Flatus Incontinence and Fecal Incontinence: A Case-Control Study

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BACKGROUND: Incontinence to gas can be a troublesome symptom impacting quality of life for patients even in the absence of fecal incontinence. Whether isolated flatus incontinence represents part of the spectrum of true fecal incontinence or a separate condition with a different pathophysiology remains unclear.

OBJECTIVE: This study aimed to evaluate the clinical features and anorectal physiology in women presenting with severe isolated flatus incontinence compared to women with fecal incontinence and healthy asymptomatic women.

DESIGN: This was a retrospective case-control study of prospectively collected data.

SETTINGS: Data from participants were obtained from a single tertiary Neurogastroenterology Unit in Sydney, Australia.

PATIENTS: Data from 34 patients with severe isolated flatus incontinence, 127 women with fecal incontinence, and 44 healthy women were analyzed.

MAIN OUTCOME MEASURES: The primary outcomes were clinical (including demographic, obstetric, and symptom variables) and physiological differences across the 3 groups.

RESULTS: Patients with flatus incontinence were significantly younger (mean 39 versus 63 years; *p* = 0.0001), had a shorter history of experiencing their symptoms (*p* = 0.0001), and had harder stool form than patients with fecal incontinence (*p* = 0.02). Those with flatus incontinence had an adverse obstetric history and impaired anorectal physiology (motor and sensory, specifically rectal hypersensitivity) but to a lesser extent than patients with fecal incontinence.

LIMITATIONS: This study was limited by its retrospective design and modest sample size.

CONCLUSIONS: Anorectal physiology was impaired in patients with flatus incontinence compared to healthy controls, but to a lesser extent than in those with fecal incontinence, raising the possibility that flatus incontinence could be a precursor to fecal incontinence. As clinical and physiological findings are different from healthy controls (including the presence of visceral hypersensitivity), isolated flatus incontinence should be considered a distinct clinical entity (like other functional GI disorders), or possibly part of an incontinence spectrum rather than purely a normal phenomenon. See **Video Abstract** at http://links.lww.com/DCR/B946.

INCONTINENCIA DE FLATOS E INCONTINENCIA FECAL: UN ESTUDIO DE CASOS Y CONTROLES

ANTECEDENTES: La incontinencia de gases puede ser un síntoma molesto que afecta la calidad de vida de los pacientes incluso en ausencia de incontinencia fecal. Aún no está claro si la incontinencia de flatos aislada representa parte del espectro de la incontinencia

fecal verdadera o una condición separada con una fisiopatología poco clara.

OBJETIVO: Evaluar las características clínicas y la fisiología anorrectal en mujeres que presentan incontinencia grave aislada de flatos, en comparación con la incontinencia fecal y mujeres sanas asintomáticas.

DISEÑO: Este fue un estudio retrospectivo de casos y controles de datos recolectados prospectivamente.

AJUSTE: Los datos de los participantes se obtuvieron de una sola Unidad de Neurogastroenterología terciaria en Sydney, Australia.

PACIENTES: Se analizaron los datos de 34 pacientes con incontinencia grave aislada de flatos, junto con 127 mujeres con incontinencia fecal y 44 mujeres sanas.

PRINCIPALES MEDIDAS DE RESULTADO: Los resultados primarios fueron clínicos (incluidas las variables demográficas, obstétricas y de síntomas), así como las diferencias fisiológicas entre los tres grupos.

RESULTADOS: Los pacientes con incontinencia de flatos eran significativamente más jóvenes (media de 39 años frente a 63 años, p = 0,0001), tenían un historial más corto de experimentar sus síntomas (p = 0,0001) y tenían heces más duras que los pacientes con incontinencia fecal (p = 0,02). Aquellos con incontinencia de flatos tenían antecedentes obstétricos adversos y fisiología anorrectal alterada (motora y sensorial, específicamente hipersensibilidad rectal); aunque en menor medida que las pacientes con incontinencia fecal.

LIMITACIONES: Este estudio estuvo limitado por su diseño retrospectivo y tamaño de muestra modesto.

CONCLUSIONES: La fisiología anorrectal se vio afectada en las pacientes con incontinencia de flatos en comparación con las controles sanos, pero en menor medida que en aquellas con incontinencia fecal, lo que plantea la posibilidad de que la incontinencia de flatos pueda ser un precursor de la incontinencia fecal. Dado que los hallazgos clínicos y fisiológicos son diferentes a los de los controles sanos (incluida la presencia de hipersensibilidad visceral), la incontinencia de flatos aislada debe considerarse como una entidad clínica distinta (al igual que otros trastornos gastrointestinales funcionales), o posiblemente como parte de un espectro de incontinencia en lugar de un trastorno puramente a un fenómeno normal. Consulte **Video Resumen** en http://links.lww.com/DCR/B946. *(Traducción—Dr Yolanda Colorado)*

Recent inroads have been made into understanding the pathophysiology of intestinal gas symptoms with several factors, including abnormal gas handling, visceral hypersensitivity, abnormal behavioral responses, intraluminal content, and the microbiome thought to be important.[1,2] In addition, it is known that disordered anorectal physiology and sensation, poor rectal emptying, and often the combination of obstetric history and increasing age contribute to fecal incontinence (FI). However, few studies have addressed the symptom of flatus incontinence from a similar perspective.

Flatus incontinence can be defined as the involuntary loss of gas per rectum[3] and may occur in association with FI or in isolation. It is a common clinical problem that is often distressing to the patient, leading to presentations to primary care physicians and gastroenterologists. Flatus incontinence has a high prevalence in questionnaire-based studies (9%–25% in community studies and 13.9%–37% in gynecologic clinics).[4–8] Similar to FI, flatus incontinence has a female predominance, with more frequent occurrences in those who are older and with higher parity.[4,9] Investigation of the pathophysiology and risk factors associated with flatus incontinence is currently lacking, but anal sphincter defects have been implicated as a possible mechanism in anal incontinence (flatus incontinence and/or FI).[10]

As with FI, flatus incontinence can lead to significant morbidity, reduced quality of life, and suboptimal sexual health.[6,11,12] Despite this, it is rarely analyzed as a separate entity in studies of anal incontinence and FI, and targeted management is often left undiscussed. Despite its prevalence, the ROME IV collaborative group has not defined this symptom as a distinct entity in its list of functional disorders of the anorectum.[13] This reflects the controversy surrounding this symptom and the consideration of what degree of flatus incontinence should be defined as pathological.

Patients have presented to our center with isolated incontinence to gas (rather than FI), causing devastating personal and significant impairment in quality of life. This has highlighted the importance of this otherwise unappreciated problem. Therefore, we aimed to assess the clinical and physiological features of patients with isolated flatus incontinence and compare these to both healthy controls and those with FI.

MATERIALS AND METHODS

Patient Selection and Baseline Assessment

A retrospective case-control study of prospectively collected data was performed in a tertiary referral Neurogastroenterology Center. The study was approved by the Northern Sydney Local Health District Human Research Ethics Committee (HREC/18/HAWKE/40). Thirty-four consecutive women with isolated flatus incontinence (absence of any FI) were evaluated with physician review and structured questionnaires including Rome

III[14] and the Hospital Anxiety and Depression Scale.[15] All had failed conservative management by a specialist Gastroenterologist or Colorectal Surgeon that included, where appropriate, dietary trials (eg, diets low in dairy or low in fermentable oligosaccharides, disaccharides, monosaccharides and polyols), pharmacological agents (eg, low dose fiber supplementation and loperamide), and optimization of bowel habit. Additionally, 127 female patients with FI confirmed by Rome III criteria[14] presenting to the unit over the same time frame were studied, and 82% of those patients experienced concurrent flatus incontinence. Their data had also been prospectively collected.

Forty-four healthy women between the ages of 20 and 75 years were recruited by public advertisement over a similar period and their anorectal physiology results were reported in full in a separate publication.[16] Healthy volunteers were not on medications that may alter GI motility, did not have any significant medical illness or anorectal pathology, and had no functional GI disorder or psychological illness as assessed by the same screening questionnaires.

Anorectal Physiological Testing

Anorectal manometry was performed in all participants using a high-resolution 7-lumen water-perfused manometry catheter with 5-mm spaced radially arranged side-holes and a compliant balloon encompassed at the end of the catheter (Mui Scientific, Toronto, Canada). The technique standard for our unit has previously been described.[17] Data were collected in digital form from individual pressure transducers and transformed using data conversion software (Neomedix, Sydney, Australia). Each anorectal physiology study comprised assessment of several parameters, including balloon expulsion test, in keeping with the International Anorectal Physiology Working Group protocol.[18]

Statistical Analysis

Quantitative measures are reported as mean and SD, whereas qualitative measures are reported as percentage and count. Two sets of contrasts are reported, both based on the general linear model and with and without adjusting for age: isolated flatus incontinence versus FI (disease control) and isolated flatus incontinence versus healthy controls. Formal statistical inference for each contrast was performed using the nonparametric bootstrap each with 1000 bootstrap replications.

RESULTS

Patient Demographic and Obstetric Features

The baseline features of patients with flatus incontinence compared to healthy controls and those with FI are presented in Table 1. Patients with flatus incontinence were significantly younger than those presenting with FI (mean 39 versus 63 years; $p = 0.0001$) and had a shorter duration of symptoms (mean 1.5 versus 5.5 years in FI; $p = 0.0001$).

TABLE 1. Baseline demographics, symptoms, and obstetric features of patients with flatus incontinence compared to healthy controls and controls with fecal incontinence

Patient characteristics	Healthy controls (N = 44)	Flatus incontinence (N = 34)	FI controls (N = 127)	p (flatus incontinence vs healthy controls)	p (flatus incontinence vs FI)
		Mean (SD) or %			
Demographics					
Age, y	56 (11.6)	39 (12.5)	63 (14.3)	0.0001	0.0001
Duration of symptoms, y	–	1.5 (2.8)	5.5 (6.5)	–	0.0001
Organic medical history[a]	2%	26%	55%	0.002	0.003
Organic surgical history (excluding obstetric injury)[b]	7%	38%	75%	0.001	<0.001
High HADS anxiety score (>7)	0%	34%	34%	<0.001	NS
High HADS depression score (>7)	0%	0%	16%	NS	0.02
Hard stool form[c]	5%	29%	14%	<0.001	0.02
Loose stool form[c]	0%	12%	43%	0.02	0.001
Rome III functional constipation (yes)	0%	26%	28%	<0.001	NS
Rome III irritable bowel syndrome (yes)	0%	12%	25%	<0.001	NS
Obstetric factors					
Multiparous	75%	91%	91%	0.06	NS
Age at time of first delivery, y	29 (6.1)	32 (4.1)	27 (5.3)	0.04	0.0001
No. of vaginal deliveries	1 (1.2)	1 (1.0)	2 (1.5)	NS	0.0001
Birth weight of last infant, g	3453 (485.1)	3596 (498.5)	3414 (592.2)	NS	NS
Previous obstetric anal sphincter injury (yes)	4%	79%	55%	<0.001	0.01
History of instrumental delivery (yes)	21%	37%	36%	NS	NS

HADS = Hospital Anxiety and Depression Scale; FI = fecal incontinence; NS = nonsignificant.
[a]"Organic medical history" refers to any disease process diagnosed clinically, biochemically, or radiologically that has the potential to cause pelvic floor dysfunction. These include disorders such as diabetes, IBD, previous pelvic radiation therapy, connective tissue disease, and neurological disorders, including spinal cord injury.
[b]"Organic surgical history" includes any surgery involving the pelvic floor, colon, or anorectum, which may potentially contribute to flatus or fecal incontinence.
[c]Where hard stool form is Bristol type 1 and 2 and loose stool form is Bristol type 6 and 7.

Compared to healthy controls ($p = 0.04$) and women with FI ($p = 0.0001$), patients with flatus incontinence were more likely to be older at the time of their first delivery. Birth weight of the last infant and a history of instrumental delivery were not associated with the development of either symptom.

Symptom Profiles and Psychology

As with FI, Rome III criteria for diagnoses of functional constipation and irritable bowel syndrome were also found in those with flatus incontinence (Table 1). Hard stools occurred more frequently in those with flatus incontinence (29% versus 14% in FI; $p = 0.02$), and loose stool form was more common in FI (43% versus 12% in flatus incontinence; $p = 0.001$).

Comparing patients with flatus incontinence to healthy controls, those with isolated flatus incontinence were more likely to report a higher impact of their bowel habits/symptom on their quality of life ($p = 0.0001$), less satisfaction with their bowel movements ($p = 0.0006$), and significantly less control of bowel function ($p = 0.0007$). These same measures were worse, however, in FI compared to flatus incontinence (Fig. 1).

When patients with flatus incontinence were compared to healthy controls, there was a higher prevalence of clinically significant anxiety as measured by the Hospital Anxiety and Depression anxiety score in the former group (34%; $p < 0.001$). This high prevalence of anxiety in the flatus incontinence group was similar to those with FI. The prevalence of depression was, however, similar in the patients with flatus incontinence and the healthy controls yet more prevalent in patients with FI (Table 1; $p = 0.02$).

Anorectal Physiology

Anorectal physiology in patients with isolated flatus incontinence, healthy controls, and patients with FI is presented in Table 2. Mean anal resting ($p = 0.006$), squeeze ($p = 0.0001$), and cough pressures ($p = 0.0001$) along with mean duration of sustained squeeze ($p = 0.0001$) were significantly lower in patients with flatus incontinence than in healthy controls. However, greater impairment of sphincter function was seen in patients with FI than in patients with flatus incontinence (Fig. 2). Dyssynergic features (such as prolonged balloon expulsion and inadequate rectal pressure on strain) were more common in patients with flatus incontinence ($p = 0.0001$) compared to healthy controls ($p = 0.002$).

The findings of rectal sensation are shown in Table 2. No statistically significant differences were found between patients with flatus incontinence and healthy controls for thresholds for the first sensation or urge to defecate. Patients with FI had a lower threshold to the first sensation compared to patients with flatus incontinence ($p = 0.04$). Patients with flatus incontinence were noted to have a lower threshold to a maximum tolerated volume compared to healthy controls ($p = 0.01$), which was similar to the lower threshold found in patients with FI ($p = NS$).

DISCUSSION

This study clearly demonstrates that patients with isolated yet troublesome incontinence to gas have anorectal dysfunction compared to healthy controls. However, this dysfunction is less severe than that seen in patients with overt FI. This is despite preexisting controversy regarding whether flatus incontinence is a discrete condition capable of causing symptoms and distress or whether it should be regarded as a normal phenomenon. Our results suggest that flatus incontinence is a distinct condition deserving assessment, treatment, and inclusion as one of
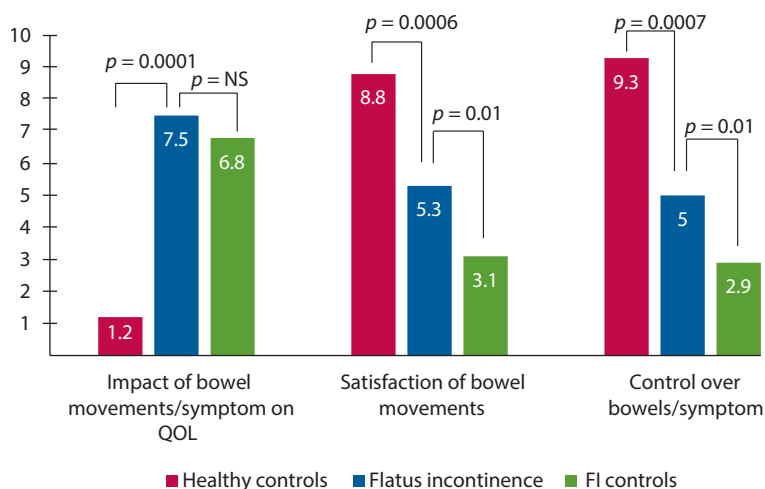
FIGURE 1. Visual analog scales (out of 10) assessing the effect of participants' bowel habits/symptoms on QOL, satisfaction of bowel movements, and sense of control over their bowels/symptoms across the 3 groups. FI = fecal incontinence; QOL = quality of life; NS = nonsignificant.

TABLE 2. Anorectal physiology parameters in patients with flatus incontinence compared to healthy controls and controls with FI

| Anorectal physiology parameter	Healthy controls (N = 44)	Flatus incontinence (N = 34)	FI controls (N = 127)	p (flatus incontinence vs health)	p (flatus incontinence vs FI)
	Mean (SD) or %				
Maximal anal resting pressure, mmHg	78 (23.2)	65 (16.8)	50 (16.2)	0.006	0.0001
Maximal anal squeeze pressure, mmHg	192 (60.6)	120 (37.0)	107 (37.2)	0.0001	0.04
Maximal anal pressure on cough, mmHg	167 (46.9)	126 (32.9)	119 (31.5)	0.0001	NS
Duration of anal squeeze, s	41 (7.9)	28 (6.4)	25 (6.7)	0.0001	0.01
Able to hold sustained squeeze >20 s	100%	91%	76%	0.04	0.05
Rectal pressure on push, mmHg	54 (19.5)	45 (20.1)	53 (21.7)	0.008	0.03
Inadequate rectal pressure on push	20%	55%	38%	0.002	0.08
Inadequate anal relaxation with push	68%	71%	80%	NS	NS
Balloon expulsion time, s	11 (26.6)	26 (33.1)	17 (34.1)	0.0001	0.0004
Success of balloon expulsion (<60 s)	98%	88%	93%	NS	NS
First sensation threshold, mL	52 (20.6)	57 (23.9)	49 (19.8)	NS	0.04
Defaecation/urge threshold, mL	107 (32.8)	119 (40.0)	113 (45.7)	NS	NS
Maximum tolerated threshold, mL	224 (44.1)	194 (55.2)	178 (58.4)	0.01	NS

FI = fecal incontinence; NS = nonsignificant.

the functional GI disorders, although it remains unclear whether it represents a milder form or a precursor of overt FI.

Obstetric features most strongly associated with the presence of flatus incontinence included a history of previous obstetric tear and older maternal age at the time of first delivery. This echoes findings from other studies of anal incontinence (flatus incontinence ± FI).[4,5,19] As with FI, direct anal sphincter injury may not be the sole physiological contributor to anorectal dysfunction in flatus incontinence. Rather, the impact of recurrent pregnancies on pelvic floor musculature and its subsequent function and coordination, particularly in older mothers, could also play a pivotal role.

The basis of this study was derived from our observation of patients describing considerable stress and interference with professional and personal life as a result of flatus incontinence in the absence of any FI. The suggestion that flatus incontinence can have significant consequences is supported by our finding that patients with flatus incontinence had anxiety scores similarly elevated to patients with FI. Additionally, we have also found an association between flatus incontinence and poorer quality-of-life measurements, which resonant with previous studies,[6,11] albeit to a lesser extent than FI.

Despite the flatus incontinence cohort being younger than healthy controls, their manometric features, including lower mean anal resting, squeeze, and cough pressures as
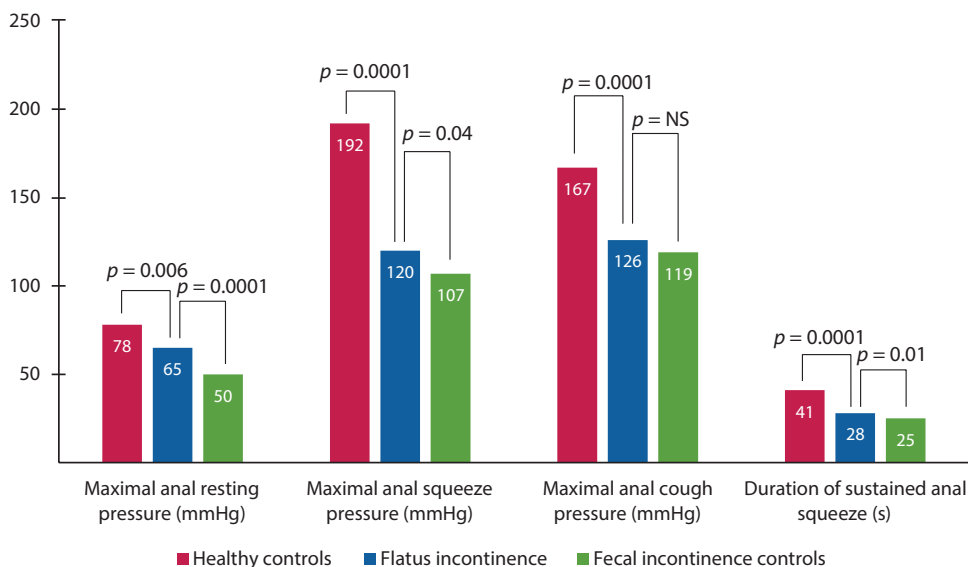
FIGURE 2. Differences in anorectal manometry pressures and duration of sustained anal squeeze between healthy controls, patients with flatus incontinence, and fecal incontinence controls. NS = nonsignificant.

well as reduced mean duration of a sustained squeeze, suggest a degree of anal sphincter dysfunction, although not as severe as those with FI. It is possible that the symptom complex of troublesome flatus incontinence in the absence of FI typically occurs in younger women, as also shown by Meyer et al,[20] often with significant obstetric history. The maximum tolerated threshold was lower in patients with flatus incontinence compared to healthy controls, raising the possibility that patients presenting with flatus incontinence could have enhanced perception of normal physiological phenomena akin to irritable bowel syndrome.

One way of incorporating flatus incontinence into our understanding of this symptom within the framework of the functional GI disorders is to think of flatus incontinence as being part of the spectrum of FI. Our study nicely demonstrates this as a linear progression in anorectal dysfunction (as assessed by resting and squeeze anal sphincter pressure and duration of anal squeeze pressure) from normal to flatus incontinence to more severe dysfunction in FI. This pattern is further emphasized by our findings related to rectal sensation, whereby a progressive impairment of sensation was seen comparing normal to flatus incontinence to FI. In addition, the spectrum of symptomatology appears to depend on stool form, whereby solid stool form is more likely to be associated with flatus incontinence, yet a liquid stool form was more associated with the patient having FI.

This study is limited by a somewhat small sample size (n = 34) of the population of patients with flatus incontinence; however, this was compared to good numbers of healthy controls (n = 44) and patients with FI (n = 127). As these patients presented to a tertiary referral center for management, it is possible that they may represent only one end of the spectrum of this symptom and not truly encompass what would be found in a community-based sample of patients. Another limitation is that we had insufficient results of radiological assessment for anal sphincter integrity in our study to report. However, recent guidelines by the American College of Gastroenterology and the American Society of Colon and Rectal Surgeons do not suggest any routine ultrasound or MRI in algorithms on the management of FI as they recognize that the relationship between abnormal findings and symptoms remains unclear.[21,22] Finally, our study did not have sufficient results to report on the use of biofeedback therapy in this group of patients (8/34 patients with isolated flatus incontinence). Although this treatment has been shown to be beneficial in the management of FI, its effectiveness in flatus incontinence is unstudied. As our results suggest a linear progression in anorectal physiological abnormalities (motor and sensory) from health to flatus incontinence to FI, it is possible that biofeedback therapy, particularly as early intervention, may be beneficial in the treatment of flatus incontinence and deserves further study.

CONCLUSION

Patients can present with troublesome, isolated incontinence to gas, which can severely impact their quality of life. These patients show differences in clinical features and anorectal physiology compared to both healthy controls and patients with FI. This suggests that flatus incontinence may be a diagnosis worthy of inclusion in future iterations of the Rome diagnostic criteria for functional GI disorders rather than being considered a purely normal phenomenon. The presence of associated rectal hypersensitivity to balloon distention in flatus incontinence further supports this. Alternatively, flatus incontinence could be included as a functional GI disorder as part of the same spectrum as FI, whereby other factors such as the degree of anorectal dysfunction, presence of rectal hypersensitivity, dominant stool form, or associated psychological disorders determine the pattern of presenting symptoms.

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