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ORIGINAL ARTICLE

Clinical and physiological risk factors for fecal incontinence in chronically constipated women

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Abstract

Background Fecal incontinence (FI) and chronic constipation (CC) are disabling symptoms that cause a significant public health problem. The pathophysiology of combined constipation and FI is not fully understood. Our aim was to delineate the clinical, physiological and anatomical factors that may contribute to the association of FI and CC.

Methods A retrospective study was performed in a pelvic floor unit in a tertiary medical center. Consecutive female patients diagnosed with CC were included, and further divided into two groups according to the co-occurrence of FI. Demographic characteristics, anorectal physiology (obtained by manometry) and pelvic anatomical pathology (as assessed by dynamic pelvic ultrasound) were recorded and subsequently compared.

Results A total of 267 women were included in the study. Of those, 62 patients (23%) had an associated FI (CCFI). The CCFI group had higher body mass index (BMI) levels and a trend toward younger average age as compared to the group without FI (CCNFI). The number of vaginal and instrumental deliveries was similar in both groups. Anal resting and squeeze pressures were significantly lower in the CCFI group (64 ± 21 vs 48 ± 18, $p = 0.004$ and 141 ± 136.2 vs. 97.5 ± 38.6, $p = 0.02$, respectively). Rectal sensation abnormalities were common, but did not differ between both groups. Dyssynergic defecation and rectocele were more common in the CCNFI group (68% vs. 51%, $p = 0.04$ and 39% vs. 24%, $p = 0/045$, respectively.

Conclusions Lower anal pressures and higher BMI were found among women with coexisting FI and CC. Pelvic floor anatomical and functional abnormalities are common in women diagnosed with CC and FI, but dyssynergia and diagnosis of significant rectocele, which cause obstructed defecation, were more common in the CCNFI group.

Keywords Fecal incontinence · Constipation · Pelvic organ prolapse · Manometry

Introduction

Fecal incontinence (FI), defined as the involuntary loss of solid or liquid feces, reflects the final common pathway of a multitude of etiological factors, with a reported prevalence of 1.6–15% [1, 2]. FI has a major negative impact on quality of life and daily activities [3], and is often accompanied by severe social restriction [4].

The cause of FI among women in whom the symptom cannot be attributed to an underlying organic disorder (e.g. inflammatory bowel disease) is not completely clear [5]. Although anal sphincter injury, mainly due to obstetric trauma, has been reported to be a major cause of FI [6], nearly 70% of women diagnosed with FI report onset after the age of 40 [1]. In a case–control study of risk factors for FI among a community sample of women from Olmsted County, MN, USA, bowel disturbances rather than prior obstetric injury were found to be the main risk factors for FI [7]. A cross sectional survey that examined the relationship between chronic constipation (CC) and FI in participants recruited in an outpatient gynecologic clinic found that constipated women were more likely to have FI than non-constipated women [8].

Data regarding the association of CC and FI is limited, and even less is known about the physiological and anatomical determinants that may define this relation. Therefore, our aim was to find risk factors for FI within a population that have CC, by delineating the clinical, physiological and anatomical factors that may contribute to this risk.

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Materials and methods

Patients

Data were collected retrospectively from medical records of female patients, age range 18–70 years, who were referred to our clinic for the evaluation of chronic constipation from 2012 to 2017. As part of their evaluation, all patients filled out a comprehensive clinical questionnaire targeted to the diagnosis and assessment of the severity of CC, FI and irritable bowel syndrome (IBS). We used the Rome III questionnaire to evaluate CC [10], the Cleveland Constipation Severity Index (SCCI) scoring system for the assessment of severity of constipation [10], and the Wexner scoring system for FI [11]. We included patients with both urge and passive FI in the study cohort. All patients had trans rectal ultrasound, dynamic perineal ultrasonography (DT-PUS) and high-resolution anorectal manometry as part of their medical evaluation.

The study was approved by the Ethical Review Board of Chaim Sheba Medical Center.

Clinical parameters and definitions

CC was defined as the presence of two of three symptoms from straining, hard stools, unproductive call, less than three stools per week, or incomplete evacuation 25% of the time. To count as CC the duration of symptoms was required to be for at least 3 months since onset and beginning at least 6 months prior to diagnosis [9]. FI was defined as recurrent episodes of uncontrolled passage of fecal material for at least 3 months [9]. FI severity was determined based on the Wexner score [11]. To include only patients with significant symptoms, we restricted the FI group to patients who had at least solid or liquid FI more than once a month.

The clinical patterns of FI have been classified clinically into three specific types: urge incontinence, defined as the unwanted loss of stool despite active attempts to inhibit defecation; passive incontinence, defined as unwanted loss of stool without patient awareness; or a combination of urge and passive incontinence [12].

Transrectal ultrasound and dynamic transperineal ultrasound (DTP-US)

The examination was performed with a transrectal ultrasound using a 360° endoanal probe with three-dimensional (3-D) anorectal reconstruction (BK Ultrasound, Peabody, MA, USA). The integrity of the puborectalis muscle was measured in the upper anal canal, and for both external and internal anal sphincter muscles in the mid anal canal. DTP-US was previously described by our group [13] and was conducted using a curvilinear 5–8 MHz probe (BK Ultrasound, Peabody, MA, USA). Enterocele was defined as a herniation of the abdominal contents developed anteriorly to the anorectal junction and extended into the vagina through the pouch of Douglas. Rectocele was diagnosed by an anterior bulging of the rectum into the posterior vaginal wall. We included only significant rectoceles with a depth of at least 2 cm or more. Intussusception was defined as folding of the rectum into either the rectum (recto-rectal), in contact with the anus (recto-anal) or penetrating into the anal canal (intra-anal). Pelvic floor dyssynergia was defined as a closure or non-opening of the posterior anorectal angle during strain. Perineal descent was defined as a pelvic floor descent greater than 2 cm.

High-resolution anorectal manometry

Anal pressures were assessed by a water perfusion system (Laborie, Medical Measurement Systems, Enschede, The Netherlands), using an eight channel catheter. Each study included an assessment of anorectal pressures at rest, during squeeze (three attempts), and in simulated evacuation with a 50 ml filled rectal balloon. The rectoanal inhibitory reflex and rectal sensation were evaluated by progressively distending the rectal balloon until patients reported severe urgency. The data were analyzed as described before [14].

Outcomes

Clinical, physiological and pelvic floor anatomical characteristics of FI among women with CC.

Statistical analysis

Descriptive statistics are presented as means ± standard deviations for continuous variables and percentages for categorical variables. Variables were checked for normality of distribution with differences between the FI and the non FI groups being determined for normal distributions by the Students *t* test or for non-normal data by the Mann–Whitney *U* test. The analysis was performed using IBM SPSS statistical software (version 20.0; Armonk, NY, USA). p values < 0.05 were reported as significant.

Results

The study cohort included 267 female patients. Sixty-two patients (23%) had a co-occurrence of CC and FI (CCFI) and 205 patients had CC but not FI (CCNFI).

There was a trend toward older average age among the CCNFI group as compared to the CCFI group

(55 ± 13.6 years vs 50 ± 18.3 years, $p = 0.07$). BMI was significantly higher in the CCFI group in comparison to the CCNFI group. (28.1 ± 1.3 kg/m^2 vs. 24.4 ± 4.5 kg/m^2, $p = 0.006$).

The number of vaginal, instrumental assisted deliveries and cesarean sections was similar in both groups. Symptoms of straining and incomplete evacuation were more common in the CCNFI group. The demographic and clinical data is summarized in Table 1.

Anal resting and squeeze pressures were significantly higher in the CCNFI group (64 ± 21 mmHg vs 48 ± 18 mmHg, $p = 0.004$ and 141 ± 136.2 mmHg vs. 97.5 ± 38.6 mmHg, $p = 0.02$, respectively). Anorectal sensory threshold abnormalities were similarly frequent in both study groups. Dyssynergic defecation was significantly more common in the CCNFI group (68% vs. 51%, $p = 0.04$). Table 2 summarizes the anorectal manometric findings in both groups.

Urge FI (CCFIU) was reported by 48 patients (77%) and mixed urge and passive FI in 14 patients (CCFIM) (23%). Resting and squeeze anal pressures were higher in the CCNFI when compared to each FI subgroup. Lower rectal capacity was found to be significantly lower in the CCNFI group as compared to CCFI and the urge CCFI subgroup. Dyssynergic defecation was more common in the CCNFI group when compared to each FI subgroup.

Pelvic floor anatomical pathologies were common in both groups (58% in the CCNFI vs. 50% in the CCFI group). Diagnosis of a rectocele was more common in the CCNFI group in comparison to the CCFI and CCFI (M) subgroup, but not to the CCFI (U) group. The prevalence of other pelvic floor pathologies such as enterocele, intussusception, pelvic floor descent and rectal prolapse was similar in both groups. Table 3 summarizes the prevalence of pelvic floor pathologies in the study population.

External anal sphincter (EAS) tears were similarly demonstrated in the CCNFI and CCFI groups (3% vs. 2%,

Table 1 Demographic and clinical characteristics of the study population

Parameter	CCNFI	CCFI	OR	*p* value
Age (years)	55 ± 13.6	50 ± 18.3		0.07
BMI (kg/m^2)	24.4 ± 4.5	28.1 ± 1.3		0.006
Vaginal deliveries	2.1 ± 1.9	1.8 ± 1.7		0.32
Assisted deliveries	0.6 ± 0.9	0.45 ± 0.8		0.29
Caesarian sections	0.3 ± 0.2	0.28 ± 0.2		0.85
Symptoms				
Straining	81%	58%	3.15 (1.7–5.8)	0.002
Incomplete evacuation	82%	64%	2.63 (1.45–4.7)	0.0018
Manual evacuation	40%	50%	0.67 (0.4–1.12)	0.35
Unsuccessful evacuation	67%	56%	1.56 (0.9–2/8)	0.11
Pain on defecation	40%	33%	1.35 (0.7–0.4)	0.47

CCNFI chronic constipation without fecal incontinence, *CCFI* chronic constipation with fecal incontinence, *OR* odds ratio, *BMI* body mass index

Table 2 Physiological (manometric) anorectal measurements in the study group

	CCNFI	CCFI	p(CCNFI vs CCFI)	CCFI (U)	p(CCNFI vs CCFI(U))	CCFI (M)	p(CCNFI vs CCFI(M))	p(CCFI(U) vs CCFI(U + P))
Resting pressure (mmHg)[a]	64.5 ± 21.8	48 ± 18	< 0.001	48 ± 17.8	< 0.001	49.25 ± 21	0.015	0.8
Squeeze pressure (mmHg)[a]	141 ± 136.2	97.5 ± 38.6	0.02	98.5 ± 39.9	0.02	94.4 ± 34.8	0.03	0.72
First sensation (ml)[a]	38.9 ± 29	41.8 ± 30.6	0.4	39.1 ± 23	0.88	50.7 ± 47.2	0.15	0.21
DTD[a]	117 ± 52	107 ± 32	0.24	105 ± 39.9	0.115	114 ± 59.6	0.9	0.5
Rectal capacity(ml)	162 ± 67.9	140.9 ± 52.3	0.04	139.7 ± 49.8	0.05	142.8 ± 66.2	0.14	0.67
Dyssynergia	68%	51%	0.04	52%	0.03	64%	0.88	0.61

CCNFI chronic constipation without fecal incontinence, *CCFI* chronic constipation with fecal incontinence, *CCFIU* chronic constipation with urge fecal incontinence, *CCFI(M)* chronic constipation with mixed urge and passive fecal incontinence, *DTD* desire to defecate

[a]Data given as mean ± SD

Table 3 Prevalence of pelvic floor pathologies in the study population

	CCNFI (%)	CCFI (%)	p(CCNFI vs CCFI)	CCFI (U) (%)	p(CCNFI vs CCFI(U))	CCFI (M) (%)	p(CCNFI vs CCFI(M))
Rectocele	39	24	0.045	29	0.33	7	0.02
Enterocele	14	11	0.67	16	0.5	7	0.9
Rectal prolapse	5	9	0.33	10	0.31	7	0.75
Intussusception	7	8	0.8	8	0.32	7	0.9
Any POP	58	50	0.55	54	0.8	42	0.45

CCNFI chronic constipation without fecal incontinence, *CCFI* chronic constipation with fecal incontinence, *CCFIU* chronic constipation with urge fecal incontinence, *CCFI(M)* chronic constipation with mixed urge and passive fecal incontinence, *POP* pelvic organ prolapse

$p=0.45$). Internal anal sphincter (IAS) tears were more common in the CCNFI group, however, the difference did not reach statistical significance (4% vs. 9%, $p=0.3$).

Discussion

To the best of our knowledge, this study is unique, as it comprehensively assessed symptoms along with anorectal and pelvic floor structure and function among women with CC and FI. Our main findings are that the CCFI group had higher mean BMI and lower anal pressures. Anorectal dyssynergy and rectocele were more common in the CCNFI group. Rectal sensation abnormalities were common and similar in both study groups.

In our study cohort, the prevalence of FI in women with CC was 23%. Although the prevalence of CC and FI in the general adult population is unknown, co-occurrence of CC and FI has been previously described. A questionnaire survey conducted in 835 patients in gastroenterology and gynecological clinics found that 29% of patients with FI reported having constipation, as compared to only 10% of non-incontinent patients [15]. More recently, a cross sectional survey preformed among 2319 women found that 43% of the incontinent women had coexisting constipation [8]. In another study, the prevalence of CC in FI patients was found to be 16% [16].

Higher BMI values and a trend toward younger average age were found to be more common in the CCFI group. The occurrence of FI in obese cohort was reported to be as high as 60% [17, 18], and can be explained by higher rate of pelvic organ prolapse [19] and abnormal stool consistency [20].

Symptoms attributed to CC were common in both study groups. Although straining and sensation of incomplete evacuation were more common in the CCNFI, manual evacuation and unsuccessful evacuation were similarly prevalent in both groups. Correspondingly, the sense of incomplete evacuation has been considered as a risk factor for FI in a few studies [21, 22]. Other constipation-related symptoms reported in women with FI are straining [23], sense of incomplete emptying [21] and digitation [24].

Interestingly, the above symptoms can be related to pelvic dysfunction [25]. This pathology, a common cause of CC, may be caused by either an anatomical obstruction at the anorectal junction (such as rectocele and intussusception) or a non-relaxing pelvic floor during defecation. Both causes were common in our study population. A potential link between defecatory disorders and the development of FI in women with pelvic floor disorders can be explained by a few mechanisms. Dyssynergic defecation occurs when the pelvic muscles contract during attempted defecation, and can result in incomplete evacuation. Subsequently, FI may result from overflow secondary to post-defecation residual stool [26]. Another possible explanation could be the lack of propulsive forces that may cause recurrent episodes of rectal distention, triggering traction induced rectal denervation and inadequate sphincter contraction, thus allowing the leakage of fecal material [27].

Correspondingly, the discordance between the rather low rate of sphincter tears and the high prevalence of abnormal anal pressures observed in the CCFI group may be explained by damage to the pelvic nerves due to rectal distension secondary to pelvic outlet obstruction, caused by anorectal dyssynergy or mechanical obstruction.

Mechanical causes for obstructive defecation may cause impaired rectal emptying, resulting in FI. Recurrent straining against defecatory outlet obstruction causes progressive pelvic organ prolapse and impairs pelvic floor muscle tone until it disappears completely. Excessive abdominal straining at stool evacuation, caused by pelvic floor prolapse, dyssynergia and rectal hyposensitivity, can cause progressive perineal descent and damage to the pelvic fascia and pelvic muscles [28].

The presence of rectocele in a cohort of women with CC has been found to be a strong independent risk factor for the occurrence of FI [7]. Moreover, surgical corrections of intussusception and rectocele have been shown to improve FI [29, 30]. Pelvic descent has been correlated to FI [31]. In our study population, pelvic floor pathologies

were common in both study groups. Any pelvic floor prolapse was found in more than 50%, with rectocele, enterocele and pelvic decent being the most common findings. However, the occurrence of pelvic floor pathology did not differ between groups, and only rectocele was found to be more common in the CCNFI group. This could be related to the common pathogenesis of CC in both study groups.

We found that rectal perception and sensation abnormalities were heterogeneous but very common in our study population. Rectal hyposensitivity can be related to denervation secondary to rectal distention in patients with pelvic floor dysfunction [27], or to pelvic floor nerve injury due to previous obstetric trauma [32], and patients with rectal hyposensitivity have most commonly constipation, but also constipation and incontinence, or fecal incontinence [28].

On the other hand, rectal hypersensitivity is usually related to sensation of urgency and it is associated with reduced rectal capacity [33]. In patients without previous rectal disease (e.g. inflammatory bowel disease or irradiation), rectal hypersensitivity usually reflects an impairment of neurological control and not a deficiency in the viscoelastic properties of the rectal wall [34]. Rectal hypervigilance may be defined as a sensation of discomfort reported at significantly lower distending pressures, which may be an anticipation response rather than a sensory perception. This phenomenon may hypothetically be caused by a state of rectal conditioning to low volumes due to anticipation of the occurrence of fecal spillage. Another possible explanation may be a co-occurrence of IBS [35].

Urge FI was the most common FI subtype in our study population, followed by mixed type of FI. Urge FI is related to significantly lower maximum voluntary contraction pressure, low maximal tolerated volume and impaired rectal compliance [36]. Passive FI is related to impaired function of the IAS that may be secondary to traumatic lesions and/or atrophy [37]. Anorectal manometry can reveal low resting anal pressure or rectal hyposensitivity with high rectal sensations. Although there were differences in both resting and squeeze pressures between the urge and the mixed FI subgroups, the main clinical relevant variances were the higher prevalence of dyssynergia in the mixed group and the higher rates of rectocele diagnosis in the urge FI group. As both finding can cause pathological defecatory obstruction, they may share a common pathway leading from obstructed defecation to FI, impairing pelvic floor structure, causing hypotonia and pudendal neuropathy.

Our study has limitations. Selection bias is possible due to the retrospective design of the study and also because the study population consisted of patients who were referred for evaluation to a tertiary center.

Conclusions

We found a high prevalence of FI among women presenting with chronic constipation. We found that anal resting and squeeze pressures were lower in women with FI, and that dyssynergic defecation and the diagnosis of a rectocele were more common in the CCNFI group. Other anorectal and pelvic physiological and anatomical parameters were not correlated to FI. Further studies focusing on the pathophysiology of FI in women with CC are warranted.

Author contributions DC: Protocol, study design, data acquisition, statistics, writing of the manuscript. EB: data acquisition, review of the manuscript. CMR: data acquisition, review of the manuscript.

Compliance with ethical standards

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

Ethical approval The study was approved by the Sheba medical center institutional ethics review board.

Informed consent For this type of study informed consent is not required.

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