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ORIGINAL ARTICLE

Impact of Body Mass Index on Postoperative Urinary Symptoms after Midurethral Sling Surgery in Female Patients

Sumin Kim, Soomin Ryu, Youjoung Lee, Mi Kyung Kong, Sang Wook Bai

Department of Obstetrics and Gynecology, Institute of Women's Life Medical Science, Yonsei University College of Medicine, Seoul, Korea

Objectives: This study aims to examine the clinical outcomes of women who underwent a midurethral sling surgery for stress urinary incontinence and compare postoperative urinary symptoms among different body mass index (BMI) groups.

Methods: A retrospective cohort study on results after midurethral sling surgery according to BMI was conducted at the institution of the current study from January 2010 to December 2019. The study population was classified into three groups according to patients' BMI (in kg/m^2) during surgery: normal weight (BMI < 23.0 kg/m^2), overweight (BMI, 23.0–24.9 kg/m^2), and obese (BMI ≥ 25.0 kg/m^2). The primary outcome was the recurrence of urinary symptoms after surgery. The secondary outcomes were operation time, estimated blood loss, length of hospital stay, and postoperative complications.

Results: This study included 376 patients (normal weight, 148; overweight, 74; and obese women, 154) who underwent midurethral sling surgery. No significant difference was noted in urinary symptom recurrence after midurethral sling surgery. Of the patients, 6.8% (n = 10), 9.5% (n = 7), and 7.8% (n = 12) were normal weight, overweight, and obese women, respectively (P = 0.775). Moreover, operation time (P = 0.589), blood loss (P = 0.138), and complication rate (P = 0.865) showed no significant difference.

Conclusions: Midurethral sling surgery is effective regardless of BMI. Even when midurethral sling surgery was performed as a concomitant surgery, no significant difference in urinary symptom recurrence, operation time, intraoperative blood loss, and complication rate was noted among different BMI groups.

Key Words: Body mass index, Obesity, Suburethral slings, Urinary incontinence

INTRODUCTION

According to the International Continence Society, urinary incontinence (UI) is defined as "the complaint of any involuntary leakage of urine" [1]. Unlike other chronic diseases such as diabetes mellitus (DM) and hypertension (HTN), UI rarely causes serious problems; however, it is one of the most bothersome diseases, and has a significant impact on the quality of life of the patients [2]. In 2008, 21.5% of the worldwide population suffered from UI and in Korea, 24.4% of women aged greater than or equal to 19 years were reported to have UI [3,4].

UI is largely subdivided into three types: urgency (UUI), stress (SUI), and mixed (MUI). UUI is the involuntary loss of urine with a strong urge to void; SUI is precipitated on effort or physical exertion, and MUI is a mixture of UUI and SUI [1]. In nulliparous women, SUI is the most common subtype among three. The prevalence of SUI ranges from 12.5% to 79% (median, 49.4%), followed by UUI, ranging from 15.6% to 41.6% (median, 31.3%), and MUI, ranging from 8.3% to 50% [5].

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Address for Correspondence: Sang Wook Bai, Department of Obstetrics and Gynecology, Institute of Women's Life Medical Science, Yonsei University College of Medicine, 50-1 Yonsei-ro, Seodaemun-gu, Seoul 03722, Korea
Tel: 82-2-2228-2230, **E-mail:** swbai@yuhs.ac, **ORCID:** https://orcid.org/0000-0001-7724-7552
Sumin Kim and Soomin Ryu contributed equally to this work as co-first authors.

Risk factors associated with UI include age, parity, obesity, and previous hysterectomy. Body mass index (BMI) has been associated with an increased risk of UI, with a relative risk of 1.35 (95% confidence interval [CI] = 1.20–1.53) for overweight women, and 1.95 (95% CI = 1.58–2.42) for obese women [6]. In a study of 6,424 women with overweight and obesity in the United Kingdom multivariate analysis revealed significantly increased risks associated with BMI for the onset of stress incontinence (odds ratio [OR], 1.4 and 2.3) and overactive bladder (OR, 1.3 and 1.2, respectively) [7].

In population based longitudinal cohort studies, overweight and obesity were associated with new onset UI or incident UI, providing documentation for a temporal relationship between a possible cause and an outcome. In 5 to 10 years of follow-up, the odds of incident UI increased by approximately 7% to 12% for each 1 kg/m^2 unit increase in BMI. Compared to women with a BMI of 21 to 22.9 kg/m^2, women with a BMI of 35 kg/m^2 or greater had an OR of 3.42 (95% CI, 2.48–4.72) for stress incontinence, 6.10 (95% CI, 3.11–11.98) for urge incontinence and 5.60 (95% CI, 3.17–9.88) for mixed incontinence [8].

In Korea, the prevalence of obesity has gradually increased from 29.7% in 2009 to 32.4% in 2015 [9]. With an increase in the incidence of type 2 diabetes mellitus (T2DM), HTN, and dyslipidemia, the number of people experiencing new onset or incident UI is expected to increase. Various solutions, including conservative, pharmacological, and surgical approaches, have been offered to patients with UI. Midurethral sling is the most frequently used surgical approach for females with SUI [10].

As prevalence of obesity and associated disease are increasing among Korean adults, a study assessing the impact of BMI on surgical outcomes of mid urethral sling surgery especially among Korean population became necessary. There are several studies on the efficacy of mid urethral sling surgery in different BMI groups. Previous studies, however, have conflicting results as to whether BMI has impact on surgical outcomes of mid urethral sling surgery [11-15]. Furthermore, there is a lack of research on Korean population.

In this study, we aimed to determine whether BMI affects the outcomes of mid urethral sling surgery for SUI especially in Korean population.

MATERIALS AND METHODS

This retrospective cohort study was conducted in patients who underwent transobturator tape (TOT) procedure for SUI at the Department of Obstetrics and Gynecology of Yonsei University Severance Hospital from January 2010 to December 2019. Patients who missed the follow-up visit or had insufficient data were excluded. This study was approved by the Institutional Review Board of the Human Research Protection Center, Yonsei University Severance Hospital (IRB No. 4-2021-0621) and the informed consent was waived by the IRB.

During the study period, 376 patients underwent midurethral sling surgery under general anesthesia. All patients underwent a urodynamic study (UDS) before surgery and were diagnosed with SUI. The TOT used in the surgery was the Gynecare TVT Obturator System (Johnson & Johnson, New Brunswick, NJ, USA). Patients were requested to report the presence of urinary symptoms at baseline, including leakage, frequency, urgency, and hesitancy in the outpatient clinic. SUI was confirmed by UDS result. We performed a Stress test and measured urethral hypermobility using the Q-tip test.

General characteristics such as age, parity, BMI, prior hysterectomy status, medical history, information about length of hospital stay, duration of operation, blood loss during surgery, and postoperative complications were obtained from the review of medical records.

Within 4 weeks after the surgery, the patients visited the outpatient clinic for routine checkup. Total follow-up period varied from 1 week to 7 years, depending on the patients'. Patients were asked to visit the clinic if any urinary symptoms recurs after the routine checkup.

The primary outcome was the recurrence of urinary symptoms including urine leakage, frequent urination, urinary urgency, voiding difficulty and hesitancy. We also investigated operation time, intraoperative blood loss, length of hospital stay and complications of each BMI groups. Complications included bleeding, infection, and groin pain after surgery.

BMI was calculated as the patient's weight in kg divided by the patient's height in m squared. According to Seo et al.'s research [9] based on the National Health Insurance Service Database (NHIS DB), which included the entire population of Korean, the first and second cutoff BMI points for increasing hazard ratios for any one of three comorbidities (T2DM, HTN, and dys-

lipidemia) were 23 kg/m^2 and 25 kg/m^2, respectively. Adult obesity, therefore, was defined as BMI ≥ 25.0 kg/m^2, pre-obese (overweight) as BMI between 23.0 kg/m^2 and 24.9 kg/m^2 and normal as BMI between 18.5 kg/m^2 and 22.9 kg/m^2 in accordance with 2018 Korean Society for the Study of Obesity Guideline. In this study, we divided patients into three groups according to BMI: normal weight (BMI < 23.0 kg/m^2), overweight (BMI, 23.0–24.9 kg/m^2), obese (BMI ≥ 25.0 kg/m^2).

Data analysis was performed using PASW software for Windows (ver. 18.0; IBM, Armonk, NY, USA). Categorical variables were analyzed by chi-square test and were reported as number (%). Continuous variables were analyzed using ANOVA and were reported as a value of mean ± standard deviation. A *P* value of < 0.05 was considered statistically significant.

RESULTS

Among the 376 women who underwent TOT at Severance Hospital from January 2010 to December 2019, the distribution of women according to BMI was as follows: normal weight (BMI < 23.0 kg/m^2), n = 148; overweight (BMI, 23–24.9 kg/m^2), n = 74; obese group (BMI ≥ 25.0 kg/m^2), n = 154. All patients visited the outpatient clinic for a postoperative follow-up check within 4 weeks after surgery. Preoperative demographic data were stratified according to BMI (Table 1).

Normal-weight group was the youngest (mean age, 52.7 ± 9.5 years) among the three groups, followed by obese group (mean age, 55.4 ± 9.2 years) and overweight group (mean age, 56.4 ± 9.2 years). There was no significant difference in the ratio of women with prior hysterectomy among three groups. HTN was more prevalent in the obese group (normal weight, 16.2%; overweight, 23.0%; obese group, 31.8%; *P* = 0.006), whereas no significant difference in the prevalence of DM was noted among these groups (normal weight, 9.5%; overweight, 8.1%; obese group, 13.0%; *P* = 0.447). Furthermore, the largest number of people had vaginal delivery in obese group (*P* = 0.006). In UDS which all patients underwent before operation, there were no significant differences in Valsalva leak point pressure (VLPP), Maximum urethra closure pressure (MUCP), max flow rate and residual urine (*P* = 0.369; *P* = 0.495; *P* = 0.988; *P* = 0.792, respectively). Bladder capacity was statistically larger in the obese group (normal weight, 399.8 ± 129.3 mL; overweight, 397.3 ± 120.0 mL; obese group, 435.2 ± 135.1 mL; *P* = 0.030). Regarding the entire cohort, there was no significant difference in the recurrence of any urinary symptom after TOT (normal weight, 6.8%; overweight, 9.5%; obese group, 7.8%; *P* = 0.775) (Table 2). Urine leakage, frequent urination, urinary urgency, voiding difficulty and hesitancy were

Table 1. General baseline characteristics according to BMI

	Normal weight (n = 148)	Overweight (n = 74)	Obese (n = 154)	*P* value
Age (y)	52.7 ± 9.5	56.4 ± 9.2	55.4 ± 9.2	0.007
BMI	21.4 ± 1.2	24.0 ± 0.6	27.2 ± 1.9	< 0.001
Prior hysterectomy	23 (15.5)	12 (16.2)	31 (20.1)	0.545
Vaginal delivery	2.0 ± 0.7	2.2 ± 0.9	2.3 ± 1.0	0.006
Medical history				
HTN	24 (16.2)	17 (23.0)	49 (31.8)	0.006
DM	14 (9.5)	6 (8.1)	20 (13.0)	0.447
UDS				
Bladder capacity (mL)	399.8 ± 129.3	397.3 ± 120.0	435.2 ± 135.1	0.030
VLPP (CLPP) (cmH_2O)	71.7 ± 29.0	77.9 ± 29.6	73.4 ± 33.1	0.369
MUCP (cmH_2O)	69.5 ± 34.3	66.6 ± 30.0	71.8 ± 29.8	0.495
Max flow rate (mL/s)	23.7 ± 8.6	23.8 ± 7.7	23.7 ± 8.4	0.988
Residual urine (mL)	11.7 ± 21.6	12.9 ± 22.9	10.9 ± 19.2	0.792

Data are presented as mean ± standard deviation or number (%).
Normal weight: BMI, 18.5–22.9 kg/m^2; Overweight: BMI, 23.0–24.9 kg/m^2; Obese: BMI ≥ 25.0 kg/m^2.
BMI: body mass index, HTN: hypertension, DM: diabetes mellitus, UDS: urodynamic study, VLPP: Valsalva leak point pressure, CLPP: cough leak point pressure, MUCP: maximum urethra closure pressure.

Table 2. Total urinary symptom recurrence by BMI groups

	Normal weight (n = 148)	Overweight (n = 74)	Obese (n = 154)	*P* value
Total urinary symptom recurrence	10 (6.8)	7 (9.5)	12 (7.8)	0.775

Data are presented as number (%).
Normal weight: BMI, 18.5–22.9 kg/m^2; Overweight: BMI, 23.0–24.9 kg/m^2; Obese: BMI ≥ 25.0 kg/m^2.
BMI: body mass index.

Table 3. Comparison of outcomes by BMI groups (including concomitant surgery receiving group)

	Normal weight (n = 148)	Overweight (n = 74)	Obese (n = 154)	*P* value
Operation time (min)	38.9 ± 28.5	46.7 ± 40.6	41.8 ± 35.8	0.279
Blood loss (mL)	9.5 ± 8.7	12.3 ± 23.8	15.3 ± 33.8	0.132
The length of hospital day	3.3 ± 0.8	3.5 ± 0.9	3.2 ± 0.8	0.060
Complication rate	13 (8.8)	5 (6.8)	15 (9.7)	0.757

Data are presented as mean ± standard deviation or number (%).
Normal weight: BMI, 18.5–22.9 kg/m^2; Overweight: BMI, 23.0–24.9 kg/m^2; Obese: BMI ≥ 25.0 kg/m^2.
BMI: body mass index.

Table 4. Comparison of outcomes by BMI groups (TOT alone)

	Normal weight (n = 117)	Overweight (n = 57)	Obese (n = 123)	*P* value
Operation time (min)	28.4 ± 7.7	29.6 ± 13.1	29.4 ± 7.7	0.589
Blood loss (mL)	8.6 ± 6.1	8.0 ± 3.9	11.9 ± 22.2	0.138
The length of hospital day	3.0 ± 0.3	3.1 ± 0.6	2.9 ± 0.5	0.004
Complication rate	12 (10.3)	5 (8.8)	14 (11.4)	0.865

Data are presented as mean ± standard deviation or number (%).
Normal weight: BMI, 18.5–22.9 kg/m^2; Overweight: BMI, 23.0–24.9 kg/m^2; Obese: BMI ≥ 25.0 kg/m^2.
BMI: body mass index, TOT: transobturator tape.

regarded as urinary symptoms.

Among 376 subjects, 79 received concomitant surgery of which the most frequent was posterior repair (n = 26), followed by total laparoscopic hysterectomy (n = 13), anterior-posterior repair (n = 11), vaginal hysterectomy (n = 9), and resectoscopy (n = 7), simple laparoscopy (n = 5), removal of previous vaginal tape (n = 4), simple laparoscopy with P-repair (n = 2), cervical amputation with posterior repair (n = 1), and abdominal sacral colpopexy with posterior repair (n = 1). The difference in the number of people who received concomitant surgery was not significant between BMI groups (normal weight, n = 31; overweight, n = 17; obese group, n = 31; $P = 0.885$).

In patients who received concomitant surgery with TOT, operation time, blood loss, length of hospital stay and complication rate showed no significant difference according to BMI group ($P = 0.279$; $P = 0.132$; $P = 0.060$; $P = 0.757$, respectively) (Table 3). Regarding patients who only received TOT (normal weight, n = 117 [79.1%]; overweight, n = 57 [77.0%]; obese group, n = 123 [79.9%]), there were no significant differences in operation time, blood loss and complication rate ($P = 0.589$; $P = 0.138$; $P = 0.865$, respectively). Length of hospital day, however, was significantly longer in overweight group (normal weight, 3.0 ± 0.3 days; overweight, 3.1 ± 0.6 days; obese group, 2.9 ± 0.5 days; $P = 0.004$) (Table 4).

DISCUSSION

SUI is one of the most common indications for surgery in women, and approximately 4% of women undergoes surgery for SUI during their lifetime [16]. Obesity is one of the well-established risk factor for SUI. Excessive weight weakens pelvic floor structures by increasing intra-abdominal pressure and possibly by neurophysiological mechanisms. However, the influence of obesity on the effectiveness of SUI surgical treatment is not well studied.

It has been reported that BMI failed to achieve independent predictor status among female patients regarding objective cure rate and satisfaction at follow-up. Accoding to the randomized clinical study conducted by Rechberger et al. [11], menopausal status and aging significantly influenced the outcome of anti-incontinence surgery, but the patient's BMI and the type of midurethral sling did not. According to Gillon et al. [12], clinical data clearly showed that the results of Marshall–Marchetti–Krantz vesicourethropexy and Burch colposuspension do not depend on the BMI of the patients. Furthermore, a study done with Korean population also showed that BMI did not influence the success rates of midurethral sling [13]. However, the association between BMI and SUI cure rate and the reason for the association have been also studied. Noblett et al. [14] demonstrated BMI is directly related to intra-abdominal pressure. Therefore, being overweight may increase stress on the pelvic floor, contributing to the development and recurrence of SUI as well as the failure of surgical treatment. Similar results were also observed in the study by Brennand et al. [15], indicating that being overweight can reduce the efficiency of surgical treatment. Brennand et al. [17] demonstrated preoperative obesity is a predictive factor for surgical failure within 5 years after surgery. Hellberg et al. [18] reported increased failure rates in obese (BMI, 30–34 kg/m^2) and morbidly obese (BMI ≥ 35 kg/m^2) groups treated with the tension-free vaginal tape (TVT) procedure. They also showed a dramatic decrease in cure rates from 81.2% in normal-weight women to 52.1% in the obese group. With these conflicting results, we aimed to investigate effects of BMI on sling operation in Korean women.

UDS performed to every patient before operation revealed no significant difference in study results among BMI groups except for bladder capacity. Janjua et al. [19] studied 69 male and female students in 2017 and bladder capacity itself was not dependent of gender or BMI.

Primary outcome of this study was recurrence of urinary symptom in patients. There was no significant difference in symptom recurrence rate among BMI subgroups (P = 0.775). Among secondary outcomes, operation time, intraoperative blood loss and complication rate, were not significantly different according to BMI. When the sling operation was conducted without concomitant surgery, a significant difference in length of hospital stay was noted (P = 0.004). However, the difference of less than one single day may be negligible since it does not require additional cost (normal weight, 3.0 ± 0.3 days; overweight, 3.1 ± 0.6 days; obese group, 2.9 ± 0.5 days).

One strong point of this study lies on the fact that we categorized patients into three BMI groups according to the criteria that are most applicable to the Korean population. Since the cutoff values for defining overweight and obesity are lower in East Asians than in non-Asians, according to the World Health Organization (WHO), selecting the criteria specific for Korean is important [9]. In addition, relatively large number of patients and limited number of operators at single center are other main strengths of this study.

One limitation of this study is relatively short postoperative follow-up. According to retrospective study of 81 women who underwent TVT procedure between 1998 and 2000 by Tsivian et al. [20], the dynamic index indicated worse recovery among overweight women in the first few months, whereas the final data after 65 months of follow-up showed that the success rates among the different BMI groups were not significantly different. These findings serve as a reminder that patients with higher BMI might need more time to achieve surgical success in objective and subjective indices. Our study revealed no significant difference among BMI groups regarding urinary symptom recurrence and thus, a further study with long-term follow-up would be necessary.

Lastly, although patients were asked to come back to hospital if they developed any urinary symptoms, few patients would not visit clinic even though urinary symptoms recurred.

In conclusion, this study of 376 women who underwent a midurethral sling surgery showed that after midurethral surgery, obese women were not inferior to normal-weight women regarding the recurrence of urinary symptom, intraoperative blood loss, operation time and complication rate. Therefore, obesity alone should not be a factor that precludes patients from undergoing sling operations.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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