Int Urogynecol J (2007) 18:1283–1289
DOI 10.1007/s00192-007-0341-9

ORIGINAL ARTICLE

The risk of anal incontinence in obese women

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Received: 11 January 2007 / Accepted: 26 February 2007 / Published online: 14 March 2007

Abstract The objectives of this study was to estimate the risk of anal incontinence in morbidly obese women and to identify risk factors associated with anal incontinence in an obese population sample. A case-control study based on the registry of a university hospital obesity unit. A consecutive sample of women with body mass index ≥35 (obesity class II) was randomly matched by age, gender and residential county to control subjects using the computerised Register of the Total Population. Data were collected by a self-reported postal survey including detailed questions on medical and obstetrical history, obesity history, socioeconomic indices, life style factors and the validated Cleveland Clinic Incontinence Score. The questionnaire was returned by 131/179 (73%) of the cases and 453/892 (51%) of the control subjects. Compared to the control group, obese women reported a significantly increased defecation frequency ($p<0.001$), inability to discriminate between flatus and faeces ($p<0.001$) and flatus incontinence ($p<0.001$). Compared with non-obese women, the adjusted odds ratio (OR) for flatus incontinence in morbidly obese women was 1.5 [95% confidence interval (CI) 1.1–4.1]. A history of obstetric sphincter injury was independently associated with an increased risk of flatus incontinence (OR, 4.3; 95% CI, 2.0–9.2) and incontinence of loose stools (OR, 6.6; 95% CI, 1.4–31.4). Other medical and life style interactions did not remain at significant levels in an adjusted multivariable analysis. Obese women are at increased risk for mild to moderate flatus incontinence.

Keywords Anal incontinence · Obesity · Women

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Introduction

The increasing prevalence of obesity in the general population is rapidly becoming a major global health concern [1]. Obesity is a major risk factor for a variety of somatic diseases related to substantially increased morbidity and mortality rates [2, 3]. Obesity, however, is also associated with a number of disorders primarily affecting quality of life and daily function [4, 5].

In a recent population-based study, the prevalence of anal incontinence in community-dwelling women was 7.2%, the frequency and severity of symptoms being closely related to increasing age [6]. It is commonly recognised that anal incontinence is associated with severe implications on life style, sexuality, mental health, social interactions and daily function [7]. Among numerous other risk factors for anal incontinence, obesity frequently is correlated to the presence of anal incontinence in cross-sectional studies [8–11]. However, previous studies focusing on the specific association between obesity and anal incontinence are few, limited by small population samples and lack of non-obese control subjects [12, 13]. Thus, the relationship between obesity and anal incontinence remain unconfirmed in controlled studies.

Considering the significant functional disability reported by women with anal incontinence [6, 14], identifying, and possibly reducing, risk factors is of general public health interest. The objective of this case-control study was to estimate the risk of anal incontinence, and associated risk

factors, in obese women with body mass index >35, when compared to non-obese women.

Materials and methods

Design

We performed a case-control-designed study based on the out-patient registry of the Obesity Unit, Karolinska University Hospital Huddinge, Stockholm, Sweden. A consecutive sample consisting of all female patients referred to the clinic for consultation between October 2004 and January 2006 was identified from the computerised patient ledger (n=179). To each patient, we randomly selected female control subjects (n=892) matched for year and month of birth and residential county from the computerised Register of the Total Population using the unique national registration number, which includes the date of birth, assigned to all Swedish residents.

The Obesity Unit is a tertiary referral clinic at Karolinska University Hospital, which receives patients aged ≥18 years, generally with a body mass index greater than 35 (obesity class II). Treatment strategy focuses on cognitive behavioural therapy, physical activity, dietary counseling and anti-obesity medical treatment.

Data collection

All cases and controls received an identical questionnaire containing detailed questions on medical and obstetrical history, obesity history, socioeconomic indices (highest level of education and annual income), life style factors and the validated Cleveland Clinic Incontinence Score [15]. The return of a questionnaire was considered informed consent. Subjects not returning the questionnaire after two reminding letters received a phone call and were offered to answer the questionnaire in a telephone interview. Control subjects with a body mass index ≥35 were excluded from the final data set. A non-response to any of the questions (blanks) in the questionnaire was not considered in the analyses. The study was approved by the Research Ethics Committee at Karolinska Institutet.

Statistical analysis

Statistical analysis was performed using Statistica software (Statistica®, Statsoft, Tulsa, OK, USA). Due to the uncommonness of stool incontinence in the general non-geriatric population [6], flatus incontinence was chosen as our primary outcome measure. A sample size calculation determined that a sample of at least 100 cases (obese) and 300 controls (non-obese) was necessary to demonstrate a 20% increase in the prevalence of gas incontinence symptoms (primary outcome variable) with a 0.05 level of significance and 80% power. Mann–Whitney U test and chi-square was used to compare independent ordinal and continuous numerical data. Multivariable logistic regression analyses were performed to assess the interaction of co-variables on the risk for anal incontinence symptoms. Selection of co-variables tried in the multivariable model was based on factors associated with anal incontinence in existing literature, including body mass index [12, 13], overall parity [16], instrumental deliveries [17], obstetrical anal sphincter injury [18], smoking [19], menopausal status [9] and depression [20]. We also added variables with a significant association to anal incontinence symptoms at univariable analysis to the multivariable model. Risk was estimated using OR with 95% confidence intervals (CI). A p value of <0.05 was considered significant for all analyses.

Results

The questionnaire was completed and returned by 131/179 (73%) of the cases, 40 subjects (22%) did not want to participate and six subjects (3%) were not available (address unknown or deceased). Among the control subjects, the questionnaire was returned by 453/892 (51%) subjects, of which 430 (48%) subjects completed the questionnaire. Twenty-two (2%) subjects did not want to answer the questions, and one subject claimed inadequate knowledge in the Swedish language. Twelve (1%) subjects were not available (address unknown or deceased), and an additional 15 women were excluded from the final analysis due to a body mass index exceeding 35, leaving 415 control subjects eligible for analysis.

Obesity history

Median duration of obesity was 20 years or more, with a range of 5 to ≥30 years. Duration of obesity among women included as cases was classified as: overweight since childhood (54/131 subjects, 41%), overweight since adolescence (30/131 subjects, 23%) and overweight debut after 20 years of age (45/131 subjects, 34%). Use of anti-obesity medications was significantly more common in the obese group compared to the control subjects (Table 1). Of 16 patients reporting current use of anti-obesity drugs, 11 patients used orlistat (Xenical®), and five patients used sibutramin (Reductil®; Table 1).

Subject characteristics

Women in the obesity group had a significantly higher body mass index (p<0.001) while the overall level of education

Table 1 Demographic characteristics

	Obese group, n=131	Control group, n=415	p values
Age[a] (years)	42.2±12.0	44.4±11.7	0.1
Body mass index[b] (kg/m^2)	39 (36–68)	23 (17–34)	<0.001
Educational level[c]			
Elementary school[d]	37 (28)	69 (17)	0.003
High school[d]	46 (35)	117 (28)	0.13
University 1–3 years[d]	26 (20)	113 (27)	0.09
University 4–6 years[d]	20 (15)	102 (25)	0.03
Annual income (Euro)[c]			
<20,000[d]	57 (43)	112 (19)	0.001
20–30,000[d]	46 (35)	157 (38)	0.57
30–50,000[d]	24 (17)	126 (30)	0.007
>60,000[d]	1 (1)	7 (2)	0.44
Parity[b]	1 (0–5)	2 (0–5)	0.05
Vaginal deliveries[c]	63 (48)	246 (59)	0.65
Caesarean delivery[c]	18 (14)	59 (14)	0.85
Obstetrical sphincter injury	10 (8)	25 (6)	0.59
Instrumental delivery[c]	11 (8)	37 (9)	0.84
Children birth weight >4 kg	30 (22)	71 (17)	0.61
Abdominal surgery[c]	1 (0.5)	6 (1.5)	0.55
Smokers[c]	22 (17)	60 (14)	0.72
Post-menopausal[c]	33 (25)	128 (31)	0.41
Menopausal age[a]	48±8.3	50±5.9	0.37
Hormone replacement treatment[c]	11 (5)	60 (14)	0.07
Depression[c]	7 (5)	10 (2)	0.09
Current obesity drug treatment[c]	16 (12)	2 (0.5)	0.008

Comparison using Mann–Whitney U test unless otherwise stated.
[a] Mean±standard deviation
[b] Median (range)
[c] Number of patients (%)
[d] Chi square analysis

(p<0.001) and annual income (p<0.001) was significantly lower compared to the control subjects (Table 1). Other life style factors and events possibly associated with anal incontinence such as smoking, years of smoking, menopausal status, menopausal age, hormone replacement treatment and abdominal surgery showed no significant differences between the cohorts. There were no significant differences between the groups with regard to obstetrical history, including overall parity, number of vaginal and caesarean deliveries, instrumental deliveries, self reported anal sphincter injury and number of children with a birth weight over 4 kg. Detailed demographic characteristics are presented in Table 1.

Prevalence of anal incontinence symptoms

Obese women had a significantly increased defecation frequency when compared to the matched control group (p<0.001; Table 2). Obese women also reported a significantly increased frequency of inability to discriminate between flatus and faeces (p<0.001) and flatus incontinence (p<0.001; Table 2). There was a non-significant increased prevalence of incontinence of stools and the use of pads due to anal incontinence in the obese group compared to the control group (Table 2).

Risk analysis

Obese women had a crude OR of 1.9 (95% CI, 1.4–5.1) for flatus incontinence when compared to the control group. When adjusting for possible confounders by adding them step-by-step to a multivariable risk model, the independent risk increase remained at significant levels, although reduced (OR, 1.5; 95% CI, 1.1–4.1; Table 3). A history of obstetric sphincter injury was independently associated with a decreased ability to discriminate faeces from flatus (OR, 2.9; 95% CI, 1.9–8.9), an increased risk of flatus incontinence (OR, 4.3; 95% CI, 2.0–9.2) and incontinence of loose stools (OR, 6.6; 95% CI, 1.4–31.4). At univariable analyses, loose stool incontinence was positively associated with depression (OR, 5.5; 95% CI, 1.4–20.8), orlistat treatment (OR, 9.7; 95% CI, 1.4–68.3) and duration of

Table 2 Frequency and comparison of anal incontinence symptoms

	Obese group, n=131		Control group, n=415		Comparison
	No. of subjects	Percent	No. of subjects	Percent	p value
Inability to discriminate flatus from feces					
No	101	77	372	90	<0.001
<1/week	19	15	25	6	
>1/week	7	5	10	2	
Daily	2	1.5	1	0.2	
Gas incontinence					
No	74	57	291	70	<0.001
<1/week	25	19	60	14	
>1/week	23	18	34	8	
Daily	9	7	21	5	
Incontinence of loose stools					
No	112	86	390	94	0.09
<1/week	13	10	9	22	
>1/week	4	3	3	0.5	
Daily	0	0	2	0.5	
Incontinence of solid stools					
No	107	82	379	91	0.07
<1/week	12	9	22	5	
>1/week	7	5	6	14	
Daily	3	2	1	0.2	
Use of pads due to anal incontinence					
No	123	94	404	97	0.45
<1/week	3	2	2	0.5	
>1/week	1	1	0	0	
Daily	3	2	2	0.5	
Mean defecation frequency (SD)*	9.6±5.2	–	7.2±3.2	–	<0.001

Statistical comparison using Mann–Whitney U test. Cumulative percent <100 indicates missing value due to blank response.
*Mean/week

obesity (OR, 1.8; 95% CI, 1.1–3.0). However, when added to the multivariable model, these associations did not remain at significant levels, and no other significant interactions between possible risk factors and various symptoms of anal incontinence were found.

Discussion

The main findings of this case-control study further substantiate the notion that obesity may be associated with an increased risk of flatus incontinence symptoms in

Table 3 Factors independently associated with anal incontinence symptoms

	Inability to discriminate flatus from feces		Flatus incontinence		Stool incontinence[a]		Defecation frequency	
	Adjusted odds ratio							
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
BMI<35[b]	1.0	Reference	1.0	Reference	1.0	Reference	1.0	Reference
BMI>35[b]	0.5	0.1–4.7	*1.5*	*1.1–4.1*	1.1	0.9–1.2	*2.9*	*1.6–5.6*
Obstetric sphincter injury	*3.9*	*1.1–14.5*	*2.8*	*1.5–6.2*	*2.3*	*1.1–5.7*	7.3	0.2–136.1

Figures in italics represent outcomes with p<0.05 significance level. Multivariate logistic regression analysis adjusted step-by-step for total parity, instrumental deliveries, smoking, menopausal status, duration of obesity, orlistat (Xenical®) treatment and depression.
[a] Defined as episodes of stool incontinence at any frequency
[b] Adjusted for age and residential county by matching

women. The increased prevalence of flatus incontinence symptoms in obese women was, however, mostly in the range of mild to moderate complaints when compared to randomly selected control subjects.

A large number of factors related to anal incontinence have been identified over the last decade including increasing age [9], obstetrical anal sphincter rupture [21], hysterectomy [22], diabetes [23] and pelvic organ prolapse [24]. Although obesity frequently appears as a risk factor for anal incontinence in population-based studies, the correlation is poorly investigated, and only a few studies have been performed with anal incontinence as the focus of investigation [12, 13]. Previous studies on the topic are limited by the lack of control groups, small population samples and unsatisfactory control for possible confounders and effect modifiers [8, 9, 12, 13].

In the present study, we found an increased prevalence of several symptoms associated with anal incontinence among obese women when compared to the control group. Severity of urinary incontinence has previously showed a positive correlation with increasing body mass index [13]. When considering the severity of the anal incontinence frequency score in relation to obese women, most of the differences lay in the range of mild–moderate complaints, and frank faecal incontinence was rare in both groups. The reported incontinence episodes were dominated by involuntary loss of flatus; as a consequence, few patients reported the use of protective pads. By matching cases and controls by birth date, an expected effect modification by age on the prevalence of anal incontinence symptoms was counteracted. We recognise that flatus incontinence is subjective and that the involuntary nature of flatus may vary between patients, whether they are obese or not. Our data are limited to analysing the frequency of flatus incontinence episodes and does not address the individual perception of under what circumstances incontinence episodes occurred or to what extent it may have affected their self-image or social situation.

Human intra-abdominal pressure varies between 0.2 kPa at rest and 20 kPa at maximum straining [25]. Chronic constipation and frequent straining at defecation may negatively affect the puborectal and anal sphincter muscle innervation, both contributing to maintained anal continence [26]. It is plausible that abdominal obesity and the corresponding chronically elevated intra-abdominal pressure in obese women [27] may have a similar adverse effect on distal autonomous nerve branches, responsible for maintaining a continuous muscle tonus of the internal anal sphincter, thereby preventing anal incontinence.

The increased defecation frequency in women with severe obesity may be associated with anal incontinence, although other explanations should be considered. First, consumption of food with a high fat content, a larger food intake in women with obesity and a different gastrointestinal microbe flora in obese women may affect defecation frequency. Second, drugs such as orlistat (Xenical®) are, by virtue of their actions, associated with gastrointestinal side effects including loose stools and increased defecation frequency [28, 29]. The number of patients receiving pharmacological obesity treatment at the time of the study was relatively few, but the combination of poor dietary habits and obesity drug treatment may have affected the reported increased mean defecation frequency in our obese group, although not reflected by the risk analysis.

Hormone replacement treatment was not associated with an increased risk of incontinence symptoms, as has been previously suggested [30]. Furthermore, age at menopause and menopausal status showed no correlations with increasing symptom frequency. These findings indicate that the increased prevalence of anal incontinence symptoms in morbidly obese women should not be attributed to inherent oestrogen depletion. Other life style factors such as smoking, which have been associated with female urinary incontinence [19], did not correlate to increased anal incontinence symptoms in either group. In concurrence with other reports, socioeconomic indices such as educational level and annual income were significantly lower in morbidly obese women [31]. These measures of social status, however, did not significantly modify the relationship between obesity and anal incontinence symptoms.

Contrary to supposition [16], increasing parity was not associated with an increased prevalence of anal incontinence. A lack of effect modification on urinary incontinence by number of deliveries has previously been reported in prospective cohort studies and a recent large cross-sectional population-based study [32–34]. In concurrence with several previous studies, obstetrical anal sphincter injury was the strongest predictor of anal incontinence symptoms [18, 35–37], acting as an effect modifier although not confounding the association between obesity and anal incontinence. The number of morbidly obese women with self-reported obstetrical anal sphincter ruptures, however, did not suffice for a separate analysis.

Our findings are strengthened by the consecutive sampling of exposed subjects, the random sampling of matched control subjects from the source population where the cases arose, the high response rate among cases and the ability to adjust for a large number of possible interactions and confounders. The unsatisfying response rate in the control group does, however, raise the concern of reporting and selection bias. Patients who have attended the obesity clinic may feel obligated to respond to a survey, whereas the randomly selected control subjects had no personal relation to the investigators and therefore might be less likely to respond. It is also plausible that control subjects generally were less willing to reveal sensitive information

on weight and incontinence symptoms than patients being used to discussing their obesity-related problems with health care providers. As age characteristics did not differ between subjects not responding and those that did and since they were randomly selected from the total population, it seems unlikely that non-responders would share an unknown common factor that at the same time acts as a confounder for anal incontinence.

In summary, morbidly obese women are at increased risk for mild to moderate flatus incontinence, which in turn, may negatively affect quality of life in this group of women. Obesity is a potentially modifiable risk factor, and previous studies have shown that weight loss may be effective in relieving symptoms of urinary incontinence [38]. Future studies should direct attention to the effects of weight loss on symptoms of anal incontinence and examine if the increased risk of flatus incontinence may serve as an additional motivation for weight loss.

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