Review Article

Trends and Current Issues in Adult Fecal Incontinence (FI): Towards Enhancing the Quality of Life for FI Patients

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Abstract

Our goals are to review the literature on the definition and epidemiology of fecal incontinence (FI), the risk factors involved, available treatment options, and measurement of the quality of life (QOL) of patients with this condition. Articles included for review were searched following the guidelines set by Cochrane Reviewers' Handbook. FI was defined variously depending upon the duration, type, and amount of leakage. About 17 published papers were reviewed on the prevalence of FI that ranged from 1.4% to 50%. Potential risk factors included perianal injury/surgery, and fair/poor general health. QOL assessment using various grading scales provided an objective method of evaluating patients before and after treatment. Management included medical, physiotherapy, and surgical options. Through the range of various references, a clear definition of FI should be specified, which reflects its epidemiology in the various studies. These differences in definition would significantly affect its prevalence. Many risk factors have been sited but further epidemiological studies are necessary to elucidate FI. Understanding the etiology of the disease is an important initial step to provide adequate treatment of FI. QOL assessment provides objective and subjective method in the analysis of effectiveness of therapy.

Key words: fecal incontinence, anal incontinence, epidemiology, risk factors, quality of life

Introduction

Fecal incontinence (FI) is the impaired ability to control gas and/or stool. Although it is not a potential life-threatening disease, symptoms of incontinence are often distressing and socially incapacitating (1).

The true prevalence of anal incontinence remains largely unknown. Studies have shown that individuals may not be forthcoming with symptoms of incontinence when questioned directly (1). Therefore, FI is often an under-estimated condition.

According to published reports, daily or weekly episodes of incontinence occur in approximately 2% of the adult population and in about 7% of healthy, independent adults over the age of 65 (2–4). When soiling is included in survey questionnaires, at least 5% of healthy subjects have experienced anal incontinence (5).

FI is the second most common cause of institutionalization in the elderly (6, 7). Among patients who are institutionalized, the prevalence may be as high as 25%. According to some reports, approximately one third of elderly people in retirement homes and hospitals are incontinent to stool (8, 9). FI is also a high cost condition: it causes expenses for over $400 million per year for FI appliances, just in the US. Although FI is a major problem in the elderly, much younger groups are also affected. In 45-year-old women, the incidence is eight times higher than in men of the same age (10).

The aim of the present paper is to review the literature on the definition and epidemiology of FI and to define the risk factors. Available FI scores and therapeutic options are also reviewed.

Methods

The review method followed the guidelines set in the Cochrane Reviewers' Handbook 4.1.6 (11).

Review process

The authors worked together to draft the protocol for the

systematic review and determined the studies to be included. The authors checked the reference list of all relevant articles that were obtained (including those from previously published systematic reviews, conference proceedings, etc.).

Search strategy

Reference list of retrieved studies were searched, electronically and manually, including journals subscribed by Hokkaido University. The search terms used were: faecal or fecal and incontinence*, where * is a truncation symbol that retrieves variations of the indicated text.

The process of following up references from one article to another sometimes referred to as pearling, the ancestry approach, or citation chasing was also done. Additional potentially relevant, articles that were identified were retrieved and assessed for possible inclusion in the review.

Inclusion criteria

Original published articles on FI were searched on November 2002 to February 2003. Articles included for review were those from 1984 to 2002.

Inclusion criteria were: English written papers, specific type of studies (e.g., randomized control trials, controlled trials, or case series). All articles were required to provide information on at least one aspect of FI (see Table 1).

Data extraction and analysis

All relevant studies were assessed for level of evidence (Table 2), tabulated, and methodologically evaluated for appropriateness of study exclusion criteria, quality of reporting and possible confounding variables. All data and results of statistical tests were extracted from the papers. For particular outcomes, papers were included in the analysis if they reported specifically on the item of interest; no assumptions were made if data were missing. For example, articles that did not report a complication rate were not assumed to have reported a zero

Table 1   Inclusion criteria

- Fecal Incontinence
- Complications
- Psychosocial Aspects
- Mortality Rates
- Cost-effectiveness
- Failure of Operation

Table 2   Quality of published evidence[96]*

I	Evidence from at least 1 properly randomized controlled trial (RCT).
II-1	Evidence from well designed controlled trials without randomization.
II-2	Evidence from well-designed cohort or case-control analytic studies, preferably from more than 1 center or research group.
II-3	Evidence from comparisons between times or places with or without the intervention. Dramatic results in uncontrolled experiments could also be included here.
III	Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

* Grades of Recommendations & Published Evidence-Canadian Task Force on Preventive Health Care.

rate; these articles were treated as if the data were missing and so were excluded from all morbidity analyses.

Results

Definition of fecal incontinence (FI)

FI is the loss of normal control of the bowels. This leads to stool leaking from the rectum (the last part of the large intestine) at unexpected times. Anal incontinence can be defined as the loss of anal sphincter control or the inability to defer the call to stool to a socially acceptable time and place, resulting in unwanted release of gas, liquid or solid stool. There are several definitions for anal incontinence, depending upon duration, type, and amount of leakage. Passive incontinence relates to leakage occurring without patient awareness, usually in association with internal sphincter dysfunction and reduced maximum resting anal pressure. Patients with urge incontinence are unable to defer defecation until a socially acceptable time, which usually reflects both external sphincter dysfunction and reduced maximum voluntary contraction (12). However, we objectively define anal incontinence as any involuntary loss of sphincter control (14). An important factor in determining the prevalence of fecal incontinence is the definition of incontinence chosen (15).

Epidemiology of FI

Several reports on the epidemiology of FI gave different prevalence results. As shown in Table 3, of the population-based studies that have been reported, the prevalence rates varies from 0.5 to 50% (1, 16–20). Other authors report incidence rate that varies from 0.1 to 5% (16, 21, 22). Johansen and Lafferty demonstrated a prevalence rate of 13.7% among individuals seen by primary care physicians, highlighting the underestimated numbers of this "silent affliction" (23). In Swedish community, soiling of underclothes more than once a month occurred in 21% of men and 14.5% of women (24). FI has also been reported to affect 1% of persons >65 years of age in the United Kingdom (18). The prevalence of fecal incontinence in urogynecology clinic reaches 12% (25), which is greater than the 2% in a general population (1). The overall prevalence of FI in an Australian study was 15% and was more prevalent in men (29%) than women (11%) (15). In Japan, Nakanishi et al. (26) reported 8.7% in men and 6.6% in women 65 years and older. A global incontinence rate of 5% fits well with some published reports (26).

It is more common in women and in the elderly of both sexes (27, 28). Kerrigan noted that FI is eight times higher in women than in men (101). However, several authors reported that FI has been shown to be as prevalent in men (1, 14–18), but women are more willing to report this symptom than men (1).

Risk factors for FI

The odds of reporting fair or poor health (rather than good health) were significantly higher among people reporting FI (29). Potential risk factors include perianal injury, perianal surgery and fair/poor general health (29). Statistically significant risk factors with FI included female sex, age older than 65 years, physical limitations, and poor general health. Multi-

Table 3   Community-based studies of fecal incontinence

Study	Study Design	Definition of Fecal Incontinence	Study Size (response rate)	Prevalence
Thomas et al. 1984, UK (16)	Two-part survey: 1 Patients known to have FI; 2 Postal survey of patients from general practitioners list	"Do you ever soil yourself?"—twice or more per month considered faecal incontinence	4,844 (89%)	1.4%
Campbell et al. 1985, New Zealand (18)	Randomly selected, age-stratified, 65 years and over. Doctor-administered questionnaire at home	"Do you have any trouble controlling your water or you bowel?" (i.e., within the last year)	559 (94.9%)	3.1%
Talley et al. 1992, USA (97)	Postal survey of randomized age-/sex-stratified people aged 65–93 (non-institutionalized)	Stool leakage once a week or more or if patient wore protective pads.	328 (77%)	3.7% (men, 4.5%; women, 3.1%)
Kok et al. 1992, Holland (19)	Postal survey. Randomly selected age-stratified community-residing women 60 years & over	"Occasional, involuntary loss of feces"	719 (69%)	60–84 years, 4.2% 85+ years, 16.9%
Drossman et al. 1993, USA (17)	Postal survey. Stratified probability, random sample of US householders selected from a database of a national marketing firm.	Not mentioned.	5,430 (66%)	7.8%
Nelson et al. 1995, USA (1)	State community survey using random digit dialing. Information obtained from the person in household most likely to know the health status of the other residents.	"In the last year have you, or any member of the household, experienced unwanted, unexpected or embarrassing loss of control of the bowel or gas?"	6,959 (2570 households) (73%)	2.2%
Nakanishi et al. 1999, Japan (26)	Random selection from age-stratified, community dwelling people 65 years & over from urban population register.	"Do you soil yourself?"	1,405 (95.4%)	men, 8.7% women, 6.6%
Giebel et al. 1998, Germany (13)	Patients & relatives above age 18 waiting in emergency department, orthopedic & surgical outpatient (excluding those with abdominal conditions)	Incontinence of solid, pasty or liquid feces or flatus (individually)	500	4.8% solid stool; 6.6% pasty stool; 6.7% liquid stool; 5.5% flatus
Roberts et al. 1999, USA (98)	Postal survey of randomized community sample 50 years & over with no history of colorectal conditions	"In the previous year, have you had accidents or soiling because of inability to control the passage of stool until you reach the toilet?"	778 men, 762 women (66%)	men, 11.1% women, 15.2%
Lam et al. 1999, USA (15)	Postal survey. Random selection form electoral roll (subjects aged 18 and over)	Positive response to at least two of the following: stool leaking, wearing a pad for faecal soiling, frequent incontinence of flatus	618 (71%)	15% men, 20% women, 11%
Kalantar et al. 2002, Australia (29)	Postal survey. Random selection form electoral roll (subjects aged 18 & over)	"Have you ever had any leakage of bowel movements (excluding flatus) at an inappropriate time or in an inappropriate place over the past 12 months?"	651 (68%)	11.3% men, 10.8%; women, 11.6%
Lafferty et al. 1996, USA (23)	Information obtained during physician visit	Reason for visit, bowel habits, frequency, type and severity of FI	881	18.4% 1.3 times more common in male
Perry et al. 2002, UK (99)	Cross sectional postal survey. Random sample of UK householders from health authority register.	Soiling of underwear or with a frequency of several times a month or more. Effect of bowel symptoms on the quality of life.	10,116 (63.6%)	1.4%
Tetzschner et al. 1996, Denmark (100)	Observational study. Patients who sustained an obstetric anal sphincter rupture in a Denmark hospital were included. (Institutional) Interventions: History, anal manometry, anal sphincter electromyography & PNTML	Frequency of anal & urinary incontinence & risk factors	72 (76.6%)	50%

Table 3 (Continue)

Chan et al. 2002, HK (25)	Retrospective study using hospital database.	Not mentioned.	120	12%
Walter et al. 2002, Sweden (24)	Postal survey. Random selection, 31 & 76 years.	"Can you withstand the urge to pass a motion longer than 15 minutes?"	2,000 (80.5%)	10% loose stool; 1.4% women & 0.4% men solid stool; 14.5% women & 21% men soiling: 4.9% women & 5.9% men flatus
Edwards et al. 2001, UK (95)	Interview. Random selection from health service authorities	"Do you have any difficulty in controlling your bowels?" "Do you ever wet yourself if you are unable to get to the lavatory as soon as you need to, or when you are asleep at night, or when you cough or sneeze?"	2,818 (94%)	3% 65–74 yrs 2%; >/=75 yrs 3%; men 1%; women 4%

variate analyses demonstrated that age, sex, poor general health, and physical limitations were independent risk factors for anal incontinence (1).

Vaginal delivery is the most important risk factor for anal sphincter injury and for development of FI in women (30–35). The risk of anal sphincter disruption is greatest during first vaginal delivery, but that damage to the pudendal nerves is cumulative with successive vaginal deliveries (30–37). However, Leeuw et al. (38) found that subsequent vaginal delivery was not associated with the development of FI and that the extent of sphincter damage is an independent risk factor for the development of FI.

Using logistic regression models, independent risk factors for FI were gender (male, odds ratio (OR)=3.9, 95% confidence interval (CI)=2.0–7.5), constipation (OR=27.1, 95% CI=12.3–59.5), straining (OR=0.24, 95% CI=0.1–0.6) and episiotomy (OR=2.9, 95% CI=1.4–6.0) (17).

Donaldson and Jagger (39) reported that the mortality rate for frequently incontinent elderly people was higher than that for continent elderly people. Similar findings were also reported for several Western countries by Ekeland and Rundgren (40) Campbell et al. (18), Berrios (41) and Goldfarb (42), and for

Japan by Koyano (43). However, none of these studies controlled other risk factors related to mortality to test this hypothesis. Nakanishi showed that there was an independent and consistent effect of incontinence on mortality in elderly people living at home (26).

Quality of life (QOL)

The importance of measuring subjective aspects of patient's health, often referred to as quality of life (QOL), has become increasingly recognized during the past decade (44–46). The use of QOL questionnaires in clinical medicine must be based on instruments that are reliable and valid (47). It is important to standardize the assessment of incontinence by using formal scoring systems. This provides an objective method of assessment of patients before and after treatment and a recognized valid method of presenting data at international Conventions. The Cleveland Clinic (2) (Table 4) and St. Mark's Hospital (48) continence scoring systems are improvements over previous systems, by including in one global assessment not only incontinence to stool and flatus, but also the frequency of losses, the need to use pads and the effect of incontinence on lifestyle. The latter system also incorporates the ability to defer

Table 4 Fecal incontinence grading scale cleveland clinic florida score*

Finding	Never	Rarely	Sometimes	Usually	Always
Solid stool incontinence	0	1	2	3	4
Liquid stool incontinence	0	1	2	3	4
Gas	0	1	2	3	4
Wears pad	0	1	2	3	4
Lifestyle alteration	0	1	2	3	4
Incontinence score=					

Definitions	per month	per week	per day
Rarely	<1 time		
Sometimes	>=1 time	<=1 time	
Usually		>=1 time	<1 time
Always			>=1 time

+(points for solid stool)+(points for liquid stool)+(points for gas)+(points for wearing pad)+(points for lifestyle alteration)
Interpretation
·A score of 0 indicates perfect control.
·A score of 20 indicates complete incontinence.
*-Jorge JMN, Wexner SD. Dis Colon Rectum 1993.

defecation for over 15 min and the use of constipating medications. Several currently used fecal incontinence grading scale are shown in Tables 4 to 7.

Probably the greatest drawback of all the currently available scoring systems is their inability to assess passive incontinence in any detail. Passive incontinence, unlike urge incontinence, is uncommonly a single event but rather an ongoing leakage over time. By definition it is not usually noted until some time after the leakage, and hence the assessment of frequency and the volume of leakage are difficult to quantify. A further weakness is that the same continence scores may be obtained by very different patients, which may not represent similar clinical expressions and levels of incontinence (49).

A major difficulty in assessing clinical and cost-effectiveness of surgery for incontinence lies in finding an appropriate measure of health outcome. Degree of incontinence to solid and liquid stool in itself does not necessarily reflect or directly correlate with the social consequences of incontinence. Outcome measures of relevance to health technology assessment include both objectively measurable clinical outcomes (continence) as well as patients' own assessment of the intervention's impact on lifestyle, such as the ability to travel, maintain employment and the effects on interpersonal relationships. A patient reporting no urge incontinence after operation

may achieve this result by remaining housebound to permit immediate access to a toilet when fecal urgency occurs. Although technically continent, this lifestyle restriction is substantial and the result cannot be considered simply as surgical 'success'. On the other hand, many patients, despite the fact that they do not reach complete continence (surgical 'failures'), may show sufficient improvement after the operation, which relates to an improvement in their QOL, and patient's overall satisfaction (50). The relationship between symptom improvement and QOL may not be obvious or long lasting; a relatively small reduction in symptoms may be enough to enable a return to work or social activities, with a substantial improvement in quality of life (49).

There are many generic, well-validated QOL instruments available, but there is only one validated instrument specific to fecal incontinence (51). It comprises four scales: lifestyle, coping/behavior, depression/self-perception, and embarrassment. Health outcome assessment should utilize both disease-specific and generic quality-of-life instruments. Information for economic evaluation requires the use of specific instruments (49).

The Cleveland Clinic Florida Incontinence Score (3) (Table 4) has become widely used for the assessment of severity of FI. It is simple to use and easily understood by patients. There were three areas in which this scale could be improved. First, the scale does not take account of fecal urgency, which can be present without overt FI. Second, the need to wear a pad has an equal impact on the occurrence of incontinence. However the use of a pad may not be a measure of the severity of fecal incontinence, but rather reflect patient's sense of insecurity. The use of a pad also often relates to the presence of coexistent urinary leakage. Finally, in the compari-

Table 5   Fecal incontinence grading scale the pescatori score*

A	Incontinence for flatus/mucous	Less than once a week	1
		At least once a week	2
		Every day	3
B	Incontinence for liquid stool	Less than once a week	1
		At least once a week	2
		Every day	3
C	Incontinence for solid stool	Less than once a week	1
		At least once a week	2
		Every day	3

AI degree	Points	AI frequency	Points	AI Score
A	1	1	1	2
A	1	2	2	3
A	1	3	3	4
B	2	1	1	3
B	2	2	2	4
B	2	3	3	5
C	3	1	1	4
C	3	2	2	5
C	3	3	3	6

AI score=AI degree+AI frequency. AI=anal incontinence
*-Pescatori M, Anastasio G, Bottini C, Mentasti A. Dis Colon Rectum 1992.

Table 7   Fecal incontinence grading scale the newly developed incontinence score*

	Never	Rarely	Sometimes	Weekly	Daily
Incontinence for solid stool	0	1	2	3	4
Incontinence for liquid stool	0	1	2	3	4
Incontinence for gas	0	1	2	3	4
Alteration in lifestyle	0	1	2	3	4
				No	*Yes*
Need to wear a pad or plug				0	2
Taking constipating medicines				0	2
Lack of ability to defer defecation for 15 minutes				0	4

* Modified from Jorge JMN, Wexner SD. Dis Colon Rectum 1993. & Schmitt S, Wexner S. Sem Col & Rec Surg 1992.

Table 6   Fecal incontinence grading scale the american medical systems score*

Over the past 4 weeks, how often:	Never	Rarely	Sometimes	Weekly	Daily	Several times daily
Did you experience accidental bowel leakage of gas?	0	1	7	13	19	25
Did you experience minor bowel soiling or seepage?	0	31	37	43	49	55
Did you experience significant accidental bowel leakage of liquid stool?	0	61	73	85	97	109
Did you experience significant accidental bowel leakage of solid stool?	0	67	79	91	103	115
Has this accidental leakage affected your lifestyle?	0	1	2	3	4	5

Several times daily, >1 episode a day; daily, 1 episode a day; weekly, 1 or more episodes a week but <1 a day; sometimes, >1 episode in the past four weeks but <1 a week; rarely, 1 episode in the past four weeks; never, 0 episodes in the past four weeks.
*-Vaizey CJ, Carapeti E, Cahill JA, Kamm MA. Gut 1999.

son of degree of incontinence preoperatively and postoperatively, the introduction of antidiarrheal drugs should be taken into account. These are often given as a part of the treatment package and a failure to recognize this aspect might give a false impression of the surgical success rate. The Cleveland Clinic Incontinence Score formed an excellent basis (3), but these modifications might improve its validity.

A new scale (see Table 7) (48) introduced an assessment of the ability to defer defecation and an additional score for the use of antidiarrheals, and reduced the emphasis on the need to wear a pad. Another QOL scale was used to assess results of Artificial Bowel Sphincter implantation (52).

Medical management

Many different therapeutic options exist for the treatment of FI, both medical and surgical. None, however, is ideal. Understanding the complex mechanism of fecal continence is an important initial step for adequate treatment of these patients (13). Possible treatment for FI is described in Table 8.

Medical illness may cause changes in stool consistency or intestinal transit time, which, even in the presence of normal pelvic floor function, may cause FI. Management of these patients should be directed at correction of identifiable underlying causes. A thorough investigation of diarrheal disorders should be conducted. Patients with identifiable causes for diarrhea or rapid transit time should be medically managed as indicated. Specific therapy in combination with constipating agents, dietary manipulation, or both will achieve satisfactory outcomes in many patients. Some patients with loose stools may benefit from dietary restrictions such as lactose or gluten. In patients with known abnormal bile salt metabolism, the addition of cholestiramine may improve diarrhea and secondary incontinence. Patient education, bowel training, and laxatives should be employed to minimize straining. Patients with idiopathic diarrhea can be managed with opioid agents such as diphenoxylate and atropine or loperamide hydrochloride. Bulk-forming or antimotility agents may help produce formed stool and minimize leakage in presence of semisolid stool (14).

Perianal strengthening exercises are simple to perform and can improve FI in some patients. Patients are instructed to contract the perineal muscle and hold the contraction for a count of 10, repeating the maneuver several times at intervals throughout the day (14).

Ho et al. (53) found that biofeedback (BF) was successful in alleviating distressing stool frequency and impaired fecal continence that affected certain patients after anterior resection and total colectomy. BF is performed using a probe with a rectal

Table 8 Therapies for fecal incontinence

Medical	Physiotherapy	Surgical
Dietary	Strengthening exercises	Sphincter repair
Pharmacologic	Biofeedback	Encirclement procedures
Bowel management		Synthetic materials
		Muscle transfer
		Artificial sphincters
		Abdominal stomata

*-Jorge JMN, Wexner SD. Dis Colon Rectum 1993.

balloon at its tip and a pressure transducer situated to measure mid-anal canal pressures. Anal pressures were displayed on a portable monitor. Increased pressure in the canal was indicated to the patient by an appropriate increase in the number of colored bulbs that lit up on the monitor screen. Thus, patients were given feedback on their efforts to contract and relax their anal sphincter muscles (53).

Because FI is a complex condition with sub-optimal surgical results in many series in the literature, a number of alternative non-surgical procedures have been recently proposed. Delivery of submucosal radio frequency energy to the muscles of the anorectal junction is known as the SECCA procedure (54). Submucosal injection of carbon coated beads into the anal canal and lower rectum represents the ACYST. Both these techniques are still experimental and results are still preliminary (14).

The safety and efficacy of the PROCON Incontinence Device, which is a 510K Class II FDA device was demonstrated and approved by the FDA. This device is a small flexible, biochemically inert catheter with a distal motion sensor electrode. It was designed to be placed in the rectal vault and to be held in place by a small balloon.

An alerting device (beeper) worn on patient's waist alerts patients when stool reaches the rectum. Due to the mechanical barrier created by the balloon, patients are given adequate time to reach a bathroom, deflate the balloon and evacuate.

Adequate selection of suitable candidates to this procedure is important and exclusion criteria for this study were pediatric patients and patients with dementia or other neurological diseases (13). Potential candidates to this conservative treatment are those patients who participate to their own treatment and have good manual dexterity.

The Procon resulted to be a unique, safe, and promising device that is able to prevent episodes of FI without the need for surgery, thereby improving QOL. Its role includes use in patients with severe FI who are unfit to undergo surgery, those in whom previous surgical treatments have failed, or those who do not wish to undergo surgery (5).

Surgical management

Treatment of severe FI is in most cases surgical (2).

Sphincter repair is considered in patients with a defined muscular defect, usually caused by obstetric or iatrogenic injury (55, 56). Despite the severity of the trauma, in these patients the remaining sphincter usually actively contracts. Although sphincter repair has also been indicated in idiopathic or neurogenic incontinence, the results are suboptimal (57). Direct repair of the injured anal sphincter can be performed by three approaches: apposition, plication, and overlapping. Apposition (Classical repair) procedure involves mobilization and division of the external anal sphincter (EAS), excision of the scar tissue, and end-to-end suturing of the apposed muscle. Despite the attractive simplicity, this procedure was associated with only 33 percent satisfactory results, as reported by Blaisdell's (58) collective results of 133 cases.

Plication (reefing) procedures may be anterior, posterior, or combined. In anterior plication procedure, limited reefing of the perineal musculature is usually done during posterior vaginal colporrhaphy. However, isolated plication procedures have

been demonstrated to be of limited use in major fecal incontinence (59).

The postanal repair essentially consists of posterior plication of the puborectalis (PR) muscle, which theoretically advances the anorectal angle (ARA) forward. This maneuver is then followed by plication of the EAS. Parks correlated the successful outcome obtained (83%) with restoration of the ARA and anal canal length (56, 60). Postanal repair may restore anatomy rather than function (61). Furthermore, in other series, no significant postoperative changes in the ARA have been demonstrated (62, 63). Postanal repair may actually lead to progression of neurogenic damage to the pelvic floor (64).

Keighley et al. (65) recently demonstrated that total pelvic floor reconstruction (anterior and posterior repair) is a viable option for treatment of neurogenic FI. In this prospective, randomized trial, postoperative evaluation revealed continence for liquid and solid stool in 8 percent after postanal repair, in 23 percent after anterior levatorplasty, and in 69 percent after total pelvic floor reconstruction. The groups, however, were not stratified, and pudendal nerve function was not assessed. Therefore, the results may merely reflect patient selection rather than true functional improvement.

Principles of the procedure overlapping anterior sphincteroplasty include preservation of the scar tissue to anchor the sutures and overlapping of the fibromuscular divided ends, which creates a bulking effect and increases the area of contact, thus reducing the chance of suture disruption (57). Satisfactory results, which include continence of solid and liquid stool, have been reported in approximately 70 to 80 percent of patients. Wexner et al. (66) found good correlation between subjective functional improvement of continence and objective physiologic improvements (anal pressures and high-pressure zone). Fleshman et al. (67) found improvement in sphincter length in 57 percent, squeeze pressures in 71 percent, and resting tone in 79 percent. Pudendal nerve terminal motor latency (PNTML) was considered the most significant predictor of outcome, since even unilateral pudendal neuropathy was associated with poor functional results (66, 88). Other factors, such as age, preoperative length of continence, and previous attempts at repair, may also affect postoperative results (69).

Repeated sphincter repair can be performed after one or more failed attempts, especially if suture disruption is suspected. Although biofeedback is always a valid alternative, it is best indicated when a snug anorectal ring is present, indicating satisfactory anatomic results, despite the persistence of incontinence. If further failure occurs, indicating a deficiency of residual muscle, encirclement procedures using synthetic materials or muscle transfer techniques might be considered. Successful results are scarce, and, as expected, the functional result of a synthetic material cannot be the same as that of a normal muscle (2).

The most common skeletal muscles used in transposition techniques are the gracilis and gluteus maximus. As described by Pickerell et al. (70), this muscle is entirely mobilized, and its distal portion is wrapped snugly around the anus and anchored to the contralateral ischial tuberosity. Satisfactory functional results have been reported in up to 70 percent of patients in small series (71–74).

Implantation of stimulating electrodes into sphincters was first described by Caldwell (75) in 1963. Construction of neorectum and neoanal sphincter from an electrically activated gracilis has been proposed for patients undergoing abdomino-perineal resection (76). Hallan et al. (77) have developed an experimental model of an electrically stimulated sartorius neosphincter. This stimulation seems to transform fibers from Type II into Type I, which are more fatigue resistant and have potential for continuous sphincter activity (78, 79). There was a high rate of peri-operative complications (80–82). This is likely to be related in part to abnormal anorectal physiology, the complexity of the technique and also to a learning curve effect (81–83).

Finally, construction of an end diverting colostomy may be indicated. Although considered as the last option in the surgical strategy, once patients understand and accept the fact that a colostomy can be better managed than an incontinent anal sphincter, their lives can be drastically improved (2).

Cost of treatment

There is limited information available on the cost-effectiveness of surgery for FI. Adang et al. (84) compared the costs and outcomes of dynamic graciloplasty with conventional medical treatment (diaper/enema) and colostomy/stoma care in patients with FI in the Netherlands. The lifetime direct costs of each option were estimated to be $28,000 for graciloplasty, $10,650 for medical care and $62,500 for colostomy and stoma care. The total incremental cost of dynamic graciloplasty is $13,221 compared to $53,065 for colostomy. QOL was improved for patients treated by graciloplasty. Compared with colostomy and stoma care, the initial high cost of graciloplasty was outweighed by the savings in ostomy supplies within 5 years, assuming a device life of 5 years or more. Unfortunately, the groups used in this study were small. Stoma care costs were based on only seven patients, with somewhat higher estimated costs than those expected in the USA (85). In addition, the data were not analyzed on an 'intention to treat' basis. In such evaluations it is important to include the costs of surgical failure, which may involve successive revisions, and of physiological testing and counseling for patients who do not eventually undergo operation. The study did not link costs with effectiveness directly (49).

The direct cost of FI is based on prevalence rates, number of incontinent episodes, nursing time, incontinence supplies, and laundry requirements; it has been calculated to be $9,771 per patient per year (86).

Costs may also be incurred for the treatment of diarrhea, prevention and treatment of breakdown of skin, increased incidence of female genital tract infection and bacteriuria, stoma care (where a stoma has been created for incontinence) and loss of productive capacity, but an exact calculation is lacking (87).

Discussion

FI is a challenging condition of diverse etiology and devastating psychosocial impact. Multiple mechanisms may be involved in its pathophysiology, such as altered stool consis-

tency and delivery of contents to the rectum, abnormal rectal capacity or compliance, decreased anorectal sensation, and pelvic floor or anal sphincter dysfunction. A detailed clinical history and physical examination are essential to understand these mechanisms and making objective assessment. Anorectal manometry, pudendal nerve latency studies, and electromyography are part of the standard primary evaluation of its pathophysiology.

FI is also a significant cause of high social costs and embarrassment for patients in a social community. It can be physically and psychologically disabling, leading to progressive isolation of patients. It is the second most common cause for institutionalization of the elderly in the USA (6, 88), and accounts for costs of over $400 million per year for adult diapers (22). Borrie et al. estimated that the annual cost of incontinence for an institutionalized patient in Canada was $9,771 (86). Patients suffering from FI may be reluctant to seek medical advice (21, 89), and doctors may be reluctant to ask about the condition.

The prevalence of FI varies depending on the definition and duration of symptoms and type of fecal incontinence (solid versus liquid or gas incontinence). This may explain the disparity of the prevalence rate between studies. Furthermore, the study design and method of population sampling may also affect the results.

None of the 17 articles reviewed was a randomized controlled trial. Most of these studies used mail questionnaires to determine the prevalence of FI. This kind of survey has its own method-related limits. An accurate estimate of epidemiology and entity of this social problem in the community would help to understand preventive and therapeutic measures to be taken wherever possible. Our aim was to review the literature on the prevalence of FI and associated risk factors, to consider the impact of the disease on quality of life and to present available treatment options.

The evaluation of idiopathic FI may require tests such as cinedefecography, spinal latencies, anal mucosal electrosensitivity tests, anal manometry, and ultrasound. These tests allow not only objective assessment but can also address therapy. Treatment options include conservative measures, biofeedback, and surgery.

In some studies, biofeedback has resulted in 90% reduction of episodes of incontinence in over 60% of patients (2, 90–94).

Surgery has many options. Overlapping anterior sphinc-

teroplasty, when indicated, has been associated with good to excellent results in 70 to 90% of patients (2). Pretreatment evaluation with anorectal physiology tests is extremely important. It is the results of these tests that permit optimal therapeutic assignment. For example, PNTML are the most important predictor factor of functional outcome in sphincter repair (2). In the absence of pudendal neuropathy, sphincteroplasty is an excellent option. If neuropathy exists, however, post anal or total pelvic floor repair remain viable surgical options despite the non-optimal results reported (2). In the absence of an adequate sphincter muscle, encirclement procedures using synthetic materials or muscle transposition techniques (gracilis, ABS) might be considered. Implantation of a stimulating electrode into the gracilis neosphincter and artificial sphincter implantation are in fact other valid alternatives. The final therapeutic option may be fecal diversion. However, new experimental minimally invasive techniques can be currently proposed to those patients in whom surgery failed.

FI is a common and distressing physical disability that requires major healthcare resources. Considering the increasing need for money savings and decreased budgets, it is particularly useful to demonstrate the clinical efficacy of new treatment options with special attention to cost-benefits ratios in order to make the best use of available financial resources. Currently, few clinical and economic evaluations of treatment options for FI exist; randomized controlled trials on cost-benefit ratios for different treatments of FI may present ethical and practical problems. Optimal evaluation requires a clearly defined goal, objective measures of clinical outcome, validated assessment of quality of life, and appropriate measures of optimization of resource utilization. Although unfamiliar to many clinicians, these complex issues deserve more attention in order to demonstrate the true value of new treatments for FI.

A reluctance to report symptoms, increased anxiety, depression, disability, and perceived lack of successful treatment suggests that older people should be questioned proactively about incontinence (95). This could be done as part of their regular assessments in primary care. Increasing awareness of the entity of the problem among health- and social-care professionals, and the elder population may lead to more appropriate and efficient management and care. This would certainly result in an improvement in the quality of life of older people, reducing the strain on carers and postponing or even preventing institutionalization.

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