjects in study I were still suffering from this. Of the initially continent subjects 140 (92%) were still continent, and 12 (8%) new incontinent subjects were detected; all were women. The overall prevalence of incontinence at any frequency was 25%.

In study I, one fourth (23.8%) of the respondents reported that they suffered from UI. Again, this was more common in women than in men, with 31.6% and 12.9%, respectively. Of the people suffering from FI at least twice a month, 63.6% also reported UI. Among those who had no FI or who suffered from FI once a month at most, the occurrence of UI was 21.6%. When comparing individuals with no or rare (at most once a month) FI to those with FI more than twice a month, there was a strong correlation ($P<0.0001$ chi-square test) between FI and UI. After 9 years, in study III, UI was present in 20% of subjects without FI and in 60% of those suffering from FI.

Initially (in study I), the occurrence of FI in women with no vaginal deliveries was 11.3%, in women with one vaginal delivery the FI occurrence was 12.3% and in women with two or more vaginal deliveries it was 12.8%. However, women with two or more vaginal deliveries had symptoms of FI at least twice a month significantly more often (62.4%) than those with one (43.2%) or no (31.3%) vaginal deliveries ($P<0.003$).

Of individuals with FI occurring at least twice a month, more than one third (36%) reported symptoms that deteriorated their QoL much or moderately. After nine years of follow-up, three scales (lifestyle, coping, depression) of four scores in the FIQLS were significantly poorer in the incontinent groups than in the continent groups.

In study I, one third (27%) of the people reporting FI at least twice a month had discussed the problem with their physician, whereas in 12.4% of the cases the physician had raised the question of FI. Only 10% of the individuals with FI had received treatment

for it, but 66% of incontinent subjects felt that they would have needed it. In study III, 12 (20%) out of 59 subjects suffering from incontinence had discussed the problem with a physician, 34 (58%) of them felt that they needed help and 27 (46%) had received some help. Medication was the most common treatment.

The results of studies I and III are depicted in Table 7.

Table 7. Faecal and urinary incontinence (I and III).

	Initially %	After 9 years of follow-up %
Incontinence total	10.6	25.3
UI all	23.8	31.3
UI in FI	63.6	62.7
Discussed with physician	27.2*	20.3
Received any management	10*	45.7

*Individuals reporting FI at least twice a month

5.2 Anterior sphincter reconstruction for FI (II)

In 36 out of the 39 cases who completed the questionnaires, the sphincter defect had been caused by a traumatic vaginal delivery and in three cases by fistula surgery. At EAUS, 31 patients had a defect in the EAS only and 25 in both the EAS and IAS. The time between the initial trauma and the operation is more than 10 years in 20 cases, 5–9 years in two cases and 0–4 years in 8 cases. In 9 cases the data is missing.

The mean follow-up time was 22.8 months in 2006 and 89.3 months in 2011. Preoperatively the median Wexner Incontinence Score was 11.8 and in a shorter follow-up it was 9.5, when score 0 means full continence and score 20 total incontinence. After the longer follow-up, the overall median score was 12.0, being at the preoperative level. In younger patients (aged 30–50 years), the median score was 10.5 preoperatively and 9.0 after the longer follow-up; in older people (aged 51–79 years) the corresponding scores were 13.0 and 15.0. In the FIQLS, all the subscores (lifestyle, coping, depression, embarrassment) improved in the shorter follow-up in 2006 in both age groups; the change was statistically significant ($p=0.003$, $p=0.001$, and $p=0.001$, respectively). In 2011, the scores were worse than in 2006 but better than preoperatively, with the exception of depression, which was even worse than preoperatively. After the longer follow-up, the differences were not statistically significant anymore. The quality of life scores were higher among the younger subjects at all points of time.

5.3 PEG tube colostomy in the treatment of colorectal dysfunction (IV)

Of the 21 patients with the PEG tube, one had the tube placed in the caecum, nine in the left part of the transverse colon and 11 in the sigmoid colon. Two tubes had to be relocated afterwards. The complication rate was 67%. The most common complication was a leakage around the tube causing irritation or inflammation in the skin around the tube, and this was also the most common reason for the removal. In addition, there was a rupture of the fascia, stricture of the tunnel or distressing pain in the stomach. In 2014, five out of the 21 patients had the tube still in use. Additionally, 3 patients had kept the tube until their death which was not related to this treatment. Four of the remaining five patients found the benefit of the tube to be excellent or good, one poor. The tube was removed from 11 patients. The time of use and the cause for removal are depicted in Table 8. The follow-up status in 2014 is depicted in Table 9.

Table 8. Cause for removal and time of use

Cause for removal	n	Time of use (years)
Faecal leakage around the tube	4	0, 1, 6, 8
Did not feel any benefit	2	0, 8
Tube slipped out	1	0
Pain in the area of the tube	1	1
Found it difficult to use	1	0
Sigmoid carcinoma	1	8
Reason unknown	1	10

Table 9. Follow-up status of the tubes in 2014

Tubes inserted	21
In use	5
Removed	11
Years in use, all patients; median (range)	8 (0–17)
Died with the tube still in place	3
Died	1

6 DISCUSSION

This study summarises the occurrence of AI or FI, its clinical features and long-term outcome in the Finnish population. Both conservative and operative tools are employed in the management. The data was gathered using various questionnaires which were sent to the subjects, by a telephone interview, and the data was completed from patient records. The subjects in studies I and III were randomly obtained from the national registry to ensure that they represent the general population. The subjects in study II and IV comprised patients operated in Tampere University Hospital because of AI.

The overall prevalence of FI at any frequency in the Finnish adult population was 10% initially and rose up to 25% after nine years of follow-up. Our study complies with the results of other recent studies in which the overall prevalence of FI among adults has ranged from 2% to 40% (see Table 2). The high dispersion of prevalence in different studies may be due to the characteristics of the questionnaires, the age of the target population and especially the definition of incontinence.

The questionnaires in studies I and III were different, which limits the comparisons. At the time of study III, generalised and validated questionnaires were preferred, although they are not validated in Finnish. Nevertheless, incontinence was a chronic problem, as 58% of the incontinent subjects suffered from the same disorder 10 years later. The incidence of new cases was, however, rather low. The response rate was also rather low (39.5% and 56.3%), which may have an influence on the results. In addition, the results were not analysed and compared in different age categories, which could have given more specified information about the incidence.

In this study, the overall prevalence of FI among women was significantly higher than among men (11.9% vs. 8.7%), but in younger groups no such difference was seen. The reason may be a lower response rate among younger people. Additionally, it is possible that the individuals who have problems with their continence are more likely to return the questionnaires. Regardless of gender, the prevalence of AI or FI increases with age, as ageing weakens the pelvic floor muscles (Rasmussen et al., 1999), which may explain this. It was also seen that UI and FI were significantly associated with each other, which has also been observed in other studies (Melville et al., 2005; Roberts et al., 1999; Edwards et al., 2001).

Within nine years of follow-up, 42% of the subjects had spontaneously recovered from FI. It is possible that women who had had a vaginal delivery had had some problems with continence but that they had not had any sphincter rupture, and therefore they have

recovered by the time of the follow-up questionnaire. It may also be that they were adjusted to live with the disorder, and did not find their symptoms distracting enough to report them in the follow-up questionnaire.

This study supports the assessment that AI is an underestimated and shameful problem (Whitehead, 2005). Only one fourth of the subjects had discussed the problem with their physician, and only 10% had received any treatment for it. It may be that women find it as a natural consequence of a vaginal delivery, which passes, and it is easier to talk about it to other women (Buurman et al., 2013). The physician had raised the relevant question in only 12% of the incontinent cases, which indicates that the disorder is not well recognised in primary health care. In the subjects who had received some help, medical treatment was the most often used treatment. The low rate of using biofeedback treatment is noticeable although it is known that it may have a positive effect in even as high as 90% of the cases (Hayden et al., 2011). Regular pelvic floor exercises at the very least should be performed beside any other treatment.

AI clearly deteriorates the quality of life. The higher the incontinence scores (Wexner Score) are, the lower the scores in the FIQLS are. The improvement of QoL should be the main goal in the treatment of AI.

When the conservative treatment alone does not give a desirable result in case of AI due to a sphincter rupture, anterior sphincter reconstruction may be the treatment of choice. The target of the treatment is to reduce symptoms and to increase QoL. In this study, the benefit to both incontinence and QoL was good in all age groups after a short follow-up, but the results deteriorated within a longer follow-up, especially in the older group. Altogether, younger patients (aged 30–50) years benefited more from the operations than the older ones. The reason may lie in better compensation of pelvic muscles of the younger patients and in a shorter time from the initial damage of the sphincter. In accordance, other studies have reported good results of anterior sphincteroplasty in the short term, but after 5–10 years only one fourth of the patients have been continent for stool, which negatively impacts on QoL (Trowbridge et al., 2006; Gutierrez et al., 2004). This indicates that operative treatment should be considered only when conservative management does not offer any help. Undiagnosed IRP may partly explain the poor long-term results of sphincteroplasty in elderly patients. Although the role of IRP in the aetiology of FI is under debate, high-grade IRP is associated with decreased maximal resting pressure in the anal canal (Harmston et al., 2011), as the IAS pressure decreases with an increasing grade of IRP (Collinson et al., 2010). High-grade IRP also causes changes in the recto-anal inhibitory reflex (Farouk et al., 1994)

In some cases, a PEG tube enema in the distal colon can be used to treat FI, especially if it is associated with outlet obstruction constipation, again in cases in which conservative treatment remains unsuccessful. Enema from the distal colon is a quicker procedure and less water is absorbed when compared to enemas using the proximal colon or the appendix. In the present study, the removal rate was high although the five patients who still used

the tube were satisfied with the treatment. The complication rate was high as well, but there were no life-threatening events. If the treatment turned out to be unsuccessful, it was easy to remove the tube, because the channel will close itself. Satisfied individuals had variable bowel problems with the application of the tube, and it was not possible to find any specific disorder in which the use of PEG tube colostomy would have been successful. Nevertheless, the sample in this study was quite small and the rate of complications was high. The procedure can be used after a careful consideration in some peculiar cases.

Prospective studies are needed to explore the overall burden of AI. The problem should be brought up actively in risk groups. Since the long-term outcome of sphincter reconstruction was relatively disappointing, patient selection is vital and subject to further studies. Neuromodulation is a potential surgical method when conservative methods do not relieve the symptoms of incontinence, and it may be considered even as a first line treatment after conservative management. Posterior tibial nerve stimulation (PTNS) is a less invasive technique than SNS, and it decreases the symptoms of incontinence and improves QoL when conservative treatment has failed (Shafik et al., 2003; Findlay et al., 2011; Pena Ros et al., 2015). Patient selection is similarly important when the PEG tube insertion to the distal colon is taken into consideration. Even in adults, the insertion of a PEG tube should not be totally abandoned, although the need for it is rare. At the moment it is challenging to choose the best treatment option for each individual patient. Operative methods can be considered for a minority of patients, and only part of them get any benefit from it. The choice of treatment for the most part is always conservative, meaning medical treatment and biofeedback treatment. As a rule, a surgeon is needed to treat the patient only if there is a traumatic sphincter rupture or an anatomic anomaly causing FI.

7 SUMMARY AND CONCLUSIONS

AI or FI is a common disorder, and often a chronic one. Because of its intimate nature, patients are hesitant to tell about their symptoms to a physician and on the other hand, physicians hesitate to ask about it or they do not recognise it. The primary healthcare system should be more aware of this condition to find the patients suffering from AI.

The management of AI is primarily conservative. Anterior sphincter reconstruction improves continence in the short term in all patients, but the results deteriorate over time. QoL may become even worse than before the operation especially in older patients. PEG tube colostomy may be used in the treatment of bowel problems, but failures are common, and only a small subgroup of patients benefit from it in the long term.

There is a need for improvement in the detection and management of AI. More attention should be paid to the selection of treatment for each individual patient suffering from AI, and increasing the QoL should be the main goal in making treatment decisions.

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Appendix 1. Kysymyskaavake (osatyö I)

KYSELYLOMAKE

Ulosteinkontinenssin esiintyvyys suomalaisessa aikuisväestössä

Olkaa hyvä ja vastatkaa alla oleviin kysymyksiin rastittamalla sopiva vaihtoehto ja täydentämällä kysymykseen liittyvä vastaustila.

Kyselylomake osa I

1	HENKILÖTIEDOT syntymäaika <input type="text"/> / <input type="text"/> / <input type="text"/> päivä kuukausi vuosi sukupuoli <input type="checkbox"/> 1 nainen <input type="checkbox"/> 2 mies
2	ASUMISMUOTO <input type="checkbox"/> 1 oma tai vuokra-asunto <input type="checkbox"/> 2 vanhainkoti tai muu hoitolaitos <input type="checkbox"/> 3 sairaalan pitkäaikaisosasto <input type="checkbox"/> 4 muu, mikä: <input type="text"/>
3	TERVEYS VIIMEISEN VUODEN AIKANA <input type="checkbox"/> 1 huonontunut voimakkaasti <input type="checkbox"/> 2 huonontunut hieman <input type="checkbox"/> 3 pysynyt ennallaan <input type="checkbox"/> 4 parantunut hieman <input type="checkbox"/> 5 parantunut selvästi
4	PITUUS JA PAINO pituuteni on <input type="text"/> cm painoni on <input type="text"/> kg
5	LÄÄKKEET Käytättekö säännöllisesti lääkkeitä? <input type="checkbox"/> 0 En käytä. <input type="checkbox"/> 1 Kyllä käytän. Rastittakaa alla olevista lääkeryhmistä ne, joihin käyttämänne lääkkeet kuuluvat ja kirjoittakaa alla olevalle viivalle lääkkeiden nimet. <input type="checkbox"/> 2 ummetuslääkkeet: _____ <input type="checkbox"/> 3 ripulilääkkeet: _____ <input type="checkbox"/> 4 virtsaamisvaivojen lääkkeet: _____ <input type="checkbox"/> 5 mielenterveyslääkkeet: _____ <input type="checkbox"/> 6 peräpukamien paikallishoitolääkkeet: _____ <input type="checkbox"/> 7 kilpirauhaslääkkeet: _____ <input type="checkbox"/> 8 sokeritautilääkkeet: _____ Onko Teillä koskaan ollut sokeritaudin tablettilääkityksenä glibenklamidivalmistetta eli Euglucon, Euglamin, Origliucon tai Daonil? <input type="checkbox"/> 0 ei <input type="checkbox"/> 1 kyllä, vuonna/vuosina: <input type="text"/>

6 SAIRAUDET JA VAMMAT

Sairastatteko tai oletteko joskus sairastaneet jotakin seuraavista sairauksista? Rastittakaa tarvittavat numerot.

- 0 En sairasta, enkä ole sairastanut mitään alla olevista sairauksista.
- 1 sokeritauti, todettu vuonna:
- 2 ummetus
- 3 ripuli
- 4 MS-tauti
- 5 dementia
- 6 selkäydinvamma
- 7 Crohnin tauti
- 8 haavainen paksusuolentulehdus
- 9 peräpukamat
- 10 halvaus
- 11 paksu- tai peräsuolen syöpä
- 12 kilpirauhasen vajaatoiminta
- 13 kilpirauhasen liikatoiminta
- 14 sappikivitauti
- 15 muu sairaus/vamma: _____

7 LEIKKAUKSET

Onko Teille tehty jokin seuraavista leikkauksista? Rastittakaa tarvittavat numerot.

- 0 Minulle ei ole tehty mitään alla olevista leikkauksista.
- 1 peräpukamaleikkaus
- 2 fistelikirurgia
- 3 peräsuolen sulkijalihasten korjausleikkaus
- 4 selkäleikkaus
- 5 kohdunpoisto
- 6 paksu- tai peräsuolisyövän poistoleikkaus
- 7 sappikivileikkaus
- 8 muu, mikä:

Jos Teillä ei ole sappikivitautia, siirrykää suoraan kysymyslaatikkoon nro 9, miehet siirtyvät laatikkoon nro 10.

8 SAPPIKIVITAUTI JA SEN HOITO

Rastittakaa tarvittavat vaihtoehdot ja täyttäkää pyydytyt vuosiluvut laatikoihin.

Onko Teillä todettu kiviä sappirakossa?

- 0 ei
- 1 kyllä, vuonna:

Onko Teillä todettu kiviä sappiteissä?

- 0 ei
- 1 kyllä, vuonna:

Onko Teille tehty sappikivien vuoksi jokin seuraavista leikkauksista tai muista toimenpiteistä?

- 0 ei leikkausta tai muuta toimenpidettä
- 1 sappirakon poisto vuonna:
- 2 sappitiekivien poisto vuonna:
- 3 sappirakon poisto ja sappitiekivien poisto vuonna:
- 4 muu toimenpide, vuonna:
- Kirjoittakaa allaolevalle viivalle mikä toimenpide oli kyseessä:
- _____

9 ALATIESYNNYTYKSET

Alatiesynnytyksien lukumäärä: kpl
Välihihan halkaiseminen on tehty minulle kertaa synnytyksen yhteydessä.

Onko peräaukon sulkijalihas koskaan revennyt synnytyksen yhteydessä?

0 ei
 1 kyllä vuonna/vuosina:

Onko sulkijalihasta koskaan korjattu kirurgien toimesta synnytyksen yhteydessä tapahtuneen repeämisen vuoksi?

0 ei
 1 kyllä vuonna/vuosina:

SUOLEN TOIMINTA JA VIRTSAAMINEN

Onko Teillä viimeisen vuoden aikana esiintynyt jotain seuraavista oireista? Merkitkää tarvittavat numerot rastilla.

- 1 ulosteen pidätyksen vaikeutta ja ulosteen karkaamista
- 2 ummetusta tai ulostamisvaikeutta
- 3 ilman karkailua
- 4 virtsan pidätyskyvyn heikkoutta

0 Ei, viimeisen vuoden aikana minulla ei ole esiintynyt mitään yllä olevista oireista. Siirtykää suoraan kohtaan 24.

Kuinka usein Teillä esiintyy tahatonta ilman karkaamista?

- | | |
|---|--|
| 1 | harvoin (eli kerran kuussa tai harvemmin) |
| 2 | joskus (eli vähintään kaksi kertaa kuussa, mutta harvemmin kuin kerran viikossa) |
| 3 | usein (eli vähintään kerran viikossa, mutta ei päivittäin) |
| 4 | lähes säännöllisesti (eli kerran päivässä tai useammin) |

12 Kuinka usein Teillä esiintyy ulosteen karkaamista?

- | | |
|---|----------------------|
| 1 | harvoin |
| 2 | joskus |
| 3 | usein |
| 4 | lähes säännöllisesti |

13 Oletteko viimeisen vuoden aikana käyttänyt ripulilääkkeitä (esim. Imodium, Imocur, Lopex) estääksenne ulosteen karkailua?

- | | |
|---|-----------------------------|
| 0 | en |
| 1 | kyllä, harvoin |
| 2 | kyllä, joskus |
| 3 | kyllä, lähes säännöllisesti |
- käyttämäni lääkkeen nimi on

14 Milloin havaitsite **ensimmäisen** kerran ulosteen karkaavan tahtomattanne?

- | | |
|---|---|
| 1 | viimeisen 6 kuukauden aikana |
| 2 | yli 6 kuukautta sitten, mutta viimeisen vuoden sisällä |
| 3 | yli vuosi sitten, mutta viimeisen 2 vuoden sisällä |
| 4 | yli 2 vuotta sitten, mutta viimeisen 5 vuoden sisällä |
| 5 | yli 5 vuotta sitten, mutta viimeisen 10 vuoden sisällä |
| 6 | yli 10 vuotta sitten, mutta viimeisen 20 vuoden sisällä |
| 7 | yli 20 vuotta sitten |

15 Oletteko koskaan viimeisen vuoden aikana käyttänyt pikkuhousunsuojaa tai jonkinlaista vaippaa estääksenne alushousujen tuhrintumisen?

- | | |
|---|----------------------|
| 0 | en koskaan |
| 1 | joskus |
| 2 | usein |
| 3 | lähes säännöllisesti |

16 Jos käytätte vaippasuojaa tuhrimisen välttämiseksi, mihin aikaan vuorokaudesta käytätte sitä?

- | | |
|---|-----------------------------------|
| 1 | hereillä ollessani |
| 2 | nukkuessani |
| 3 | hereillä ollessani ja nukkuessani |
| 0 | en käytä vaippasuojaa |

17 Milloin viimeisen vuoden aikana olette huomanneet ulosteenkarkailua useimmiten tapahtuvan?

- | | |
|---|---|
| 1 | hereillä ollessani |
| 2 | nukkuessani |
| 3 | ulosteen karkailua tapahtuu yhtä paljon hereillä ollessa kuin nukkuessa |

18 Viimeisen vuoden aikana, onko tahtomattanne karannut uloste ollut löysää tai vetistä?

- | | |
|---|----------------------|
| 1 | ei koskaan |
| 2 | joskus |
| 3 | usein |
| 4 | lähes säännöllisesti |

19 Viimeisen vuoden aikana, onko tahtomattanne karannut uloste ollut koostumukseltaan kiinteää?

0	ei koskaan
1	joskus
2	usein
3	lähes säännöllisesti

20 Kuinka paljon ulostetta karkaa kerrallaan?

1	hyvin vähän
2	määrä, joka vaatii usein vaippasuojien käyttämistä
3	määrä, joka vaatii usein vaatteiden vaihtamisen
4	karkaava uloste on kiinteää

21 Viimeisen vuoden aikana, onko Teillä ollut ulostamistarpeen tunne peräsuolessa ennen ulosteen karkaamista?

1	ei koskaan
2	joskus
3	usein
4	lähes säännöllisesti

22 Tunneteko ulosteen valumisen hetkellä, jolloin uloste pääsee karkaamaan?

1	en koskaan
2	joskus
3	usein
4	lähes säännöllisesti

23 Pystytekö erottamaan ulostamistarpeen ja ilmavaivan toisistaan?

1	en koskaan
2	joskus
3	usein
4	lähes aina

24 Oletteko viimeisen vuoden aikana joutuneet rajoittamaan kodinulkopuolisia menojanne ulosteenpidätysvajavuuden vuoksi?

0	ei
1	harvoin
2	joskus
3	usein

25 Koetteko, että ulosteen karkaaminen on heikentänyt elämänlaatuanne?

0	ei
1	lievästi
2	kohtalaisesti
3	paljon

Kyselylomake osa III**MUUT SUOLEN TOIMINTAAN LIITTYVÄT KYSYMYKSET**

26 Onko Teillä viimeisen vuoden aikana esiintynyt alla lueteltuja maha-suolikanavaan liittyviä oireita?
Merkitkää rastilla kaikki Teillä ilmenneet oireet.

- | | | |
|--------------------------|----|--|
| <input type="checkbox"/> | 0 | Viimeisen vuoden aikana minulla ei ole esiintynyt mitään alla olevista oireista. |
| <input type="checkbox"/> | 1 | ylävatsakipua yli kuusi kertaa vuodessa |
| <input type="checkbox"/> | 2 | alavatsakipuja yli kuusi kertaa vuodessa |
| <input type="checkbox"/> | 3 | yöllä herättävää vatsakipua |
| <input type="checkbox"/> | 4 | syömisen yhteydessä pahenevaa kipua |
| <input type="checkbox"/> | 5 | syömisen yhteydessä helpottavaa kipua |
| <input type="checkbox"/> | 6 | kipua, joka helpottaa ulostamisen jälkeen |
| <input type="checkbox"/> | 7 | löysät ulosteet yli kolme kertaa vuorokaudessa |
| <input type="checkbox"/> | 8 | ummetus |
| <input type="checkbox"/> | 9 | muutos suolen toiminnassa viimeisen vuoden aikana |
| <input type="checkbox"/> | 10 | tunne, ettei peräsuoli tyhjene täydellisesti ulostamisen aikana |
| <input type="checkbox"/> | 11 | oksentelu |

Kyselylomake osa IV**ULOSTEEN PIDÄTYSKYVYTTÖMYDESTÄ KÄRSIVÄ POTILAS JA LÄÄKÄRI**

27 Oletteko koskaan ottanut esille ulosteen karkailuun liittyvää ongelmaa lääkärin vastaanotolla?

- | | | |
|--------------------------|---|-------|
| <input type="checkbox"/> | 1 | en |
| <input type="checkbox"/> | 2 | kyllä |

28 Onko lääkäri koskaan ottanut puheeksi ulosteen karkaamiseen liittyviä asioita?

- | | | |
|--------------------------|---|------------|
| <input type="checkbox"/> | 1 | ei koskaan |
| <input type="checkbox"/> | 2 | kyllä |

29 Oletteko saanut lääkärinne kautta hoitoa ulosteen pidätyskyvyn heikkouteen?

- | | | |
|--------------------------|---|-------|
| <input type="checkbox"/> | 1 | kyllä |
| <input type="checkbox"/> | 2 | en |

30 Tuntuuko Teistä, että tarvitsisitte hoitoa ulosteen karkailu-oireeseen?

- | | | |
|--------------------------|---|-------|
| <input type="checkbox"/> | 1 | kyllä |
| <input type="checkbox"/> | 2 | ei |

KIITÄMME TEITÄ SYDÄMELLISESTI VASTAUKSISTANNE. POSTITTAKAA TÄMÄ LOMAKE VALMIIKSI MAKSETUSSA PALAUTUSKUORESSA.

Appendix 2. Ulosteenpidätyskyvyn vajavuuden vaikeusasteen mittari (osatyöt II ja III)

TAYS

Lomakkeen täyttöpäivämäärä: _____

Nimi+ syntymäaika: _____

Arvioi kunkin kohdan A.–E. esiintymisen yleisyys ja ympyröikää oikea vaihtoehto.

Pidätyskyvyttömyyden muoto tai haitta	Ongelman esiintymisen yleisyys				
	Ei koskaan	Harvoin	Joskus	Useimmiten	Aina
A. Kiinteä uloste karkaa	0	1	2	3	4
B. Löysä uloste/ripuli karkaa	0	1	2	3	4
C. Kaasu (ilma) karkaa	0	1	2	3	4
D. Suojasiteen/vaipan käytön tarve	0	1	2	3	4
E. Elämäntapojen muutos/ rajoitus pidätyskyvyn vajavuuden vuoksi	0	1	2	3	4

Mittarin tulos on kohtien A.–E. yhteenlaskettu summa, 0 = normaali pidätyskyky, 20 = täydellinen inkontinenssi.

Harvoin = alle 1 / kuukausi, joskus = alle 1 / viikko mutta useimmin kuin 1 / kuukausi, useimmiten = alle 1 / päivä mutta useimmin kuin 1 / viikko, aina = yli 1 / päivä

Appendix 3. Elämänlaatukysely ulosteenpidätyskyvyn vajavuudesta kärsiville potilaille (osatyöt II ja III)

TAYS/GAS1

Elämänlaatukysely ulosteenpidätyskyvyn vajavuudesta kärsiville potilaille (Fecal Incontinence Quality of Life Scale)

Nimi: _____ Syntymäaika: _____

- Millaiseksi katsot yleisen terveydentilasi:
 - Erinomainen
 - Todella hyvä
 - Hyvä
 - Kohtalainen
 - Huono
- Jokaisen seuraavan väittämän kohdalla, arvioi kuinka paljon päivittäisestä ajastasi väittämän asia vaivaa sinua johtuen ulosteenpidätyskyvyn vajavuudesta ja ympyröi oikea kohta. (Jos asia vaivaa muusta syystä kuin ulosteenpidätyskyvyn vajavuudesta ympyröi rasti kohdassa "en osaa sanoa/ei ole kohdallani ajankohtainen" (EK))

	Usein	Joskus	Harvoin	Ei koskaan	EK
	1	2	3	4	X
Johtuen ulosteenpidätyskyvyn vajavuudesta:					
a. Pelkään lähteä ulos	1	2	3	4	X
b. Vältän ystävien tapaamista	1	2	3	4	X
c. Vältän yöpymistä poissa kotoa	1	2	3	4	X
d. Minun on vaikea lähteä ulos ja mennä esim. elokuviin tai kirkkoon	1	2	3	4	X
e. Vähennän syömistäni ennen ulosmenoa	1	2	3	4	X
f. Kun olen poissa kotoa yritän pysytellä niin lähellä vessaa kuin mahdollista	1	2	3	4	X
g. Minulle on tärkeää suunnitella päivän tekemiseni suoleni toiminnan mukaan	1	2	3	4	X
h. Vältän matkustamista	1	2	3	4	X
i. Olen huolissani etten ehdi ajoissa vessaan	1	2	3	4	X
j. Tunnen etten pysty kontrolloimaan suoleni toimintaa	1	2	3	4	X
k. En pysty pidättämään hädän tultua niin kauaa että ehtisin vessaan	1	2	3	4	X
l. Ulostetta valuu tietämättäni	1	2	3	4	X
m. Yritän välttää pidätyskyvyttömyyden vahinkoja pysyttelemällä lähellä vessaa	1	2	3	4	X

3. Arvioi missä määrin olet SAMAA MIELTÄ tai ERI MIELTÄ oheisten väittämien kanssa johtuen ulosteepidätyskyvyn vajavuudesta. (Jos asia vaivaa muusta syystä kuin ulosteepidätyskyvyn vajavuudesta ympyröi rasti kohdassa ”en osaa sanoa/ei ole kohdallani ajankohtainen” (EK)).

	Vahvasti samaa mieltä	Jonkun verran samaa mieltä	Jonkun verran eri mieltä	Vahvasti eri mieltä	EK
	1	2	3	4	X
Johtuen ulosteepidätyskyvyn vajavuudesta:					
a. Olen häpeissäni	1	2	3	4	X
b. En voi tehdä monia asioita mitä haluaisin	1	2	3	4	X
c. Pelkään pidätyskyvyn vahinkoja	1	2	3	4	X
d. Tunnen oloni masentuneeksi	1	2	3	4	X
e. Pelkään, että muut haistavat ulosteeni	1	2	3	4	X
f. Tunnen etten ole terve	1	2	3	4	X
g. Nautin elämästä vähemmän	1	2	3	4	X
h. Harrastan seksiä harvemmin kuin haluaisin	1	2	3	4	X
i. Tunnen olevani erilainen kuin muut ihmiset	1	2	3	4	X
j. Ulostevahingon mahdollisuus on aina mielessäni	1	2	3	4	X
k. Pelkään rakastelua	1	2	3	4	X
l. Vältän lentokoneella tai junalla matkustamista	1	2	3	4	X
m. Vältän ulos syömään menemistä	1	2	3	4	X
n. Milloin tahansa menen johonkin uuteen paikkaan otan selvää, missä vessat ovat	1	2	3	4	X

4. Viimeisen kuukauden aikana, oletko tuntenut itsesi niin surulliseksi, toivottomaksi tai onko sinulla ollut niin monia ongelmia että olet ajatellut onko millään mitään väliä?

1. Erittäin paljon – jopa niin että olen lähes luovuttamassa
2. Paljon
3. Melko paljon
4. Jonkun verran – niin paljon että tunne on vaivannut minua
5. Vähän
6. En ollenkaan

Lomakkeen täyttöpäivämäärä: _____

KIITOS!

Appendix 4. Täydentävät kysymykset (osatyö II)

Nimi _____

1. Onko Teille tehty pidätyskyvyn parantamiseksi jokin toimenpide?

Kyllä _____ Ei _____

Jos vastasitte kyllä, niin millainen toimenpide? _____

Jos vastasitte kyllä, niin milloin? _____

Jos vastasitte kyllä, niin missä toimenpide tehtiin? _____

2. Onko Teillä käytössä jokin kuituvalmiste (esim. Vi-Siblin tai Agiocur)?

Kyllä _____ Ei _____

3. Onko Teillä käytössä esimerkiksi Imodium tai Imocur (vaikuttava aine loperamidi)?

Kyllä _____ Ei _____

KIITOS VASTAUKSISTANNE!

Appendix 5. Täydentävät kysymykset (osatyö III)

Olkaa hyvä ja vastatkaa alla oleviin kysymyksiin ympyröimällä oikea vaihtoehto tai täydentämällä kysymyksiin liittyvä vastaustila.

1. HENKILÖTIEDOT

Nimi _____
Syntymäaika (pvä/kk/v) _____
Sukupuoli 1. Nainen _____
2. Mies _____

2. ASUMISMUOTO

1. Oma tai vuokra-asunto
2. Vanhainkoti tai muu hoitolaitos
3. Muu, mikä? _____

3. TERVEYS VIIMEISEN VUODEN AIKANA

1. Huonontunut voimakkaasti
2. Huonontunut hieman
3. Pysynyt ennallaan
4. Parantunut hieman
5. Parantunut selvästi

4. PITUUS JA PAINO

Pituuteni on _____ cm
Painoni on _____ kg

5. LÄÄKKEET

Käytättekö säännöllisesti lääkkeitä?

0. En käytä

1. Kyllä käytän. Ympyröikää ao. lääkeryhmistä ne, joihin käyttämänne lääkkeet kuuluvat.
 2. Ummetuslääkkeet
 3. Ripulilääkkeet
 4. Virtsaamisvaivojen lääkkeet
 5. Mielenterveyslääkkeet
 6. Sokeritautilääkkeet
 7. Peräpukamien paikallishoitolääkkeet

Oletteko viimeisen vuoden aikana käyttänyt ripulilääkettä (esim. Imodium, Imocur) estääksenne ulosteen karkailua?

1. Kyllä
2. En

Oletteko viimeisen vuoden aikana käyttänyt kuituvalmistetta (esim. Vi-Siblin, Agiocur) estääksenne ulosteen karkailua?

1. Kyllä
2. En

6. SAIRAUDET JA VAMMAT

Onko Teille vuoden 2003 jälkeen kehittynyt jokin seuraavista sairauksista? Ympyröikää numero tai numerot.

0. Ei ole
1. Sokeritauti
2. Ummetus
3. Ripuli
4. MS-tauti
5. Dementia
6. Selkäydinvamma
7. Chronin tauti
8. Haavainen paksusuolentulehdus
9. Peräpukamat
10. Halvaus
11. Peräaukon sulkijalihaksen repeämä synnytyksen yhteydessä
12. Paksu- tai peräsuolen syöpä

7. LEIKKAUKSET

Onko Teille vuoden 2003 jälkeen tehty jokin seuraavista lantion- tai peräsuolenalueen leikkauksista? Ympyröikää numero tai numerot.

0. Ei ole tehty mitään alla olevista leikkauksista
1. Peräpukamaleikkaus
2. Fisteliikkaus
3. Peräaukon sulkijalihaksen korjausleikkaus
4. Selkäleikkaus
5. Kohdunpoisto
6. Paksu- tai peräsuolisyövän poistoleikkaus
7. Muu, mikä _____

8. ALATIESYNNYTYKSET

Oletteko vuoden 2003 jälkeen synnyttänyt alateitse?

1. Kyllä
Synnytysten lukumäärä _____ kpl
Välilihan halkaiseminen on minulle tehty _____ kertaa synnytyksen yhteydessä
2. En

9. SUOLEN TOIMINTA JA VIRTSAAMINEN

Onko Teillä viimeisen vuoden aikana esiintynyt jotain seuraavista oireista? Ympyröikää numero tai numerot.

0. Ei, viimeisen vuoden aikana minulla ei ole esiintynyt mitään alla olevista oireista.
1. Ulosteen pidätyksen vaikeutta ja ulosteen karkaamista
2. Ummetusta
3. Virtsan pidätyskyvyn heikkoutta

10. TERVEYSPALVELUJEN KÄYTTÖ

Oletteko vuoden 2003 jälkeen ottanut esille ulosteen karkailuun liittyvää ongelmaa lääkärin vastaanotolla?

1. Kyllä
2. En

Onko vuoden 2003 jälkeen lääkäri ottanut puheeksi ulosteen karkaamiseen liittyviä asioita?

1. Kyllä
2. Ei

Oletteko saanut lääkärinne kautta jotakin alla mainituista hoitomuodoista ulosteen pidätyskyvyn heikkouteen?

0. En ole saanut mitään hoitoa
1. Lääkehoito (ripulilääke tai kuitu)
2. Lantionpohjan lihasten lihasjumppa (ns. biofeedback hoito)
3. Sulkijalihasten leikkaushoito
4. Muu, mikä _____

Jos olette saanut hoitoa, onko ulosteen pidätyskyky

1. Pysynyt ennallaan
2. Tullut paremmaksi
3. Huonontunut
4. Minulla ei enää ole ulosteen pidätyskyvyn vajetta ollenkaan.

Tuntuuko Teistä, että tarvitsisitte hoitoa ulosteen karkailuoireeseen?

1. Kyllä
2. Ei

POSTITTAKAA SUOSTUMUSKAAVAKE JA KAIKKI KYSELYLOMAKKEET PALAUTUSKUORESSA, JONKA POSTIMAKSU ON VALMIIKSI MAKSETTU.

KIITÄMME VASTAUKSISTANNE.

Appendix 6. Kysymykset huuhteluavannepotilaille puhelinhaastattelussa (osatyö V)

Potilaan nimi ja sotu: _____

Haastattelupvm: _____

Lupa? _____

1. Onko letku paikoillaan? _____ Jos poistettu niin milloin? _____
2. Käytättekö huuhtelua säännöllisesti? _____ Kuinka usein? _____
3. Onko pääasiallinen syy miksi käytätte huuhteluavannetta ummetus, ulostamisvaikeus, pidätyskyvyn vajavuus vai näiden yhdistelmä?
4. Onko huuhtelun avulla ongelmaanne saamanne hyöty arvionne mukaan
 - a. huono
 - b. kohtuullinen
 - c. hyvä
 - d. erinomainen
5. Oletteko tähän hoitomuotoon tyytyväinen/ siltä väliltä/ tyytymätön?
6. Mitkä ovat olleet suurimmat ongelmat huuhteluavanteen käytössä?
7. Muuta?

11 ORIGINAL PUBLICATIONS

Prevalence of faecal incontinence in adults aged 30 years or more in general population

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Abstract

Objective The aim of this study was to estimate the prevalence of and factors associated with faecal incontinence in a Finnish population.

Method A population-based age-stratified random sample of 8000 people aged 30–81 years from a large city was obtained from the national population registry. A postal questionnaire was sent to all subjects. Questions regarding faecal incontinence were adopted from a previously developed validated questionnaire.

Results Response rate was 39.8%. Overall, the prevalence of faecal incontinence occurring in any frequency within the last year was 10.6% (CI: 9.5–11.6%). Women suffered significantly more often than men (11.9% vs. 8.7%). The prevalence of faecal incontinence occurring at least twice a month was 5.2% (CI: 4.5–6%). Of these subjects, 62.3% used a pad at least twice a month to protect their

underwear (91 women, 10 men), 23.6% used it daily. There was a strong correlation between faecal incontinence and urinary incontinence. Of the 162 subjects reporting faecal incontinence at least twice a month, only 27.2% had discussed the problem with their physician. In 12.4%, their physician had raised the question of faecal incontinence. Only 10% had received treatment for it, but 66% (107/162) felt they needed treatment.

Conclusion Faecal incontinence is a common problem. Only a minority had reported this symptom to their physician and surprisingly few had received treatment for it. General awareness of faecal incontinence and treatment options should be improved among primary care physicians and general population.

Keywords Faecal incontinence, population-based, continence, prevalence

Introduction

Prevalence studies of faecal incontinence in the general population, including all adult age groups and both genders, are still rare. Most of the earlier population-based studies have focused on elderly people [1,2]. More recent studies have been restricted to women [3,4], although faecal incontinence has been shown to be almost as much of a problem to men [5,6].

Faecal incontinence is still an underestimated and, in many cases, unrecognized problem [7]. A surprisingly small minority seeks help and reports this symptom to their physician. As there is a strong association between increasing age and faecal incontinence, [2,5] the increasing proportion of older age groups in the Western population will probably increase its burden to health

care significantly. To estimate the need for care, population-based studies are needed.

The aim of this study was to estimate the prevalence of and factors associated with faecal incontinence in a Finnish population. Furthermore, we sought to establish its impact on quality of life and the need for care for this symptom.

Method

A computer-based random sample of 8000 people aged 30–81 years living in the city area of Tampere, Finland (population 201 061), was obtained from the national population registry (Statistics Finland) (Table 1). The sample was age-stratified, the proportion of subjects from the total sample in each age group being the same as in the target population.

A postal questionnaire was sent to all subjects, comprising items on general health, abdominal symptoms, medication, previous anorectal and gynaecological

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Variable	Response rate (%)	Respondents (%)	Sample (%)*	Population (%)*
Age				
30–39	27.3	486 (15.7)	1783 (22.3)	27955 (22.9)
40–49	30	559 (18.0)	1864 (23.3)	26861 (22)
50–59	41.2	799 (25.7)	1940 (24.3)	28082 (22)
60–69	55	710 (22.9)	1290 (16.1)	18056 (14.8)
70–79	49.4	492 (15.9)	996 (12.5)	13960 (11.4)
80–81	44.9	57 (1.8)	127 (1.6)	2000 (1.6)
Total	39.5	3163 (100)†	8000 (100)	122290 (100)
Sex				
Female	1845 (58.3)			
Male	1318 (41.7)			
Total	3163			

*Calculated from the total.

†Sixty subjects with missing age data were not included in the age group figures, percentage calculated from a total of 3103.

operations and urinary incontinence. Women were asked whether they had undergone hysterectomy, the number of vaginal deliveries, the number of episiotomies and possible anal sphincter rupture during delivery.

More specific questions concerned faecal incontinence within the last year. Questions regarding faecal incontinence were adopted from a previously developed validated questionnaire [8]. However, we added questions on flatus incontinence which were not included in the original questionnaire. The frequency of faecal or flatus incontinence was assessed by asking whether it occurred rarely (at most once a month), sometimes (at least twice a month but less than once a week), often (at least once a week but not daily) or regularly (once a day or more often).

The impact of faecal incontinence on quality of life was assessed by asking the respondents whether the condition had lowered their quality of life (no, slightly, moderately or a lot) and whether they had had to restrict their outdoor activities because of it (no, seldom, sometimes or regularly). Subjects were also asked, in the case where they had faecal incontinence, whether they had talked about the problem with their physician, whether their physician had asked about possible faecal incontinence, whether they had received treatment for it and whether they thought they needed treatment.

Statistical analysis

Statistical analyses were performed with spss 12.0 (SPSS Inc., Chicago, Illinois, USA) for Windows. Comparisons of variables by faecal incontinence status were made using chi-square tests for categorical variables. Multivariate logistic regression analyses were used to find risk factors

Table 1 Demographics of respondents, the sample and the city of Tampere population.

for the prevalence of faecal incontinence. The study protocol was approved by the Ethics Committee of Tampere University Hospital.

Results

Of the 8000 questionnaires posted, 40 (0.05%) were excluded because the subjects no longer lived at the address in question. Of the remaining 7960 questionnaires, 3184 were returned and only 3163 (39.5%) could be analysed (17 returned empty and four had insufficient data; in addition 60 questionnaires lacked age data) (Table 1).

Overall, the prevalence of faecal incontinence occurring in any frequency within the last year was 10.6% (334/3163, CI: 9.5–11.6%). Women suffered significantly more often than men (11.9% vs 8.7%, $P < 0.005$). The prevalence of gas incontinence alone without faecal incontinence within the last year was 19.5% (women 23.2%, men 14.3%). It occurred daily in 3.9% of subjects (women 4.5%, men 3.2%).

The prevalence of faecal incontinence occurring at least twice a month was 5.2% (CI: 4.5–6%) (Table 2). Of the subjects concerned, 61% used a pad to protect their underwear at least twice a month, 23.6% used it daily. Most subjects had problems only during daytime (88.8%). In two-thirds (68.3%), leaking faeces was often or regularly loose or watery. There was a significant difference in the prevalence of faecal incontinence between the age groups ($P < 0.024$) and between men and women ($P < 0.006$).

Overall, 23.8% subjects (women 31.6%, men 12.9%) reported problems in urinary continence during the last year (Table 3). There was a strong correlation between

Table 2 Prevalence of faecal incontinence occurring at least twice a month by age within the last year.

Age groups (years)*	Faecal incontinence		
	Total (%)	Female (%)	Male (%)
30–39	3.3 (16/486)	2.6 (8/305)	4.1 (8/194)
40–49	3.4 (19/559)	4.2 (14/333)	3.6 (8/222)
50–59	5.6 (45/799)	6.9 (31/449)	2.9 (10/339)
60–69	6.3 (46/710)	8.5 (33/389)	4.2 (13/307)
70–79	6.7 (33/492)	8.3 (24/288)	5.3 (10/187)
≥80	8.8 (5/57)	11.4 (4/19)	7.1 (1/14)
Overall	5.2 (164/3163)	6.5 (114/1843)**	4.0 (50/1263)

*Sixty subjects with missing age data were not included in the age group comparisons.

**Significant difference between women and men ($P < 0.006$).

Table 3 Relation between anorectal and pelvic surgery and faecal incontinence.

Characteristic	All	Subjects with no or rare FI	FI more than twice monthly	<i>P</i> -value*
All subjects		<i>n</i> = 2996	<i>n</i> = 165	
Age (years)	55 ± 13.3	54.8 ± 13.3	58.9 ± 12.8	ns
Urinary incontinence	23.8%	21.6%	63.6%	< 0.0001
Haemorrhoidectomy	6.5%	6.2%	12.1%	< 0.002
Anal fistula surgery	1.4%	1.3%	3.6%	< 0.013
Women		<i>n</i> = 1730	<i>n</i> = 113	
Urinary incontinence	31.6%	29.1%	69.0%	< 0.0001
Hysterectomy	21.3%	20.5%	34.5%	< 0.0001
Vaginal delivery	72.4%	71.8%	81.4%	< 0.027
Sphincter rupture during delivery	3.9%	3.4%	14.3%	< 0.0001

FI, faecal incontinence.

*Comparing respondents with no or rare FI and those with FI more than twice monthly (chi-square test).

faecal incontinence and urinary incontinence. About two-thirds (63.6%) of those suffering faecal incontinence at least twice monthly reported urinary incontinence as against 21.6% in those having rare or no faecal incontinence ($P < 0.0001$).

There was no significant difference in the occurrence of faecal incontinence between women with no, one or two or more vaginal deliveries (11.3%/12.3%/12.8%). There was, however, a correlation between the number of vaginal deliveries and the frequency of faecal incontinence. Women reporting faecal incontinence and two or more vaginal deliveries had frequent symptoms significantly more often (at least twice a month) when compared with that of those with no or one delivery (62.4% vs 31.3%/43.2%, $P < 0.003$). Women with faecal incontinence more than twice per month were more likely to have concurrent urinary incontinence, a previous hysterectomy, vaginal delivery and sphincter rupture during delivery than those with no or rare faecal incontinence (Table 3).

In the logistic regression analysis in women, the number of vaginal deliveries, sphincter tears during

delivery, episiotomy or hysterectomy seemed not to be significantly associated with increased odds of faecal incontinence. In contrast, urinary incontinence OR 5.38 (CI: 4.23–6.84), anal fistula surgery OR 2.43 (CI: 1.12–5.27) and haemorrhoidectomy OR 1.88 (CI: 1.26–2.82) seemed to be significantly associated with faecal incontinence.

Over one-third of respondents with faecal incontinence occurring at least twice a month reported that it had a moderate or major deteriorating impact on their quality of life (Table 4). Correspondingly, of these 29.8% had to restrict their outdoor activities at least twice a month. In logistic regression analysis, faecal incontinence was the symptom exerting the greatest negative impact on the quality of life (OR 19.4/CI: 8.6–42.7) when compared with other general abdominal symptoms within the last year (change in bowel function OR 3.6/CI: 1.9–6.9, vomiting OR 3.5/CI: 1.5–8.3, abdominal pain relieved after defecation OR 1.9/CI: 1.1–3.2).

Of the 162 subjects reporting faecal incontinence at least twice monthly, only 27.2% had discussed the problem with their physician. In 12.4% of cases, their

Frequency of faecal incontinence	No or little impact % (<i>n</i>)	Moderate or major impact % (<i>n</i>)	Total % (<i>n</i>)
Less than twice a month	93.7 (148)	6.3 (10)	100 (158)
Twice or more a month	64.2 (104)	35.8 (58)	100 (162)

$P < 0.001$.

physician had raised the question of faecal incontinence. Only 10% had received treatment for it, but 65.6% felt that they needed treatment for it.

Discussion

When we decided to select the study subjects from the general population randomly without prior selection, we were aware that this approach might lead to a low response rate. As in most previous studies participants have been chosen from health registers of some sort, we wanted the target population to be truly randomly selected. As expected, the response rate was the lowest in younger age groups where this problem is not so serious. The overall low response rate may have caused overestimation of the faecal incontinence prevalence figures if a greater proportion of those who had incontinence responded compared with those who had not. This bias resulting in falsely higher prevalence rates is likely to be true at least in the two youngest age groups where the response rates were 30% or under.

Faecal incontinence is a symptom, and the subjective perception of the patient must therefore be the foundation for any evaluation of incontinence or its impact [9]. In this respect, the postal questionnaire is a good tool. The problem when comparing results of different studies on the prevalence of faecal incontinence is that almost all researchers have developed and used different questionnaires [10]. Furthermore, set thresholds to identify clinically significant faecal incontinence vary between studies and there is actually no agreed definition for clinically significant faecal incontinence. When designing our questionnaire, we decided to use a previously validated set of questions. However, the question regarding the frequency of incontinence was divided into four parts. We decided to regard those subjects with faecal incontinence at least twice monthly or more frequently as having significant incontinence and based the main part of our analysis on this. Subjects suffering incontinence rarely, at most once a month, may simply be having occasional haemorrhoidal problems or diarrhoea.

The estimated prevalence of faecal incontinence among community-dwelling adults has varied from 0.4% to 18% [11]. In a recent meta-regression analysis including 29 studies, the overall average rate of solid and

liquid anal incontinence was 4.3% [12]. The rates were similar in men and women among younger participants, being on average 0.8% in men and 1.6% in women. However, in those aged over 60, rates were on average 5.1% in men and 6.2% in women. Our findings among men and women in the older age groups are in accord with these results, but in younger age groups our prevalence rates are much higher. This may be due to the low response rate in the younger age groups. Previous studies have also shown lower overall prevalence rates. Nelson *et al.* [2] found a 2.2% anal incontinence rate in a North-American population, whereas a group under Perry [5] showed monthly or more leakage in 3.3% and soiling in 2.7% of adult subjects [3]. In a Swedish study, leakage of faeces more than once a month in the case of loose stools was 10% and for solid faeces 1.4% and 0.4% for women and men respectively. [6].

Urinary incontinence was significantly associated with faecal incontinence. This has been shown in previous studies, about two-thirds of those suffering faecal incontinence also had urinary incontinence [3,13,14]. The association has been shown not only in women, but also in men [15]. Our finding that anal fistula surgery and haemorrhoidectomy were associated with faecal incontinence was interesting. It is known that there is a risk of faecal incontinence after anal fistula surgery [16], but to our knowledge this has not been demonstrated in population-based studies.

Only about a third of subjects reporting incontinence at least twice monthly had ever discussed the problem with their physician. In nearly half of these cases, it was their physician who had raised the question of incontinence and not the patient. These findings are in accord with those in earlier studies. Johanson and Lafferty [15] found that only one-third of individuals with faecal incontinence had ever discussed the problem with a physician. In a recent study comprising women, again only 10% had discussed the symptom with a physician in the preceding year [4]. Individuals may be so embarrassed by their symptoms that they are reluctant to mention them even to their physician. Unfortunately, this also means that they will not receive treatment even if available. This is well illustrated in our study, as only 10% having incontinence at least twice monthly had received treatment for it, while two-thirds felt that they needed it.

Table 4 Faecal incontinence and its impact on quality of life.

Similarly, Perry *et al.* [5] showed that of those with major faecal incontinence with a substantial impact on quality of life, nearly two-thirds (64.9%) wanted help for their symptoms. These results may imply that general awareness of this problem among Finnish primary care physicians and general population is low. The 'if you don't ask, they won't tell' attitude should be emphasized in the primary care setting.

Initial treatment for faecal incontinence should always be conservative, including dietary changes, the addition of supplementary fibre, bowel habit training and pelvic floor training [17]. Those patients not responding to conservative treatment should be sent to a specialized colorectal clinic for further diagnostic workup. Those found to have anal sphincter defect may benefit from sphincter repair. Sacral nerve stimulation has emerged as an effective therapy and may be used in the future not only for end-stage faecal incontinence but also as the first- or second-line surgical therapy [18].

Conclusions

This study has shown that faecal incontinence is a common problem occurring more often in women than men. It is strongly associated with urinary incontinence. Of those suffering from it more than twice a month, only about one-third had talked about it with their physician, while two-thirds felt they needed treatment for it. General awareness of faecal incontinence and treatment options should be improved among primary care physicians and the general population.

Acknowledgements

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Seven-year follow-up after anterior sphincter reconstruction for faecal incontinence

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Abstract

Purpose The aim was to evaluate the effects of anterior sphincter repair on faecal incontinence and quality of life.

Patients and methods Fifty-six patients who underwent anterior anal sphincteroplasty between January 2003 and December 2005 were asked to complete questionnaires containing the Wexner Incontinence Score (a score of 0 corresponds to full continence and 20 to total incontinence) and Faecal Incontinence Quality of Life Scale preoperatively, in May 2006 (mean follow-up time, 22.8 months) and in August 2011 (mean follow-up time, 89.3 months). Thirty-nine (69.6 %) patients completed the questionnaires before the operation and in 2006, and 36 (64.3 %) in 2011.

Results The overall severity of faecal incontinence improved in 26 patients (67 %), and quality of life improved in 2006 as a whole, but after a longer follow-up (in 2011), the severity of faecal incontinence was about the same as preoperatively (median, 12.0 months) in all the patients. Among younger patients (≤ 50 years), the situation was better, but older patients (> 50 years) had an even worse situation than before the operation. In the group of younger patients, the preoperative median of the overall incontinence score was 10.5, and in 2011, it was 9.0, while in the group of older patients, the corresponding numbers were 13.0 and 15.0. In 2011, quality of life was still better than preoperatively as a whole, but the results had deteriorated from those in 2006.

Conclusions Initially, both overall faecal incontinence and quality of life improved, but younger patients achieved a greater benefit. However, the results deteriorated with a longer

follow-up. Operative management should be considered preferably in relatively young subjects as their results are better.

Keywords Faecal incontinence · Anal incontinence · Sphincteroplasty · Quality of life

Introduction

Anal incontinence, defined by the inability to control the passage of air or stool, is often considered very embarrassing and intimate, and the patients may be reluctant to discuss their problem with the physician. This makes it difficult to estimate how common the condition is. Therefore, in various studies, the prevalence has been highly variable ranging from 2 to 17 % and depending on the type and frequency of incontinence [1]. In our previous population-based work, we found a 10.6 % prevalence of faecal incontinence at any stool frequency; only 27 % of those individuals who were suffering from faecal incontinence at least twice a month had discussed the problem with their physician [2].

The most common cause of anal incontinence is traumatic sphincter rupture, which is usually due to vaginal delivery but may also follow anal surgery. After the delivery, the symptoms may appear after many years. The damage can involve both sphincters or just one.

The management of anal incontinence aims at reducing the symptoms and improving the quality of life. The treatment results are related to the severity of incontinence and the type of the leakage [3]. On the other hand, it has been shown that the fear of incontinence may cause general psychological distress which can impact the quality of life more than incontinence itself [4].

Conservative treatment mainly consists of dietary fibre, drugs (loperamide), or biofeedback. Loperamide slows the gut transit time, increases the fluid reabsorption and reduces the intestinal secretion. Biofeedback is used to improve the

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muscular strength and coordination. Surgery is usually considered in severe incontinence when conservative treatment fails [5].

Sacral nerve stimulation has emerged as an option even in patients with sphincter defect [6, 7], and the role of sphincter repair has been questioned, especially in the long term. Therefore, our aim was to evaluate prospectively the results of sphincter repair and especially the effect of the operation on the quality of life in a long-term follow-up.

Patients and methods

Fifty-six patients with faecal incontinence underwent anterior anal sphincteroplasty in Tampere University Hospital in 2003–2005, after the conservative management had been unsuccessful. As a diagnostic workup, the patients had undergone clinical examination, endoanal ultrasound and anal manometry previously; pudendal nerve terminal motor latency test had been performed selectively to rule out neurogenic aetiology.

In the operation, the anoderm was mobilised from the external sphincter muscle and scars; both ends of the external sphincter muscle were then mobilised to allow a sufficient overlap by a technique originally described by Parks and McPartlin [8], which has become the operation of choice. If overlapping repair was not achieved, end-to-end repair was performed. The torn ends of the sphincter were attached to each other with figure-of-eight sutures.

All patients received antibiotic prophylaxis at the induction of the anaesthesia (ceftriaxone, 2 g, and metronidazole, 500 mg i.v.). Additional antibiotics were at the surgeons' discretion. Our standard postoperative management included immediate start of an oral fluid diet with return to the normal diet as soon as possible. All patients received stool softeners also.

Before the operation, all patients were asked to complete the Wexner Incontinence Score (0–20) [9] and Faecal Incontinence Quality of Life Scale [10] questionnaires. The Wexner Incontinence Score helps to evaluate the grade of incontinence. There are questions about the type and frequency of incontinence or disadvantage (solid stool, liquid stool, flatulence, the use of diapers or pads, restriction of life). A score of 0 corresponds to full continence and 20 to total incontinence. The Quality of Life Scale consists of 29 questions which form four different scales: lifestyle, coping/behaviour, depression and embarrassment. The same questionnaires were again sent to all patients in May 2006 and again in August 2011. Thirty nine (70 %) of the 56 patients completed the questionnaires before the operation and in 2006, and 37 (66 %) in 2011; two of the patients had died meanwhile; one had an unknown address. Three patients who had returned the questionnaires were excluded:

one with a severe Alzheimer's disease and one with a stroke were not able to answer the questions; one had got a stoma. Thus, the number of subjects analysed was 34 (61 %). Clinical pelvic floor examinations were carried out routinely to all patients 4–6 weeks postoperatively.

The study protocol was approved by the Ethics Committee of Tampere University Hospital.

Statistical methods

The changes in Wexner's faecal incontinence score were assessed by subtracting the postoperative values from the corresponding preoperative values. The difference was classified as improvement or deterioration separately on each scale if the change was at least one unit. Those with no change were classified into their own group. The mean differences on the quality of life scales in different FIS groups were analysed by ANOVA. The Wilcoxon signed rank test was used to compare the faecal incontinence quality of life scales before and after anterior sphincter repair. The results were analysed separately for subjects over 50 years of age and for those aged 50 years or less.

Results

Patients and follow-up

All patients were women; their mean age was 51.6 years (range, 30–79). In 36 (92 %) cases, the sphincter defect was caused by traumatic vaginal delivery and in 3

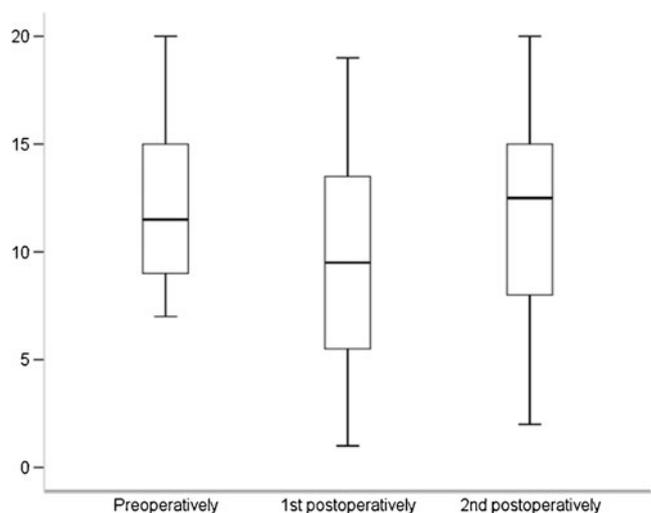


Fig. 1 The overall incontinence score preoperatively and after the operation in 2006 (first postoperatively) and in 2011 (second postoperatively) according to Wexner score in the whole population. Higher scores indicate worse incontinence

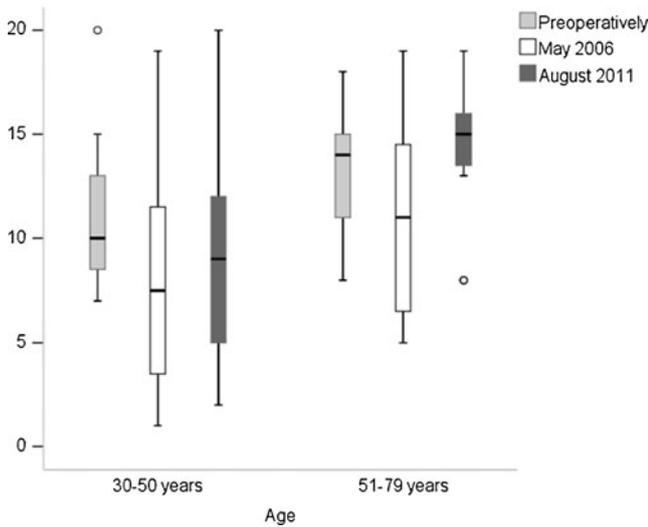
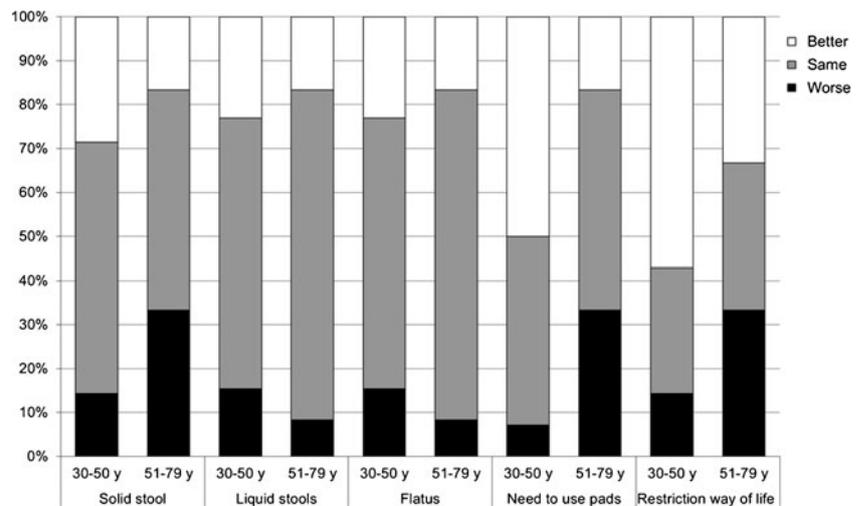


Fig. 2 The overall incontinence score preoperatively and after the operation in May 2006 and August 2011 according to Wexner score in different age groups

(8 %) cases, by fistula surgery. Preoperative anomanometry was performed for 38 patients; the mean preoperative resting pressure was 30.3 mmHg (median, 25.0; range, 2–83), and the mean squeezing pressure was 35.2 mmHg (median, 33.0; range, 10–83). At ultrasound, 31 (55 %) patients had a defect in the external sphincter and 25 (45 %) both in the external and internal sphincters. Thirty-six patients underwent overlapping sphincteroplasty and three, end-to-end sphincteroplasty; five patients had additional levatorplasty. Postoperative superficial wound rupture and/or wound infection treated with antibiotics was detected in ten (26 %) patients. The mean follow-up time was 22.8 months in 2006 (range, 4.1–37.9) and 89.3 months (range, 74.6–104.2) in 2011.

Fig. 3 Types of incontinence after follow-up in 2011 according to Wexner score in different age groups (how many patients reported the situation better, the same or worse in 2011)



Wexner score

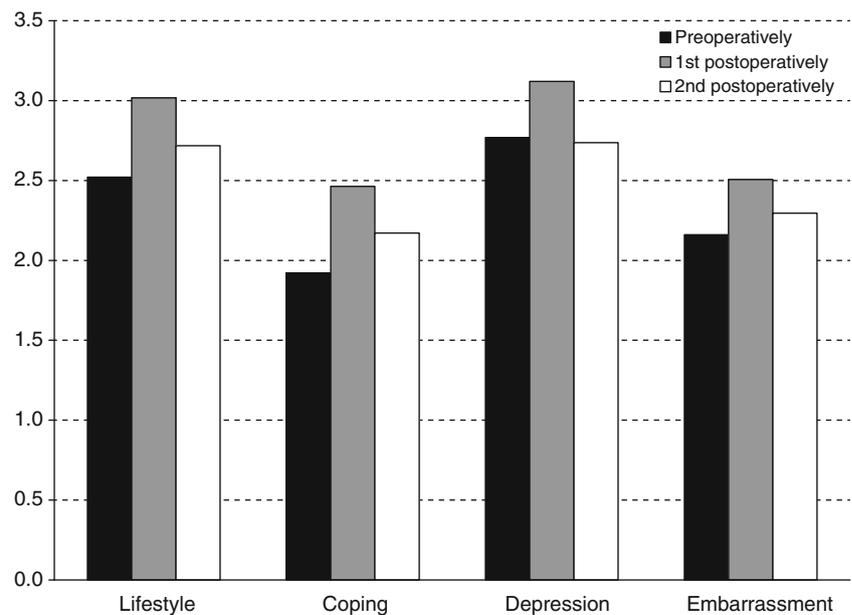
The median overall Wexner score was preoperatively 11.8 and postoperatively in short term, 9.5 ($p=0.003$), but after a longer follow-up, the overall median score had deteriorated to the preoperative level of 12.0 (Fig. 1). Altogether, younger patients (30–50 years, $N=19$) benefited more from the operation than older ones (51–79 years, $N=15$). In the group of younger patients, the preoperative median of the overall score was 10.5, and in 2011, it was 9.0, while in the group of older patients, the corresponding numbers were 13.0 and 15.0. The differences between different age groups in 2006 and 2011 were statistically significant ($p=0.003$) (Fig. 2).

The long-term results in 2011 according to the subscores are depicted in Fig. 3. Less than 30 % of the patients in both age groups felt that their symptoms in regard to solid, liquid and flatus incontinence had improved. However, in the younger age group, about 50 % felt that their need for pads and the restriction on the way of life were still smaller than before the operation.

Quality of life

Quality of life measured by the Faecal Incontinence Quality of Life Scale improved in all subscores in 2006, the change being statistically significant on subscores 1 (lifestyle, $p=0.003$), 2 (coping, $p=0.001$) and 3 (depression, $p=0.009$). In 2011, the scores worsened compared to those in the 2006 questionnaire, but all except depression remained at a higher level preoperatively, but the differences were not statistically significant anymore (Fig. 4). In general, the quality of life scores were better among the younger than the elderly subjects (Fig. 5), but the differences between the preoperative and long-term scores were not statistically significant.

Fig. 4 Faecal Incontinence Quality of Life Scales preoperatively and after the operation in 2006 and 2011 in all patients



Discussion

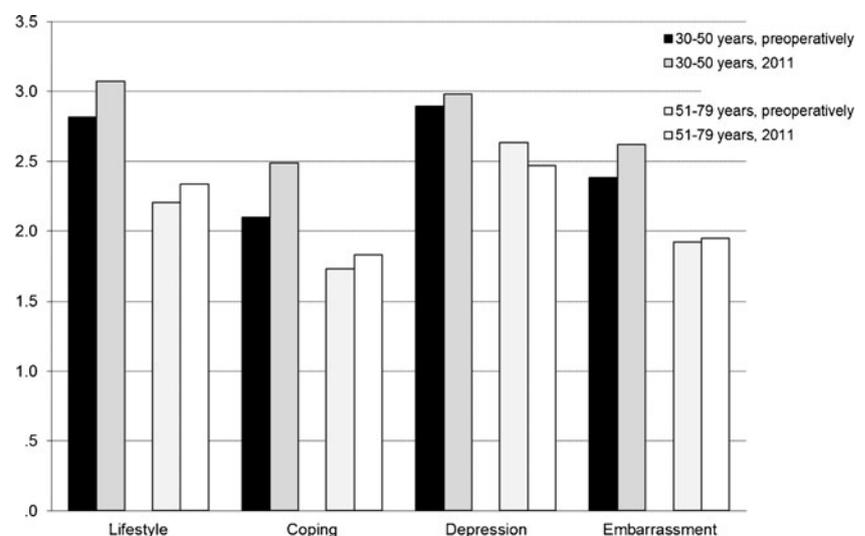
In the present study, an improvement in incontinence was observed in short term, but this beneficial effect was lost within a longer follow-up time. This was especially evident in the older patients, whereas in the younger patients, some improvement in incontinence remained. From the patient's point of view, the quality of life is a more important qualifier than the clinical and physical outcome when evaluating the results of surgery. As in incontinence, the beneficial effect in the short-term quality of life was lost, but some improvement was observed even in the long term (Fig. 4), although not statistically significantly. Here, the younger patients had better scores than the older ones. It has earlier been shown that

younger women usually have a better outcome after the surgery than older ones. This may be due to a general weakening of the pelvic floor with age [11].

In accordance with our data, the short-term outcome of anterior anal sphincteroplasty is reported to be good, but after 5 to 10 years, only 25–40 % of patients are continent for stool after delayed anterior anal sphincteroplasty, and this has a negative effect on the quality of life [12, 13].

Barisic et al. [14] evaluated the severity of incontinence after operating anterior anal sphincteroplasty for injuries that had various reasons. Again, similarly to our study, they observed that sphincter repair yields satisfactory results initially in more than two thirds of the cases but only in half of the cases after a longer follow-up. By

Fig. 5 Faecal Incontinence Quality of Life Scales preoperatively and after the operation in 2011 in different age groups



contrast, Maslekar and colleagues [15] showed that 80 % of the patients had a successful outcome at a 7-year follow-up. They attributed such a good outcome to their operating technique: they dissected both sphincters separately and then did an overlap repair for the external sphincter. Furthermore, Vaizey et al. [16] showed improved continence for the majority of patients after a repeat standard overlapping anterior sphincter repair after a follow-up of over 5 years. Pinta and colleagues [17] evaluated the clinical outcome of delayed anal sphincter repair caused by obstetric tears with questionnaires. They showed that after the follow-up time of median 22 months, the outcome was good in 31 % of the patients, acceptable in 38 % of the patients, and poor in 31 % of the patients. A defect found by postoperative endoanal ultrasound correlated with a poor clinical outcome.

Sacral nerve stimulation (SNS) has also been a treatment option for patients with severe faecal incontinence since 1995. It is a minimally invasive technique, but the mechanisms of its action are unclear. Originally, SNS was performed for patients with a morphologically intact anal sphincter, either for patients with an initially intact sphincter or for patients who had had a repair after a defect in the sphincter. Later, it has been shown that an intact anal sphincter is not a prerequisite for a successful treatment by SNS [18]. Accordingly, recent reports show that SNS could also be a first-line treatment option when conservative treatment has failed, even in patients with sphincter defects or previous sphincter repairs [19, 20]. Currently, we have SNS in our use, and it is considered a treatment option every time we consider a sphincter repair.

There are some limitations of the study. We did not perform routine endoanal ultrasounds to all patients at follow-up. Therefore, some late ruptures of the sphincter repair affecting the results may have gone undetected. At least eight (20 %) of the patients received postoperative biofeedback therapy. Because many patients were referred to us only for the preoperative evaluation and operation, we do not know if they had received biofeedback elsewhere after the first post-op checkup. Only about two thirds of the patients participated in the long-term follow-up, possibly causing a selection bias. However, one would expect that especially those patients who suffer more from incontinence were more likely to send back the questionnaires than the patients who have a better situation with their continence. Therefore, our results may be worse than they would be with a complete follow-up.

Our series suggest that operative management should be considered preferably in relatively young subjects as their results are better. It is possible that older patients' general weakening of the pelvic floor and muscle strength accounts for the difference found in the results.

However, age itself is not the only criterion, and we have to evaluate every patient individually. The median overall Wexner score was preoperatively 11.8, as in many studies, it has been over 15. This suggests that in some cases with rather low scores, we should have continued with conservative management. However, the problem is that the Wexner score does not directly reflect what kind of impact faecal incontinence has on the quality of life. Patients with the same Wexner scores, but a different occupation and way of life, may have big differences. Therefore, the score itself cannot be considered the only criterion for operation, and patients' subjective feeling must be taken into account too.

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ORIGINAL ARTICLE

Anal incontinence: long-term alterations in the incidence and healthcare usage

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Abstract

Objective. The aim of the study was to determine the alterations in the occurrence of incontinence and how subjects suffering from incontinence seek and receive healthcare services over a 10-year follow-up period. **Methods.** Postal questionnaires (Wexner Incontinence Score, Fecal Incontinence Quality of Life Scale, a questionnaire to investigate the management of fecal incontinence and the frequency of urinary incontinence) were sent to subjects who had reported anal incontinence in our population-based study in 2003. For each incontinent person ($n = 155$) from the 2003 series, we identified two control subjects ($n = 310$) who did not suffer from incontinence. **Results.** Of the initially incontinent, 47 (58%) had remained incontinent after a follow up of 10 years. Almost 80% of the incontinent subjects in 2012 were female. Of the 152 initially continent, 12 (7.9%) had developed symptoms, all of whom were females. Urinary incontinence was present in approximately 60% of incontinent subjects. The majority (57.8%) of the subjects still incontinent in 2012 felt that they needed help for the complaint, but only 30.9% had received any, and only 7.4% received any benefit. The most common treatment was medication. The subjective incontinence impaired the quality of life. **Conclusion.** Incontinence is a chronic long-lasting disorder. The current management of anal incontinence is not satisfactory. The primary healthcare system should be more aware of the nature of this condition to find and offer treatment for the patients.

Key Words: anal incontinence, healthcare usage, incidence

Introduction

Anal incontinence is an embarrassing disorder with remarkable social consequences. Its prevalence varies depending on the symptom definition and frequency. Only a few studies report how patients suffering from anal incontinence use healthcare resources. In our own population-based study, the prevalence of anal incontinence occurring at least twice a month in adults aged ≥ 30 years was 5.2%. Flatal incontinence as the only complaint was found in 19.5% of them. As 23.8% also suffered from urinary incontinence, there was a strong

correlation between anal and urinary incontinence. Only 27% of the individuals suffering from anal incontinence at least twice a month had discussed their problem with the physician, although 66% felt they needed treatment and only 10% had received any [1].

The aim of this population-based follow-up study was to determine the outcome and incidence of incontinence, and how individuals suffering from anal incontinence used or would need healthcare resources in the long term. As control subjects we had individuals who initially reported not suffering from incontinence.

Table I. Incontinence and continence in 2003 and 2012.

Group 2003	Group 2012	Female (%)	Age, median (range)	Urinary incontinence <i>n</i> (%)
Incontinent <i>n</i> = 81	Incontinent (II) <i>n</i> = 47 (58%)	78.7	72 (41–88)	30 (63.8)
	Continent (IC) <i>n</i> = 34(42%)	52.9	66 (40–90)	10 (29.4)
Continent <i>n</i> = 152	Continent (CC) <i>n</i> = 140 (92%)	68.6	70 (40–88)	26 (18.6)
	Incontinent (CI) <i>n</i> = 12 (8%)	100	70 (54–85)	7 (58.3)

Methods

To estimate the prevalence and factors associated with anal incontinence in a Finnish population, we had investigated a random sample of 8000 people living in the city area of Tampere, Finland, obtained from the national registry in 2003 [1]. There were no obvious differences in their access to healthcare in this area. In January 2013, we sent the Wexner Incontinence Score (0–20) [2] and Fecal Incontinence Quality of Life Scale (FIQLS) [3] questionnaires to those who had complained of anal incontinence. Wexner Incontinence Score includes questions about the type and frequency of incontinence or disadvantage (solid stool, liquid stool, flatulence, use of diapers or pads, restriction of life). A score of 0 corresponds to full continence and score of 20 corresponds to total incontinence. The quality of life (QOL) scale consists of 29 questions which form four different scales: lifestyle, coping/behavior, depression, and embarrassment. In addition, we sent a questionnaire to investigate the management of anal incontinence and the frequency of urinary incontinence. We further asked about the use of healthcare resources because of anal incontinence, whether the subjects had received any management for incontinence (medicine, biofeedback, operation) and whether it had had any effect. For comparison, we identified two control subjects for each incontinent person from the same 2003 series. The control subjects had not reported suffering from incontinence. They were of the same gender as the incontinent cases, and <2 years older or younger. Another inquiry was sent to individuals who did not respond to the first one.

Of the 162 subjects who had reported anal incontinence in 2003, we were able to identify 155, and we

selected 310 continent controls for them. Twenty-four subjects with incontinence and of control subjects had died. The final number of incontinent persons was 138 and that of controls was 276. Of the incontinent people, 81 (59%) returned the questionnaires, and of the continent ones, 152 (55%) returned the questionnaires.

The subjects were separated in four different groups: incontinent 2003–incontinent 2012 (II), incontinent–continent (IC), continent–incontinent (CI), and continent–continent (CC).

Statistics

Descriptive results are presented as percentages or medians followed with the minimum and maximum values or quartiles. The Wexner Score, and the QOL in all different QOL scales between the subgroups were compared using the Kruskal–Wallis test. SPSS for Windows (IBM SPSS Statistics for Windows, Version 19.0; Armonk, NY: IBM Corp., USA) was used for the data analysis.

The study protocol was approved by the Ethics Committee of Tampere University Hospital.

The number of individuals in the four subgroups and the demographic data are shown in Table I. Of the 81 incontinent patients, 47 (58%) patients had remained incontinent after a follow up of 10 years. There was a female preponderance in the II group in 2013, and all the new 12 incontinent subjects (CI group) were females. Urinary incontinence was present in approximately 60% of incontinent subjects, but also in 19–30% of those who did not suffer from anal incontinence.

In the II and CI groups, approximately 20% of the patients had discussed their problem with a physician.

Table II. Management of individuals who suffered from fecal incontinence in 2003 or 2012.

Group	Discussed with a physician <i>n</i> (%)	Need of help <i>n</i> (%)	Received any management <i>n</i> (%)	Received some benefit <i>n</i> (%)	Drugs (loperamide or fiber) <i>n</i> (%)	Biofeedback <i>n</i> (%)
II	10 (21.3)	26 (57.8)	21 (30.9)	5 (7.4)	13 (27.7%)	3 (6.4)
IC	3 (8.8)	2 (6.3)	11 (16.2)	5 (7.4)	3 (8.8%)	1 (2.9)
CI	2 (18.2)	8 (72.7)	6 (8.8)	4 (5.9)	1 (8.3)	1 (8.3)

Table III. Data of Wexner incontinence score and FIQLS in different groups. A high Wexner score indicates symptoms of incontinence, and a low QOL score indicates poor QOL.

Group	Overall Wexner score, median	QOL1 (Lifestyle) Q ₁ ,Q ₂	QOL2 (Coping) Q ₁ ,Q ₂	QOL3 (Depression) Q ₁ ,Q ₂	QOL4 (Embarrassment) Q ₁ ,Q ₂
II	8.5	2.2, 3.7	1.7, 2.8	2.0, 3.5	1.7, 3.0
IC	2.5	2.9, 4.0	2.5, 4.0	2.3, 3.8	2.0, 4.0
CC	1.0	3.9, 4.0	3.4, 4.0	3.5, 4.5	4.0, 4.0
CI	7.0	2.0, 3.7	2.0, 3.2	2.3, 3.8	2.0, 4.0

Differences between groups CC/II and IC/II are statistically significant in all the scales and differences between groups CC/CI are statistically significant in all the scales except QOL4 (Embarrassment).

Over 50% of the incontinent subjects in 2013 felt that they needed help for the complaint, although a much fewer number had received any, and the management was beneficial for only 6–7% (Table II). The most common treatment was medication, and biofeedback was employed only occasionally.

The subjective feeling of incontinence was verified by the Wexner Scores, which were significantly higher in the incontinent groups (II and CI) than in the continent groups (IC and CC). The subjective incontinence impaired the QOL, which was evident in all different QOL scales (Table III).

Discussion

In our original series, 5.2% of the population suffered from anal incontinence at least twice a month [1]. According to the current study, 58% of the incontinent subjects were still suffering from similar problems after a follow up of 10 years (Table I). On the other hand, 42% had recovered spontaneously. It may be that some people with mild anal incontinence had become accustomed to live with the trouble over these years and therefore did not report it anymore. Nevertheless, the disorder was often chronic and bothersome, and the Wexner Scores were clearly higher than in the continent individuals. The annual incidence of new cases in the control group was low, <1%. All the new incontinent subjects in this study were women. Earlier the prevalence of anal incontinence was reported to increase by age, regardless of gender [1]. The median age in the present study was 66–72 years in different study groups, but the lower age limit was relatively low, 30 years in the initial study [1]. This may have an impact on the results. On the other hand, we believe that the age distribution was fairly suitable for this kind of study.

Subjects with stable continence (CC) had somewhat better Wexner scores and QOL than those experiencing recovery in continence (IC) (Table III). This might indicate that some problems still remain. On the other hand, the differences between the groups were small and not statistically significant.

Conservative methods are the initial management of anal incontinence. Less than one-third of the incontinent subjects had received any treatment. However, that is more than the number of those who had reported having discussed the problem with a physician. Probably some of the subjects have reported self-management with over-the-counter drugs as drugs were used most often. It is known that biofeedback treatment may have a positive effect at least in 50% of the cases, sometimes even up to 90% of the cases [4]. Therefore, it is of interest that it was so seldom offered to patients at the primary care level, even though it is mentioned in Finnish treatment guidelines as one of the primary treatment options. However, as this study is based on our population-based study, the results do not reflect how different treatment options are used at the specialized care level.

To the best of our knowledge, there are no studies which would try to elucidate the use of specialized care treatments on a population level for anal incontinence. However, sphincter reconstruction and sacral nerve stimulation are possible alternatives. In general, the long-term results have been disappointing, especially in elderly people [5]. In our recent study, we observed that both the overall severity of anal incontinence and QOL improved first but, after a longer follow up, the severity of fecal incontinence was by and large the same as preoperatively in the whole population. Among younger patients (≤50 years of age) the condition was better, but among older patients (>50 years) the condition was even worse than before the operation [6].

The disorder impairs the QOL but is often overlooked. Only a minority had received some benefit, probably due to the fact that the disorder is self-managed and the patients very rarely discuss it with their physician. Women may think that incontinence is a natural consequence of a natural event such as vaginal delivery and it will pass away. They may be more likely to talk about the disorder mostly to other women [7]. Many may also think that incontinence is much more uncommon than it is and are not aware of

different treatment options. The more severe the symptoms are and the longer the history of incontinence is, the more readily the patients seek help [8–10]. There is a need for better detection and treatment of anal incontinence in primary healthcare. The treatment of anal incontinence clearly has a beneficial effect on the individuals' QOL by decreasing social isolation; in addition, it has an economic impact [11,12].

Urinary incontinence quite often accompanies anal incontinence. Boreham et al. found a prevalence of 28.4% of any kind of anal incontinence; 9.9% had both anal and urinary incontinence [13]. According to Roberts et al., the prevalence of combined urinary and anal incontinence in women was 9.4% [14]. Here, >50% of the incontinent people had also urinary incontinence. It is important to recognize both conditions when considering treatment options. Pelvic floor training and biofeedback have been shown to be effective treatments for both anal and urinary incontinence [15,16].

The response rate was >50%, which we find good after 9 years. The respondents may be selected while those with the symptoms are more likely to answer to the postal inquiry.

In conclusion, anal incontinence is most often a chronic and disabling condition. Its current detection and management are not satisfactory. The primary healthcare system should be more aware of the nature of this condition to find the patients suffering from it. Controlled studies are needed to evaluate different treatment regimens.

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Antegrade transverse or sigmoid colonic enema through a percutaneous endoscopic gastrostomy tube is an option in the treatment of colorectal dysfunction

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Abstract

Background Antegrade colonic enemas are used in patients with colorectal dysfunction resistant to conservative therapy. A number of different operative techniques are applied, but their effectiveness is by and large unknown. We therefore evaluated the long-term usefulness of the left-sided percutaneous endoscopic gastrostomy (PEG) tube method in adult patients.

Methods Twenty-one patients with colorectal dysfunction underwent insertion of a PEG tube colostomy by laparotomy between 1997 and 2006. In 2014, we evaluated how many of the patients had the tube still in place, how the patients coped with the tube, and what the reasons for the removal were.

Results The main indications were severe constipation or fecal incontinence mainly related to neurological diseases. In 2014, 5 out of 21 patients had the tube still in use (median follow-up 14 years, range 11–17 years) and 4 out of 5 deceased patients had had the tube in use until their death, unrelated to this treatment (median follow-up 7 years, range 0–8 years). Four out of the 5 living patients considered the benefit of the tube to be good or excellent. Tubes were removed in 11 (52 %) patients for various reasons, local skin irritation being the most common.

Conclusions A left-sided PEG tube colostomy was removed in over half of the patients, but despite that, it still seems to be a viable long-term option in the treatment of

individual patients with colorectal dysfunction, when conservative methods are ineffective.

Keywords Constipation · Fecal incontinence · Colorectal dysfunction · Antegrade colonic enema

Introduction

Chronic constipation and fecal incontinence are common problems especially in patients with neurogenic diseases. When conventional therapies are insufficient, one alternative may be the antegrade colonic enema procedure [1]. A variety of different antegrade or retrograde colonic enema methods have been used. A transverse or sigmoid tube colostomy technique has lately been described in children [2]. The data in adults are sparse, which prompted us to evaluate the long-term effects of this procedure in our cohort of adult patients.

Materials and methods

The study comprised all patients from 1997 to 2006 who underwent the application of a tube colostomy due to colorectal dysfunction after having failed conservative bowel management. Percutaneous endoscopic gastrostomy (PEG) size 14 Ch tubes were used (Flocare, Nutricia, Netherlands). A stoma therapist marked the best site for the tube on the skin preoperatively. Through a laparotomy, a purse-string suture was applied either to the left transverse or sigmoid colon, or to the cecum. The tube was tunneled through the abdominal wall, and the tip with the balloon was advanced through a small hole in the middle of the purse-string suture to the colon. The balloon was inflated

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with aqua, and the purse-string suture was tightened. The site was then fixed to the anterior abdominal wall with absorbable sutures in order to create a watertight tunnel. Therapeutic enemas were started under the guidance of a stoma therapist 3 weeks after the application. The patients were shown how to check the position and fluid volume of the tube retention balloon once a month. It was recommended that the tube was changed every third month. If the patient preferred a less prominent tube, after the first 3 months the traditional PEG tube was changed to a Mic-Key GTM (Ballard Medical Products, Draper, UT, USA), which is a low profile skin level “button” PEG tube. The indications for the application of the tube were evaluated. The reasons for removal were assessed based on data from the hospital files. The benefit of the tube was assessed by phone contact in those cases where the tube was still in place. A follow-up was carried out by means of phone interviews, and the hospital records were scrutinized.

Results

The study comprised 21 patients, 18 women and 3 men (median age 53 years, range 29–79 years). The demographic data and indications for the procedure are shown in Table 1. The main reasons for the operation were neurological followed by outlet obstruction and fecal incontinence. In 11 patients, the tube was placed into the sigmoid colon, in nine patients into the left transverse colon, and in one patient into the cecum. In two patients, the tube had to be relocated afterward. One tube was inserted using a laparoscopic technique and all the others with an open technique.

Fourteen (67 %) patients had some complications after the procedure. One had fascial dehiscence. One developed a stricture of the tunnel within 4 months; this was revised and a new tube inserted. One patient had an inflammation around the tube, but no signs of leakage. Five patients had fecal leakage around the tube. Six had distressing pain in the stomach.

In 2014, after a median follow-up of 14 years, 5 (24 %) out of 21 had the tube in use. A further four out of five patients had had the tube in use until their death, which was unrelated to this treatment, while in one deceased patient, data on tube were missing.

Of the five patients alive with the tube in place, two patients used it once a day, two patients 3–4 times a week, and one patient 3–4 times per day. The latter is scheduled to have an end sigmoidostomy in the near future. Four of the five patients felt that the benefit was excellent or good, and one patient felt there was no benefit from using the tube. The outcomes of the study patients are shown in Fig. 1.

The tube has been removed from altogether 11 patients making the overall removal rate of 52 %. In six patients, this occurred within the first year and in five patients later (6, 8, 8, 8, 10 years). The tube has been in use for altogether 140 patient-years (median 7 years). The reasons for removal were diverse. Four patients had excessive fecal leakage around the tube, resulting in a subcutaneous infection and skin irritation. Two with slow-transit constipation did not feel they benefitted from transverse colon enemas. In the case of one patient, the tube had slipped out from the colon and the channel was closed before the enemas were scheduled to start in 3-week time. One patient with sigmoid carcinoma and one with difficult pelvic dysfunction did not have enough benefit from the PEG tube and ended up with a permanent colostomy despite additional sacral nerve stimulation. One patient with incontinence due to anal atresia had pain in the area of the tube and had to defecate frequently in spite of the enemas. One patient just felt that the tube was too difficult to use, and in the case of one patient, the reason remained unknown. All tunnels closed spontaneously after the removal of the PEG tube.

Discussion

This follow-up study shows that the PEG tube enema technique can be used for the treatment of colorectal dysfunction if conservative therapy is unsuccessful. Even though the enema tube was eventually removed from over half of the patients, 8 out of 21 (38 %) had it still in use or had kept it until their death.

Different intestinal structures (appendix, colon, stomach) are used to create an enema conduit. The conduit may prevent backward leakage, but is susceptible to other complications such as pain. The Malone antegrade continence enema (MACE) uses the appendix [3] or the terminal ileum in case the appendix is no longer available [4]; the whole colon is thus washed out. There are reports indicating that the MACE is associated with a high failure rate when used in adults [5]. Techniques where the enema is performed through the left colon have been described. The left Monti–Malone procedure was reported in 2002: A part of the descending colon is isolated with its blood supply, and a special Monti tube is implanted into the left colon [6]. Kim et al. [7] reported their series of 19 patients using the left colonic antegrade continence enema (LACE) technique. With this technique, either the retubularized ileum or sigmoid colon is anastomosed into the left colon to facilitate the administration of enemas. The authors recommended the LACE as the procedure of choice for children with any condition predisposing to fecal incontinence or constipation intractable to conventional treatment.

Table 1 Demographic data, indication, and follow-up results of antegrade colonic enema

Patient	Sex	Age (years)	Cause	Bowel problem	Tube site	Follow-up status in 2014	FU time (years/ years in use)	Benefit in 2014 (poor/moderate/good/excellent)	End procedure
1	F	62	Hypothyroidism arthritis rheumatoides	Constipation + incontinence	Cecum	In use	17	Good	
2	M	29	Meningomyelocele, paraparesis	Constipation + incontinence	Sigmoid	In use	15	Excellent	
3	F	53	Pelvic dysfunction Charcot-Marie-Tooth disease	Outlet obstruction	Transverse	In use	14	Poor	
4	F	67	Rectal invagination + rectopexy	Outlet obstruction	Sigmoid	In use	12	Excellent	
5	M	35	Anal atresia	Incontinence	Sigmoid	In use	11	Good	
6	M	32	Paraparesis	Incontinence	Transverse	Removed	10		Anal wash-out
7	F	46	Cauda equina	Outlet obstruction + incontinence	Sigmoid	Removed	0.1		Sigmoidostomy
8	F	33	Multiple sclerosis	Incontinence	Sigmoid	Died in 2006	6		Tube still in place
9	F	76	Rectal prolapse/rectopexy	Constipation + incontinence	Transversecolon	Removed	8		Diaper
10	F	53	Pelvic dysfunction	Outlet obstruction	Sigmoid	Removed	8		Colostomy
11	F	51	DM, hypothyroidism	Slow-transit constipation	Transversecolon	Removed	0		Colectomy and ileo-rectal anastomosis
12	F	57	Cauda equina	Constipation + incontinence	Sigmoid	Removed	6		Diaper
13	F	74	Meningomyelocele, paraparesis	Outlet obstruction, incontinence	Transverse colon	Removed (tube slipped out in a few days)	0		Died
14	F	49	Spinal trauma, paraparesis	Incontinence	Transverse colon	Removed	0.2		
15	F	36	Traumatic delivery, sphincter rupture	Outlet obstruction, incontinence	Sigmoid	Removed	8		Colostomy
16	F	78	Multiple sclerosis	Incontinence	Sigmoid	Died in 2013	7		Died with the tube
17	M	79	Multiple sclerosis	Constipation	Sigmoid	Died in 2012	7		Died with the tube
18	F	58		Outlet obstruction	Transverse colon	Died in 2006	1		Died with the tube
19	F	51	Neuropathy, hypothyroidism	Constipation	Transverse colon	Removed	1		Colectomy and ileo-rectal anastomosis
20	F	42	Anal atresia	Incontinence	Sigmoid	Removed	1		Graciloplasty in 2005, sigmoidostomy in 2010
21	F	65	Parkinson's disease	Constipation	Transverse colon	Died in 2012	8		No data

FU Follow-up, DM Diabetes mellitus

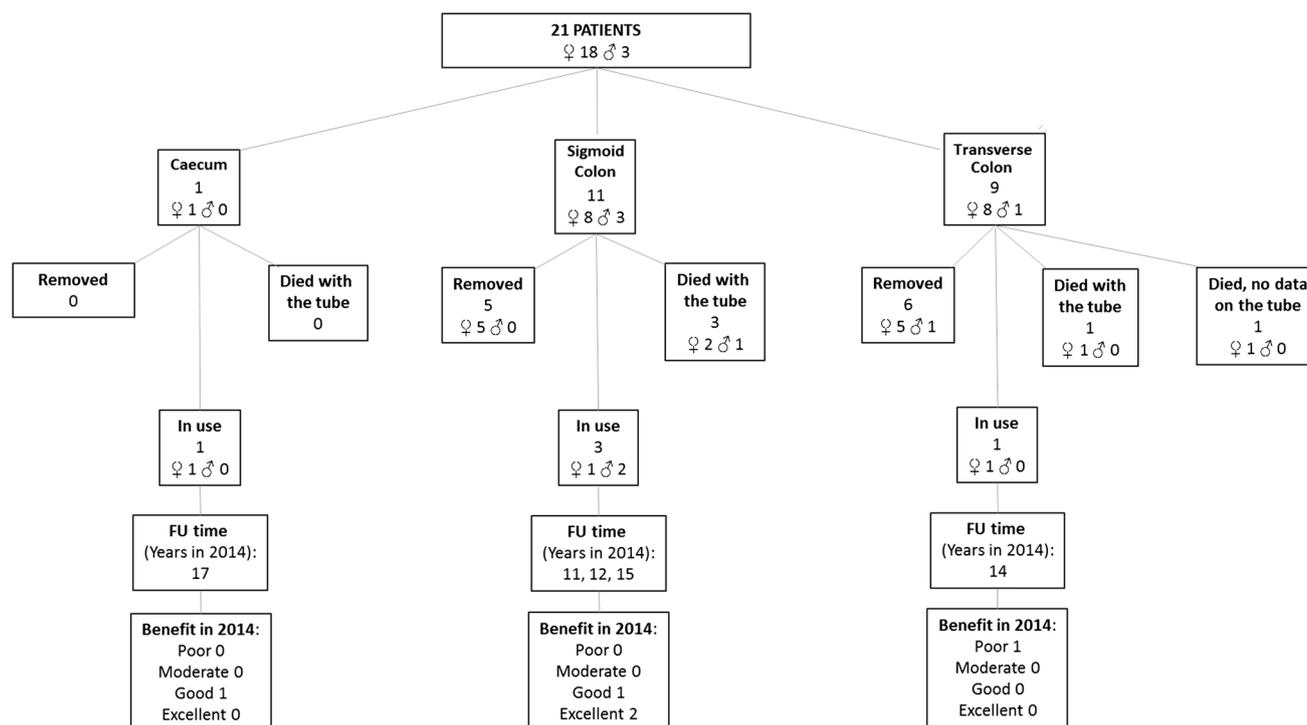


Fig. 1 Outcome of the patients with the tube inserted

Apart from the cecum, sites in the colon have rarely been used for tube enemas in children and adults. The distal enema location provides a shorter enema wash-out time. The more distally the tube is inserted, the less the water is absorbed when performing the enema. This was the reason to use the distal technique in the present report. Instead of percutaneous application, we decided to use laparotomy in order to make sure to approximate the colon and anterior abdominal wall as tightly as possible.

Our complication rate (67 %) was rather high, but there were no major life-threatening complications. It seemed that if the patient was able to use the tube for more than 1 year (seven patients had it removed within the first year), it remained for a long time, a minimum of 6 years. In four out of 11 patients (36 %), the reason for tube removal was local skin irritation or a superficial infection, indicating that careful stoma care and good compliance are of the utmost importance. This is in accordance with a recent study reporting leakage and superficial wound infection in 9 (47 %) out of 19 patients after the application of percutaneous endoscopic caecostomy due to severe constipation [8]. Over one-third (36 %) of those who failed tube colostomy treatment ended up with a permanent colostomy.

The reversal of the procedure is usually easy; after the removal of the PEG tube, the tunnel will close spontaneously. This means that the application of the tube can be considered even when the risk of removal is high, as shown in the present study.

Conclusions

An antegrade colonic enema using a left-sided PEG tube colostomy still seems to be a viable option in the treatment of patients with colorectal dysfunction, even though the removal rate is high. Some patients are satisfied with the tube, and if not, it is easy to remove. Further studies are needed to confirm our results.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval The anal incontinence project was approved by the local ethical committee.

Informed consent Informed consent was obtained from all individual participants included in the study.

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