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ORIGINAL ARTICLE

Does flatus incontinence matter?

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Abstract

Introduction and hypothesis This study aimed to determine whether incontinence to flatus is associated with women's bother in a symptomatic population and with sonographically diagnosed external anal sphincter (EAS) trauma.

Methods This is a retrospective study of women attending a tertiary urogynecological unit between May 2013 and November 2015. Baseline evaluation included a standardized interview with St. Mark's Incontinence Score (SMIS) and visual analog scale (VAS) assessment for bother, as well as a physical examination and translabial pelvic floor ultrasound. At least one volume obtained covered the entire length of the EAS. These volumes were analyzed with the reviewer blinded to all clinical data.

Results During the inclusion period, 1104 patients visited the unit. Fifty-three patients were excluded from the study for missing data, leaving 1051 for final analysis. Mean age was 57 years (56–58) and mean body mass index (BMI) 29.1 kg/m^2 (28.8–29.6). The prevalence of any anal incontinence (AI) and flatus incontinence were 16.4% (172/1051) and 13.9% (146/1051), respectively. In the group of patients with AI, mean SMIS was 11.8 (11.0–12.6), and mean VAS for AI bother was 5.4 (5.0–5.9). Significant EAS trauma was detected in 9.8% (103/1051) of patients and was associated with flatus incontinence ($p = 0.002$). Including a flatus incontinence question in the SMIS questionnaire improved the prediction of patient bother from AI (R^2 87.8% versus R^2 86.3%, $p = 0.04$).

Conclusions Flatus incontinence is associated with ultrasound findings of EAS trauma and with higher patient bother from AI.

Keywords Bother · Exoanal ultrasound · Flatus incontinence · Obstetric anal sphincter trauma · St. Mark's incontinence score · Visual analogue scale

Introduction

Self-reported symptoms are important in the assessment of pelvic floor dysfunction and in assessing quality of life (QoL). Anal incontinence (AI) is the involuntary loss of flatus, mucus, or liquid or solid stool [1]. Flatus is the most common type of accidental bowel leakage in women, with an estimated prevalence of between 25% to >50% [2, 3]. However, this symptom is often overlooked by physicians, as expressed by the commonly used definition fecal incontinence, in which flatus is disregarded [4, 5]. The impact of flatus incontinence on women's QoL is unclear [2, 6–8].

Several scoring systems have been proposed to assess the severity of AI and its impact on QoL. The St. Mark's incontinence score (SMIS) is one of those validated tools [9]. It consists of seven questions with a total score ranging from zero (total continence) to 24 (complete incontinence), and it was shown to have the highest correlation with physicians' clinical impression of AI severity [9, 10]. Moreover, the SMIS correlates with the QoL and bother of AI in women with obstetric anal sphincter injury (OASI) [11, 12].

Since the introduction of anal sonography, it has been established that anal sphincter defects are a major etiological factor for AI and is a common finding in symptomatic women [13–15]. Recent studies using exoanal sonography have shown that defects of the external anal sphincter (EAS) are associated with a twofold increased risk and defects of both EAS and internal anal sphincter (IAS), with a fourfold increased risk of AI [4]. IAS injury seems relatively less

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important [4, 16]. The role of avulsion and ballooning of the levator ani in AI is controversial [17, 18].

The aim of this study was to determine correlations between women with AI bother and SMIS with and without the flatus incontinence component to establish whether this item improves SMIS performance. Furthermore, the correlation between flatus incontinence and sonographic EAS trauma was investigated.

Materials and methods

This was a retrospective cohort study of 1104 women attending a tertiary urogynecological unit between May 2013 and November 2015, which was approved by the local Human Research Ethics Committee (NBMLHD HREC 13/70). Baseline assessment consisted of three steps: (1) a standardized physician-directed interview for pelvic floor dysfunction using the SMIS [9] and bother assessment using a visual analog scale (VAS) [12], (2) a standard physical examination using the International Continence Society Pelvic Organ Prolapse Quantification (ICS POP-Q) scoring system [19], and (3) 4D translabial pelvic floor ultrasound (TLUS) using a GE Voluson 730 Expert system with 4- to 8-MHz curved-array volume transducer. Scans were performed with patients in the supine position after voiding, at rest, on pelvic floor contraction, and on Valsalva maneuver. At least one registered volume contained the entire length of the EAS [20]. Images were later analyzed by postprocessing on a desktop personal computer using the proprietary software GE Kretz 4D View version 10.0 (GE Medical Ultrasound Kretz GmbH, Zipf, Austria) by a reviewer blinded to all clinical data. A test–retest series of 20 ultrasound volume data sets was performed by LC and MG to determine interobserver agreement in detecting EAS abnormalities and defects (Cohen's kappa 0.71). Tomographic ultrasound imaging (TUI) was used to evaluate the EAS, as previously described (Fig. 1) [20]. A significant defect was diagnosed if the EAS circumference measured ≥30° in at least four of six slices [14, 21]. TUI was also used to determine the integrity of the levator ani muscle, as previously described [22]. The area of the levator hiatus was measured on Valsalva, and overdistension (or ballooning) was defined as ≥25 cm^2 [23]. Symptoms, demographic data, and obstetric variables were collected from participants' files, and potential predictors of sphincter injury were analyzed: current age, body mass index (BMI), delivery mode, neonatal weight and age at first delivery.

Statistical analysis

Statistical analysis was performed using SAS V9.2 (Cary CR: SAS Institute Inc., Cary, NC, USA) for Windows. Normality of data was assessed using the Kolmogorov–Smirnov method. Normally and nonnormally distributed continuous data are expressed as means and standard deviations (SD) or medians and interquartile ranges (IQR), respectively. Statistical analysis was performed using a logistic regression for binary endpoints and linear regression for continuous variables. A backward elimination strategy was applied to evaluate the association between flatus incontinence, total SMIS score, and AI bother. A $p < 0.05$ was considered statistically significant. Power calculations were not performed, as this was a retrospective study. Our null hypotheses were defined as follows: (1) incontinence to flatus is not associated with AI bother in a symptomatic population, (2) incontinence to flatus is not associated with sonographically diagnosed EAS trauma, and (3) exclusion of flatus incontinence does not affect the predictive ability of the SMIS for such trauma.

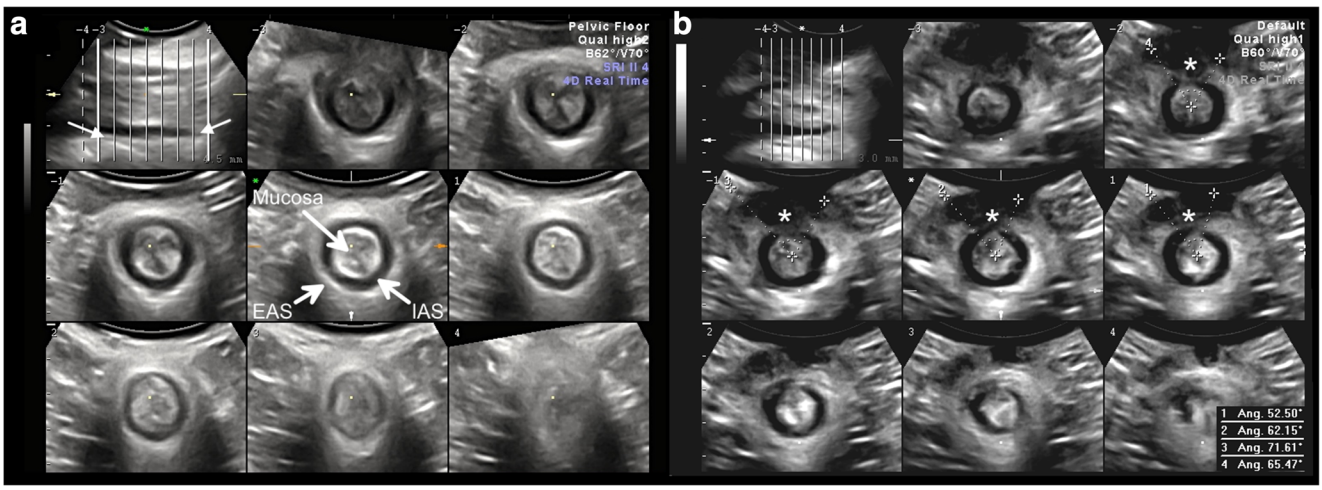

Fig. 1 Coronal plane tomographic imaging of the anal sphincter using translabial ultrasound. Normal anal sphincter in asymptomatic woman (**a**) and residual sphincter defect in patient with flatus incontinence (**b**). The *top left slice* in both images demonstrate the midsagittal plane, and the *white arrows* depict the cranial (left) and caudal (right) ends of the EAS. Defect angle measurements are marked with *dotted lines*, with values shown in the *right bottom part* of the figure. *IAS* internal anal sphincter, *EAS* external anal sphincter)

Results

During the study period, 1104 patients visited our unit. Among them, 44 were excluded for missing SMIS or VAS of AI bother data, and nine patients were excluded due to suboptimal quality of ultrasound volume data sets. All results pertain to the remaining 1051 patients (95.2%), whose demographic data are shown in Table 1. The presenting symptoms were stress urinary incontinence (SUI) in 72.4% (761/1051), urge urinary incontinence (UUI) in 73.2% (769/1051), and pelvic organ prolapse (POP) in 54.2% (570/1051). Prevalence of AI and of incontinence to flatus were 16.4% (172/1051) and 13.9% (146/1051), respectively.

Postprocessing of TLUS volumes demonstrated the prevalence of any EAS abnormality (that is, any positive slice on tomographic imaging) to be 31.8% (334/1051), while a significant EAS defect was detected in 9.8% of patients (103/1051) (Table 2). Both findings were associated with AI ($p < 0.001$ and $p < 0.001$, respectively) and with flatus incontinence ($p = 0.003$ and $p = 0.002$, respectively). Furthermore, significant EAS defects were associated with higher SMIS ($p = 0.01$) and with worse VAS bother of AI ($p < 0.001$). In addition, we found a levator ani avulsion in 25.6% of all study patients (269/1051): 32.6% (56/172) of patients with AI vs. 24.2% (213/879) in anally continent patients ($p = 0.03$) (Table 2). We also found ballooning of the hiatus in 59.9% (629/1051) of patients: 67.4% (116/172) in those with AI vs. 58.4% (513/879) in continent patients ($p = 0.03$). In the group of patients with AI, the mean SMIS was 11.8 (11.0–12.6), and mean VAS for AI bother was 5.4 (5.0–5.9). In women with AI and flatus incontinence, mean VAS bother for AI was 5.6 (5.0–6.1) vs. 4.4 (3.2–5.6) in patients without flatus incontinence ($p = 0.07$).

To assess the predictive value of flatus incontinence, we applied a backward elimination strategy of SMIS items. SMIS including the flatus component gave an R^2 of 87.8% for predicting patient bother, while omitting the flatus incontinence question gave an R^2 of 86.3% for bother prediction ($p = 0.04$ for the difference). Furthermore, incontinence to flatus was significantly associated both with any sonographically detected EAS abnormalities [odds ratio (OR) 1.72, CI 1.20–2.46, $p = 0.003$)] and significant residual EAS defects (OR 2.19, CI 1.34–3.57, $p = 0.002$). Hence, all three null hypotheses were disproven.

Table 1 Characteristics of the study population

Demographic variables	Values
Current age in years	57 (56–58)
Current BMI in kg/m^2	29.2 (28.8–29.6)
Postmenopausal state	67.0% (704/1051)
Current systemic hormone replacement	10.4% (73/704)
Obstetric variables	
Vaginally parous	91.7% (964/1051)
Only caesarian section	3.1% (33/1051)
Nulliparous	5.1% (54/1051)
Vaginal parity	2 [0–9]
Age at 1st birth in years	24.1 (23.8–24.4)
Infant birth weight in grams	3365 (3329–3400)
Forceps extraction	25.6% (269/1051)
Vacuum extraction	3.1% (33/1051)
Symptoms of pelvic floor dysfunction	
Urinary incontinence	
Stress	72.4% (761/1051)
Urge	73.2% (769/1051)
Pelvic organ prolapse	54.2% (570/1051)
Anal incontinence	16.4% (172/1051)
Solid fecal	11.7% (123/1051)
Liquid fecal	14.1% (148/1051)
Flatus	13.9% (146/1051)
Fecal urgency	10.7% (112/1051)
Obstructed defecation	58.6% (616/1051)

Data presented as mean (95% CI) and prevalence as % (ratio) or median [IQR]

CI confidence interval, *IQR* interquartile range, *BMI* body mass index

Discussion

Flatus incontinence is a common symptom among women with pelvic floor dysfunction [2, 3]. Despite its high prevalence, women underreport it and physicians do not routinely address it [3]. It is sometimes considered irrelevant or of no pathophysiological significance, since flatus is clearly a universal phenomenon [16]. We believe that a better understanding of this symptom and its impact on patient bother might improve clinical care in affected patients.

In this retrospective study, we investigated the predictive role of the flatus incontinence component of the SMIS for patient bother and found that it is bothersome for women, independently of other anorectal symptoms. Women with pelvic floor dysfunction reported worse AI bother if they were also incontinent to flatus. In our population, the prevalence of flatus incontinence was 13.9%, consistent with previous studies in urogynecologic patients (7.7–22.9%) [24–26]. This symptom was significantly associated with sonographically diagnosed defects of the EAS. All three null hypotheses were disproven. We conclude that the symptom of flatus incontinence is common, associated with sphincter trauma, and conveys an independent burden for patients. In short, it matters to patients, and it should matter to us. Its inclusion in the SMIS is justified.

The study has some limitations. First, it was a retrospective analysis of a data set of a urogynecological cohort of patients consulting for pelvic floor dysfunction. Most of them were menopausal and Caucasian. Those demographic limitations must be taken into account in that our results might not be

Table 2 Ultrasound findings and their association with anal incontinence

Ultrasound findings	Prevalence	*P* value
EAS abnormality	31.8% (334/1051)	<0.001
EAS defect (≥4 TUI slices with EAS abnormality)	9.8% (103/1051)	< 0.001
Any LAM defect	25.5% (268/1051)	0.03
Bilateral	10.0% (105/1051)	
Hiatal area on Valsalva (cm^2)	27.4 [21.6–34.5]	0.03

Data presented as prevalence % (ratio) or median [IQR]

EAS external anal sphincter, *TUI* tomographic ultrasound imaging, *LAM* levator ani muscle, *IQR* interquartile range

applicable to any other female population. Furthermore, the prevalence of AI in our population was low (16.4%), which resulted in limited power regarding characteristics of AI. We expected this prevalence to be lower than in a colorectal service but higher than in the general female population due to overlapping risk factors in symptomatic patients. In addition, it has to be acknowledged that AI, while clearly associated with OASI, has multiple other etiological contributors, such as diabetes, neuropathic conditions, and chronic bowel conditions, the prevalence of which will vary from one population to the next. We have not been able to control for such confounding factors, which evidently is a weakness of this study.

Nevertheless, we think our study design has some strengths. First, we collected data using standardized validated tools to assess AI (SMIS and bother in women with pelvic floor dysfunction) [9, 12]. Second, the study included a large sample of patients who all underwent sonographic assessment of the anal sphincter, so that anal symptoms could be examined in relation to ultrasound findings of anal sphincter integrity. To our knowledge, this is the first study attempting to demonstrate an association between the symptom of flatus incontinence and anal sphincter defects detected by exoanal ultrasound. Furthermore, we show that women with even minor sphincter abnormality (of less than two thirds of the anal sphincter length) are also more likely to be incontinent to flatus. This is a novel finding, which contrasts with the two thirds rule for diagnosing significant sphincter defect [9, 12]. Further investigation might define the clinical significance of these minor abnormalities on imaging.

In a previous study, Paka et al. found a significant correlation between bother for AI and some components of the SMIS, such as fecal urgency ($p = 0.05$), impact on lifestyle ($p = 0.002$), and use of pad or plug ($p < 0.001$) [12]. However, no significant correlation with flatus incontinence was noted, possibly due to the smaller sample size ($n = 516$). In our population ($n = 1051$), we were able to demonstrate a correlation between bother for AI and flatus incontinence ($p = 0.04$). This finding is consistent with results reported by Steinberg et al., who found an association between the presence of flatus incontinence and questionnaire-derived QoL [2]. In a study on double incontinence (urinary and anal), Slieker-ten Hove et al. found a worse QoL in those with flatus incontinence [24]. Johannessen et al. described a higher embarrassment level in women with flatus incontinence [6]. Others claim that flatus incontinence should be considered a minor symptom and that patients who exclusively complain of flatus incontinence should be categorized together with asymptomatic patients [16]. Our results do not support this position. Flatus incontinence seems to contribute to the negative psychosocial impact of AI due to social implications that derive from its unpredictable sound and unpleasant odor. In particular, the auditory component of the event conveys a burden that would not be expected from any other form of AI.

In conclusion, this study assessed the impact of flatus incontinence in women with pelvic floor dysfunction. We show that the flatus incontinence component has a negative impact on bother of AI. Therefore, we suggest that flatus incontinence be included in the symptoms inquiry of patients with pelvic floor dysfunction. It is clearly an important component of the SMIS. We also suggest to systematically address flatus incontinence in the management of AI, e.g., through dietary modification and the use of medication to reduce flatulence. Finally, we encourage the use of the VAS scale, as it is an easy-to-use, universal tool for the quantification of symptom impact on QoL.

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Compliance with ethical standards

Conflicts of interest None.

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