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GASTROENTEROLOGY IN GERIATRIC PATIENTS (SITA CHOKHAVATIA)

Constipation and Fecal Incontinence in the Elderly

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Abstract

Purpose of Review To review the epidemiology, pathogenesis, clinical features, and management of primary constipation and fecal incontinence in the elderly.

Recent Findings Among elderly people, 6.5%, 1.7%, and 1.1% have functional constipation, constipation-predominant IBS, and opioid-induced constipation. In elderly people, the number of colonic enteric neurons and smooth muscle functions is preserved; decreased cholinergic function with unopposed nitrergic relaxation may explain colonic motor dysfunction. Less physical activity or dietary fiber intake and postmenopausal hormonal therapy are risk factors for fecal incontinence in elderly people. Two thirds of patients with fecal incontinence respond to biofeedback therapy. Used in combination, loperamide and biofeedback therapy are more effective than placebo, education, and biofeedback therapy. Vaginal or anal insert devices are another option.

Summary In the elderly, constipation and fecal incontinence are common and often distressing symptoms that can often be managed by addressing bowel disturbances. Selected diagnostic tests, prescription medications, and, infrequently, surgical options should be considered when necessary.

Keywords Defecatory disorder · Nursing home · Bowel leakage · Constipation · Elderly · Fecal incontinence

Introduction

Constipation and fecal incontinence (FI) are common symptoms that may coexist and affect the quality of life in elderly people. This article reviews the burden, pathogenesis, and management of these symptoms with an emphasis on the elderly.

Constipation

Epidemiology

Constipation may be defined by self-report, symptom criteria, or based on laxative use. The Rome criteria categorize constipated patients into four syndromes (i.e., functional constipation, constipation-predominant irritable bowel syndrome, defecatory disorders (DDs), and opioid-induced constipation (OIC) [1, 2]. Functional constipation (FC) and constipation-predominant IBS (IBS-C) are symptom-based diagnoses. DDs are defined by symptoms of FC or IBS-C and anorectal tests indicating impaired rectal evacuation. OIC is defined by worsening symptoms of constipation when initiating, changing, or increasing opioid therapy in patients who satisfy criteria for FC.

Among adults, the mean prevalence is approximately 14% with a range of 2–35% [3, 4]. In some but not all studies, chronic constipation was slightly more common in older people [4]. An internet-based survey from the USA, Canada, and the UK observed that constipation was *less* common in the 65+ group versus people aged 18–34 years [5•]. Whether this is explained by reduced internet access in the elderly is unknown. In that study, the prevalence of FC, IBS-C, and opioid-induced constipation diagnosed by Rome IV criteria in the 65+ age group was 6.5%, 1.7%, and 1.1% respectively. By contrast to these cross-sectional studies, the prevalence of self-reported constipation increased from 14 to 21% and laxative use increased from 6 to 15% over time among 239 elderly community residents in the Australian Longitudinal

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Study of Ageing [6]. By comparison to these community-based studies, constipation is much common in institutionalized elderly adults with a prevalence ranging from 45 to 67% [7••].

The incidence of diagnosis of DD is associated with age [8]. In women, the incidence is greatest (57 per 100,000) between the age of 20–29 years, then declines with a second peak between the age of 80–89 years. In men, the incidence was less than or around 10 per 100,000 person-years until the age of 80–89 years, where it increased to 30 per 100,000 person-years.

Constipation is associated with an impaired quality of life (QOL) [9, 10]. The extent to which the impact on QOL is related to age and/or comorbid conditions (e.g., depression) is unknown.

Pathophysiology

Effects of Age on the Enteric Nervous System

Phillips and Powley extensively reviewed the effects of aging on intrinsic and extrinsic (i.e., sympathetic and parasympathetic) innervation of the gastrointestinal tract [11]. In rodents, the age-associated loss of cholinergic neurons in the myenteric and submucosal plexus is more severe in the distal GI tract. By contrast, nitrergic neurons are spared. Aging is also associated with progressive accumulation of dystrophic axonal swellings and markedly dilated varicosities in the sympathetic, vagal, dorsal root, and enteric nitrergic innervation of the gut.

More recently, a landmark study compared enteric neuropathology and physiology, particularly the response to electrical field stimulation (EFS), in ex vivo colonic muscle strips obtained from 239 adult (35–60 years) or elderly (≥ 70 years) individuals who had surgery for colon cancer [12••]. In older people, electrical stimulation was more likely to cause muscle relaxation rather than contraction in the ascending colon; the descending colon was not affected by age. By contrast to rodents, there was no loss of enteric cholinergic neurons and the density of intramuscular axon bundles, number of nitrergic neurons, and smooth muscle contraction and relaxation were also preserved. Hence, decreased cholinergic *function* with unopposed nitrergic relaxation probably explains the impaired contractile response to electrical stimulation. The number and volume of ICC networks also decline with age in the human stomach and colon [13]. Perhaps reduced cholinergic-mediated contractile responses to stimulation predispose to acute colonic pseudo-obstruction in situations (e.g., after abdominal surgery) that are associated with sympathetic stimulation in older people.

In mice, aging is also associated with attenuated mechanosensation, more so for high-threshold than low-threshold functions, and reduced chemosensory functions that are mediated by serotonin and transient receptor potential cation channel subfamily V member 1 (TrpV1) pathways [14••]. Perhaps reduced mechanosensation may explain why elderly people have a lower prevalence of painful diseases such as irritable bowel syndrome and have lesser awareness of gastrointestinal injury (e.g., with acute abdomen) [15].

Effects of Aging on Colonic and Rectoanal Sensorimotor Functions

In small studies of patients with and without constipation, aging is not associated with slow colon transit [16, 17]. The effects of age on colon transit in *asymptomatic* healthy people are unclear. Increased age is associated with increased stiffness and reduced sensation in the colon and rectum, reduced anal resting, and to a lesser extent squeeze pressures, and increased perineal laxity [18, 19]. Increased age is also associated with longer and more polyphasic motor unit potentials, which may be markers of neurogenic injury, in nulliparous women [20]. Together, these changes may predispose to FI in elderly females [21••].

Pathophysiology

Colonic sensorimotor disturbances and pelvic floor dysfunction are the most widely recognized causes of chronic constipation; they may coexist [22••]. Other potential mechanisms are reduced caloric intake, disturbances of the microbiome, anatomical issues, and medications. Colonic motor dysfunction resulting from a loss of colonic nerves and/or interstitial cells of Cajal (ICC) is implicated to cause slow colonic transit constipation. However, normal and slow colonic transit may not necessarily reflect normal and impaired colonic motor function; indeed, intraluminal assessments of colonic motor function under fasting conditions, after a meal, and/or pharmacological stimuli suggest that some patients with normal transit have colonic motor dysfunctions and vice versa [23, 24]. Sensory disturbances, such as exaggerated perception of colonic distention, may explain abdominal pain and bloating, which are more common in patients who have normal transit constipation or IBS-C [25–27].

Germ-free mice colonized with fecal microbiome from constipated patients developed slow colonic transit suggesting that the colonic microbiome may also contribute to constipation [28, 29]. In humans, the colonic mucosal microbiome discriminated between constipated patients and controls with 94% accuracy even after adjusting for diet and colonic transit [30].

Defecatory Disorders

Defecation requires increased rectal pressure, which is generally secondary to increased abdominal pressure, coordinated with anal relaxation [31]. Defecatory disorders (DDs) result

from abdomino-pelvic discoordination, which results in decreased rectal propulsive forces and/or increased resistance to evacuation [32]. Other disturbances (e.g., reduced rectal sensation [33, 34]) and anatomical abnormalities (e.g., large rectocele) may contribute. In the elderly, excessive straining can weaken the pelvic floor increasing the risk for excessive perineal descent [33], rectal intussusception [35], solitary ulcer syndrome [36], and pudendal neuropathy which in turn can increase the risk of FI [37].

Clinical Features

Chronic constipation may be a primary symptom or secondary to another disease; the vast majority of patients have primary constipation. Similar to younger people, female sex, medications, especially opioids, lower socioeconomic status, less, self-reported activity, malnutrition, and depression are associated with idiopathic constipation in elderly [38–41]. While older people are more likely to have diseases that cause constipation, the proportion of older patients who have secondary constipation is unknown (Table 1). Of note, in Parkinson's disease, the constipation may precede motor symptoms by 20 years or longer [42].

The symptoms include infrequent stool passage (fewer than 3 bowel movements per week) and, more commonly, straining at stool, feeling of incomplete evacuation, need for digital assistance during defecation, bloating, and passing hard, lumpy stools [43]. The Rome IV defines functional constipation (FC) by the presence of constipation for at least 6 months and two or more symptoms for 25% of bowel movements for the last 3 months. By contrast, IBS-C is defined by the presence of abdominal pain that is associated with 2 of the features: altered stool form, altered frequency, or relief of abdominal pain with defecation.

Since patients with FC and IBS-C may have abdominal pain, it can be difficult to distinguish between them [44, 45]. Alternatively, constipated patients may be categorized as painless (or mild pain) and painful constipation. Compared to "mild pain" constipation, patients with "painful" constipation had more prominent bowel symptoms and were more likely to have upper gastrointestinal (e.g., dysphagia and dyspepsia) and anorectal symptoms, urinary and sexual symptoms, anxiety and depression, and slower rectosigmoid transit.

Diagnostic Approach

The history will identify alarm symptoms such as new onset rapidly progressive symptoms, rapid weight loss, hematochezia, or features of colonic obstruction [22, 41]. A digital rectal examination is essential to assess for a rectal mass, anal fissure, stool in the rectal vault, tenderness to palpation of the levator ani, and anal sphincter tone at rest, during squeeze, and evacuation. A complete blood count, age-appropriate screening for colon cancer, and, based on the clinical features, additional tests (e.g., thyroid functions, metabolic parameters) should be performed (Fig. 1). Thereafter, a therapeutic trial of fiber supplementation and/or osmotic or stimulant laxatives should be considered. Non-responders who are candidates for pelvic floor biofeedback therapy should undergo anorectal manometry (ARM) and a rectal balloon expulsion tests (BET) to identify defecatory disorders followed by barium or MR defecography if necessary. The results of the colonic transit study classify patients into NTC and STC [22••].

Table 1 Common medical conditions associated with constipation

Cause	Comments
Drug effects	
Mechanical obstruction: colon cancer, external compression from malignant lesion, strictures (diverticular or post ischemic), rectocele (if large), megacolon, anal fissure	Often associated with alarm clinical features or laboratory tests, apparent on digital rectal examination (fissure) or X-ray image of the abdomen, or preceded by the primary event (diverticulitis).
Metabolic conditions: diabetes mellitus, hypothyroidism, hypercalcemia, hypokalemia, hypomagnesemia, uremia, heavy metal poisoning, uremia, heavy metal poisoning	All are associated with/can be diagnosed by abnormal results from laboratory tests, which should be performed only when there is a high index of suspicion (such as in patients on diuretics).
Myopathies: amyloidosis, scleroderma	Typically associated with other clinical features of these conditions.
Neuropathies: Parkinson's disease, spinal cord injury or tumor, cerebrovascular disease, and multiple sclerosis	Constipation, either due to slow colon transit and/or DD, is common in patients with these disorders, which have many other features.
Other conditions: depression, degenerative joint disease, autonomic neuropathy, cognitive impairment, immobility, cardiac disease	The disorder and/or medications may contribute to constipation.

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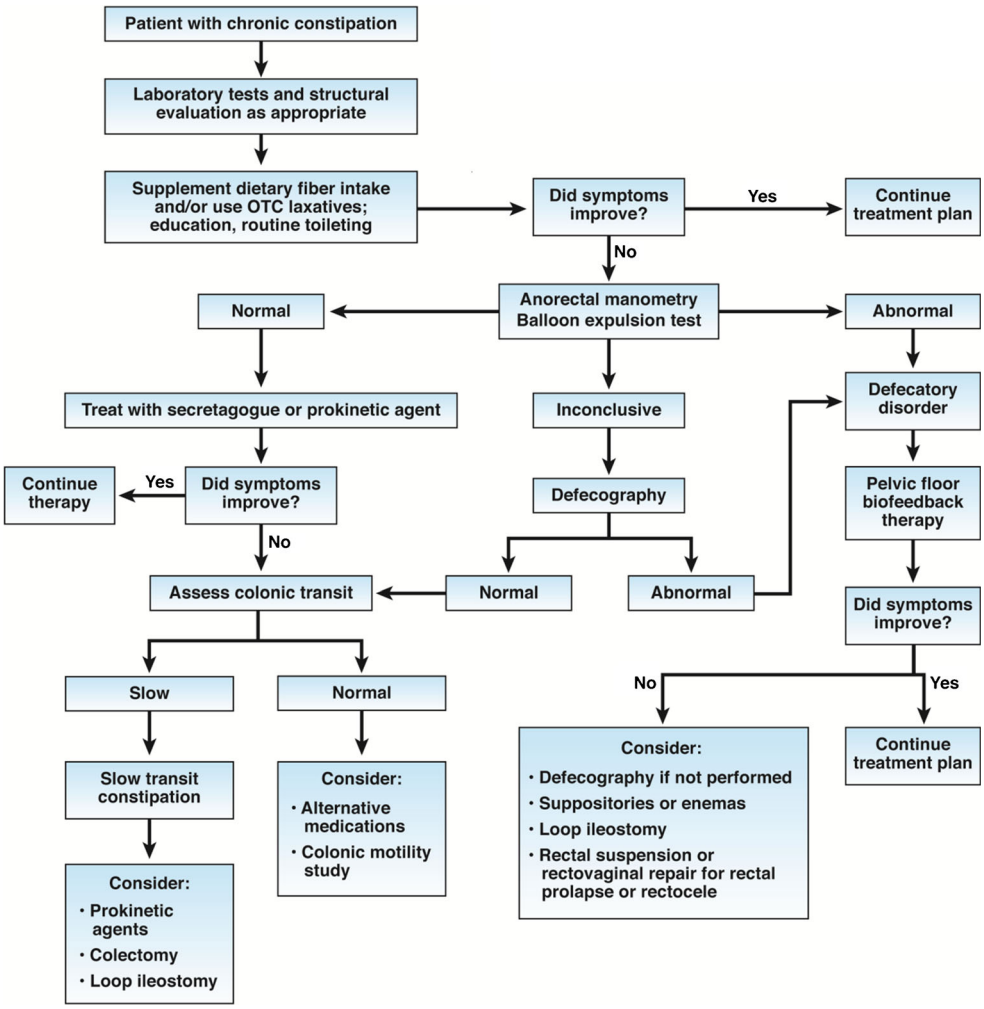

Fig. 1 Algorithm for managing chronic constipation (reprinted from [22••])

Medical Management

A stepwise approach is recommended [22••]. Constipating medications should be discontinued where possible. Lifestyle modifications should be implemented diligently. Adequate exercise and fluid intake are generally beneficial but their effects on constipation are unclear [46]. When possible, dietary fiber intake, which is often deficient in elderly individuals, should be increased [47]. Fiber (e.g., fresh fruit and vegetables, legumes, whole grains, or a supplement) should be introduced at low doses and increased slowly to 25–30 g fiber day in an attempt to reduce the incidence of flatulence, bloating, and abdominal pain [48, 49]. In elderly patients, dietary fiber accelerates intestinal transit but the effects on symptoms are inconsistent [50, 51]. A prolonged trial is required because a response may take several weeks. At least in younger people, failure to respond to fiber may suggest the presence of slow transit constipation or a DD [52].

If lifestyle interventions are ineffective, medications are necessary; osmotic or stimulant laxatives are first-line therapy. These agents are at least as effective and less expensive than newer agents for treating chronic constipation in adults (Table 2) [22••]. Polyethylene glycol (PEG), lactulose, and sorbitol have been studied in elderly populations (Table 2). PEG, administered for 6 months to patients older than 65 years, is safe, not associated with malabsorption, electrolyte abnormalities, or micronutrient deficiencies, and more effective than lactulose [54]. Osmotic agents are associated with diarrhea, distension, flatulence, and bloating, which usually resolve with a lower dose [54, 55]. Senna products are more effective and as well tolerated as lactulose or placebo [58, 68]. Bisacodyl is effective but its effects in elderly patients have not been characterized [69]. A practical approach is to administer an osmotic laxative regularly, supplemented as required with a stimulant laxative suppository. The suppository should preferably be administered 15–30 min after the morning meal to coincide with the gastrocolonic reflex.

Among the newer drugs, the strongest data regarding efficacy in the elderly is for the 5-HT_4 receptor agonist prucalopride, which improved symptoms and quality of life in a 4-week study of 300 constipated patients over 65 years old [60]. The 1 and 2 mg doses were equally effective. The

Table 2 Treatment of constipation treatment

	Number needed to treat in adult patients with CC and IBS-C	Cost per month (US$, 2019)	Studies or analyses in patients over 65 years of age	Comments regarding patients over 65 years old
Bulking agents	CC: 2 (95% CI, 1–3) [53] IBS-C: 10 (95% CI, 6–33) [53]	$8.34	Yes	Variable effect on symptoms of constipation [50, 51]. Failure to respond may suggest STC or DD.
Polyethylene glycol	CC: 3 (95% CI, 2–4) [2] IBS-C: NA	$30.90	Yes	Effective at relieving symptoms of constipation in patients over 65 [54, 55]. PEG 400 is more palatable without than with electrolytes [56].
Lactulose and sorbitol	NA	$11.20	Yes	Both may improve symptoms of constipation; no comparison with baseline bowel function is reported [57]. Nausea is more common with lactulose than sorbitol. Lactulose is inferior to PEG 4000 or senna with fiber [54, 58].
Bisacodyl	CC: 4 (95% CI, NA) [59] IBS-C: NA	$5.17	No	No data.
Senna		$5.90	Yes	Long-stay elderly patients receiving a combination of senna with fiber experienced more frequent and softer bowel movements, passed with more ease, than patients receiving lactulose. However, drug effects were not compared with baseline [58].
Prucalopride	CC: 6 (95% CI, 5–9) [2] IBS-C: NA	$395.67	Yes	Increases bowel motion frequency [60] without adverse cardiovascular events [60, 61].
Linaclotide	CC: 72 μg, 12 (95% CI, 6–29) 145 μg, 10 (95% CI, 6–19) [62] IBS-C: 290 μg, 6 (95% CI, 4–16)	$395.41	No	No data.
Lubiprostone	CC: 24 μg, 4 (95% CI, 3–6) [53] IBS-C: 8 μg, 12 (95% CI, 8–25)	$342.92	No	Abstracts suggest that lubiprostone is as effective and safe in patients older versus younger than 65 years [63, 64]. Patients over 65 are less likely to experience nausea [(65], [64)] or to discontinue lubiprostone [66]. Age is not associated with a higher likelihood of requiring diose adjustment [67].
Plecanatide	CC: 3 mg, 11 (95% CI, 8–19) 6 mg, 12 (95% CI, 8–23) [62] IBS-C: 3 mg, 9 (95% CI, 6–16); 6 mg, 9 (95% CI, 6–17)	$384.36	No	No data.
Tenapanor	IBS-C: NA	NA	No	No data.

NA not available

European Medicines Agency recommends a starting dose of 1 mg in patients over 65 years [70]. In contrast, the Food and Drug Administration in the USA recommends dose adjustment only in the setting of impaired renal function [71]. No cardiac side effects have been associated with prucalopride [60].

Abstracts suggest that safety and efficacy of lubiprostone are comparable in the elderly [63, 64]. Indeed, elderly patients were less likely to experience nausea [64, 65] or discontinue the medication [66]. There are no studies or analyses specifically describing the efficacy or safety of linaclotide, plecanatide, or tenapanor, a small-molecule inhibitor of the gastrointestinal sodium-hydrogen exchanger-3, in older populations. Two phase 3 trials of linaclotide in patients with constipation-predominant IBS, which were subsequently pooled for analyses, contained only 40 [72] and 45 [73] patients over 65 years old. In the largest single trial of linaclotide, comparing placebo, 72 μg linaclotide, and 145 μg linaclotide, there were 39 (10%), 36 (9%), and 43 (11%) patients over 65 years old in each cohort [74•]. Although not specifically reported, the phase 3 trials of plecanatide [75–77] and tenapanor [78•] appear to have few elderly patients. Thus, even pooled, retrospective analyses of this population are likely to be underpowered. The 5-HT_4 receptor agonist tegaserod is effective for treating constipation and constipation-predominant IBS and approved by the FDA for the latter [79, 80]. In comparative studies, tegaserod was inferior to PEG 3350 for constipation [81]. Efficacy trials enrolled 331

elderly patients (approximately 13% of participants) in studies regarding constipation, but no subgroup analyses were performed [82]. No dose adjustments are needed in the elderly or in patients with chronic kidney disease [83, 84]. The medication was withdrawn from market in the USA for many years due to cardiovascular events [53, 62]. After additional safety studies, it was reintroduced for treating adult women less than 65 years of age with irritable bowel syndrome with constipation [85].

Phosphate or tap water enemas or transanal irrigation are often useful on an as needed basis. Transanal irrigation, in which a device is used to irrigate the colon, is useful in retrospective studies [59, 86, 87]; prospective studies are underway. There is insufficient evidence to recommend the use of probiotics such as *Bifidobacterium longum* to manage constipation in the elderly [88].

Pelvic Floor Retraining

DDs are managed with biofeedback-aided therapy that promotes relaxation of the pelvic floor muscles, coordinated with abdominal effort, during defecation [89]. Undertaken frequently and with motivation on the part of the patient and therapist, biofeedback therapy (BFT) can provide symptomatic benefit in the majority of adult patients with DD; five to six sessions, each 30–60-min long, at 2-week intervals, has demonstrated superiority to PEG [90], sham feedback [91], or diazepam [92]. A single small study suggests that BFT is effective in elderly patients with a DD [93•]. Irrespective of age, successful outcomes require adequate physical and mental capacity. Therefore, not all patients are suitable for BFT. BFT is underused because expertise is not widely available and the third-party coverage is suboptimal [94].

Surgical Management

Patients with refractory symptoms despite discontinuation of constipating medications, a 4-week trial of pharmacologic therapy with each laxative and a 3-month trial of BFT if a DD was present, are considered for surgical therapy, i.e., a colectomy with ileorectal anastomosis [95, 96]. In patients with predominant pain or bloating, prior to a colectomy, a temporary loop ileostomy might be useful to determine if symptoms originate from the small intestine or colon; outcomes after colectomy are poorer in patients with generalized intestinal dysmotility [97].

Prior to surgery, rectoanal function and colonic transit, on laxatives, should be reevaluated. A DD, whether identified by manometry, BET, or defecography, is a contraindication for colectomy and warrants further BFT [22••]. Structural abnormalities identified on defecography may respond to targeted surgery if they obstruct defecation; we must strongly emphasize that pelvic organ prolapse is frequently encountered in health and rarely underlies constipation [98, 99].

Among adult patients undergoing colectomy with ileorectal anastomosis in order to manage constipation, approximately 88% report being "satisfied" or "very satisfied" with the outcome [95]. Perioperative complications, recurrent small bowel obstruction, and mortality occur in 20–30%, 10–20%, and 0.4% of patients. Other functional complications including diarrhea and incontinence, abdominal pain, recurrent constipation, and bloating remain or recur in 5–15%, 30–50%, 10–30%, and 10–40% of patients respectively [95]. Outcomes in elderly patients have not been described. However, prospective studies of oncologic colorectal surgery suggest that age is associated with higher complication rates and is independently associated with a higher 1-year overall and cardiovascular-specific mortality [100, 101]. Thus, especially in the elderly, surgical management should not be considered lightly. Patients should be counseled appropriately with regards postoperative morbidity and the risk of persistent symptoms.

Fecal Incontinence

Epidemiology

FI is the involuntary passage of solid or liquid feces; anal incontinence also includes the loss of flatus. The prevalence in the community increases with age, for example, from 2.6% in the third decade to 15% in the eighth decade [102, 103]. Among elderly individuals who do not reside at home, the prevalence is higher, i.e., 18–33% in hospitals, 38% in home health, and 50–70% in nursing homes [104–106]. In a retrospective study of 15,432 patients served by a hospice agency mostly 75 years or older, most patients with FI complained of incontinence at the time of the hospice admission [107•]. There is mixed evidence as to whether FI contributes to institutionalization independent of cognitive impairment in the elderly [108]. Twenty percent of initially continent individuals develop FI within 10 months of admission to a nursing perhaps due to comorbid conditions and low functional status [109].

FI can profoundly impair the quality of life in several domains, especially those that involve eating or leaving home, and can be associated with considerable psychosocial distress [110]. In a retrospective analysis of 41,932 community-dwelling older adults aged 65 and older who required some assistance, FI was associated with an increased likelihood of death (i.e., a hazard ratio 1.28) [111]. In this context, FI probably represents a marker of underlying frailty rather than the cause of death.

Associated Factors

1The risk factors and associated conditions are listed in Table 3 [103, 112, 113, 117, 119–122]. While obstetric anal sphincter injury can cause FI, most community women develop FI in the seventh decade. Among women in the community, rectal urgency and diarrhea are the strongest and independent risk factors for FI [113, 123, 124]; obstetric anal sphincter injury is not independently significant after adjusting for other risk factors [113, 121]. Rectal urgency was also associated with severity of FI [125]. Risk factors that are more germane to older individuals include dementia [107, 109, 115, 126], impaired mobility [127, 128], comorbid conditions [109, 114], polypharmacy [116], depression symptoms, and poor self-related health [129]. Conversely, in the Nurses' Health Study, more physical activity and increased long-term dietary fiber intake were associated with a modest reduction in FI [130•].

Pathophysiology

Fecal continence is maintained by the internal and external anal sphincters and the puborectalis muscle of the levator ani complex, rectal compliance, and rectoanal sensation [125]. Bowel disturbances typically diarrhea, anal sphincter weakness due to obstetric or iatrogenic trauma, or neurogenic causes like pudendal neuropathy, reduced rectal compliance, and/or altered rectal sensation cause FI [131, 132]; many patients have more than one disturbance [133]. The structural injury is documented by imaging [134]. Anal weakness is assessed by measuring the anal resting and squeeze pressure, reflecting IAS and EAS function with a digital rectal examination [135] or with manometry (HR-ARM) [136, 137]. During manometry, rectal sensation [138], which can be increased, reduced, or normal in FI, can also be assessed [139, 140]. When decreased, it leads to a weakened reflex for the sphincters and the pelvic muscles to contract when the rectum is distended, leading to FI. Conversely, rectal hypersensitivity can be secondary to a reduced rectal compliance or capacity and/or capacity, partly explaining the symptom of urgency [141, 142]. IBS is associated with rectal hypersensitivity [143]. Compared to women, anal sphincter dysfunction is less common whereas impaired rectal sensation and compliance were more common in men [144]. In conclusion, old age affects all the mechanisms which maintain continence, lending support to the observation that aging is an important risk factor of FI (Table 4).

Table 3 Fecal incontinence—associated conditions and risk factors

In population-based and/or case-control studies
- Old age * [103, 107, 109, 112]
- Diarrhea * [103, 113, 114]
- Rectal urgency
- Multiple chronic comorbidities * [103, 112, 114]
- Urinary incontinence * [103, 109, 112–114]
- Poor self-related health * [103, 114–116]
- Major depression * [112, 114, 116, 117]
- Obesity [113]
- Current smoking [113]
- Stroke and other neurological diseases * [107, 109, 114, 117]
- Dementia, cognitive disorders, and functional limitation with poor mobility * [107, 109, 115]
- Prostate diseases with prostatectomy and radiation for prostate cancer * [114, 115]
- Hysterectomy with oophorectomy* [114]

Not in population-based and/or case-control studies
- Type 2 diabetes mellitus* [117]
- Chronic kidney disease * [115]
- Multiparity * [117]
- Polypharmacy * [116]
- Menopausal hormonal therapy * [118]

* Risk factors apply to studies done in an elderly population

Clinical Features

A substantial proportion of FI patients, approximately 50% in some studies, do not share the symptom with a physician, indeed not even with friends or close relatives [102, 145]. Hence, older people should always be asked if they have FI. Among four characteristics are necessary to assess the severity of FI: frequency, type of stool, urgency, and amount of stool [21, 110]. So characterized, the severity of FI is strongly correlated with the QOL-weighted symptom severity score [110]. The severity of FI is however not related to age.

Management

The goals are to reduce the physical and social consequences of FI [146, 147]. The critical step is to identify FI through direct enquiry. Thereafter, management progresses in a stepwise manner (Fig. 2).

Lifestyle Management

Toileting advice, dietary triggers, and pads and undergarments should be thoroughly discussed with patients (Fig. 2) [148]; their efficacy should be emphasized. Elderly women acknowledge the association between diet and FI and are willing to modify their personal triggers [149, 150]. Smokers should be counseled to quit. Adequate fiber consumption should be promoted for prevention [151, 152] and treatment [153, 154]. Therapeutically, psyllium, but not carboxymethylcellulose, guar gum, or placebo, reduced the frequency of FI episodes but did not affect quality of life [153••]. In a placebo-controlled crossover study (68% male), psyllium was as effective as loperamide for reducing FI episodes but was associated

Table 4 Components of a comprehensive history in fecal incontinence

Question	Rationale
Elucidate whether a patient has incontinence	• Patients may not volunteer the symptom spontaneously
Onset, natural history, and risk factors	• Relationship of symptom onset/deterioration to other risk factors may suggest etiology • Natural history, e.g., recent symptomatic deterioration may reveal reason for seeking medical attention
Bowel habits/type of leakage	• Disordered bowel habits are critical to pathogenesis of incontinence • Incontinence for solid stool suggests more severe sphincter weakness than for liquid stool • Management should be tailored to specific bowel disturbance
Degree of warning before incontinence	• Urge and passive incontinence are associated with more severe weakness of the external and internal anal sphincter respectively • These symptoms may also reflect rectoanal sensory disturbances, potentially amenable to biofeedback therapy
Diurnal variation in incontinence	• Nocturnal incontinence occurs uncommonly in idiopathic fecal incontinence and is most frequently encountered in diabetes and scleroderma
Impact of FI on quality of life	Critical to ascertain severity of incontinence
Urinary incontinence—presence and type	• Association between urinary and FI • Same therapy may be effective for both conditions
Evaluate possible causes for incontinence	• Most conditions listed in Table 2 are associated with other, i.e., non-anorectal manifestations • The obstetric history must inquire specifically for known risk factors for pelvic trauma, e.g., forceps delivery, episiotomy, and prolonged second stage of labor • Medications, including laxatives and artificial stool softeners, may cause or exacerbate incontinence

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with fewer side effects [154]. However, the effect was maintained during the washout phase in both groups suggesting an effect from factors unrelated to the study interventions.

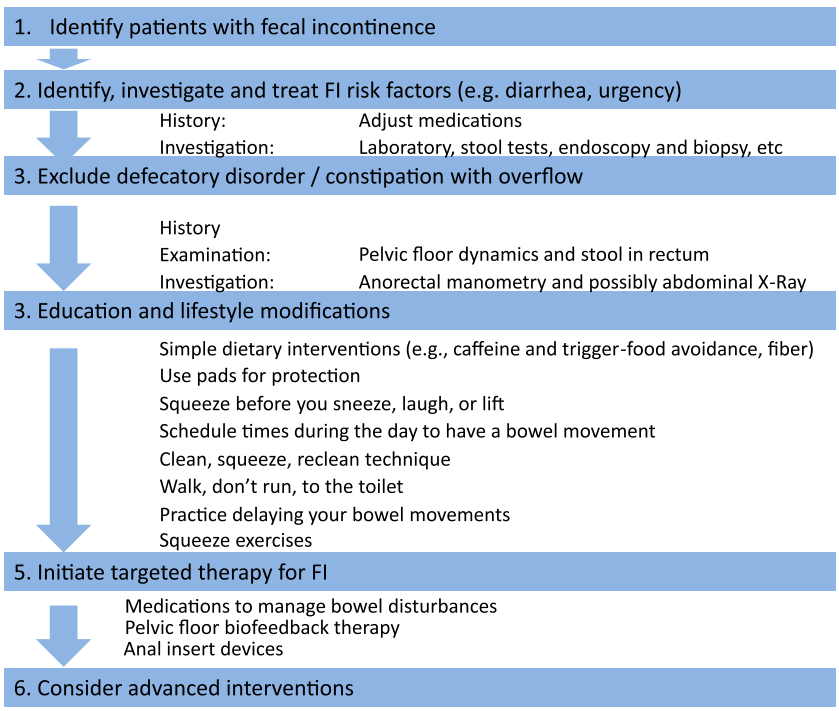

Fig. 2 Algorithm for managing fecal incontinence

Treatment of Constipation

This is summarized in the section on constipation. Between 13 and 36% of patients of FI have a DD, which should be managed with BFT [144]. When BFT is not possible, medical therapy may be helpful. In a cohort of elderly constipated patients with cognitive and physical impairment and impaired rectal evaluation, neither lactulose nor the combination of lactulose, a daily glycerin suppository, and weekly tap water enemas improved FI [155]. However, FI improved in the subgroup of patients with adequate rectal clearance (i.e., no stool in the rectal vault on repeated examinations). In contrast, compared to placebo, lactulose reduced the number of days with FI in elderly patients with uncharacterized constipation [156].

Medical Management

Osmotic laxatives should be discontinued if loose stool or urgency is present. Loperamide, an opioid receptor agonist, reduced urgency and increased stool consistency and anal resting pressure in patients with both normal [157–159] and surgically altered anatomy [160]. Diphenoxylate plus atropine reduced stool weight and frequency versus placebo; however, the duration of treatment (i.e., 3 days each with drug and placebo) was insufficient to assess the effects on fecal continence [161]. Loperamide was equivalent to codeine and superior to diphenoxylate plus atropine for reducing urgency and stool frequency in patients with diarrhea [162, 163]. However, the effects in patients with FI have not been studied. More recent studies suggest that loperamide is equivalent to psyllium [154] or placebo, education, and BFT [164•] for the treatment of FI. Colesevelam, cholestyramine, and amitriptyline improved fecal continence in small uncontrolled studies [165–167]. Clonidine did not improve continence in women with urge predominant FI; however, clonidine reduced diarrhea and tended to improve fecal continence in patients with diarrhea [168]. The main side effect of these therapies is constipation. This can usually be overcome by use of a stimulant laxative or enema if no bowel motion has been passed in 48–72 h. The average age of patients in the majority of these studies is approximately 60 years.

Biofeedback

Conceptually, biofeedback therapy (BFT) seeks to improve pelvic floor muscle contraction in response to rectal distension, maintain sustained contraction, and address rectal sensory abnormalities [89]. BFT was not superior to education [169] or pelvic floor exercises taught by digital rectal examination [170, 171]. However, it was superior to exercises taught verbally in patients who had failed medical therapy [172]. Follow-up studies suggest that two thirds of patients respond to BFT and half maintain a durable response [173•]. Age is associated with a greater likelihood of completing BFT but whether older age is associated with response to BFT is unclear [174, 175]. Therapy provided remotely or in secondary care has shown equal efficacy to care provided in tertiary care institutions and could facilitate greater access in the future [176, 177]. Used in combination, loperamide and BFT were more effective than placebo, education, and BFT [178•]; loperamide, fiber, and BFT were more successful than the individual therapies [179]; and cholestyramine and BFT were more beneficial than BFT alone [166]. However, in a randomized study comparing (1) placebo and education; (2) placebo, education, and BFT; (3) loperamide and education; and (4) loperamide, education, and BFT, no intervention group demonstrated superiority [164•].

Barrier Devices

In a multicenter, prospective, open-label study of the Renew anal insert, 62% achieved a ≥ 50% reduction in FI frequency in an intention-to-treat analysis [180]; 78% of patients who completed that study were very or extremely satisfied with the device and no serious adverse events occurred. In an open-label study of a vaginal insert and pressure-regulated pump, 61 of 110 participants successfully completed the fitting period. Of these, 79% achieved treatment success, defined as greater than a 50% reduction of incontinent episodes at 1 month [181, 182]. These devices may be an effective treatment option for patients who fail standard conservative or surgical therapy.

Perianal Injection of Bulking Agents

When compared to sham injections in 206 patients with moderately severe FI, patients receiving dextranomer were more likely to experience a 50% reduction in FI episodes (odds ratio 2.36, 95% CI 1.24–4.47) [183]. The beneficial effects on symptoms and quality of life were observed at 36 months [184]. However, anal bulking agents were not superior to anorectal BFT in FI patients [185].

Surgery

The most widely used option, sacral nerve stimulation, reduced the frequency of FI and improved quality of life in open-label studies [186, 187]. However, the mechanisms underlying these benefits are unclear [188]. The largest study of 120 implanted patients demonstrated that 83% of subjects had a > 50% reduction in FI episodes and that 41% achieved complete continence [189]. Efficacy persisted after 5 years in the 76 patients (63%) evaluated

[190]. Complications were frequently; among the 120 patients who initially underwent implantation, 33% experienced implant site pain, 19% experienced paresthesia, 12% experienced a "change in sensation of stimulation," 10% experienced implant site infection, and 8% experienced urinary incontinence [190]. Furthermore, 10 patients (8%) underwent 10 device revisions, 29 (24%) patients underwent 40 device replacements (12 of which were for battery depletion), and 22 patients (18%) had the device removed (11 of which were for lack of efficacy) [190]. Because sham stimulation is associated with clinically and statistically meaningful improvement, more controlled studies are necessary [187••]. Age did not substantially influence the outcomes after SNS for FI [191, 192]. Percutaneous tibial nerve stimulation (PTNS) was not better than sham electrical stimulation [193••] and was comparable to SNS in a small study [194]. The effects of anal sphincteroplasty are not durable [109]. The artificial anal sphincter has been abandoned due to high complication rates [195••]. A colostomy is the last resort for patients with FI [196].

Compliance with Ethical Standards

Conflict of Interest Dr. Bharucha has a patented anorectal manometry device with royalties paid to Medspira Inc, a patented anorectal catheter fixation clip pending to Medtronic, and a patented anal insert device for fecal incontinence pending to Minnesota Medical Technologies. The other authors declare that they have no competing interests.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subject performed by any of the authors.

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