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The Impact of Obesity on Urinary Incontinence Symptoms, Severity, Urodynamic Characteristics and Quality of Life

Holly E. Richter, PhD, MD[1,†], **Kimberly Kenton, MD, MS**[2,‡], **Liyuan Huang, MSc**[3], **Ingrid Nygaard, MD, MS**[4], **Stephen Kraus, MD**[5,§], **Emily Whitcomb, MD**[6], **Toby C. Chai, MD**[7,*], **Gary Lemack, MD**[8,¶], **Larry Sirls, MD**[9], **Kimberly J. Dandreo, MSc**[3], and **Anne Stoddard, ScD**[3,**]

[1]University of Alabama at Birmingham, Birmingham, AL

[2]Loyola University, Maywood, IL

[3]New England Research Institutes, Watertown, MA

[4]University of Iowa, Iowa City, IA

[5]University of Texas Health Science Center at San Antonio, San Antonio, Texas

[6]University of California at San Diego, San Diego, CA

[7]University of Maryland, Baltimore, MD

[8]University of Texas Southwestern, Dallas, Tx

[9]William Beaumont Hospital, Royal Oak, MI

Abstract

Purpose—To compare urinary incontinence (UI) severity measures and impact of stress UI in normal, overweight and obese women.

Materials and Methods—Baseline characteristics of subjects in the Stress Incontinence Surgical Treatment Efficacy Trial (SISTEr, N=655) and the TOMUS (N=597) were analyzed. Body mass index [BMI] was defined as normal (<25 kg/m^2), overweight (25kg/m^2 ≤BMI<30 kg/m^2) and obese (≥30 kg/m^2). Independent UI severity measures included 3 day diary including incontinence episode frequency (IEF), Urogenital Distress Inventory (UDI) scores, and valsalva leak point pressure (VLPP) from urodynamic testing (UDS). Impact was measured using the Incontinence Impact Questionnaire (IIQ). Multivariable regression models were fit for each severity measures (UDI, IEF, VLPP and IIQ) on weight category. Covariates included age and variables significantly associated with BMI in bivariate analysis.

Results—Mean age (SD) of participants was 51.9 (10.3) in SISTEr and 52.9 (11.0) in TOMUS. In each trial, 45% of subjects were obese. In SISTEr, multivariable regression analyses showed that increasing BMI was independently associated with higher mean UDI scores (p=0.003), IEF (p<0.0001), VLPP (p=0.003) and IIQ score (p=0.0004). In TOMUS, increasing BMI was not

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[§]Financial interest and/or other relationship with Pfizer and Laborie Medical Technologies.

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Corresponding Author: Holly E. Richter, 618 20th St South, NHB 219, Birmingham, AL 35233, Phone: 205-934-1704, Fax: 205-975-8893, hrichter@uabmc.edu.

associated with UDI scores (p=0.24), but was associated with higher IEF (p=0.0003), VLPP (p=0.0006) and IIQ score (p<0.0001).

Conclusion—Obese women undergoing surgery for stress urinary incontinence report more incontinence episodes, more symptom distress and worse quality of life despite better measure of urethral function (higher VLPP) on urodynamics.

Keywords

obesity; stress incontinence severity and impact; urodynamics

Introduction

Stress urinary incontinence (SUI) is prevalent among women in the United States and has significant quality of life impact[1]. Consequently, SUI presents tremendous health-related[2] and economic[3] burdens. Obesity is a modifiable risk factor for the development of urinary incontinence (UI) with numerous epidemiological studies describing the impact of obesity on UI prevalence[4–6]. The estimated prevalence of obesity, defined as a body mass index (BMI) of ≥ 30 kg/m^2, exceeds 30% of the adult population in the United States[4]. Increased BMI is associated with both prevalent and incident UI, as well as UI severity[6]. A large cross-sectional study demonstrated that each 5-unit increase in BMI was associated with a 60% increase in daily UI, with obesity having the largest attributable risk for daily UI compared to other factors[7]. These findings were confirmed in surgical cohorts[8, 9]. Both behaviorally induced[10–12] and surgically induced [13, 14] weight reduction are associated with decreased UI severity.

The pathophysiologic basis posited for the relationship between obesity and UI lies in the significant correlation between BMI and intra-abdominal pressure, suggesting that obesity may stress the pelvic floor secondary to a chronic state of increased pressure[15, 16]. However, there are limited data on the impact of obesity on patient oriented and urodynamic parameters and on the mechanistic factors that may underlie UI in obese and normal weight women.

To more clearly understand the specific factors that may be associated with signs and symptoms of UI, we sought to compare baseline characteristics between a large number of normal weight, overweight and obese women who enrolled in two randomized comparative effectiveness trials for the surgical treatment of SUI. Specifically, the aim of this study is compare UI severity measures and impact of SUI among obese, overweight and normal weight women planning SUI surgery.

Materials and Methods

The Urinary Incontinence Treatment Network (UITN) performed two large randomized comparative effectiveness trials studying surgical treatment of SUI in women. The first trial, Stress Incontinence Surgical Treatment Efficacy Trial (SISTEr), randomized 655 subjects to either Burch colposuspension or autologous rectus fascial sling in treatment of SUI. The second trial, Trial of Midurethral Slings (TOMUS), randomized 597 subjects to polypropylene midurethral slings placed either in the retropubic or transobturator approach. Primary outcomes for SISTEr have been published[17] and will be available for TOMUS in the summer, 2009. Design papers are published for both trials[18, 19]. This paper represents the analyses of the preoperative data collected from these two trials. World Health Organization definitions of BMI were used to define weight groups: obese, ≥30 kg/m^2, overweight, 25kg/m^2 ≤BMI<30 kg/m^2, and healthy weight, <25 kg/m^2.

Demographic variables reported included age, race/ethnicity, education, marital status, and occupational score. Continuous clinical variables included height, weight, BMI, specific parameters from the pelvic organ prolapse quantification examination (POPQ); the most prolapsed portion of the anterior vaginal wall [Ba]; the most prolapsed portion of the posterior vaginal wall [Bp]; and the genital hiatus [gh]), Q-tip test (delta angle), mean muscle strength (Brink) scores, 24-hour pad weight, incontinence episode frequency (IEF) from a 3-day bladder diary and general patient health score. Categorical clinical variables included prior UI surgery, prior prolapse surgery, prior hysterectomy, menopausal status, hormone replacement use (HRT), diabetes, and smoking status. Subjective measures included the Urogenital Distress Inventory (UDI), Incontinence Impact Questionnaire (IIQ), and the Medical, Epidemiologic and Social Aspects of Aging Questionnaire (MESA). Subjective categorical variables included responses to questions about physical accommodation, character of urine stream and fecal incontinence. Continuous urodynamic (UDS) variables included, valsalva leak point pressure (VLPP), intravesical pressure (Pves), intra-abdominal pressure (Pabd), bladder volume at first desire, bladder volume at strong desire, maximal cystometric capacity, and pressure-flow data (maximum flow rate [Qmax], Pves at Qmax, Pabd at Qmax, time to Qmax). The only categorical urodynamic variable was pressure-flow voiding pattern (normal or abnormal).

Analyses were carried out in parallel for the SISTEr and TOMUS subjects as the trials had different inclusion and exclusion criteria representing different populations. Continuous variables were summarized by mean and standard deviation (SD). Distributions of continuous measures were assessed for normality. Although the distribution of some measures were moderately skewed, we elected to conduct and report analyses in the natural scales for ease of interpretation. To investigate the bivariate relationships of demographic, clinical and UDS variables with BMI category, one-way analysis of variance (ANOVA) was used for continuous measures and cross-classification and Chi square test or Fisher's Exact test for categorical measures as appropriate. In order to assess multi-colinearity among the multiple measures of incontinence a preliminary principal components analysis (PCA) was computed[20]. The PCA indicated that there were 3 independent dimensions of stress incontinence. One dimension was weighted most heavily by the subjective measures composed of the MESA stress score, UDI stress and IIQ total scores. The second dimension was most heavily weighted by the objective measures of pad weight and mean incontinence episodes/day. The third dimension was weighted by the objective urodynamic measures of composed of VLPP and MUCP (latter in TOMUS only). Based on this analysis we selected independent measures of incontinence for further analysis to reduce the number of redundant hypothesis testing. Within each dimension we selected a *single* measure to represent that aspect of incontinence, except in the subjective dimension as we wanted to explore both subjective symptom distress and symptom impact. Thus, we report the association of weight category with one objective measure of UI severity (IEF), two subjective measures of UI severity (UDI total score and IIQ), and one urodynamic parameter of UI severity (VLPP)[21]. To further understand the associations of weight category with severity, we computed an analysis of covariance (ANCOVA) of each severity and impact measure on weight category controlling for clinically important variables and those significantly associated with weight in bivariate analysis.

Analyses were performed using SAS version 9.2 (SAS Institute, Inc. Cary, NC). Because of the large number of hypothesis tests, we defined statistical significance by p=0.01.

Results

Participants in the SISTEr and TOMUS trials had mean ages of 51.9 (SD 10.3) years and 52.9 (SD 11.0) years, respectively. In SISTEr the mean (±SD) BMI of the normal weight

women was 22.9(1.6), the overweight women was 27.5(1.4), and the obese women was 35.4(4.8). Similarly, in TOMUS the mean (±SD) BMI of the normal weight women was 22.6(1.7), the overweight women was 27.4(1.2), and the obese women was 36.5(5.0). Seventy three percent of SISTEr subjects and 79% of those in TOMUS were Caucasian. In both trials, compared to normal weight women, obese women were more likely to have less education and report poorer health than normal weight women. Additionally, obese women in SISTEr were more likely to smoke and less likely to use hormone therapy. There were no differences among the groups in age, cesarean deliveries, hysterectomy, prior UI surgery, prior prolapse surgery or POPQ stage (Table 1).

In both trials (Table 2), obese women had a greater q-tip resting angle and smaller difference between the strain and resting q-tip angles. Other POP-Q points did not differ significantly by weight group.

Sixteen percent of women in SISTEr and 10% in TOMUS reported fecal incontinence as well as UI; the proportion did not differ by weight category (10%, 17% and 17% in SISTEr and 9%, 6%, and 13% in TOMUS for normal weight, overweight and obese women, respectively). Obese women did not differ from their normal weight counterparts in reporting abnormal voiding symptoms, such as slow stream, hesitating, or splinting (data not shown). The baseline UDS measures for each trial are summarized in Table 3. In both trials obese women had higher VLPP, Pves and Pabd at baseline and Pves and Pabd at Qmax than normal and overweight women. Interestingly, there were no differences in the presence of detrusor overactivity among normal, overweight and obese subjects in these trials.

Obese women had poorer scores on all three measures of incontinence severity and impact (Table 4). Specifically, in both trials, obese women experienced more incontinence episodes, reported higher symptom distress, had higher VLPP's and greater symptom specific impact on quality of life.

In order to explore whether the association of these measures of incontinence with weight category remained when covariates were controlled, we computed a multivariable analysis (ANCOVA) of each severity measure on weight category controlling for age, race and ethnicity, education, general patient health score, HRT use, diabetes and smoking. This analysis showed that in SISTEr, weight category remained significantly associated with higher UDI total scores ($p=0.003$), increasing IEF ($p<0.0001$), higher VLPP's ($p=0.003$) and higher impact ($p=0.0004$). In TOMUS, weight category was no longer associated with higher UDI scores ($p=0.24$), but was associated with increased incontinence episodes ($p=0.0003$), higher VLPP ($p=0.0006$) and higher impact ($p<0.0001$) when covariates were controlled. As a check on our decision to conduct analyses utilizing the natural scales of the measures, sensitivity analyses using normalizing transformations were performed and the results were the same as those reported in Table 4.

Discussion

Obese women with SUI participating in two large randomized surgical trials had worse objective and subjective measures of UI severity compared to normal weight women. Obese women report greater symptom distress and impact on quality of life from UI symptoms and experience more incontinent episodes, suggesting they have worse disease and/or experience other factors which increase their symptom burden. As BMI weight categories increased, subjective and objective UI severity seemed to increase. Interestingly, while women in both trials reported greater overall symptom distress from UI, stress-specific symptom distress did not differ among the obese and normal and overweight women. However in these subjects, obese women with SUI did have more concomitant urge incontinence as compared

to normal and overweight women which may have contributed to their increased symptoms (Table 4). Clinicians commonly believe that women with mixed UI symptoms (SUI and urge urinary incontinence [UUI]) have more severe UI than those with either pure SUI or UUI. In a large epidemiological study, 38% of women with mixed incontinence had severe incontinence and almost half were bothered by their incontinence. In contrast, only 17% of SUI only women had severe incontinence and only a third were bothered[22].

We found that weight group remained significantly associated with higher IEF when other characteristics were held constant, implying that UI severity is not explained by other factors that may be associated with increasing BMI. This is consistent with weight reduction data showing that incontinence episode frequency decreases with significant weight loss[7, 10–12]. A recent study comparing an intensive 6-month weight loss program (diet, exercise and behavior modification) to a structured education program demonstrated that in the intervention group, a BMI decrease of 8% was associated with 47% fewer incontinence episodes, while in the control group, there was a mean BMI decrease of 1.6% with a 28% decrease in incontinence episode frequency[12]. In addition, the intervention group had a greater decrease in SUI episodes, but not urge incontinence episodes. These data differ somewhat from our subjective data, which suggest a difference in bother from UUI but not SUI in obese women when compared to normal weight women. We did not differentiate between stress and urge incontinence episodes in our diary data.

Several urodynamic parameters differed between obese and normal and overweight women. Consistent with previous studies, we found that obese women had higher baseline intravesical and abdominal pressures than normal weight women[15, 16]. Previously, it has been hypothesized that higher abdominal pressures in women with greater BMI may explain the greater prevalence of UI and UI severity in obese women[13, 15]. In a small cohort of women after surgical weight loss, intravesical pressure decreased[13]. It seems plausible that the increased UI severity seen in obese women may be in part due to the higher abdominal and vesical pressures which put them closer to their leakage threshold regardless of urethral function. This hypothesis requires further study.

We found that while obese women had worse UI severity than normal weight women, they had higher VLPP values than normal and overweight women. The association between VLPP and obesity in women had been noted in a previous analysis looking at clinical and demographic factors associated with VLPP in the SISTEr population[23]. We did not measure urethral pressure simultaneously with vesical and abdominal pressures at baseline to determine if higher pressures were transmitted to the urethra in obese women, similar to the higher pressures transmitted to the bladder and abdomen. It seems plausible that at rest, urethral pressures are higher in obese women, but their urethras are unable to “respond” to events, which require quick increases in urethral pressure. Possibly, obese women rely on greater muscle contraction and force at rest, thereby recruiting a larger proportion of their motor unit pool to maintain continence at rest. When a stress event occurs, they are unable to recruit any additional motor units resulting in urinary leakage. Such a hypothesis is consistent with Henneman’s principle for motor unit recruitment in striated muscles which states that as the requirement for greater muscle contraction and force increases, more and larger motor units are recruited[24]. Research in other fields has demonstrated that obesity is associated with slower median nerve conduction velocities, which further supports a potential neuromuscular etiology for our findings[25]. Further studies which more precisely assess urethral neuromuscular function in obese and normal weight women are necessary.

Obese women had less urethral mobility with straining (as measured by change in Q-tip angle from rest with straining) than normal weight women. Lack of urethral mobility is associated with poorer outcomes after SUI treatments and may contribute to increased UI

severity in obese women despite better measures of intrinsic urethral function. In a case-control study of stress incontinent and continent control women, DeLancey et al recently demonstrated that urethral function, measured as MUCP, was more strongly associated with SUI than urethral mobility/support[26]. MUCP predicted half the occurrence of SUI; however, urethral support/mobility did predict 16% of SUI cases.

Our analyses are strengthened by inclusion of a large number of stress incontinent women representing all BMI categories from two randomized surgical trials. Study participants are well-characterized using validated subjective and objective measures. In addition, urodynamic techniques were standardized and validated across participating sites[27]. The consistency of the findings across the two study samples supports the conclusion that the associations found are robust in women with SUI. Our study may have been strengthened by the inclusion of urethral pressure measurements during cystometry and VLPP measurements. Such inclusion may have provided further insight into urethral function. It may also have been more informative if incontinence episodes had been broken down by cause ie associated with stress or urge UI.

The main statistical limitation is of multiple hypothesis testing because this can lead to identification of apparent associations due to chance. However, performing the analysis in parallel across the 2 samples showed consistency, providing evidence of a real association and not just chance. Modeling was performed to assess whether relationships between BMI and incontinence severity measures held controlling for confounders. However, we only partially addressed collinearity, did not test any interaction effects and did not formally test models for goodness of fit. These issues would be more relevant if we were trying to develop an explanatory model for incontinence, which was not the purpose of this report.

Conclusion

In summary, obese women planning incontinence surgery have more severe UI symptom distress, quality of life impact, and objective findings than normal weight women. Surprisingly, obese women also seem to have better urethral function as measured by traditional urodynamic techniques. Factors other than urethral failure may contribute to UI in obese women. Further investigation into urethral function changes with stress events is warranted.

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Abbreviations

ANOVA	Analysis of variance
ANCOVA	Analysis of Covariance
BMI	Body mass index
HRT	Hormone replacement therapy
IEF	Incontinence episode frequency
IIQ	Incontinence Impact Questionnaire
MESA	Medical Epidemiologic, Social Aspects of Aging

MCC	(from Table 4)
MUCP	Maximum urethral closure pressure
Pabd	Intra-abdominal pressure
PFS	Pressure Flow Study
POPQ	Pelvic organ prolapse quantification
Pves	Intravesical pressure
Qmax	Maximum flow rate
SD	Standard deviation
SISTEr	Stress Incontinence Surgical Treatment Efficacy Trial
SUI	Stress urinary incontinence
TOMUS	Trial of Midurethral Slings
UDI	Urogenital Distress Inventory
UDS	Urodynamics
UI	Urinary incontinence
UITN	Urinary Incontinence Treatment Network
UUI	Urge urinary incontinence
VLPP	Valsalva leak point pressure

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CO-INVESTIGATORS

Amy Arisco, MD; Jan Baker, APRN; Diane Borello-France, PT, PhD; Kathryn L. Burgio, PhD; Ananias Diokno, MD; Melissa Fischer MD; MaryPat Fitzgerald, MD; Chiara Ghetti, MD; Patricia S. Goode, MD; Robert L. Holley, MD; Margie Kahn, MD; Jerry Lowder, MD; Karl Luber, MD; Emily Luckacz, MD; Alayne Markland, DO, MSc; Shawn Menefee, MD; Pamela Moalli, MD; Elizabeth Mueller, MD; Pradeep Nagaraju MD; Kenneth Peters, MD; Elizabeth Sagan, MD; Joseph Schaffer, MD; Amanda Simsiman, MD; Robert Starr, MD; Gary Sutkin, MD; R. Edward Varner, MD.

STUDY COORDINATORS

Laura Burr, RN; JoAnn Columbo, BS, CCRC; Tamara Dickinson, RN, CURN, CCCN, BCIAPMDB; Rosanna Dinh, RN, CCRC; Judy Gruss, RN; Alice Howell, RN, BSN, CCRC; Chaandini Jayachandran, MSc; Kathy Jesse, RN; D. Lynn Kalinoski, PhD; Barbara Leemon, RN; Kristen Mangus; Karen Mislanovich, RN; Elva Kelly Moore, RN; Caren Prather, RN; Sylvia Sluder, CCRP; Mary Tulke, RN; Robin Willingham, RN, BSN; Kimberly Woodson, RN, MPH; Gisselle Zazueta-Damian.

DATA COORDINATING CENTER:

Kimberly J. Dandreo, MSc; Liyuan Huang, MS; Rose Kowalski, MA; Heather Litman, PhD; Marina Mihova, MHA; Anne Stoddard, ScD (Co-PI); Kerry Tanwar, BA; Sharon Tennstedt, PhD (PI); Yan Xu, MS.

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Table 1

Association of selected participant characteristics with weight classification in the SISTEr and TOMUS Trials

	SISTEr Trial			TOMUS Trial		
Variable	**Normal**	**Overweight**	**Obese**	**Normal**	**Overweight**	**Obese**
N (%)	142 (22)	218 (33)	290 (45)	137 (23)	192 (32)	262 (45)
Age [1] (mean, SD)	51.4(10.9)	52.5(10.1)	51.7(10.1)	52.5(11.5)	54.2(11.3)	52.1(10.4)
Race/ ethnicity[2]						*
Non-white	32(23%)	53(24%)	88(30%)	23(17%)	31(16%)	69(26%)
White	110(77%)	165(76%)	201(70%)	114(83%)	161(84%)	193(74%)
Education[2]			**			**
<High school	34(24%)	93(43%)	98(34%)	31(23%)	55(28%)	96(37%)
>High school	58(41%)	78(36%)	123(42%)	44(32%)	72(38%)	99(38%)
Completed college	50(35%)	47(21%)	69(24%)	62(45%)	65(34%)	67(25%)
Smoking[2]			**			*
Never smoking	91(64%)	120(55%)	141(49%)	81(59%)	100(52%)	135(52%)
Former smoking	37(26%)	60(28%)	110(38%)	47(34%)	69(36%)	80(30%)
Current smoking	14(10%)	38(17%)	39(13%)	9(7%)	23(12%)	47(18%)
Diabetes[2]	4(3%)	12(6%)	29(10%)*	5(4%)	8(4%)	26(10%)*
Hormone therapy[2]			**			
No	30(21%)	89(41%)	112(39%)	46(34%)	76(40%)	117(45%)
Yes	58(41%)	71(33%)	92(32%)	39(28%)	64(33%)	67(26%)
Pre-Menopausal	54(38%)	57(26%)	86(30%)	52(38%)	52(27%)	76(29%)
Cesarean[2]	10(7%)	18(8%)	22(8%)	13(9%)	13(7%)	32(12%)
Prior hysterectomy[2]	42(30%)	68(31%)	91(31%)	35(26%)	52(27%)	78(30%)
Prior UI surgery[2]	16(11%)	33(15%)	44(15%)	22(16%)	19(10%)	36(14%)
Prior prolapse surgery[3]	5(4%)	6(3%)	2(1%)	4(3%)	9(5%)	10(4%)
General health score[2]			***			***
Excellent	47(33%)	53(24%)	45(16%)	65(47%)	42(22%)	43(17%)

	SISTEr Trial			TOMUS Trial		
Variable	**Normal**	**Overweight**	**Obese**	**Normal**	**Overweight**	**Obese**
Very good	56(39%)	78(36%)	103(36%)	54(39%)	97(51%)	100(38%)
Good+Fair+Poor	39(27%)	87(40%)	139(48%)	18(13%)	50(27%)	118(45%)

N and percent were presented except age which were reported with mean and SD;

[1] Equality of means tested by ANOVA

[2] Equality of frequencies tested by Chi-square

[3] Prior prolapse surgery was tested using Fisher's exact test

* $0.01 \leq P < 0.05$

** $0.001 \leq P < 0.01$

*** $P < 0.001$ by Chi-square test

Table 2

Association of anatomic characteristics with weight categories in the SISTEr and TOMUS Trials

Variable	SISTER Trial			TOMUS Trial		
	Normal	Overweight	Obese	Normal	Overweight	Obese
Resting angle [1]	8.8(15.0)	14.9(15.6)	19.0(19.5)***	6.7(13.0)	5.5(11.7)	11.8(13.5)***
Strain angle[1]	59.2(18.8)	60.0(17.8)	60.8(18.4)	46.9(20.2)	44.7(21.5)	46.5(20.5)
Delta[1]	50.5(18.0)	45.1(17.6)	41.7(18.1)***	40.3(18.7)	39.2(20.5)	34.7(17.9)**
POP-Q [N(%)] [2]						
Stages 0–I	33 (23%)	54 (25%)	74 (26%)	64 (47%)	82 (43%)	120 (46%)
Stage II	85 (60%)	119 (55%)	180 (62%)	60 (44%)	93 (48%)	124 (47%)
Stage III	24 (17%)	45 (21%)	36 (12%)	13 (9%)	17 (9%)	18 (7%)
Point Ba[1]	−0.4(2.1)	−0.4(2.0)	−0.8(1.6)*	−1.2(1.5)	−1.2(1.8)	−1.4 (1.3)
Point Bp[1]	−1.7(1.8)	−1.6(1.7)	−1.7(1.4)	−1.9(1.3)	−1.8(1.8)	−2.0 (1.1)
Point Gh[1]	3.5(1.0)	3.5(1.3)	3.7(1.2)	3.3(1.0)	3.4(1.0)	3.6(1.1)*
Brink score [1]	9.1(2.0)	8.9(2.2)	8.9(2.0)	8.9(1.8)	8.7(2.1)	8.7 (2.0)

Mean and SD were presented except POP-Q;

[1] Equality of means tested by ANOVA

[2] Equality of frequencies tested by Chi-square

* 0.01≤P< 0.05

** 0.001≤ P <0.01

*** P<0.001

Table 3

Association of urodynamic measures with weight categories in the SISTEr and TOMUS Trials

Variable	SISTER Trial			TOMUS		
	Mean (SD)			Mean (SD)		
	Normal	Overweight	Obese	Normal	Overweight	Obese
VLPP	107.3(31.8)	115.8(37.1)	122.2(39.6)***	107.9(35.2)	114.0(39.3)	130.2(46.1)***
Pves baseline	31.7(10.4)	35.4(10.8)	40.3(11.8)***	32.3(9.2)	35.0(11.1)	39.4(11.9)***
Pabd baseline	30.0(10.5)	33.5(11.1)	38.4(12.2) ***	30.3(9.7)	33.0(11.2)	37.8(11.2)***
Bladder vol, first desire	150.1(108.8)	145.6(96.5)	135.1(88.7)	133.4(85.8)	111.5(85.4)	111.5(73.1)*
Bladder vol, strong desire	276.0(155.9)	259.2(138.2)	252.0(126.6)	250.1(126.4)	222.1(119.0)	219.1(111.7)*
MCC	399.9(141.0)	391.8(140.9)	387.6(134.4)	371.0(136.4)	350.3(122.4)	341.4(114.5)*
Detrusor Overactivity	12/139(9%)	15/217(7%)	33/285(12%)	12/133(9%)	21/190(11%)	37/260(14%)
Max Flow (PFS)	20.8(10.6)	21.7(9.8)	21.3(9.8)	21.9(10.6)	21.9(11.2)	22.2(10.5)
Pves at Qmax	50.4(18.4)	54.2(23.8)	65.5(24.8)***	47.5(19.1)	53.8(28.1)	64.1(27.2)***
Pabd at Qmax	33.8(18.6)	36.6(21.7)	44.6(23.7)***	30.2(21.2)	36.0(28.9)	42.5(27.0)***
Time to max flow, sec	24.9(33.4)	19.2(23.3)	17.5(25.8)*	20.6(25.6)	21.7(30.2)	24.1(48.5)

Mean and SD were presented. Equality of means tested by ANOVA

* 0.01≤ P < 0.05

** 0.001≤ P <0.01

*** P<0.001

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Table 4

Association of weight category with Incontinence Severity: Unadjusted and adjusted

Variable	SISTER Trial			TOMUS		
	Normal	**Overweight**	**Obese**	**Normal**	**Overweight**	**Obese**
Unadjusted means (sd) [1]						
IIQ total score	132.1(87.0)	170.5(102.5)	191.2(101.1)***	119.9(78.3)	132.3(89.7)	182.7(102.6)***
UDI total score	138.8(43.7)	146.7(51.4)	160.0(46.4)***	125.2(41.1)	129.9(44.0)	143.3(47.1)***
UDI urge subscale score	39.6(22.6)	45.7(24.5)	53.3(25.4)***	33.7(21.4)	37.6(25.6)	48.2(25.5)***
UDI stress subscale score	77.2(19.3)	74.0(24.6)	81.4(20.4)***	75.7(21.9)	74.6(21.4)	73.8(21.4)
IEF	2.2(2.1)	3.3(3.3)	3.6(3.0)***	2.9(3.3)	2.8(2.2)	3.9(3.1)***
VLPP	107.3(31.8)	115.8(37.1)	122.2(39.6)**	107.9(35.2)	114.0(39.3)	130.2(46.1)***
Adjusted means [2]						
IIQ total score	151.3	175.9	189.7***	158.2	155.0	189.8***
UDI total score	144.9	147.2	159.1 **	143.9	142.3	149.1
IEF	2.8	3.8	4.2 ***	2.9	2.7	3.8 ***
VLPP	108.3	118.0	124.8 **	110.8	116.6	131.9 ***

[1] Unadjusted Mean and SD were presented Equality of means tested by ANOVA

[2] Means adjusted for age, education race/ethnicity, smoking status, general health HRT use, diabetes using ANCOVA

* 0.01≤P< 0.05

** 0.001≤ P <0.01

*** P<0.001