Epidemiologic Trends and Diagnostic Evaluation of Fecal Incontinence

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Abstract: Fecal incontinence (FI) is a prevalent condition that occurs in up to 15% of the Western population and significantly impairs quality of life. The current understanding of the epidemiology of FI is shifting because of an increasing recognition of FI in men, better appreciation for the impact of changing obstetric practices on FI in women, and comprehension of the effect of modifiable risk factors on the development of FI over time. The pathophysiology of FI is complex and multifactorial, which necessitates the use of multiple diagnostic tests, including tests of anorectal sensorimotor function, peripheral nerve function, and anatomic structure. Translumbosacral anorectal magnetic stimulation is an emerging noninvasive diagnostic test for assessing lumbosacral neuropathy. This article is not intended as a comprehensive recitation of the literature, but rather focuses on recent developments in the understanding of the epidemiology of FI, as well as on the diagnostic evaluation of this condition. This article aims to increase awareness of FI and to outline an initial diagnostic approach to affected patients.

Fecal incontinence (FI) is the recurrent unintended passage of mucus and/or liquid or solid stool for at least 3 months.1 FI is present in 7% to 15% of the general Western population and is associated with a considerable impact on quality of life, which, in turn, is compounded by social stigma, leading to isolation and confinement to home.2 Anal incontinence is the involuntary passage of gas or flatus in addition to FI. Incontinence of gas may occur in healthy individuals and is, therefore, excluded from the definition of FI. In clinical practice, providers may consider querying male patients about gas incontinence, as they often experience concurrent FI, associated with an impaired anorectal sampling mechanism. Similar to urinary incontinence, FI can be subtyped into passive incontinence, urge incontinence, or both. Passive incontinence occurs when patients unknowingly have stool leakage during the day or, particularly, the night. Urge incontinence is associated with a

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strong urge to defecate with the inability to prevent leakage before reaching the toilet. FI also includes fecal seepage, the uncontrolled leakage of a small amount of stool after a normal bowel movement. Fecal seepage can also be associated with other conditions, such as poor hygiene, prolapsing hemorrhoids, or rectal prolapse.

The clinically significant threshold for frequency of FI episodes remains unclear. The most recent Rome criteria (Rome IV) suggest that FI should occur twice a month, compared to monthly in the Rome III criteria. In a recent Internet-based survey of approximately 6000 respondents in the United States, United Kingdom, and Canada, 16% reported FI. Of those, 70% had FI less than twice a month; nevertheless, these responders experienced a significant impairment on quality of life.

This article focuses on recent developments in the understanding of the epidemiology of FI, as well as on its diagnostic evaluation. In addition, the article aims to heighten awareness of this condition and present new diagnostic approaches. Readers seeking knowledge on the management and treatment of FI are referred to comprehensive summaries elsewhere in the literature.

Epidemiology and Predictive Factors

Age and Ethnicity
Increasing age is well established as the most common risk factor for FI, with prevalence rates exceeding 15% in adults older than 65 years. FI is especially prevalent among adults admitted to the hospital and residing in nursing homes, with estimated rates up to 33% and 70%, respectively. Due to mounting caregiver burden, FI is the second most frequent reason for referral to nursing home placement. FI results in increased need for the caregiver’s time, as well as in the health deterioration and emotional distress of the caregiver. In institutionalized individuals, FI is also strongly associated with the increased prevalence and severity of decubitus ulcers compared to urinary incontinence alone or combined urinary incontinence and FI. In the National Gastrointestinal Survey, which consisted of more than 70,000 Americans, 1 in 7 responders had experienced FI in the past. One in 20 responders reported FI episodes in the previous 7 days. Latino individuals were found to have the most severe and highest likelihood of FI among all ethnicities. Multiple other studies have demonstrated that African-American women have lower prevalence rates compared to their white counterparts.

Gender
Over the next 30 years, the prevalence of FI is estimated to increase by 60%, affecting up to 17 million American women. However, accounting for FI prevalence only in women may lead to gross underestimation. FI in men is often underappreciated by providers, underreported by patients, and understudied by investigators. Multiple large-scale epidemiologic studies have demonstrated similar prevalence rates of FI between men and women.

Men experience more frequent FI episodes than women, likely due to inexperience with routine use of protective measures such as pads or diapers. This compounds the effect on quality of life, leading to even greater impairment in activities of daily living. 

Shifts in obstetric practice have resulted in declining rates of cesarean sections, episiotomy, and instrument-assisted delivery techniques such as those involving a vacuum or forceps. These trends have correlated with a decline in the incidence of immediate postpartum FI from 13% to 8%. Approximately 80% of sphincter defects are not recognized as obstetric anal sphincter injury at the time of first delivery. The onset of FI related to anal sphincter injury experienced during childbirth may be more indolent. The median onset of FI in women is 55 years of age, frequently several decades removed from childbirth.

Eighteen percent of women with an external anal sphincter defect and 29% with an internal anal sphincter defect experience FI 15 to 24 years after first delivery. The prevalence of FI in women peaks in the fifth decade of life at 22% and remains stable into the ninth decade. These epidemiologic trends suggest a multiple-hit hypothesis for FI in women. Obstetric anal sphincter injury may serve as the initial hit, likely followed by the development of pelvic neuropathy over time.

Lifestyle Modifications
Most epidemiologic studies on FI sample a population of individuals at one point in time, which does not provide longitudinal insight into the association of lifestyle changes. Studying more than 55,000 female respondents to the prospective Nurses’ Health Study, investigators have examined the association of modifiable risk factors on FI over more than 20 years. Findings have suggested that hormone therapy is associated with an increased risk of FI, especially in postmenopausal women taking combined estrogen and progesterone therapy. An 18% decreased FI incidence in women consuming greater than
25 g of fiber per day was also observed. Furthermore, a prospective cohort of older women had a 25% lower risk of developing FI when engaged in physical activity of greater than 27 metabolic equivalents of task per week. Prior studies have shown mixed results in terms of the association of body mass index and FI. In the Nurses’ Health Study, the association of FI and body mass index attenuated after adjusting for confounders, particularly the amount of physical activity.

**Other Conditions**

Iatrogenic causes of FI include hemorrhoidectomy associated with internal anal sphincter injury, lateral anal sphincterotomy in the treatment of anal fissures, surgical management of anorectal fistulas, and anal dilation. FI is common in patients with ileoanal pouches, with prevalence rates up to 40%. Perineal trauma and pelvic fracture are also associated with FI through direct anal sphincter injury. Myopathies associated with FI include muscular dystrophy, myasthenia gravis, internal sphincter degeneration, and radiation exposure. Central neuropathies such as multiple sclerosis, dementia, stroke, brain tumors, and spinal cord lesions can also be associated with FI. High FI prevalence rates of up to 30% are seen in patients with multiple sclerosis. One-quarter of cystic fibrosis patients are estimated to have stress FI that occurs with coughing, sneezing, or laughing. Both diarrhea and constipation are associated with increased odds of FI, although FI with diarrhea is approximately 3 times more prevalent.

**Evaluation**

FI is a diagnosis that can be made on clinical history alone; however, patient-reported symptoms are a poor indicator of underlying pathophysiology. Digital rectal examination (DRE) is useful and should be performed in the clinical evaluation of anorectal disorders. DRE aids in the detection of anorectal incoordination or dyssynergic defecation as well as large rectoceles. Detection of a gaping anus at rest or a scar from prior surgery or obstetric trauma while straining during DRE indicates low resting anal sphincter pressure and diminished anal squeeze pressure, respectively. However, DRE itself is not well correlated with objective measures of resting anal sphincter tone or squeeze pressure. Therefore, in addition to DRE, anorectal physiologic testing is required for thorough evaluation of anorectal function and to guide clinical management beyond conservative therapy.
Tests of Sensorimotor Dysfunction

Anorectal manometry for FI should include concomitant rectal sensory and compliance testing. Thirty percent of FI cases can be attributed to delayed rectal sensation, or rectal hyposensitivity, which can be corrected with sensory retraining. The high-pressure zone of the anal canal comprises the puborectalis and the internal and external anal sphincters. Anorectal manometry studies have demonstrated that 60% of the resting anal tone is provided by the internal anal sphincter smooth muscle fibers and less than 30% is attributed to the striated external anal sphincter, which further decreases its contribution during sleep.

Low resting and maximum squeeze anal sphincter pressures can be seen in FI patients. Sustained squeeze pressure assesses the duration of squeeze and allows for evaluation of anal sphincter muscle fatigue (Figure 1). Although expensive, fragile, and requiring regular maintenance for reuse, high-resolution and high-definition anorectal manometry catheters have replaced conventional water-perfused, air-charged, or solid-state probes with unidirectional sensors in the last decade. High-resolution and high-definition anorectal manometry provide better spatial resolution of the anal sphincter pressure profile, eliminate the need for station pull-through limited by motion artifact, are much easier to calibrate, and are more accurate in detecting anal hypocontractility in FI compared to conventional probes. High-definition anorectal manometry with 3-dimensional reconstruction of the high-pressure zone via 256 circumferentially arranged sensors is also able to detect excessive perineal descent, rectal mucosal intussusception, rectoceles, and anal sphincter defects. In an attempt to address wide variability in anorectal manometry practice, the International Anorectal Physiology Working Group outlined a standardized protocol consisting of 3-minute stabilization after probe placement, a 60-second rest period, 3 5-second squeezes with 30-second intermittent recovery periods, a 30-second squeeze with 60-second recovery for FI, 2 coughs and 3 15-second pushes or bear downs with 30-second intermittent recovery periods, and finally rectal sensory testing and rectoanal inhibitory reflex assessment (Figure 2). It is estimated that the entire standardized protocol can be completed in 12 minutes, although this estimate seems to lack feasibility in clinical practice. The International Anorectal Physiology Working Group also outlines disorders of anal tone and contractility within the London classification (part II) to characterize high-resolution anorectal manometry findings of FI as major or minor disturbances (Figure 3). Further validation of these disorders is warranted prior to widespread adoption in clinical practice.

Use of emerging technologies such as functional luminal impedance topography (endoluminal functional lumen imaging probe [EndoFLIP, Medtronic]) and Fecobionics may provide additional insight into anorectal disorders. EndoFLIP is a catheter that includes a distensible bag without inherent resistance itself that measures the true distensibility of sphincteric regions throughout the gastrointestinal tract. This instrument may be useful in conditions associated with hypertensive anal sphincters, which are generally seen in constipation. Its utility in FI.

Figure 2. The International Anorectal Physiology Working Group standardized protocol for anorectal manometry evaluation in the assessment of anorectal disorders. RAIR, rectoanal inhibitory reflex.
remains to be demonstrated. Fecobionics is simulated artificial stool (10 cm in length and 12 mm in width) that is aided by impedance to provide more physiologic information, such as axial pressure signatures, anorectal angle, and geometric mapping during defecation. This technology may also be useful in providing mechanistic understanding of anorectal incoordination or dyssynergic defecation in constipated patients.

**Tests for Peripheral Neuropathy**

Peripheral spinoanal and rectal neuropathy has been demonstrated by novel brain-gut testing to play a major role in the pathophysiology of FI when compared to healthy controls. The spinoanal reflex arc can be assessed by eliciting the anocutaneous reflex during physical examination. To evoke the anocutaneous reflex, the examiner uses a cotton swab to centripetally and gently stroke the perianal region in all 4 quadrants, eliciting a brisk contraction of the perianal skin and underlying external anal sphincter. The spinoanal reflex can also be assessed during high-resolution anorectal manometry, when patients cough or blow air into a party balloon to elicit an increase in intra-abdominal pressure, in response to which the external anal sphincter should simultaneously contract. A central neurologic lesion above the cauda equina is suspected when the reflex is present but patients lack the ability to generate any significant voluntary anal squeeze pressure, whereas peripheral neuropathy below the cauda equina may be present if the reflex is absent.

Anal electromyography and pudendal nerve terminal motor latency testing can assess nerve function between the terminal portion of the pudendal nerve and the anal sphincter. However, these tests carry significant limitations. The American Gastroenterological Association technical review determined that pudendal nerve terminal motor latency testing cannot be recommended for patients with FI due to poor correlation with clinical symptoms and histologic findings, poor sensitivity and specificity, operator dependence, and inability to predict surgical outcome. Alternatively, newly developed trans-lumbosacral anorectal magnetic stimulation (TAMS) is a safe and well-tolerated method to more accurately assess nerve function in FI (Figure 4). By using a magnetic coil to stimulate the bilateral plexi at L2 to L3 (lumbar) and S2 to S3 (sacral) regions with single pulses, motor-evoked potentials can be recorded with a specially designed electromyography probe in the anorectum. In a prospective observational study of 30 FI patients and 20 healthy controls, TAMS was superior to pudendal nerve terminal motor latency, with a significantly higher yield of neuropathy (87% vs 63%) and 63% positive agreement. TAMS studies of an FI patient and a healthy individual are shown in Figure 4.

**Tests of Anatomic Defects**

Anal ultrasound or endosonography can closely examine anal sphincter morphology in the hands of experienced operators. Pathology such as scars, thinning or
hypertrophy of anal sphincters, and sphincter defects, and prior surgical interventions such as episiotomy and anal sphincteroplasty can be observed (Figure 5). 69,72 High-frequency ultrasound probes have dramatically improved resolution of obtained images. 73 Examination of internal and external anal sphincters by 2-dimensional anal ultrasound results in good interobserver agreement for sphincter defects (κ=0.8). 74 Anal sphincter and defect volumes can be measured by 3-dimensional anal endosonography. Although further studies are needed to investigate clinical utility of 3-dimensional anal endosonography, 2-dimensional anal ultrasound is widely used in clinical practice to evaluate anal sphincter morphology with normative data in the absence of sphincteroplasty. Using a specifically designed endoanal coil, endoanal magnetic resonance imaging can precisely measure anal sphincter morphology, and this technology has led to recognition of external sphincter atrophy as a contributor to FI. 73 Expense and availability of endoanal magnetic resonance imaging remain a major limitation for widespread adoption.

**Conclusion**

FI is a common problem that significantly impacts quality of life. Health care providers should strongly consider screening for this condition in both male and female patients over 55 years of age. FI in men is underreported and grossly underestimated. FI episodes occurring less frequently than in the diagnostic Rome IV criteria may still have a significant impact on quality of life.
Modifiable risk factors should be identified, and, when possible, changes in hormonal therapy, increased fiber intake, and regular exercise should be encouraged. A recently validated FI stool application could improve diagnosis and disease monitoring. DRE should be performed in the evaluation of FI to assess for coexisting dys-synergic defecation, large rectoceles, gaping anus, or prior surgeries. Further diagnostic evaluation assessing anorectal sensorimotor function, nerve function, and anatomy aids in the understanding of multifactorial pathologic insults in FI and can be used to guide management. TAMS, an emerging diagnostic test for anorectal neuropathy, should be considered in the evaluation of FI.

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References

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