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Lower Urinary Tract Symptoms and Sexual Dysfunction in the Bariatric Patient Population: A Comprehensive Review

Paulette C. Dreher[1], Gabrielle R. Yankelevich[2], Kelly Lurz[1], Shaun Hager[1], Antoine Ghorayeb[3], Daniel Edwards[1,4,5] and Darlene Gaynor[1]

[1]*Department of Urology, Main Line Health, Bryn Mawr, PA, USA*
[2]*Philadelphia College of Osteopathic Medicine, USA*
[3]*Department of Urology, Cook County Health, Chicago, IL, USA*
[4]*Levine Cancer Institute at Atrium Health. Charlotte, NC, USA*
[5]*Center for Urologic Care of Berks County. Reading, PA, USA*

Abstract

Introduction & Objective: The growing epidemic of obesity is a leading cause of morbidity and is associated with dysfunction across multiple organ systems. Bariatric surgery may result in significant and sustained weight loss along with potential improvement of obesity-related comorbidities, including genitourinary dysfunctions. Recent data suggest the potential of bariatric surgery associated weight loss to improve urinary symptoms and sexual dysfunction (SD) in both men and women. The aim of this review is to assess the urinary and sexual function outcomes in the bariatric surgical patient.

Methods: PUBMED was searched in accordance with PRISMA guidelines for relevant articles in English. Ineligible articles were excluded and articles meeting all inclusion criteria (n=32) went on to review by 2 reviewers. Outcomes results were catalogued and summarized across articles. As a result of the substantial heterogeneity of outcome measures and follow-up intervals, meta-analytic techniques were not applied to the data.

Results: Most reports consist of one or more validated questionnaire (87.5%, n=28) and non-validated surveys (9.4%, n=3) prospectively given to patients preoperatively and postoperatively in order to demonstrate a significant improvement in urinary incontinence (UI) and/or sexual function after weight loss. We found that LUTS was evaluated in 53.1% (n=17), SD in 25% (n=8) and 21.9% evaluated both LUTS and SD. The most frequently utilized questionnaires were the ICIQ, PFDI and the IPSS. The majority of studies reported improvements in both LUTS 95.8% (n=23) and SD 66.7% (n=10).

Conclusion: Literature suggests a significant reduction in UI in patients who have undergone bariatric surgery. With regards to LUTS and SD, there appears to be improvement following bariatric surgery; however, the paucity and heterogeneity of literature examining SD and LUTS in the bariatric surgery population necessitates further research be performed.

Keywords: Bariatric; Urinary incontinence; Sexual dysfunction; Weight loss; Obesity

Abbreviations

BMI: Body Mass Index; UI: Urinary Incontinence; SD: Sexual Dysfunction; ED: Erectile Dysfunction; PFD: Pelvic Floor Disorders; SUI: Stress Urinary Incontinence; UUI: Urge Urinary Incontinence; LUTS: Lower Urinary Tract Symptoms; QoL: Quality of Life; OAB: Overactive Bladder; POP: Pelvic Organ Prolapse; BPH: Benign Prostatic Hyperplasia, BS: Bariatric Surgery; LGB: Laparoscopic Gastric Bypass; RYGB: Roux-en-Y Gastric Bypass; ORSD: Obesity Related Sexual Dysfunction

Introduction

Obesity is a global epidemic with increasing prevalence worldwide [1] Based on a definition of a body mass index (BMI) of 25-29.99 kg/m^2 as overweight and BMI>30 kg/m^2 as obese, the World health organization (WHO) estimates that approximately 1.9 billion and 600 million adults (age>18) are overweight and obese worldwide, respectively [2]. Obesity affects both sexes, all socioeconomic classes and both modern and developing populations. Not only does obesity have a significant I lmpact on quality of life, but also contributes to a large majority of healthcare costs due to associated comorbidities, including cardiovascular disease, cerebrovascular disease, diabetes and dyslipidemia [3]. Concordantly, it has been well-documented that disorders associated with obesity may improve or even resolve after BMI reduction, such as may be expected to occur after bariatric surgery, and the desire to improve medical comorbidities is the primary reason that patients seek bariatric surgery [4,5]

While the cardiovascular and metabolic sequelae of obesity are well-recognized, less commonly considered are the effects that obesity and weight loss may have on genitourinary function, including lower urinary tract symptoms (LUTS) and sexual dysfunction (SD) [6,7]. Additionally, while the American Society of Metabolic and Bariatric Surgery (ASMBS) clinical practice guidelines indicate that severe UI in the setting of BMI>35 kg/m^2 is an indication to offer bariatric surgery, no such recommendations exist with regards to other bothersome urinary symptoms or SD despite their significant impact on quality of life [8]. While prior systematic reviews and meta-analyses have examined the role of bariatric surgery with regards to UI outcomes, few have examined other LUTS and none have discussed SD in a systematic review [9,10]. The current systematic review seeks to catalogue and summarize clinical research examining the deleterious effects of obesity on LUTS and SD and review sexual and urinary outcomes associated with bariatric weight-reduction surgery.

***Corresponding author:** Gabrielle Yankelevich, Philadelphia College of Osteopathic Medicine, USA, Tel: 610-564-9673; E-mail: gabrielleya@pcom.edu

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Methods

A systematic review of the literature was completed to identify English language articles pertaining to LUTS and SD in patients undergoing bariatric surgery published between 1990-2017 utilizing Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRIMSA) standards. Using PUBMED, search terms and nomenclature derivatives included "bariatric surgery and urinary symptoms," "bariatric surgery and LUTS," "bariatric surgery and SD," "bariatric surgery and sexual function," and "bariatric surgery and erectile dysfunction." The PubMed function "cited references" and reference lists of all included articles were screened for any additional relevant articles. All titles and abstracts were screened for relevance. Case reports, review papers, articles without full-text availability, non-English language articles were excluded from final review. The remaining 43 screened articles were reviewed for eligibility by two reviewers. Ultimately, 32 retrospective and prospective studies of patients undergoing laparoscopic sleeve gastrectomy (LSG), Lap Band (LB), Roux-en-y Gastric Bypass (RYGB) or a combination with reporting on UI and/or SD were included in review and read in entirety by senior reviewer (Table 1). Please refer to Figure 1 for a complete illustration of our search protocol. Meta-analytic techniques were not applied to these data because of the heterogeneity of reported outcome measures and follow-up, as well as the lack of standardization of surveys and surgical procedures across studies.

Author	No. of pts.	Study Type	Investigator	Followup (mo)	Bariatric Surgery	Questionnaire	Outcomes	Comments
Ahroni et al. [11]	195	prospective	Behavioral Health (PhD)	12	Lap Band	Non-validated	No significant changes in SUI	80% reduction in SUI medications
Ait Said et al. [12]	140	prospective	Urology, Gen Surgery	12	RYGB	USP ICIQ	USP scores pre *vs.* postoperatively: 74.1% *vs.* 21.6% (p<0.001) ICIQ scores pre *vs.* postoperatively: 3.9 ± 5.3 *vs.* 1 ± 3 (p<0.001)	
Bond et al. [13]	77	prospective	Psych, Gen Surgery	6	RYGB, Lap Band	FSFI	FSFI pre *vs.* postoperative scores for laparoscopic gastric bypass and Roux-en-Y gastric bypass respectively: 24.2 ± 5.9 *vs.* 29.1 ± 4.1 and 23.7 ± 7.4 *vs.* 29.1 ± 4.7	Female only
Bullbuller et al. [2]	120	prospective	Surgery, Urology	6	LSG	ICIQ, IIQ-7	ICIQ and IIQ-7 scores postoperatively were significantly improved but numerical data was not disclosed	Female only
Burgio et al. [14]	101	prospective	Geriatric, UroGyn, Gen Surgery	12	RYGB	UDI, IIQ	UDI scores pre *vs.* postoperatively: 21.6 ± 21.1 *vs.* 9.3 ± 11.9 (p<0.001) IIQ scores pre *vs.* postoperatively: 15.8 ± 24.5 *vs.* 6.1 ± 18.0 (p<0.001)	Female only
Castro et al. [15]	24	prospective	Gen Surgery	12	NR	KHQ	KHQ domain for urinary incontinence scores pre *vs.* postoperatively: 56.86 *vs.* 7.84 (p=0.001)	Female only
Dallal et al. [16]	97	prospective	Gen Surgery, Urology	19	RYGB	BFSI	BFSI average scores were significantly improved in all domains, but overall score was not reported (p<0.01)	Male only
Daucher et al. [17]	34	prospective	UroGyn	6	Not specified	PFDI, PFIQ, PISQ-12	PFDI improvement in UDI:41 ± 32 to 15 ± 10, p=0.05 PFIQ improvement in UIQ 44 ± 60 to 27 ± 40, P=0.05 No significant difference in PSIQ-12	Female, POPQ score assessed
Efthymiou et al. [18]	80	prospective	Psychiatry, Gen Surgery, Endocrinology	12	RYGB, LSG, BPD	FSFI IIEF	FSFI average scores pre *vs.* postoperatively: 21.72 ± 10.18 *vs.* 27.72 ± 8.06 (p=0.001) IIEF average scores pre *vs.* postoperatively: 5.29 ± 2.91 *vs.* 8.59 ± 1.32 (p<0.001)	
Goitein et al. [19]	48	prospective	Gen Surgery	6 to 7	RYGB, LSG	FSFI BSFI	FSFI scores pre *vs.* postoperatively: 24 *vs.* 30 (p=0.006) BSFI scores pre *vs.* postoperatively: 40.2 *vs.* 43.9 (p=0.08)	
Groutz et al. [20]	55	prospective	UroGyn, Gen Surgery	3	LSG	IPSS IIEF	Pre *vs.* postoperative IPSS scores: 5.5 ± 4.4 *vs.* 2.7 ± 2.6 (p<0.001) IIEF pre *vs.* postoperative scores: 22.7 ± 7.2 *vs.* 26.1 ± 6.5 (p=0.02)	Male only

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Kinzl et al. [21]	117	prospective	Psych, Gen Surgery	12	Lap band	Non- validated	63% enjoyed sex more after surgery. 12% enjoyed sex less after surgery	Female only
Knepfler et al. [22]	116	prospective	Surgery, Gyn	11.3	RYGB, LSG	PFDI-20	PFDI scores pre *vs.* postoperatively: 62 *vs.* 53 (p=0.047)	
Knoepp et al. [23]	3898	Retrospective	Gyn, UroGyn, Gen Surgery, Urology	36	Not specified	None	62.4% no longer diagnosed w/ urinary incontinence postoperatively *vs.* 6.2% gained the diagnosis postoperatively	Female only; used ICD10 coding to tract LUTS
Kun et al. [24]	39	Retrospective	Endocrin e	12	RYGB	IIEF	IIEF average scores pre *vs.* postoperatively: 17.3 *vs.* 23.8 (p<0.05)	Male only
Kuruba et al. [25]	201	prospective	Gen Surgery	12	RYGB, Lap Band	Sandvik Incontinence Severity Index	SISI scores pre *vs.* postoperatively: 5.4 ± 2.3 *vs.* 2.3 ± 2.8 (p<0.001)	
Laugnani et al. [26]	470	prospective	Urology, Gen Surgery	12	RYGB	ICIQ-short	ICIQ-short pre *vs.* postoperative scores: 7.6 ± 4 *vs.* 3.0 ± 4 (p=0.001)	Female only
Lesham et al. [27]	150	prospective	Not specified	6	Not specified	ICIQ, PFDI, BFLUTS	ICIQ decreased from 9.3 ± 3.9 to 3.3 ± 3.8 postop (p<0.001)	Female only
Luke et al. [6]	70	prospective	Urology	1.5-12	LSG LGB Open GB	BFLUTS, IPSS	significantly reduction in overall symptom score postoperatively (p<0.01), but raw data was not reported	
McDermott et al. [28]	63	prospective	UroGyn, Gen Surgery	12mo	RYGB, LSG	PFDI-20 UDI-6 PFIQ-7	Female only	
Mora et al. [29]	39	prospective	Endocrine	12mo	RYGB, LSG	IIEF	Improved IIEF 54.85 ± 16.59 to 61.21 ± 14.10 (p<0.01)	Male only; also evaluated hormonal changes
O'Boyle et al. [7]	240	prospective	Gen Surgery, UroGyn	15 mo	RYGB, LSG, Lap Band	ICIQ-UI	ICIQ-UI scores pre *vs.* postoperatively: 9.3 *vs.* 4.9 (p<0.05)	
Olivera et al. [30]	44	prospective	UroGyn	36mo	RYGB, LSG, Lap Band	UIQ FSFI	UIQ scores pre *vs.* postoperatively: 143.41 ± 66.56 *vs.* 108.49 ± 18.12 (p=0.002) FSFI scores pre *vs.* postoperatively: 17.70 ± 8.38 *vs.* 16.91 ± 9.75 (p=0.58)	Female only
Palleschi et al. [4]	120	prospective	Urology, Gen Surgery	180 days	LSG	OABq	OABq scores pre *vs.* postoperatively: 18.69 ± 8.9 *vs.* 12.18 ± 3.2	
Ranasin et al. [31]	160	Retrospective	Not specified	31mo	LGB	ICIQ IPSS IIEF	ICIQ females pre *vs.* postoperative scores: 5.24 *vs.* 3.93 (p<0.05) ICIQ males pre *vs.* postoperative scores: 1.82 *vs.* 1.67 (p=0.54) IPSS males pre *vs.* postoperative scores: 6.87 *vs.* 6.90 (p=0.96) IIEF males pre *vs.* postoperative scores: 51.39 *vs.* 48.17 (p=0.70)	
Romero-Talmas et al. [32]	132	prospective	Gen Surgery, Gyn	12	RYGB, LSG, Lap Band	PFDI-20 PFIQ-7 PISQ-12	PFDI-20 scores pre *vs.* postoperatively: 76.7 ± 47.2 *vs.* 52.2 ± 50.9 (p<0.001) PFIQ-7 scores pre *vs.* postoperatively: 30.3 ± 39.2 *vs.* 16.8 ± 36.9 (p=0.002) PISQ-12 scores pre *vs.* postoperatively: no improvement	Female only
Rosenblatt et al. [33]	23	prospective	Not specified	72-144	RYGB	IIEF	IIEF scores for post-surgical patients *vs.* obese controls: 56.7 ± 14.4 *vs.* 49.0 ± 11.9 (p=0.02)	Male only
Scozzari et al. [34]	32	prospective	Gen Surgery	15	LSG, RYGB,	PFDI-20 (UDI-6)	PFDI-20 urinary domain median scores pre *vs.* postoperatively: 14.6 *vs.* 8.3 (p<0.001) PFIQ-7 urinary domain median scores pre *vs.* postoperatively: 2.4 *vs.* 0.0 (p=0.03)	Female only

Shimonov et al. [35]	80	prospective	Gen Surgery, UroGyn	6	LSG	ICIQ-UI PFDI	ICIQ-UI scores pre *vs.* postoperatively for incontinent women: 9.28 ± 3.6 *vs.* 2.9 ± 3.8 (p<0.001) PFDI scores pre *vs.* postoperatively for incontinent women: 54 ± 30.9 *vs.* 20.3 ± 19.8 (p<0. 001)	Female only
Subak et al. [5]	1987	prospective	Gyn, Gen Surgery	36	RYGB, LSG, Band, Dudodenal switch	Self-Report Questionnaire	Baseline presence of weekly urinary incontinence was 49.3% in females and 21.8% in males w/ significant improvements 1 year postoperatively for both genders, 18.2% and 10.4% respectively	
Uruc et al. [36]	22	prospective	Urology, Gen Surgery	NR	LSG	IPSS, ICIQ	Decrease ICIQ 1.82 ± 2.15 to 0.32 ± 0.95 and IPSS 4.5 ± 2.22 to 1.91 ± 1.48 (p<0.01)	Male only
Whitcomb et al. [37]	100	prospective	UroGyn	6 to 12	Lap Band LSG	PFIQ, PFDI, EPIQ	SUI prevalence decreased 32% to 20% PFIQ decreased (p<0.001)	Female only

Table 1: Summary of articles.

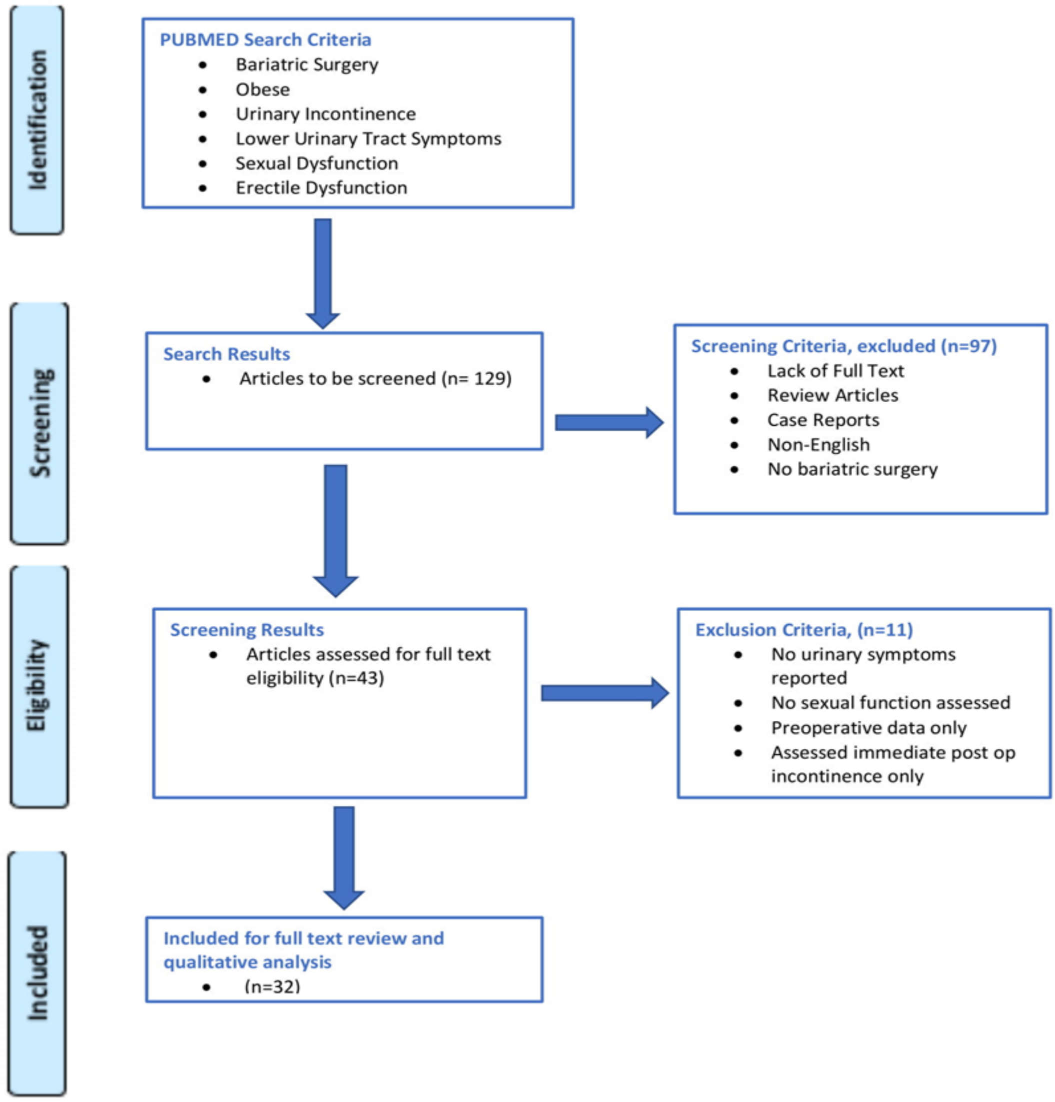

Figure 1: Study selection process and criteria for inclusion based on the Preferred Reporting Items for Systematic Reviews and Meta-analysis guidelines (PRSIMA).

Separate surveys have been established to assess male and female sexual function. The most common verified questionnaires to evaluate SD are International Index of Erectile Function (IIEF), the Female Sexual Function Index (FSFI), the Brief Male Sexual Function Index (BSFI) and Impact of Weight on Quality of Life (IWQOL)-Lite questionnaire. Questions incorporate sexual satisfaction, desire/libido, quality of erections, and frequency of sexual intercourse. However, there has been a lack of consistency with regard to the use of these surveys across studies.

Results

Of the 32 studies meeting the inclusion and exclusion criteria, 9.4% (n=3) and 90.6% (n=29) were retrospective and prospective in nature, respectively. 53.1% (n=17) evaluated LUTS, 25% (n=8) evaluated SD, and 21.9% (n=7) evaluated both LUTS and SD. Men were evaluated in 18.8% (n=6), 46.9% (n=15) evaluated women, and 34.4% (n=11) considered both. While the majority of studies utilized prospective validated surveys to assess genitourinary problems, there was significant heterogeneity. When considering questionnaires, 34.4% (n=11) used one validated questionnaire, 53.1% (n=17) used more than one validated questionnaire, 9.4% (n=3) used non-validated questionnaires and 3.1% (n=1) used no questionnaire (ICD-10 coding). Of the studies that utilized validated questionnaires, the most frequently used to assess LUTS or UI were the ICIQ 38.1% (n=8), PFDI 38.1% (n=8) and the IPSS 19% (n=4). When evaluating for SD the IIEF 57% (n=4) and the FSFI 57% (n=4) were the most common validated questionnaires. Please see Table 2 for a more detailed illustration of each reported validated questionnaire. The General Surgery or Bariatric Department was the most commonly cited investigator/author. They were involved in 71.9% (n=23) of studies, UroGyn/FPMRS Department in 28.1% (n=9), and Urology in 25% (n=8). Complete relevant article characteristics and data are summarized in Table 1.

Epidemiology/Pathophysiology of Luts & Ui in the Bariatric Surgery Population

UI affects approximately 30 million US adults and can result in substantial distress, diminished quality of life, and limiting daily function [5]. The prevalence of incontinence has been reported to be as high as 60%-70% among morbidly obese women and 24% among obese men [5,14,38-40]. Epidemiological studies have shown that obesity is an independent risk factor for incontinence, reporting each 5-unit increase in BMI results in a 40-70% increase risk of UI [5]. There is limited data to assess the change in LUTS after weight loss in both men and women [6]. In the obese population, bothersome LUTS is a common development, and the consequential various urogenital complications are directly associated with obesity [4]. In men and women, a documented higher BMI and waist to hip ratio as well as a decreased level of physical activity were both associated with increased risk of LUTS [41]. Additionally, obesity as measured by waist circumference may be used as a predictor of LUTS [9]. A recent meta-analysis by Lee et al. [9] suggested that bariatric surgery results in the improvement or resolution of any UI in 56%, SUI in 47%, and UUI in 53% of patients. The etiology, mechanism and pathophysiology of bothersome LUTS in obese men and women is multifactorial; Diabetes mellitus (DM) is a condition often associated with obesity and a worsening of LUTS. Investigators have shown that obesity and concurrent type 2 DM result in detrusor over-activity, voiding dysfunction and increased incidence of LUTS [2,4].

More women than men undergo bariatric surgery according to a nationwide ten-year review (80.7% versus 19.3% respectively) [42], In the female population, obesity is a well-established and researched risk factor for UI [39,43,44]. In this group, UI is most frequently associated with obesity [26,34]. Osborn et al. [45] report as great as 71% of obese women seeking bariatric surgery complain of UI. Of these women, the rate of stress urinary incontinence (SUI) was 60%, urgency urinary incontinence (UUI) was 53%, and mixed incontinence was 42% [45]. As BMI rises there is an increase in intra-abdominal pressure, which results in a higher prevalence of pelvic organ prolapse (POP), overactive bladder (OAB) and SUI [37]. It follows that, improvement of intra-abdominal pressure afforded by weight loss thereby decreases mechanical stress on the bladder and pelvic floor and improves LUTS/UI [34].

While the relationship between obesity and urinary symptoms in male patients is less often considered, several authors have demonstrated an association between obesity and increased prevalence of BPH and LUTS defined by the IPSS [44,46,47]. It was reported by Kristal et al. [47] that each 0.05 increase in waist-to-hip ratio was associated with a statistically significant 10% increased risk of total ($p<0.003$) and severe ($p<0.02$) BPH. Additionally, in men it was demonstrated than increase in waste circumference, from <90 to >90 cm, was associated with a greater likelihood of higher IPSS (OR 1.68) [48].

Questionnaire	Abbreviation	Assessment
Bristol Lower Urinary Tract Symptom Score	BFLUTS	Assesses domain of incontinence, voiding, and filling
Epidemiology of Prolapse and Incontinence Questionnaire	EPIQ	Screen for female pelvic floor disorders; assess for POP, SUI, OAB and Fecal Incontinence
Incontinence Impact Questionnaire	IIQ-7	Severity of urinary incontinence and impact on quality of life
International Consultation on Incontinence	ICIQ	Type and severity of UI and impact on QoL
International Index of Erectile Function	IIEF	Clinical assessment of erectile dysfunction; examines 4 domains of male sexual function; erectile, orgasmic, sexual desire, and satisfaction
International Prostate Symptom Score	IPSS	Presence and severity of LUTS; classify as mild, moderate or severe
Kings Health Questionnaire	KHQ	Measures the impact of urinary incontinence on the quality of life of women
Overactive Bladder short question	OABq	Assesses OAB symptom bother and health related QoL
Pelvic Floor Disability Index	PFDI-20	Degree of bother for urinary, colorectal-anal, and Pelvic organ prolapse distress
Pelvic Floor Impact Questionnaire	PFIQ	Extent of female LUTS, lower GI tract, and POP symptoms in last 3 months
Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire	PISQ	Evaluates sexual function in female with pelvic organ prolapse
Sandvik Incontinence Severity	SIS	Calculates severity of urinary incontinence in women
Urogenital Distress Inventory	UDI-6	Subjectively measures presence of urogenital dysfunction and its level of bother
Urinary Symptom Profile	USP	Assess stress incontinence, OAB, and obstructive symptoms in both men and women

Table 2: Validated Questionnaires utilized in the reviewed studies.

Outcomes in Luts Following Bariatric Surgery

Female LUTS/UI outcomes

Most included studies grouped SUI and UUI together while describing the effects of obesity and weight loss surgery on UI in women despite different pathophysiology [32]. A study by Laungani et al. [26] of 58 obese women before and after gastric bypass showed an improvement in post-operative UI with the most significant reduction in SUI compared to UUI. Improvement in all three UI subtypes has been seen at 6 months postoperatively as measured on the ICIQ and IIQ-7, with a decreased incident of SUI by 61%, UU by 39% and MUI by 25% [2]. Surgically induced weight loss was associated with statistically significant improvement in UI, storage phase symptoms, condition-related QOL and POP symptoms. In a study of 56 women reporting preoperative incontinence, 88% (n=49) reported some improvement and 48% (n=27) reported complete resolution following bariatric surgery [27]. Rarely have women reported new onset of LUTS after undergoing bariatric surgery. It is reported that up to 1.3% experience de novo UI detected by both the ICIQ and BFLUTS questionnaires, as well as prolapse symptoms detected on the PFDI-20 questionnaire [27]. Interestingly, a study showed that when adjusted for weight loss there was a worsening in UUI, despite improvements of UI and SUI in female population [40]. While this could be due to long lasting effects of obesity (i.e. pelvic laxity or detrusor instability) it was not a common finding amongst studies. In a study of 77 women, Shimonov et al. [35] utilized 4 different validated questionnaires (ICIQ-UI, BFLUTS, PDFI, PSIQ) to assess the effects of bariatric surgery on UI in women. At 6 months, surgically induced weight loss was associated with improvement in UI, POP, filling symptoms, and QoL. A statistically significant, 51.7% of women described complete resolution in symptoms p<0.01 [35]. Scozzari et al. [34] demonstrated postoperative improvement in urinary score (14.6 *vs.* 8.3, p<0.001), with an overall decrease in UUI from 43.8% to 15.6% (p =0.029). When correlating with weight loss, one study showed that for each kilogram of weight loss there was a 0.05 improvement in the ICIQ score (p=0.03) [40].

Some studies utilized non-validated questionnaires or measured and reported UI and LUTS by other standards. For example, Knoepp et al. [23] sought to evaluate improvement in UI after bariatric surgery by evaluating CPT codes. They found that 62.4% of patients diagnosed with UI before their surgery, no longer had the same coding diagnosis at 5 years post operatively [23]. In another female predominant study, it was shown that there was an 80% reduction in patients medicated for incontinence [11]. Using self-report UI questions, Subak found significant (p<0.001) decreases in UI for women of 31% and 25% at 1 and 3 years [5]. Pad per day usage was also used a means of assessing improvement in UI, with a reported decrease in pads from 3.5/day to 1.75/day after bariatric surgery [17]. Interestingly, Talamas et al. [32] used urodynamic testing pre and post operatively to assess for UI. They reported a decrease in prevalence of UDS identified SUI after surgery (76.9% to 30.8%, p=0.01).

Male LUTS/UI outcomes

For Men, the IPSS was the most commonly utilized validated questionnaire to assess degree of LUTS and bother. Using the IPSS, Groutz et al. [20] showed a statistically significant improvement in storage phase LUTS among obese men who had undergone bariatric surgery. The postoperative total IPSS score decreased from 5.5 to 2.7 (p<0.001), and only improvement in storage phase symptoms was noted. Subjectively, 24% of men reported complete resolution of LUTS after surgically induced weight loss [20]. Similarly, a prospective study from Uruc et al. [36] identified improvements in IPSS from 4.5 to 1.91 (p<0.01). A positive correlation (62.8%) between post-operative BMI change ratio and IPSS change was noted. The same study also noted a decrease in ICIQ from1.82 to 0.32 (p<0.001) [36]. Using self-report UI questions, Subak found significant (p<0.001) decreases in UI 12% and 9%, at 1 and 3 years respectively [5]. Another study reported an improvement in number of voids/day, from a mean of 9.6/day preoperatively to 6.6/day post-operatively [4]. In a multicenter study by Luke et al. [6] men reported mild preoperative LUTS with mean IPSS score of 6.65, there was an observed improvement and/or resolution of these symptoms as early as 6 weeks postoperatively which was sustained at 1 year. Moreover, there were also statistically significant, p<0.01, improvements in all QoL, stream, urgency, intermittency, frequency. Contrastingly, 24% men with reported preoperative UI saw no improvement in LUTS/UI measured by IPSS (mean total IPSS preoperative 6.8 *vs.* postoperative 6.9) [40].

Epidemiology & Pathophysiology of SD in the Bariatric Surgery Population

Gender unspecified sexual dysfunction

While there has been less investigation, studies have shown that obesity can lead to SD [49]. Obesity is linked to a diminished sexual desire, poor sexual performance, and avoidance of sexual encounters. It has also been implicated as an independent risk factor for erectile dysfunction (ED) [13,50,51]. SD in obese patients is a common but complex condition that results in considerable personal distress and adversely affects health and quality of life [13,19,16]. Ultimately the improvement in sexual satisfaction in bariatric patients in the post-operative period is multifactorial. Various aspects such as fewer physical limitations, self-esteem, improved erectile function, and increased sexual desire, all likely play a role.

Female specific SD

Female sexual dysfunction (FSD) is characterized by impairments in sexual response cycle and pain during or after intercourse [13,52]. Although a multifactorial issue, women seeking BS are at high risk of FSD and reported a lower sexual quality of life than obese controls [13]. Review of the literature shows that up to 60% of women seeking BS report FSD as defined by the FSFI [13,53]. On a preoperative study, women with incontinence reported a greater degree of SD compared to continent women [27]. Additionally, Steffan et al. [49] report that no sexual activity is most commonly attributed to being too tired/not interested or not having a partner. When considering psychiatric causes, studies have found that anxiety impacted sexual desire, arousal, satisfaction and overall SD. Depression, however, was only associated with decreased desire [50]. In a preoperative evaluation, 11% of patients reported difficulty in engaging in sexual intercourse because of physical restrictions [21].

Male specific SD

More than one third of men (36%) presenting for BS reported ED [53]. Obesity appears to adversely impact male SF through several interlinked mechanisms [29]. A multi-institution study found that obese men most commonly attributed no sexual activity to physical problems [49]. Obesity and insulin resistance have been identified as causes of peripheral vascular disease secondary to subsequent endothelial dysfunction and atherosclerosis, both of which are known risk factors for ED [40]. Additionally, obesity has been associated with decrease in both total testosterone (TT) and sex hormone-binding globulin, as well as increase in estradiol in men [53,54]. Low T levels in obese men have been associated with increased estrogen production by adipose tissue, insulin resistance, low grade systemic inflammation as well as other risks associated with metabolic syndrome [29,51]. Hypotheses to the root cause of this dysfunction include low androgen levels, increased conversion of testosterone to estrogen in men and secondary to other comorbidities (i.e. arteriogenic ED as a result of peripheral vascular disease or long-standing hypertension) [55,56]. Few studies have been able to capture the complete effect of BS on SD in men, including the hormonal response [21].

Outcomes in SD Following Bariatric Surgery

Gender unspecified outcomes related to SD

Weight loss attained through BS improves body image and sexuality [57]. In a survey (non-validated) based study, in which only 28 of 94 patients who had undergone BS responded, 50% reportedly enjoy sex more, 44% report improved orgasms and 80% felt more attractive [57]. Improved SD and increased sexual activity in individuals who lost weight was associated with a variety of factors, including improved self-esteem, heightened libidinous body assessment of themselves, or their partners, and by fewer physical limitations [21]. Goietein et al. [57] reported an improvement in general satisfaction, desire, and erectile function with the BSFI scoring system, although results were not statistically significant [57].

Female specific SD outcomes

Studies have reported a dramatic reversal of FSD after bariatric surgery, with resolution in 68% patients by 6 months and improvement to levels that mirrored controls [13]. FSFI scores improved from 24.2+5.9 to 29.4+4.3 after LGB and from 23.7+7.4 to 29+4.7 after RYGB [13]. In another study, 59% of women preoperatively reported SD with FSFI <24 and only 15% reported postoperative SD. Average FSFI index improved from 24+9.6 to 30+4.5 (p<0.006), with an independent increase in all FSFI parameters, except for desire [19]. All sexually active women reported significant postoperative improvements in SD, BFLUTS (decrease 0.3+0.9 to 0.1+0.6, p=0.011) and increased PISQ-12 (36 +7.3 to 39+5, p=0.003) [27]. A study of 82 female patients assessed postoperatively at 1 year with a non-validated questionnaire found that 63% of patients subjectively reported that they enjoyed sex more [21]. Improvements in SD were not found to be dependent on the amount of weight lost, and greater improvements in sexual function were noted with younger age, being married and worse preoperative SF [13]. Contrastingly, Olivera's study of 36 women demonstrated that FSFI scores did not improve with weight loss across all domains: desire, arousal, lubrication, orgasm, satisfaction and pain [30].

Male specific SD outcomes and erectile dysfunction outcomes

The IIEF questionnaire was the most commonly utilized questionnaire to assess male SD (Table 1). In a study by Groutz et al. [20] the IIEF score was analyzed 3 months post-operatively in 53 patients who underwent sleeve gastrectomy. Questions regarding erectile function showed a significant improvement from 22.7 to 26.1 (p=0.02). There was also a statistically significant improvement in intercourse satisfaction (9.5-11.5) and overall satisfaction (7.9-8.9) (p<0.02) [20]. In addition to improved overall postoperative IIEF scores (54.85 *vs.* 61.21, p<0.001), BMI change was shown to be an independent predictor of changes in IIEF at 1 year post operatively on multivariate regression analysis (beta:-0.397, p=0.001) [29]. Kun et al. [24] utilized the IIEF, carotid/cavernosal intima-media thickness, endothelial function (L-arginine test), and cavernosal peak systolic velocity to analyze erectile function at one year postoperatively in 39 men who underwent RYGB. Significant improvements were seen for IIEF (17.3 *vs.* 23.8, p<0.05), cavernosal peak systolic velocity (23 *vs.* 37, p<0.05), and endothelial scores (6.1 vs 8.2, p<0.05) that mirrored weight loss one year after surgery. Furthermore, on multivariate correlation Kun showed that endothelial function was positively associated with change in IIEF (r=0.438, p<0.02) [24]. Interestingly, Kun extrapolates that beyond improvement in sexual function these patients also noted a significant improvement in vasculopathy, suggesting a functional recovery as well [24]. Using the BFSI, Dallal et al. [16] reports improvement of BFSI in 95 men who underwent GB with normalization of erectile function compared to age-matched subjects, unfortunately raw data regarding score change was not reported. Additionally, they comment that weight loss was an independent predictor of BSFI improvement. A prospective study demonstrated an increase in baseline BSFI score (40.2 to 43.9), with improvements in general satisfaction index, desire and erection, although this did not achieve statistical significance (p=0.064) [57]. Contrastingly, Ranasinghe et al. [40] report no improvement in total IIEF score despite weight loss. This was confirmed on multivariate analysis, and further reporting revealed an increase in men using PDE5-Inhibitors [40].

Studies have shown improvement in TT levels but no consistent changes in estradiol, sex hormone binding globulin, and gonadotropins [29]. Rigon et al. [54] report that 29 men who underwent bariatric surgery had notable improvements in postoperative TT levels (229.53 *vs.* 338.38). When compared to a control group there was no statistical difference in TT for the study group (p=0.099) [54]. Mora et al. [29] sought to better define this relationship. They found that serum T levels significantly improved at 1 year postoperative (256.36 *vs.* 508.01, P<0.01), as did FSH and Inhibin [29]. Interestingly, they saw no significant change in LH or estradiol levels [29]. While it has been acknowledged that psychological variables may also be a strong influence on sexual behavior and SD, there is limited study in the bariatric population to assess this.

Conclusion

Bariatric surgery associated weight loss appears to be consistently associated with improvements in LUTS and these improvements are not limited to urinary incontinence alone. Consequently, guideline recommendations should consider including LUTS as an indication for bariatric surgery in appropriately selected patients.

Similarly, SD may improve after weight loss surgery. Unfortunately, the data regarding SD is heterogeneous and often with poor follow up, necessitating further research be performed to assess gender-specific outcomes following bariatric surgery.

Ultimately, the accurate characterization of sexual and urinary outcomes following bariatric surgery necessitates multidisciplinary collaboration and, considering the increasing prevalence of obesity and the performance of bariatric surgery, future prospective studies should be pursued on an institutional level.

References

1. Stevens GA, Singh GM, Lu Y, Danaei G, Lin JK, Finucane M, et al. (2012) National, regional, and global trends in adult overweight and obesity prevalence. Popul Health Metr 10: 22.

2. Bullbuller N, Habibi M, Yuksel M (2017) Effects of bariatric surgery on urinary incontinence. Therapeutics and Clinical Risk Management 13: 95-100.

3. Ul-Haq Z, Mackay DF, Fenwick E, Pell JP (2013) Meta-analysis of the association between body mass index and health-related quality of life assessed by the SF-36. Obesity 3: 322-327.

4. Palleschi G, Pastore AL, Rizello M, Cavallaro G, Silecchia G, et al. (2015) Laparoscopic sleeve gastrectomy effects on overactive bladder symptoms. J Surg Res 196: 307-312.

5. Subak LL, King WC, Belle SH, Chen J, Courcoulas AP, et al. (2015) Urinary incontinence before and after bariatric surgery. JAMA Intern Med 175: 1378-1387.

6. Luke S, Addison B, Broughton K, Masters J, Stubbs R, et al. (2015) Effects of bariatric surgery on untreated lower urinary tract symptoms: A prospective multicentre cohort study. BJU Int 115: 466-472.

7. O'Boyle CJ, O'Sullivan OE, Shabana H, Boyce M, O'Reilly BA (2016) The effect of bariatric surgery on urinary incontinence in women. Obes Surg 26: 1471–1478.

8. Mechanick JI, Youdim A, Jones DB, Garvey WT, Hurley DL, et al. (2013) Clinical practice guidelines for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient -- 2013 Update: Cosponsored by the AACE, TOS, and ASMBS. Surgery for Obesity and Related Disease 21: 1-27.

9. Lee Y, J Yu, K Tikkinen, Pędziwiatr M, Major P, et al. (2019) The impact of bariatric surgery on urinary incontinence: A systematic review & meta-analysis. BJU Int 124: 917-934.

10. Purwar B, Cartwright R, Cavalcanti G, Digesu GA, Fernando R, et al. (2019) The Impact of Bariatric Surgery on Urinary Incontinence: A systematic Review & Meta-analysis. Int Urogynec 30: 1225-1237.

11. Ahroni JH, Montgomery KF, Watkins BM (2005) Laparoscopic adjustable gastric banding: weight loss, comorbidities, medication Usage and quality of life at one year. Obes Surg 15: 641-647.

12. Ait Said K, Leroux Y, Menahem B (2017) Effect of bariatric surgery on urinary and fecal incontinence: prospective analysis with 1-year follow-up. Surg Obes Relat Dis.13:305-312.

13. Bond DS, Vithiananthan S, Leahey TM (2009) Prevalence and degree of sexual dysfunction in a sample of women seeking bariatric surgery. Surg Obes Relat Dis 5: 698-704.

14. Burgio KL, Richter HE, Clements RH, Redden DT, Goode PS (2007) Changes in urinary and fecal incontinence symptoms with weight loss surgery in morbidly obese women. Obstet Gynecol 110: 1034–1040.

15. Castro LA, Sobottka W, Baretta G, Freitas AC (2012) Effects of bariatric surgery on pelvic floor function. Braz Arch Dig Surg 25: 263–268.

16. Dallal RM, Chernoff A, O'Leary MP, Smith JA, Braverman JD, et al. (2008) Sexual dysfunction is common in the morbidly obese male and improves after gastric bypass surgery. J Am Coll Surg 207: 859-864.

17. Daucher JA, Ellison RE, Lowder JL (2010) Pelvic support and urinary function improve in women after surgically induced weight reduction. Female Pelvic Med Reconstr Surg 16: 263-267.

18. Efthymiou V, Hyphantis T, Karaivazoglou K, Gourzis P, Alexandrides TK, et al. (2015) The effect of bariatric surgery on patient HRQOL and sexual health during a 1-year postoperative period. Obes Surg 25: 310-318.

19. Goitein D, Zendel A, Segev L, Feigin A, Zippel D. (2015) Bariatric surgery improves sexual function in obese patients. The Israel Medical Association Journal 10: 616-619.

20. Groutz A, Gordon D, Schachter P (2017) Effects of bariatric surgery on male lower urinary tract symptoms and sexual function. Neurourol Urodyn 36: 636-639.

21. Kinzl JF, Trefalt E, Fiala M, Hotter A, Biebl W, et al. (2001) Partnership, sexuality, and sexual disorders in morbidly obese women: Consequences of weight loss after gastric banding. Obes Surg 11:455–458.

22. Knepfler T, Valero E, Triki E, Chilintseva N, Koensgen S, et al. (2016) Bariatric surgery improves female pelvic floor disorders. J Visc Surg 153: 95–99.

23. Knoepp LR, Semins MJ, Wright EJ (2105) Does bariatric surgery affect urinary incontinence? Urology 82: 547-551.

24. Kun L, Pin Z, Jianzhong D, (2015) Significant improvement of erectile function after Roux-en-Y gastric bypass surgery in obese Chinese men with erectile dysfunction. Obes Surg 25: 838-844.

25. Kuruba R, Almahmeed T, Martinez F, Torrella TA, Haines K, et al. (2007) Bariatric surgery improves urinary incontinence in morbidly obese individuals. Surg Obes Relat Dis 3: 586–590.

26. Laungani RG, Seleno N, Carlin AM (2009) Effect of laparoscopic gastric bypass surgery on urinary incontinence in morbidly obese women. Surg Obes Relat Dis 5: 334–338.

27. Lesham A, Shimonov M, Amir H, Gordon D, Groutz A (2017) Effects of bariatric surgery on female pelvic floor disorders. Urology 105: 42-47.

28. McDermott CD, Terry CL, Mattar SG, Hale DS (2012) Female pelvic floor symptoms before and after bariatric surgery. Obes Surg 22: 1244–1250.

29. Mora M, Aranda GB, Hollanda A, Flores L, Puig-Domingo M, et al. (2013) Weight loss in a major contributor to improved sexual function after bariatric surgery. Surg Endosc 27: 197-204.

30. Olivera CK, Herron DM, Kini SU (2012) Long-term quality of life and pelvic floor dysfunction after bariatric surgery. Am J Obstet Gynecol 207: 431.

31. Ranasin WKB, Wright T, Attia J, McElduff P, Doyle T, et al. (2010) Effects of bariatric surgery on urinary and sexual function. BJU International, 107: 88-94.

32. Romero-Talamás H, Unger CA, Aminian A, Schauer PR, Barber M, et al. (2016) Comprehensive evaluation of the effect of bariatric surgery on pelvic floor disorders. Surg Obes Relat Dis 12: 138–143.

33. Rosenblatt A, Faintuch J, Cecconello I (2013) Sexual hormones and erectile function more than 6 years after bariatric surgery. Surg Obes Relat Dis 9: 636–640.

34. Scozzari G, Rebecchi F, Giaccone C, Chiaro P, Mistrangelo M, et al. (2013) Bariatric surgery improves urinary incontinence but not anorectal function in obese women. Obes Surg 23: 931-938.

35. Shimonov M, Groutz A, Schachter P (2017) Is bariatric surgery the answer to urinary incontinence in obese women? Neurourol Urodyn 36: 184–187.

36. Uruc F, Akan S, Aras B (2016) Effects of obesity surgery (laparoscopic sleeve gastrectomy technique) on lower urinary tract symptoms, depression and quality of life of males: Prospective study. Arch Ital Urol Androl 2016; 88: 258-261.

37. Whitcomb EL, Subak LL (2011) Effect of weight loss on urinary incontinence in women. J Urol 2011; 3: 123–132.

38. Deitel M, Stone E, Kassam HA, Wilk EJ, Sutherland DJ (1988) Gynecologic–obstetric changes after loss of massive excess weight following bariatric surgery. J Am Coll Nutr 7: 147–153.

39. Richter HE, Burgio KL, Clements RH, Goode PS, Redden DT, et al. (2005) Urinary and anal incontinence in morbidly obese women considering weight loss surgery. Obstet Gynecol 106:1272–1277.

40. Ransinghe WK, Wright T, Attia J, McElduff P, Doyle T, et al. (2011) Effects of bariatric surgery on urinary and sexual function. BJU Int 107: 88–94.

41. Penson DF, Munro HM, Signorello LB, Blot WJ, Fowke JH (2011) Obesity, physical activity and lower urinary tract symptoms: Results from the Southern Community Cohort Study. J Urol 186: 2316–2322.

42. Young MT, Phelan MJ, Nguyen NT (2016) A Decade Analysis of Trends and Outcomes of Male vs Female Patients Who Underwent Bariatric Surgery. J Am Coll Surg 222: 226-231.

43. Hunskaar S, Burgio KL, Clark A (2005) Epidemiology of Urinary (UI) and Faecal (FI) Incontinence and pelvic organ prolapse (POP). In: Abrams P et al, (eds). Incontinence, 3rd international consultation on incontinence. Paris (France): Health Publications Ltd; pp: 255–312.

44. Brown JS, Grady D, Ouslander JG, Herzog AR, Varner RE, Posner SF (1999) Prevalence of urinary incontinence and associated risk factors in postmenopausal women. Heart & Estrogen/Progestin Replacement Study (HERS) Research Group. Obstet Gynecol 94: 66–70.

45. Osborn DJ, Strain M, Gomelsky A, Rothschild J, Dmochowski R. (2013) Obesity and female stress urinary incontinence. Urology 82: 759–763.

46. Parsons JK, Sarma AV, McVary K, Wei JT (2013) Obesity and benign prostatic hyperplasia: Clinical connections, emerging etiological paradigms and future directions. J Urol 189: S102–S106.

47. Kristal AR, Arnold KB, Schenk JM, Neuhouser ML, Weiss N, et al. (2007) Race/ethnicity, obesity, health related behaviors and the risk of symptomatic benign prostatic hyperplasia: Results from the prostate cancer prevention trial. J Urol 177: 1395–1400.

48. Lee RK, Chung D, Chughtai B (2012) Central obesity as measured by waist circumference is predictive of severity of lower urinary tract symptoms. BJU Int 110: 540-545.

49. Steffen KJ, King WC, White GE, Subak LL, Mitchell JE, et al. (2017) Sexual functioning of men and women with severe obesity before bariatric surgery. Surg Obes Relat Dis 13: 334-343.

50. Assimakopoulos K, Panayiotopoulos S, Iconomou G (2006) Assessing sexual function in obese women preparing for bariatric surgery. Obes Surg 16: 1087-1091.

51. Esposito K, Giugliano D (2005) Obesity, the metabolic syndrome, and sexual dysfunction. Int J Impot Res 17: 391-398.

52. Basson R. Berman J, Burnett A, Derogatis L, Ferguson D, et al. (2000) Report of the international consensus development conference on female sexual dysfunction definitions and classifications. J Urol 163: 888-893.

53. Sarwer DB, Spitzer JC, Wadden TA, Rosen RC, Mitchell JE, et al. (2013) Sexual functioning and sex hormones in persons with extreme obesity and seeking surgical and nonsurgical weight loss. Surg Obes Relat Dis 9: 997-1007.

54. Rigon FA, Ronsoni MF, Hohl A (2019) Effects of Bariatric Surgery in Male Obesity-Associated Hypogonadism. Obes Surg 29: 2115–2125.

55. Giovannucci E, Rimm EB, Chute CG (1994) Obesity and benign prostatic hyperplasia. Am J Epidemiol. 140: 989.

56. Corona G, Mannucci E, Forti G (2009) Hypogonadism, ED, metabolic syndrome and obesity: A pathological link supporting cardiovascular diseases. Int J Androl 32: 587-598.

57. Camps MA, Zervos E, Goode S (1996) Impact of bariatric surgery on body image perception and sexuality in morbidly obese patients and their partners. Obes Surg 6: 356–360.