



The Changes of Voiding Pattern After Midurethral Sling Between Pure Stress Urinary Incontinence and Stress Urinary Incontinence With Overactive Bladder Group

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Purpose: The purpose of this study is to compare changes in voiding pattern after mid-urethral sling surgery (MUS) between the stress urinary incontinence (SUI) group and the overactive bladder (OAB)+SUI group.

Materials and Methods: From January 2008 to February 2011, a retrospective survey was conducted of 225 female patients who had been diagnosed with SUI and undergone MUS. The subjects were divided into the SUI group and the OAB+SUI group. Changes in the overactive bladder symptom score (OABSS) and American Urological Association-Symptom Index (AUA-SI) before and three months after the MUS were compared.

Results: Of the 225 patients, 165 patients (73.3%) were classified as SUI group, and 60 patients (26.7%) were classified as OAB+SUI group. The mean age of the subjects was 54.7 years (range, 31-80 years), and the mean age of patients was 53.9 years (range, 34-80 years), and 56.8 years (range, 31-78 years) in the SUI group and OAB+SUI group. In SUI group, voiding symptom and storage symptom among the AUA-SI were significantly increased ($p < 0.05$). OABSS were slight increased, but was statistically insignificant ($p=0.847$). In OAB+SUI group, voiding symptom score and OABSS showed a significant increase ($p < 0.05$), but storage symptom score showed an insignificant increase ($p=0.790$).

Conclusions: OAB may occur in approximately 18% of SUI patients who undergo MUS surgery, and voiding dysfunctions with deteriorated voiding symptom and storage symptom may also occur. The deteriorated OAB was shown in 45% of SUI patients with OAB after the surgery.

Keywords: Midurethral sling; Overactive bladder; Stress urinary incontinence; Urge incontinence

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Article History:

received 19 November, 2013
accepted 7 June, 2014

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INTRODUCTION

Female stress urinary incontinence (SUI) is a disease that negatively affects personal life style and health-related quality of life. It has been reported to have a prevalence of 21.0%-22.9% in Korean middle-aged women [1,2]. Mixed urinary incontinence (MUI) is a disease accompanying urgency urinary incontinence (UUI) and SUI, and accounts for 36.4%-63% of total patients with urinary incontinence

[2,3]. MUI has been known to more negatively affect the quality of life compared to pure SUI [3]. Since the introduction of Tension-free vaginal tape (TVT) surgery, midurethral sling surgery (MUS) has been mainly used for the treatment of SUI patients due to its advantages such as relatively simple and less invasive technique, less complications, and better efficacy [4]. Although the success rate of MUI is lower than that of SUI, Rezapour and Ulmsten [5] reported that MUS as a primary treatment method was

effective in the treatment of MUI.

The mechanism of MUS is to prevent urinary leakage by providing the urethra with dynamic kinking when abdominal pressure increases [6]. Theoretically, MUS does not cause voiding dysfunctions such as weak stream, hesitancy, urgency, and straining. However, many studies reported that voiding dysfunctions such as decreased postoperative Qmax and increased postvoid residual (PVR) volume were observed [7]. In addition, it was reported that persistent symptoms or the occurrence of new symptoms were shown in 11%–45% of urinary incontinence patients who had undergone MUS [8,9]. There was a chance for overactive bladder symptom to be developed after MUS surgery on pure SUI patients in the clinical field. On the other hand, there was also feasibility for SUI patients with overactive bladder symptom to improve the conditions of symptom. MUI is generally defined as a case of having both UI and SUI. However, cases of having both urgency and SUI seem to be more frequently seen in clinical practices. Accordingly, the authors divided the subjects into the SUI group and the OAB+SUI group, and compared changes in voiding pattern after MUS between the SUI group and the OAB+SUI group.

MATERIALS AND METHODS

This study was conducted on 225 female patients who had been diagnosed with SUI and undergone MUS, and who were followed-up for 3 months or longer of those who visited the Department of Urology of The Catholic University of Korea, Yeouido St. Mary's Hospital from January 2008 to February 2011.

The study was retrospectively conducted via the analysis of patient's medical records, medical interview on the current health status of the patients, and survey, after approval from the Institutional Review Board (SC12RISI0020). The subjects were divided into the SUI group and the OAB+SUI group. Patients with complaint of involuntary loss of urine on effort or physical exertion (e.g., sporting activities), or on sneezing or coughing were assigned to the SUI group, whereas patients with SUI accompanied with overactive bladder symptom which defined as urinary urgency, usually accompanied by frequency and nocturia, with or without UI, in the absence of urinary tract infection or other obvious pathology, were assigned to the OAB+SUI group [10]. Patients who had anticholinergic medication before the surgery or who received previous conservative treatments excluded from the subjects. Changes in the overactive bladder symptom score (OABSS) and American Urological Association-Symptom Index (AUA-SI) before and after the surgery were compared between the SUI group and the OAB+SUI group. In addition, AUA-SI was analyzed by categorizing questionnaires related to voiding symptoms (questions No. 1, 3, 5, and 6) and storage symptoms (questions No. 2, 4, and 7).

The mean age of the subjects was 54.68 years (range, 31–80 years). All patients underwent preoperative examina-

tions including disease history taking, physical examination, urinalysis, urine culture, 1-hour pad test, Q-tip test, daily voiding check, uroflowmetry, and the measurement of the residual urine amount, and OABSS. In addition, the AUA-SI was assessed to examine the storage symptom and voiding pattern of the bladder before and after the surgery. Most patients underwent general anesthesia or spinal anesthesia before the surgery, whereas some patients underwent monitored anesthetic care (MAC) as a preoperative treatment, followed by local anesthesia of the surgery area. The surgery using outside-in transobturator tape (TOT) procedure via transobturator route was conducted.

The OABSS and AUA-SI were measured before the surgery and 3 months after the surgery in each group, and the changes in voiding pattern before and after treatment was observed by comparing the preoperative and postoperative scores in each group.

A statistical analysis was conducted using PASW Statistics 18.0 (SPSS Inc., Chicago, IL, USA). An independent t-test, and paired t-test were conducted for back-testing. If $p < 0.05$, it was considered statistically significant.

RESULTS

Of the 225 patients, 165 patients (73.3%) were classified as SUI group, and 60 patients (26.7%) were classified as OAB+SUI group. The mean age of the subjects was 54.7 years (range, 31–80 years), and the mean age of patients was 53.9 years (range, 34–80 years), and 56.8 years (range, 31–78 years) in the SUI group and OAB+SUI group ($p < 0.05$). In addition, there was no significant difference between these two groups in terms of symptom period, mean body index, mean 1-hour pad test, and mean Q-tip test (Table 1). The mean preoperative and postoperative AUA-SI were shown to be 0.96 points (range, 0–3 points) and 2.89 points (range, 0–6 points), respectively, in the SUI group. When the voiding symptom (questions No. 1, 3, 5 and 6) among the AUA-SI were compared, the mean preoperative and postoperative scores were shown to be 0.71 points (range, 0–2 points) and 2.23 points (range, 0–4 points), respectively, which showed a significant increase ($p < 0.05$). In addition, when the storage symptom (questions No. 2, 4, and 7) among the AUA-SI was compared, the

TABLE 1. Basic characteristics of 225 patients

Characteristic	SUI group (n=165)	OAB+SUI group (n=60)	p-value
Age (y)	53.7±10.9	56.8±10.7	0.0775
Symptoms period (y)	7.9±5.3	8.1±5.1	0.8007
Body mass index (kg/m ²)	24.5±3.4	24.1±2.1	0.3944
1-Hour pad test (g)	21.7±12.5	23.1±14.8	0.4807
Q-tip test (°)	36.1±11.8	37.5±11.4	0.4280

Values are presented as mean±standard deviation.

SUI, stress urinary incontinence; OAB, overactive bladder.

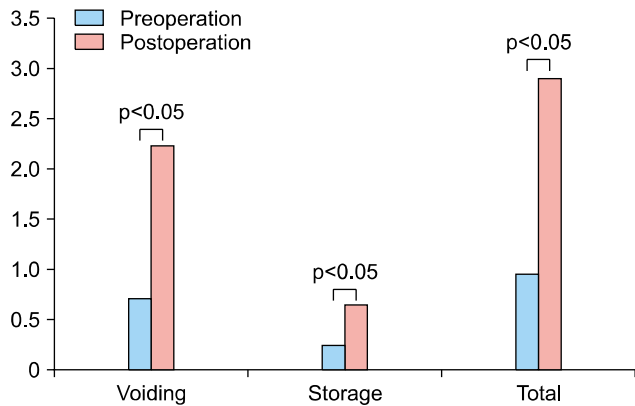


FIG. 1. Preoperative and postoperative changes of American Urological Association-Symptom Index (AUA-SI) in patients with stress urinary incontinence (SUI). All of total AUA-SI, voiding symptom score and storage symptom score were all statistically significantly increased after the SUI group compared to before surgery.

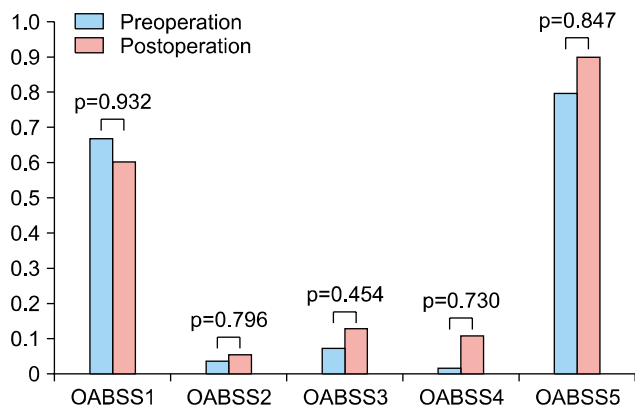


FIG. 2. Preoperative and postoperative changes of overactive bladder symptom score (OABSS) in patients with stress urinary incontinence (SUI). OABSS was little bit increased after surgery in SUI group compared to before surgery, but there was no statistically significant difference.

mean preoperative and postoperative scores were shown to be 0.25 points (range, 0-1 points) and 0.65 points (range, 0-3 points), respectively, which showed a significant increase ($p < 0.05$) (Fig. 1). The mean preoperative and postoperative OABSS were shown to be 0.80 points (range, 0-3 points) and 0.90 points (range, 0-4 points), respectively, which showed a slight increase, but was statistically insignificant ($p = 0.847$) (Fig. 2).

Meanwhile, the mean preoperative and postoperative AUA-SI were shown to be 8.55 points (range, 4-12 points) and 11.15 points (range, 2-16 points), respectively, in the OAB+SUI group. When the voiding symptom (questions No. 1, 3, 5, and 6) among the AUA-SI was compared, the mean preoperative and postoperative scores were shown to be 1.90 points (range, 0-8 points), and 3.85 points (range, 0-11 points), respectively, which showed a significant in-

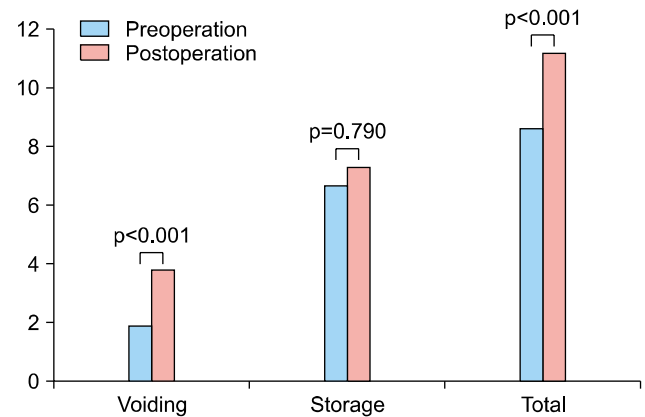


FIG. 3. Preoperative and postoperative changes of American Urological Association-Symptom Index (AUA-SI) in patients with overactive bladder (OAB)+stress urinary incontinence (SUI). Total AUA-SI, voiding symptom scores were significantly increased after the surgery for OAB+SUI group compared to before surgery. Storage symptom score also was increased, but there was no statistically significant difference.

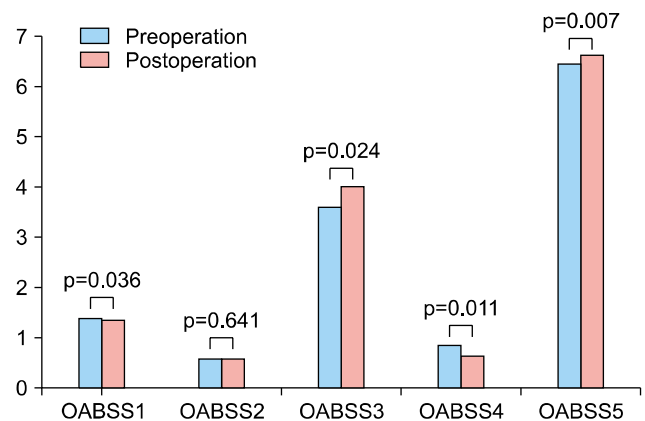


FIG. 4. Preoperative and postoperative changes of overactive bladder symptom score (OABSS) in patients with overactive bladder+stress urinary incontinence (OAB+SUI). OABSS was statistically increased after the surgery for OAB+SUI group compared to before surgery.

crease ($p < 0.05$). In addition, when the storage symptom (questions No. 2, 4, and 7) among the AUA-SI was compared, the mean preoperative and postoperative scores were shown to be 6.65 points (range, 3-9 points), and 7.3 points (range, 4-10 points), respectively, which showed an insignificant increase (Fig. 3). The mean preoperative and postoperative OABSS were shown to be 6.45 points (range, 4-11 points) and 6.60 points (range, 2-9 points), respectively, which showed a significant increase ($p < 0.05$) (Fig. 4). When the postoperative overactive bladder symptom was compared, OAB symptom newly occurred in 30 patients (18%) of the SUI group. Meanwhile, in the OAB+SUI, there were 27 patients (45%) that complained aggravated conditions of OAB symptoms after surgery. Among them, 12 patients (20%) had reported that they newly developed

UII. In addition, 15 patients (25%) improved the conditions of OAB symptoms after the surgery. As for the remaining patients, there was no difference before and after conducting the surgery.

After the surgery, there were 6 patients (3.6%) and 2 patients (3.3%) with vaginal wall injury in SUI group and OAB-SUI group, respectively. In addition, there were no bladder perforation, urethral injury, and massive bleeding in need of transfusion. There were 2 patients (1.2%) from SUI group and 1 patient (1.7%) from OAB+SUI group that had vaginal erosion after the surgery. Furthermore, all of them were solved by conservative treatment such as antibiotics therapy. Other than them, there was no complication after surgery including acute urinary retention, mesh exposure, urinary tract infection, and wound infection.

DISCUSSION

MUS is most commonly used for the treatment of SUI due to its advantages such as relatively simple technique, good outcome, and less complications. Its surgical mechanism brings no change to the urethra in the case of normal abdominal pressure, and prevents SUI by providing the urethra's dynamic kinking in the case of increased abdominal pressure. Although it does not theoretically induce voiding dysfunction such as weak stream, hesitancy, urgency, and straining [6], many studies reported that voiding dysfunction was observed in patients with SUI who underwent MUS.

Jang et al. [6] reported that when MUS was conducted on 156 patients with SUI, three patients (1.9%), 2 patients (1.3%), and 7 patients (4.5%) complained of weak stream, residual urinary sensation, and frequency, respectively, and that voiding dysfunction occurred in the total 12 patients (7.7%). Salin et al. [7] reported that when MUS was conducted on 100 patients with SUI, five patients (5%) complained of urinary retention and 6 patients (6%) complained of hesitancy, slow stream, and feeling of incomplete emptying, and that voiding dysfunction occurred in the total 11 patients (11%). Kim et al. [11] have reported that voiding dysfunction was occurred after TOT surgery due to postoperative edema of bladder neck or urethra. Most of them were temporary and actually started to improve as time passed by. In this study, when the voiding symptom among the AUA-SI was compared, the mean score was shown to be 0.71 point before the surgery and 2.23 points after the surgery, which showed a significant increase. 82% of the pure SUI patients in this study complained aggravated conditions of voiding symptom after surgery, and 49% had reported aggravated conditions of storage symptoms. In addition, 35% of patients had one point more on the OABSS. Compared to previous studies, the result of this study showed a higher rate of voiding dysfunction. In the previous studies, voiding dysfunction was assessed according to objective criteria such as maximal flow rate, PVR, postoperative urodynamic study finding. Meanwhile, in this study, voiding dysfunction was assessed ac-

ording to the patient's subjective symptoms. In addition, the previous studies were conducted 6-12 months after the surgery, whereas this study was conducted three months after the surgery, which showed a difference in study conduct time. Thus, the aforementioned two factors are likely to have contributed to the difference in the results between the previous studies and this study.

Medication such as antimuscarinic agent, dopamine, or serotonin, conservative treatments including behavioral therapy and pelvic muscle exercise, electric stimulation, and surgical treatment have been used for the treatment of MUI. However, since Rezapour and Ulmsten [5] recently reported that surgical treatment was effective in the treatment of not only SUI but also urgency or UII in patients with MUI, many studies have reported that MUS was effective in the treatment of MUI [12,13]. There are various theoretical backgrounds that support the application of MUS to patients with MUI. Because urine leakage which occurred at increased abdominal pressure stimulated the proximal urethra to cause urgency, detrusor overactivity, Koonings et al. [14] reported that urgency and UII were improved when urinary leakage caused by increased abdominal pressure was prevented. Rezapour and Ulmsten [5] reported that in the case of UII, which is caused by detrusor instability urethral relaxation and uninhibited premature micturition, TVT improved it by supporting the pubic urethral ligament and by inducing dynamic kinking when abdominal pressure increased. At the present, however, compared to SUI, surgery success rate and patient's satisfaction are lower in MUS due to persistent urgency symptom and UII after the surgery. Jeffry et al. [15] reported that when TVT procedure was conducted on 112 patients with MUI, 66% of the patients showed an objective success. Sinha et al. [16] reported that a success rate of 75% was shown in patients with MUI after TVT procedure, and that the success rate of MUI was lower in the TVT procedure compared to that of SUI. Kim et al. [17] reported that a SUI success rate of 96.4% was shown in patients with MUI when MUS was conducted on them, and that the resolution and improvement of urgency symptom were observed in 84.6% of the patients. In this study, when the AUA-SI was compared, 85% of the OAB+SUI patients complained aggravated conditions of voiding symptoms, and 50% had reported aggravated conditions of storage symptoms. On the other hand, when the mean OABSS was compared, 45% of patients showed a score increase of 1 point or more after the surgery. The patient's degree of symptom improvement was shown to be lower in this study than in other studies. This is likely to be attributable to the facts that the criteria of comparing the patient's degree of symptom improvement mainly depended on the survey in this study unlike other studies, and that the period of comparing the postoperative patient's satisfaction was shorter in this study than in other studies.

This is a retrospective study and has limitations in that the improvement of SUI and MUI were assessed only via disease history taking and questionnaire. For the accurate

assessment of postoperative voiding dysfunction, a prospective study is further required via the analysis of objective tests such as urodynamic study in addition to the conduct of the survey. As no mechanism of MUS in the treatment of voiding dysfunction and MUI that occur after urinary incontinence surgery has been established yet, further follow-up and studies are additionally required.

CONCLUSIONS

When implementing MUS on patients with SUI, 18% of the patients newly developed OAB symptoms 3 months after the surgery as well as voiding dysfunction that aggravated voiding symptom or storage symptom. In addition 45% of the SUI patients with OAB complained aggravated condition of OAB symptoms 3 months after surgery. Therefore, it seems to be required to provide additional medicine treatment as well as special concern on sensitive bladder after the surgery especially for patients with urinary incontinence.

CONFLICTS OF INTEREST

The authors have nothing to disclose.

REFERENCES

- Kim UH, Kim JM, Kim YH, Jeon YS, Kim ME, Lee NK, et al. The prevalence of overactive bladder syndrome and urinary incontinence in young and middle aged women. *J Korean Continence Soc* 2003;7:9-14.
- Choo MS, Ku JH, Oh SJ, Lee KS, Paick JS, Seo JT, et al. Prevalence of urinary incontinence in Korean women: an epidemiologic survey. *Int Urogynecol J Pelvic Floor Dysfunct* 2007;18:1309-15.
- Dooley Y, Lowenstein L, Kenton K, FitzGerald M, Brubaker L. Mixed incontinence is more bothersome than pure incontinence subtypes. *Int Urogynecol J Pelvic Floor Dysfunct* 2008;19:1359-62.
- Deng DY, Rutman M, Raz S, Rodriguez LV. Presentation and management of major complications of midurethral slings: Are complications under-reported? *Neurourol Urodyn* 2007;26:46-52.
- Rezapour M, Ulmsten U. Tension-Free vaginal tape (TVT) in women with mixed urinary incontinence: a long-term follow-up. *Int Urogynecol J Pelvic Floor Dysfunct* 2001;12 Suppl 2:S15-8.
- Jang HA, Bae JH, Lee JG. Incidence and risk factors of postoperative de novo voiding dysfunction following midurethral sling procedures. *Korean J Urol* 2009;50:762-6.
- Salin A, Conqy S, Elie C, Touboul C, Parra J, Zerbib M, et al. Identification of risk factors for voiding dysfunction following TVT placement. *Eur Urol* 2007;51:782-7.
- Athanasios S, Grigoriadis T, Giannoulis G, Protopapas A, Antsaklis A. Midurethral slings for women with urodynamic mixed incontinence: what to expect? *Int Urogynecol J* 2013;24:393-9.
- Barber MD, Kleeman S, Karram MM, Paraiso MF, Walters MD, Vasavada S, et al. Transobturator tape compared with tension-free vaginal tape for the treatment of stress urinary incontinence: a randomized controlled trial. *Obstet Gynecol* 2008;111:611-21.
- Haylen BT, de Ridder D, Freeman RM, Swift SE, Berghmans B, Lee J, et al. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. *Neurourol Urodyn* 2010;29:4-20.
- Kim JH, Shin SH, Oh MM, Park JY, Lee JG, Bae JH. Factors affecting transient urinary retention after transobturator tape mid-urethral sling surgery for female patients with stress urinary incontinence: a single center experience. *Eur J Obstet Gynecol Reprod Biol* 2013;168:107-11.
- Choe JH, Choo MS, Lee KS. The impact of tension-free vaginal tape on overactive bladder symptoms in women with stress urinary incontinence: significance of detrusor overactivity. *J Urol* 2008;179:214-9.
- Tahseen S, Reid P. Effect of transobturator tape on overactive bladder symptoms and urge urinary incontinence in women with mixed urinary incontinence. *Obstet Gynecol* 2009;113:617-23.
- Koonings P, Bergman A, Ballard CA. Combined detrusor instability and stress urinary incontinence: where is the primary pathology? *Gynecol Obstet Invest* 1988;26:250-6.
- Jeffrey L, Deval B, Birsan A, Soriano D, Darai E. Objective and subjective cure rates after tension-free vaginal tape for treatment of urinary incontinence. *Urology* 2001;58:702-6.
- Sinha D, Blackwell A, Moran PA. Outcome measures after TVT for mixed urinary incontinence. *Int Urogynecol J Pelvic Floor Dysfunct* 2008;19:927-31.
- Kim JJ, Bae JH, Lee JG. Preoperative factors predicting the outcome of a midurethral sling operation for treating women with mixed incontinence. *Korean J Urol* 2008;49:1112-8.