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Effects of bariatric surgery on urinary incontinence

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Introduction: Obesity is an important modifiable etiological factor associated with several diseases. There is strong evidence that urinary incontinence (UI) is positively correlated with body mass index (BMI).

Aim: One of the many benefits experienced by obese patients after bariatric surgery is decrease in UI. To investigate this correlation, we aimed to examine the effects of weight loss on UI in female patients who had undergone laparoscopic sleeve gastrectomy (LSG).

Materials and methods: Obese female patients (n=120), ≥18 years of age, and planning to undergo LSG were included in this prospective study. We administered the International Consultation on Incontinence Questionnaire-Urinary Incontinence-Short Form (ICIQ-UI-SF) and Incontinence Impact Questionnaire (IIQ-7) to the patients prior to surgery and 6 months after the surgery. Using the collected data, we determined the incidence of UI and examined the relationship between the preoperative and postoperative BMI and UI values.

Results: The mean age of the patients was 39.19 (standard deviation [SD] =9.94) years and the mean preoperative BMI was 46.17 (SD =5.35). Of the 120 patients, 72 (60%) complained of UI preoperatively. Among these 72 patients, 23 (31.95%) described urge incontinence, 18 (25%) stress incontinence, and 31 (43.05%) mixed-type incontinence. At 6 months postoperatively, the percentage of excess weight loss was 70.33% (SD =14.84%). For all three UI subtypes, the 6-month postoperative ICIQ-UI-SF and IIQ-7 scores decreased significantly compared to the preoperative scores ($P<0.05$).

Conclusion: LSG results in a clinically significant improvement in most common types of UI, regardless of patient reproductive history, existence of comorbid conditions, and smoking status.

Keywords: bariatric surgery, obesity, urinary incontinence

Introduction

Obesity and overweight are major preventable health problems affecting populations globally. Based on a definition of a body mass index (BMI) of ≤18.49 kg/m^2 as underweight, 18.50–24.99 kg/m^2 as normal weight, 25.0–29.99 kg/m^2 as overweight, and ≥30 kg/m^2 as obese,[1] the World Health Organization (WHO) estimates that 1.9 billion and 600 million adults >18 years of age are overweight and obese, respectively, throughout the world.

An important modifiable etiological factor, obesity, is associated with several diseases, including cardiovascular disease, the most common cause of death; musculoskeletal disorders; diabetes mellitus (DM); and some types of cancer (colon, endometrium, and breast).[1,2] Based on a systematic review of data reported between 1990 and 2009, Withrow and Alter[3] estimated that treatment of these and other obesity-related problems account for between 0.7% and 2.8% of total global health expenditures.

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Obesity has also been associated with the development of urinary incontinence (UI), which not only reduces quality of life but also increases medical costs. Previous research has associated a five-point increase in BMI with a 20%–70% increased risk of UI.[4]

The most common types of UI, defined as involuntary loss of urine, are stress urinary incontinence (SUI), urge urinary incontinence (UUI), and mixed urinary incontinence (MUI).[5] SUI, also referred to as activity-related incontinence, is the involuntary loss of urine on effort or physical exertion (eg, physical activities), or on sneezing or coughing in the absence of bladder contractions. UUI is the involuntary loss of urine when a strong, sudden need to urinate causes the bladder to contract or spasm. MUI is the involuntary loss of urine associated with urgency as well as with effort or physical exertion or on sneezing or coughing. Treatment depends on the type of UI, but all types appear to benefit from fluid restriction, regulation of diuretics and other drugs, pelvic floor and Kegel exercises, as well as weight loss.[6] Whereas primary treatment of UUI comprises antimuscarinic pharmacotherapy, treatment of SUI via pharmaceutical therapy is more limited, with surgical methods such as placement of a midurethral sling being most commonly used.[7]

There is strong evidence that both SUI and UUI are positively correlated with BMI.[8] Etiologically, four factors associated with obesity are hypothesized to increase the risk of UI: increased abdominal fat, which increases intravesical pressure; urethral hypermobility and increased abdominal pressure, which cause detrusor instability; and intervertebral disk herniation, which affects innervation of the bladder.[9] Urodynamic studies support the existence of these processes, having found that weight loss leads to decrease of intravesical pressure and increase of cystometric capacity.[10,11] DM, as another obesity-associated condition, may also increase the risk of UI as a result of detrusor overactivity.[12–14]

Aim

Bariatric surgery is considered the most effective and safest means of treatment of morbid obesity. One of the many benefits experienced by obese patients after bariatric surgery is decrease in UI.[15,16] To examine the impact of treatment of obesity by bariatric surgery on UI, we prospectively examined the impact of laparoscopic sleeve gastrectomy (LSG) on the three most common types of UI in 120 morbidly obese female patients.

Materials and methods

Upon approval of the study by the ethics committee of Antalya Training and Research Hospital on April 30, 2015, 120 obese female patients, ≥18 years of age, planning to undergo LSG were included in this prospective study. The inclusion criteria, namely, appropriate indications for bariatric surgery and female sex, were those stipulated by the National Institutes of Health Consensus Development Conference Panel.[17]

The exclusion criteria were history of anti-incontinence surgical procedures before and/or after study initiation, initiation of a new drug (eg, anticholinergic medication) for treatment of UI within the past year, and/or history of neurological diseases that can affect pelvic innervation.

Written informed consent was provided by all patients.

Demographic data, including age, weight, height, tobacco use, BMI, number of pregnancies and vaginal deliveries, history of obstetric surgery, and presence and treatment of DM and arterial hypertension (AHT), were recorded. Tobacco use was defined as positive if active tobacco use had been terminated <10 years ago. The presence of DM was defined as blood glycemia level >126 mg/dL, glycated hemoglobin (HbA1c) >7%, and/or use of medication for DM. The presence of AHT was defined as presence of systolic blood pressure >140 mmHg, diastolic blood pressure >90 mmHg, and/or use of any antihypertensive medication.

Prior to surgery, the patients completed the International Consultation on Incontinence Questionnaire-Urinary Incontinence-Short Form (ICIQ-UI-SF) and Incontinence Impact Questionnaire (IIQ-7).[18,19] Both forms measure the severity of UI and its impact on quality of life, with higher scores correlated with more severe UI. The validity, reliability, and responsiveness of both questionnaires were tested and confirmed by the Fifth International Consultation on Incontinence.[8] Diagnosis of SUI or UUI was based on the answer to Question 6 of the ICIQ-UI-SF, "When does urine leak?" Patients who answered as "leaks before you can get to the toilet" were diagnosed with UUI, those who answered as "leaks when you cough or sneeze" or "when you are physically active/exercising" were diagnosed with SUI, and those who answered both "leaks before you can get to the toilet" and "leaks when you cough or sneeze" or "when you are physically active/exercising" were diagnosed with MUI. The scores for Questions 3, 4, and 5 of the ICIQ-UI-SF (range 0–21) and the scores for Questions 1–7 of the IIQ-7 (range 0–21) were added together and used to support the diagnosis.

Six months after surgery, the patients were recalled to assess changes in weight; need for DM and AHT medications; and incidence and severity of UI, as determined by readministration of the ICIQ-UI-SF and IIQ-7 questionnaires. Patients who had been diagnosed with UI during the first meeting who answered "urine never leaks" to Question 6 of the ICIQ-UI-SF at the 6-month follow-up were considered to no longer have UI. The cure rate for UI was expressed as a percentage. Descriptive statistics regarding patient characteristics were calculated in terms of mean and standard deviation (SD), frequency (n), and percentage (%). The paired *t*-test was performed to investigate the differences between preoperative and postoperative ICIQ-UI-SF and IIQ-7 values. Values of $P<0.05$ were considered statistically significant. Analysis was performed with SPSS 22.0 software package.

Results

Table 1 shows a summary of the patient demographic and characteristic data. Between April 2015 and December 2015, 120 patients of a mean age of 39.19 years (SD =9.94 years) and a mean preoperative BMI of 46.17 (SD =5.35) were planning to undergo LSG. By 6 months after surgery, the patients had experienced a mean percentage weight loss of 70.33% (SD =14.84%) and a mean decrease in BMI to 31.60 (SD =4.37), with 52 patients (43%) experiencing a decrease in BMI to <30. Prior to surgery, 23 patients (19%) had been diagnosed with AHT, 36 (30%) with DM, and 72 (60%) with UI. Of the 72 patients diagnosed with UI, 18 (25%) were diagnosed with UUI, 23 (31%) with SUI, and 31 (43%) with MUI. There was no loss of participants to follow-up for any reason.

Table 2 shows the recovery rates of the patients with UI, and Table 3 shows the results of comparison of preoperative and 6-month postoperative ICIQ-UI-SF and IIQ-7 scores by UI subtype. As can be observed, the ICIQ-UI-SF and IIQ-7 scores of patients with MUI were higher than those of patients with SUI and UUI (ICIQ-UI-SF: MUI =10.58±5.73 vs UUI =8.76±5.42 vs SUI =8.77±5.33; IIQ-7: MUI =7.68±3.84 vs UUI =6.73±3.58 vs SUI =7.10±3.30). For all three UI subtypes, the 6-month postoperative ICIQ-UI-SF and IIQ-7 scores decreased significantly compared to the preoperative scores ($P<0.05$).

Table 1 Demographic data (N=120)

Characteristics	Number
Age, mean (SD), years	39.19 (9.94)
Preoperative BMI, mean (SD), kg/m^2	46.17 (5.35)
Postoperative BMI, mean (SD), kg/m^2	31.60 (4.37)
EWL, mean % (SD)	70.33 (14.84)
Preoperative urinary incontinence	72 (60%)
Smoking	57 (47%)
Parity	84 (70%)
Parity number, mean (SD)	1.81 (1.69)
Previous vaginal delivery	36 (30%)
Previous cesarean section	34 (28%)
Both cesarean section and vaginal delivery	14 (11%)

Abbreviations: BMI, body mass index; EWL, excess weight loss; SD, standard deviation.

Table 2 Recovery rates of patients with urinary incontinence

Type of urinary incontinence	Number	Total cure, n (%)
All types of urinary incontinence	72	28 (38)
Stress urinary incontinence	18	11 (61)
Urge urinary incontinence	23	9 (39)
Mixed urinary incontinence	31	8 (25)

Analysis of the scores of the patients with DM revealed that for both patients who were cured and those who were not cured, the postoperative ICIQ-UI-SF and IIQ-7 scores were significantly lower than the preoperative scores ($P<0.05$). Likewise, the postoperative scores of smokers decreased significantly compared to their preoperative scores ($P<0.05$). Analysis of patients by reproductive characteristics (no parity, previous cesarean section, vaginal delivery, and both previous vaginal delivery and cesarean section) revealed that the postoperative ICIQ-UI-SF scores of each group were significantly lower than the preoperative scores ($P<0.05$). Although the preoperative ICIQ-UI-SF and IIQ-7 scores of patients with more than two instances of parity (7.05±6.34 and 4.20±5.59, respectively) were higher than those of patients with two or fewer instances of parity (3.86±4.87 and 3.27±3.85, respectively), the postoperative scores of both groups decreased significantly compared to their preoperative scores ($P<0.05$).

Discussion

Treatment of UI, a condition that can greatly disrupt quality of life, is complex and costly. Research has revealed that both SUI and UUI are more prevalent among patients who experience increase in BMI.[6] In accordance, obese and overweight patients tend to undergo surgical treatment for UI more frequently than normal-weight patients.[20] However, there are concerns about the decreasing success rate of anti-incontinence surgery procedures, such as midurethral sling placement, in obese patients. In a long-term (mean: 68 months) follow-up of morbidly obese (BMI >35) patients who had undergone midurethral sling placement, Hellberg et al[21] observed a higher rate of failure in obese patients (52%) compared to normal controls (19%).

Consideration of these findings has led to a focus on treating the cause of UI, namely obesity, rather than simply controlling the symptoms of UI. In a 2013 study, Knoepp et al[22] searched US national insurance databases to collect the data of 3,898 obese patients who had undergone bariatric surgery for obesity and 3,898 obese patients who had not

Table 3 Comparison of preoperative and postoperative ICIQ-UI-SF and IIQ-7 scores by urinary incontinence subtype

Patient group	Mean ICIQ-UI-SF score (SD)	Mean IIQ-7 score (SD)
Urge urinary incontinence	Preoperative 8.76 (5.42), $P<0.05$	Preoperative 6.73 (3.58), $P<0.05$
	Postoperative 2.64 (2.91), $t=7.63$	Postoperative 2.53 (2.31), $t=7.30$
Stress urinary incontinence	Preoperative 8.77 (5.33), $P<0.05$	Preoperative 7.10 (3.30), $P<0.05$
	Postoperative 2.57 (2.94), $t=7.78$	Postoperative 2.27 (2.33), $t=8.20$
Mixed urinary incontinence	Preoperative 10.58 (5.73), $P<0.05$	Preoperative 7.68 (3.84), $P<0.05$
	Postoperative 3.74 (3.02), $t=6.73$	Postoperative 3.16 (2.34), $t=4.67$
Improvement or remission of diabetes mellitus	Preoperative 7.86 (7.05), $P<0.05$	Preoperative 6.07 (4.39), $P<0.05$
	Postoperative 1.79 (2.36), $t=3.99$	Postoperative 1.36 (2.06), $t=4.19$
Improvement or remission of diabetes mellitus	Preoperative 4.10 (4.88), $P<0.05$	Preoperative 3.47 (4.39), $P<0.05$
	Postoperative 1.15 (2.37), $t=6.03$	Postoperative 1.22 (2.01), $t=6.05$
No parity	Preoperative 1.91 (2.52), $P<0.05$	Preoperative 1.86 (2.40), $P<0.05$
	Postoperative 0.18 (0.85), $t=3.71$	Postoperative 0.18 (0.85), $t=3.58$
Previous vaginal delivery	Preoperative 6.95 (6.37), $P<0.05$	Preoperative 5.55 (4.44), $P<0.05$
	Postoperative 2.23 (2.74), $t=4.34$	Postoperative 1.82 (2.40), $t=4.62$
Previous cesarean section	Preoperative 5.00 (5.34), $P<0.05$	Preoperative 3.95 (3.80), $P<0.05$
	Postoperative 1.57 (2.62), $t=4.60$	Postoperative 1.38 (2.04), $t=3.94$
Both previous vaginal delivery and cesarean section	Preoperative 5.78 (6.70), $P<0.05$	Preoperative 4.89 (5.33), $P<0.05$
	Postoperative 0.78 (2.33), $t=4.24$	Postoperative 1.11 (2.26), $t=4.46$
Smoking	Preoperative 4.14 (5.42), $P<0.05$	Preoperative 3.74 (4.27), $P<0.05$
	Postoperative 0.71 (1.78), $t=4.59$	Postoperative 0.91 (1.74), $t=4.91$
≤2 instances of parity	Preoperative 3.86 (4.87), $P<0.05$	Preoperative 3.27 (3.85), $P<0.05$
	Postoperative 0.90 (2.09), $t=5.43$	Postoperative 1.08 (1.91), $t=5.29$
>2 instances of parity*	Preoperative 7.05 (6.34), $P<0.05$	Preoperative 5.59 (4.20), $P<0.05$
	Postoperative 2.14 (2.77), $t=4.57$	Postoperative 1.64 (2.22), $t=4.97$

Note: *Calculation of the critical value was selected according to the group distribution and the calculated median value. The paired *t*-test was performed to investigate the differences between preoperative and postoperative ICIQ-UI-SF and IIQ-7 values.
Abbreviations: ICIQ-UI-SF, International Consultation on Incontinence Questionnaire-Urinary Incontinence-Short Form; IIQ-7, Incontinence Impact Questionnaire; SD, standard deviation.

undergone bariatric surgery and been followed-up for at least 3 years. They found that 62.4% of the surgery cohort but only 42.1% of the no-surgery cohort experienced improvement in UI.[22] In a study of 80 obese patients who had undergone sleeve gastrectomy and completed four UI questionnaires (the ICIQ-UI, Bristol Female Lower Urinary Tract Symptom-Scored Form [BFLUTS-SF], Pelvic Floor Distress Inventory Questionnaire-Short Form 20 [PFDI-20], and Pelvic Organ Prolapse/Incontinence Sexual Questionnaire [PISQ-12]) before surgery and 6 months after surgery, Shimonov et al[23] found that surgical weight loss had led to a statistically significant improvement in UI values and complete resolution of UI in 51.7% of patients.

Evidence exists that improvement in UI after bariatric surgery persists. In a study of 2,458 male and 2,458 female patients who had undergone bariatric surgery and completed the Urinary Incontinence Questionnaire (IIQ) 3 years after surgery, Subak et al[24] found that improvement in UI postsurgery persisted for 3 years. In a 2016 study of 72 female patients with any type of pelvic floor disorder who had undergone bariatric surgery (the vast majority gastric bypass), Romero-Talamás et al[16] found that the prevalence of SUI and UUI, as well as associated symptoms, significantly decreased after surgery. In a 2015 study of female patients who had undergone bariatric surgery, which was similar to our study, O'Boyle et al[15] observed that moderate-to-severe UI decreased in 38% of patients, symptoms decreased in 84%, total cure occurred in 33%, and frequency of use of pads decreased in 19%. In accordance with these results, we observed remarkable improvement in UI in obese patients experiencing SUI, UUI, and MUI 6 months after surgery, but particularly in those experiencing SUI, for whom the cure rate was the highest (SUI 61% vs UUI 39% vs MUI 25%). We concluded that, the decrease of urethral hypermobility and bladder pressure together as a result of reduction of intraabdominal pressure leads to greater improvement in the SUI group compared to the UUI group.

Our study supports previous studies that observed that surgical weight loss decreased not only the incidence and severity of UI in obese patients but also the incidence of several other comorbidities. One such condition is DM, which is known to cause detrusor overactivity, and whose incidence has been increasing in obese patients.[12–14] Based on previous research, we hypothesize that DM may increase the incidence of UI as well as other mechanisms, such as excessive abdominal pressure, urethral hypermobility, and detrusor instability.[9–11] In accordance, we found that by 6 months postsurgery, 63% of our patients with DM had experienced complete remission, defined as fasting blood glucose (FBG) $<$100 mg/dL or ability to terminate use of diabetic medications, or improvement of DM, defined as significant reduction in FBG (by $>$25 mg/dL) or reduction in FBG accompanied by a decrease in antidiabetic medication requirement. When we examined changes in the UI scores of patients by DM group (no DM recovery/improvement or DM improvement/recovery), we found that the UI symptom scores of both groups had improved after surgical weight loss.

Conclusion

Our study faced several limitations that should be considered when reviewing the results. One limitation was the relatively brief duration of the follow-up period. Future researchers can overcome this limitation by designing long-term studies that follow the patients 12, 24, and 36 months after surgery. Another limitation was the lack of urodynamic testing. However, urodynamic testing itself poses certain limitations, including being a relatively invasive means of testing that may lack reliability, and it provides no standardized means of assessing SUI.[7] A final limitation was our use of questionnaires without first assessing the intellectual capacity of the patients to determine if they could understand what the questions asked. If the patients had experienced difficulty understanding the questions, their answers may not have been valid. Future studies can overcome this limitation by using more objective means of assessing UI, such as asking patients about the use of UI pads.

Despite these limitations, the results of our study provide strong evidence that bariatric surgery is effective in the treatment of the most common types of UI, regardless of patient reproductive history, existence of comorbid conditions, and smoking status. Future studies that examine the impact of bariatric surgery on UI in the long term are now needed to confirm our findings.

Disclosure

The authors report no conflicts of interest in this work.

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