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The effects of "unilateral midurethral sling cut down" in women with voiding dysfunctions after anti-incontinence surgery

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Abstract

Purposes Midurethral synthetic sling (MUS) placement via either the retropubic or transobturator route is the standard surgical procedure for women with stress urinary incontinence. However, a small portion of patients experienced voiding dysfunction after the surgery, which was debilitating to their quality of life. Our study was aimed at demonstrating the effectiveness of the unilateral sling cut down for post-midurethral sling (MUS) voiding dysfunction and, secondarily, at evaluating the changes in urodynamic parameters.

Methods We retrospectively reviewed the charts of patients who received unilateral midurethral sling cut down for voiding dysfunction after an MUS procedure. The cut-down procedures were performed at the urethral meatus, in the 9 or 3 o'clock direction. Preoperative and postoperative subjective and objective parameters were compared to evaluate the outcome of the cut-down procedures.

Results We selected 15 patients who underwent unilateral MUS cut down for voiding dysfunction after anti-incontinence procedures with various MUSs. The cut-down procedures were performed at a median interval of 7.1 months after sling insertion. The subjective results of the Patient Global Impression of Improvement (PGI-I) after the cut-down procedure showed an overall satisfaction of 93.33%. After the cut-down procedure, the median flow rate increased from 14.8 to 22 ml/s ($P > 0.05$), and the post-void residual urine volume decreased from 193.5 to 35.0 ml ($P < 0.05$). All patients attained continence after the cut-down procedures.

Conclusions Unilateral MUS cut down is effective in the management of voiding dysfunction after anti-incontinence surgery, with a low risk of recurrence of urinary incontinence.

Keywords Anti-incontinence surgery · Voiding dysfunction · Cut-down procedures · Midurethral sling

Introduction

Midurethral synthetic sling (MUS) placement, via either the retropubic route (RPR) or transobturator route (TOR) [1], is the effective and standard surgical procedure for women with stress urinary incontinence (SUI) [2, 3]. On the basis of the integral theory (IT), Ulmsten introduced a minimally invasive surgical procedure to insert a tension-free vaginal tape (TVT) at mid-urethra in 1996 [4–6]. The current update of the IT states that inadequate closure of the urethra is due to lax insertion points that weaken the muscle; hence, the imperative "repair the structure, restore the function" [7]. According to the Cochrane Database of Systematic Reviews in 2017, long-term (> 5 years) subjective cure rates ranged from 43 to 92% in the TOR group and from 51 to 88% in the RPR group [6]. However, this perfect option of treatment for SUI is not without complications. The overall rate of adverse events, which include bladder perforation, major vascular injury, groin or suprapubic pain, and vaginal tape erosion or extrusion, is low [5, 6, 8]. A systematic review reported that the incidence of urinary retention after anti-incontinence surgery ranged from 2.4 to 24% [9–12].

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Until now, clear definitions to clarify voiding dysfunction are lacking. They can include failure to store urine, failure to empty urine, or both [10, 11]. The occurrence of iatrogenic voiding dysfunctions after MUS procedures that lead to various symptoms is not rare. This voiding difficulty is debilitating to the patients' quality of life, not inferior to incontinence before the MUS procedure. It may be caused by extreme bladder neck elevation [10, 13] or overtension of the sling [5]. Detrusor underactivity (DU) before MUS insertion is also a possible predictor of voiding dysfunction after sling insertion. Management for these iatrogenic voiding dysfunctions, including clean intermittent self-catheterization (CISC), prolonged Foley catheter use, pushing the proximal urethra downward using Hegar's dilator, or a sling take-down procedure [10]. Hence, our study was aimed at demonstrating the effectiveness of unilateral sling cut down for postoperative voiding dysfunction and, secondarily, at evaluating changes in urodynamic parameters.

Methods

Study design

This is a retrospective study approved by the ethic committee of Chang Gung Medical Foundation Institutional Review Board (approval reference No. 201800354B0; date of approval: March 15, 2018. We selected 263 patients who underwent MUS procedures performed by an experienced surgeon (FC Chuang) between 2008 and November 2017. We reviewed the charts of patients who received unilateral sling cut down for voiding dysfunction after the MUS procedure. Anti-incontinence procedures include various methods of MUS placement, including RPR, TOR, or single-incision MUS placement.

Voiding dysfunction after anti-incontinence surgery was diagnosed on the basis of the patients' symptoms, post-void residual (PVR) urine, or urodynamic evidence. All patients were first managed with conservative treatment, including position-dependent micturition (ex. squat, semi-squat, or standing), medication use (alpha-blocker, parasympathetic mimicking agents), CISC for a period at home, and pushing the proximal urethra downward using Hegar's dilator. If these less invasive steps fail, we offered a unilateral sling cut down.

Preoperative and postoperative subjective and objective parameters were compared to evaluate the outcome of the cut-down procedures.

Surgical procedure

The cut-down procedures were performed at the urethral meatus, in the 9 or 3 o'clock direction. The patients were treated in an outpatient-basis surgery under intravenous general anesthesia.

The patients were placed in the lithotomy position. An approximately 1.5-cm vertical vaginal incision was made at the site in the 9 or 3 o'clock direction from the urethral meatus. The vaginal wall was carefully dissected until the previously inserted tape, the shiny and white fiber overlying the suburethra, was exposed. We cut off the sling unilaterally and left it in place (Fig. 1). We usually did not remove this tape, leaving a "J" shape sling in situ [14]. Urethrocystoscopy was performed in all patients during the operation to confirm the integrity of the lower urinary tract and rule out tape erosion into the urethra or bladder. The vaginal wound was closed with Vicryl-2-0, and the patient was discharged with a painkiller prescription after the procedure.

Statistical analysis

We retrospectively analyzed the urodynamic parameters before and after the MUS placement and cut-down procedures. Data were analyzed using the Statistical Product and Service Solutions (SPSS) Version 22 software and the non-parametric Wilcoxon signed-rank test. A P value of < 0.05 was considered statistically significant.

Results

We selected 263 patients who underwent the MUS procedure with various MUSs (Fig. 2). Fifteen patients who had a voiding dysfunction after undergoing MUS placement received a cut-down procedure (Table 1). They presented with various signs and symptoms such as voiding difficulty, urgency, frequency, nocturia, post-void dribbling, slow

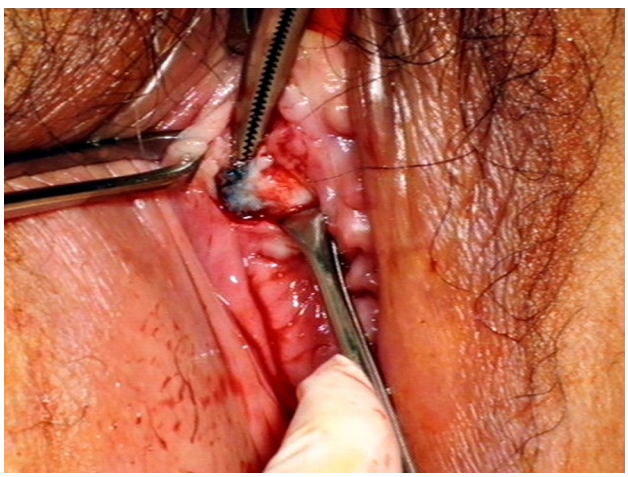

Fig. 1 Unilateral midurethral sling cut-down procedure performed at the urethral meatus, in the 9 or 3 o'clock direction

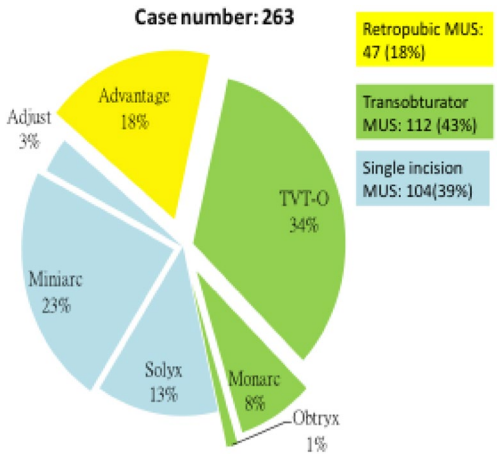

Fig. 2 Subtypes and number of MUS procedures performed in our study. *MUS* midurethral sling

stream, intermittent voiding, urination in a special posture, hesitancy, and dysuria. Only one patient developed urinary tract infection among them and she was completely cured with medications before cut-down procedures.

Cut-down procedures were performed without complications in all patients at a median (± SD) interval of 7.1 ± 10.5 months and mean interval of 10.3 months (range 0.6–39.3 months) after sling insertion. After the cut-down procedure, all the patients attained continence during follow-up. The subjective results of the Patient Global Impression of Improvement (PGI-I) after the cut-down procedures showed an overall satisfaction of 93.3%, with 14 of 15 patients reporting PGI-I scale scores of 1 (very much better) and 2 (much better). One patient (No. 13) reported a PGI-I scale score of 3 (a little better) after the cut-down procedure, mainly because of poor relaxation of the pelvic floor muscle during urination, which was confirmed with video urodynamics.

Among these cases, 33.3% (5/15) had a pelvic organ prolapse (POP) and preoperative SUI, and we performed a combination of pelvic reconstruction surgery and MUS procedure concurrently. Sacrospinous ligament suspension (SSS) was performed in patients 1 and 12; and transvaginal mesh placement, in patients 4, 8, and 9. Before the MUS procedures, DU was suspected in 40% (6/15) of these cases, whose urodynamic parameters showed a low maximum flow rate (Q_{max}) and low detrusor pressure at maximum flow ($P_{det}Q_{max}$).

The overall incidence rates of the cut-down procedure in the advantage, TVT-O, and Solyx subgroups were 4.2% (2/47), 9.09% (8/88), and 14.7% (5/34), respectively (Fig. 3). No cut-down procedure was performed in the MiniArc, Monarc, Ajust, and Obtryx subgroups. These 15 women were diagnosed as having a voiding dysfunction on the basis of their clinical presentation and urodynamic parameter data. The overall incidence of iatrogenic urethral obstruction required with a cut-down procedure after a MUS procedure was 5.70% (15/263).

Tracing back to their voiding conditions after the MUS procedures, all of these women had a median (± SD) PVR urine volume of 97.5 ± 240.6 ml and a mean PVR urine volume of 249.6 ml after Foley catheter removal and

Table 1 Patients' characteristics

Patient	Age	DM	UDS before sling	Operation methods	Interval between sling and cutoff (months)	PGI-I after cutoff	SUI after cutoff
1	80	–	USI	VTH + bil. SSS + TVT-O	3.4	1	–
2	53	–	USI, DU, straining	TVT-O	39.2	1	–
3	54	–	USI, straining	TVT-O	3.7	1	–
4	55	+	USI	VTH + Ant. Elevate + TVT-O	7.1	1	–
5	48	–	USI, DU, straining	TVT-O	0.3	1	–
6	56	+	USI	LAVH + TVT-O	11.0	1	–
7	65	–	USI	Advantage	2.2	1	–
8	67	+	USI, DU	Ant&Post Elevate + TVT-O	14.1	2	–
9	66	–	USI, DU, straining	VTH + Ant Elevate + TVT-O	17.4	1	–
10	69	–	USI, DU	Advantage	5.2	1	–
11	60	–	USI, DU	Solyx	7.8	1	–
12	59	–	USI	RSSS + Solyx	26.0	2	–
13	61	–	USI	Solyx	3.6	3	–
14	44	–	USI	LAVH + Solyx	3.7	1	–
15	47	–	USI	Solyx	9.3	1	–

UDS urodynamic study, *PGI-I* Patient Global Impression of Improvement (1, very much better; 2, much better; 3, a little better; 4, no change), *USI* urodynamic stress incontinence, *SSS* sacrospinous suspension, *RSSS* right sacrospinous suspension

spontaneous voiding. After the MUS procedure, the median pad test result decreased from 2 to 0 g, the median maximum flow rate decreased from 27.0 to 14.8 ml/s, and the PVR urine increased from 27 to 193.5 ml, all with a significant difference ($P < 0.05$; Table 2).

After the cut-down procedure, the median maximum flow rate increased from 14.8 to 22 ml/s ($P > 0.05$), the voided volume decreased from 324.5 to 288.5 ml ($P > 0.05$), and the PVR volume decreased from 193.5 to 35.0 ml ($P < 0.05$; Table 3). According to our observations, after the annoying problems of voiding difficulty were resolved via the sling cut-down procedure, most of the patients have low willingness and even hesitate to cooperate with full urodynamic studies. We evaluated the patients with subjective symptoms improvement, non-invasive uroflow, and residual urine during the follow-up.

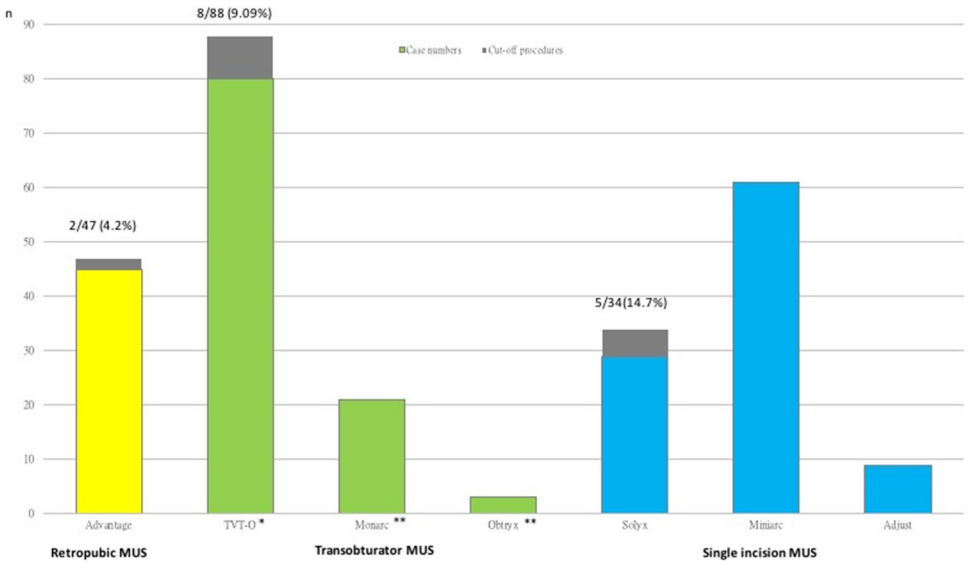

Fig. 3 Incidence of "cut-off procedures" in subgroups. *MUS* midurethral sling. *Inside-out transobturator MUS. **Outside-in transobturator MUS

Table 2 Comparison of urodynamic study results before and after MUS

Urodynamic parameters	Before MUS ($n = 15$)	After MUS ($n = 14$)	P value
Pad test (g)	2 ± 51.0	0	0.001*
Q_{max} (ml/s)	27.0 ± 9.4	14.8 ± 7.6	0.003*
Voided volume (ml)	346 ± 189	324.5 ± 142.2	0.14
Post-void residual urine (ml)	27 ± 24.8	193.5 ± 144.5	0.001*
$P_{det}Q_{max}$ (cm H_2O)	13 ± 8.4	18.0 ± 8.1	0.201
MUCP (cm H_2O)	53.0 ± 31.1	53.0 ± 16.5	0.314
FUL (cm)	2.9 ± 0.6	2.9 ± 0.7	0.610

Values are median (± SD)

MUS midurethral sling, Q_{max} maximal flow rate, $P_{det}Q_{max}$ detrusor pressure at maximum flow, *MUCP* maximum urethral closure pressure, *FUL* functional urethral length

*Statistically significant difference ($P < 0.05$)

Table 3 Comparison of uroflow parameter results before and after cut-down procedure

Uroflow parameters	Before cut down ($n = 14$)	After cut down ($n = 9$)	P value
Q_{max} (ml/s)	14.8 ± 7.6	22.0 ± 5.4	0.068
Voided volume (ml)	324.5 ± 142.2	288.5 ± 126.0	0.484
Post-void residual volume (ml)	193.5 ± 144.5	35.0 ± 43.8	0.036*

Values are median (± SD)

Q_{max}, maximal flow rate

*Statistically significant difference ($P < 0.05$)

Discussion

Iatrogenic voiding dysfunction after the MUS procedure that leads to various symptoms is not rare. This voiding dysfunction is debilitating to their quality of life, not inferior to incontinence before the MUS procedure. It may be caused by extreme bladder neck elevation [10, 13] or overtension of the sling [5].

In our study, the overall incidence of iatrogenic iatrogenic urethral obstruction that required a cut-down procedure after the MUS procedure was 5.7% (15/263). By reviewing data on the incidence of iatrogenic urethral obstruction that required a cut-down procedure, Klutke et al. reported an incidence of 2.8% (17/600) in 2001 [15]; Long et al. 9.9% (7/71) in 2004 [14]; and Lo et al. 9.2% (12/131) in 2016 [9]. The incidence of iatrogenic urethral obstruction in our practice of MUS procedures is acceptable. Among the cases that required cut-down procedures, 53.3% (8/15) were TOR MUS with all TVT-O subtypes, 33.3% (5/15) were single-incision sling (SIS) placement with all Solyx subtypes, and only 13.3% (2/15) were RPR MUS (advantage). Solyx had the highest incidence of cut-down procedure due to undue tension applied by surgeon, since this is an unadjustable single-incision tool. This hinting the existence of learning curve of surgeon for the procedure.

No consensus has been reached regarding the timing to perform the cut-down procedure. Long et al. suggested an interval of > 14 days after the MUS procedure [14], or, optimally, 4 weeks after the initial procedure can also be considered [5, 16]. In 2007, Glavind et al. suggested pulling down the tape after 1–3 weeks [17]. Recurrent SUI after a cut-down procedure is one of our considerations about timing to perform this procedure. Defreitas et al. had a 34% recurrence rate of stress incontinence after lateral incision of the sling [18]. Long et al. reported an SUI recurrence rate of 28.6%, with a mean time from initial surgery to tape excision of 28 days (range 4–108 days) [14]. A large series that assessed the release of an obstructing MUS reported a decreased incidence of repeat surgery for SUI, with an increased time to sling release [19]. According to Ulmsten and Petros in 1995 [2, 20], the polypropylene mesh around the suburethral area will enhance the strength of the pubourethral ligament, suburethral vaginal wall, and paraurethral tissues at 3 months after the MUS procedure. In our study, the cut-down procedures were performed without complications in all patients at a mean interval of 10.29 months and median (± SD) interval of 7.1 ± 10.47 months after sling insertion. All patients remained continent without recurrence of SUI during follow-up.

DU is considered an important risk factor of voiding dysfunction after anti-incontinence surgery [21]. Its prevalence increases with age, and it is an age-related dysfunction of bladder contractility [22]. Abrams et al. [23] and the international continence society report [22] defined DU as a contraction of reduced strength and/or duration, resulting in prolonged bladder emptying and/or failure to achieve complete bladder emptying within a normal time span. Its etiology is multifactorial [24, 25]. However, currently, DU has no standard definition or diagnostic criteria. At present, pressure-flow study is widely used for the diagnosis of DU [24]. Urodynamic parameters indicating DU basically include low maximum flow rate (Q_{max}) and low detrusor pressure at maximum flow ($P_{det}Q_{max}$) [22]. The most common symptoms observed among patients with DU include hesitancy, sensation of incomplete emptying, voiding with straining, urgency, and frequency [25]. In our study, 40% (6/15) of the cut-down procedures were performed in the patients with DU diagnosed before MUS placement. We should provide this information to patients with DU who will receive anti-incontinence surgery.

In our study, patient 5 underwent a radical hysterectomy for cervical cancer 9 years before the MUS procedure, and she had an annoying SUI after the radical surgery. Interruption of the autonomic fibers innervating the bladder during radical hysterectomy may also cause a bothersome iatrogenic functional disorder of the lower urinary tract [25–27]. In the study of Chuang et al. [27], DU was found in 85.7% of patients after radical hysterectomy with or without radiotherapy. For this case, UDS before the MUS procedure confirmed the presence of urodynamic stress incontinence (USI) and DU with straining on voiding. Considering her DU, we informed her of the possibility of CISC if she wanted the "dry" effect of the MUS procedure. However, she regretted having undergone CISC when informed preoperatively and requested to reverse the condition urgently. Thus, we offered the cut-down procedure to her 2 weeks after operation.

Whether to perform concurrent combination surgery with POP and SUI or not is still the surgeon's decision. According to a review by Lo et al. [28], the urinary retention rate of this combination surgery is between 9 and 43%. However, the latest review in 2017 by van der Ploeg et al. [29], which included ten trials stated that combination surgery did not increase the risk of surgery for voiding dysfunction. In our study, one-third (5/15) of patients who received a cut-down sling procedure had a combination surgery.

We selected 263 cases who underwent an MUS procedure and collected data about the incidence of iatrogenic urethral obstruction in all the subgroups. However, the main limitation of our study is the small number of patients who underwent a cut-down procedure. This implies a low incidence of iatrogenic urethral obstruction, which requires a cut-down procedure. Another limitation is the small number of patients with complete UDS. This is mainly because of

the patients' poor compliance of UDS follow-up after their symptoms were relieved by the cut-down procedure. However, to minimize this bias, we analyzed our data using the nonparametric Wilcoxon signed-rank test.

Conclusions

Iatrogenic urethral obstruction occurring after an anti-incontinence procedure should not be ignored. Unilateral midurethral sling cut down is effective for the management of voiding dysfunctions after anti-incontinence surgery, with a low risk of recurrence of urinary incontinence. We suggest that the cut-down procedure should be offered to patients who develop a bothersome voiding dysfunction after undergoing a midurethral sling procedure.

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Compliance with ethical standards

Conflict of interest The authors declare that there is no conflict of interest regarding the publication of this paper.

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