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ORIGINAL ARTICLE

Predicting for postoperative incontinence following sling incision

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Abstract
Introduction and hypothesis Our objective was to assess preoperative risk factors for developing recurrent stress urinary incontinence (SUI) following transvaginal sling incision (TVSI) for bladder outlet obstruction (BOO).
Methods We identified 101 women who underwent TVSI and/or removal of a midurethral sling. Thirty-nine underwent TVSI for clinical and videourodynamic demonstrable BOO. Eighteen of 39 women demonstrated preoperative clinical SUI and urodynamic BOO. A comparative analysis was performed specifically looking at several clinical factors and the risk of the occurrence of postoperative SUI.
Results Mean age, number of prior surgeries, parity, and pre- and postoperative PVRs did not predict for postoperative SUI. Nine of 18 (50%) of women with SUI and BOO preoperatively vs. only 2/21 (10%) of women with BOO alone developed postoperative SUI. This difference in the incidence of postoperative SUI was statistically significant ($p<0.01$).
Conclusions In patients with BOO, the presence of preoperative clinical SUI is a predictor for postoperative SUI following TVSI.

Keywords Bladder outlet obstruction · Midurethral sling · Stress urinary incontinence · Urodynamics

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Abbreviations

TVSI	Transvaginal sling incision
BOO	Bladder outlet obstruction
UDS	Urodynamics
MUS	Midurethral sling
SUI	Stress urinary incontinence
BMI	Body mass index
ISD	Intrinsic sphincter deficiency

Introduction

Stress urinary incontinence may affect up to 40% of American women and is expected to increase as the population ages [1]. The number of antiincontinence surgeries being performed in the US is increasing and the midurethral sling is emerging as the most commonly performed surgical procedure for stress urinary incontinence (SUI) in women [2, 3]. Complications of midurethral sling (MUS) occur with varying frequency, 4.3% to 75.1% [4], but may be underestimated [2, 4]. Bladder outlet obstruction (BOO) following midurethral sling placement is estimated to occur at a frequency of 1.9–19.7% [5].

Urethrolysis is an effective treatment for iatrogenic BOO following many types of antiincontinence surgery [6–8] but is associated with recurrence of SUI in a significant number of patients [7, 9]. In comparison to urethrolysis, transvaginal sling incision (TVSI) is a technically simpler, minimally invasive treatment option for BOO following sling [10–13]. Nevertheless, TVSI may also be associated with the recurrence of stress incontinence [10, 13, 14]. Risk factors for the development of recurrent SUI after TVSI are not well understood. Our objective was to determine the

rate of recurrent SUI following TVSI of a MUS for BOO and to determine preoperative risk factors for developing recurrent SUI.

Materials and methods

We reviewed the files of all women treated at our institution for MUS complications between 2004 and 2008. All medical charts were retrospectively reviewed to collect data pertaining to patient age, body mass index (BMI), number of prior pelvic surgeries, vaginal deliveries, complications, urinary symptoms, continence, outcome, and follow-up. Preoperative clinical evaluation included history and physical examination with cough test, voiding diary, urinalysis and culture, cytology, cystoscopy, and videourodynamics.

A total of 101 women were identified who underwent TVSI or removal during this 4-year period. The decision to incise the suburethral sling was determined by a combination of subjective symptoms and objective findings including sling erosion or extrusion, pain, and bladder outlet obstruction among others. Fifty-one patients underwent sling removal or excision for indications other than obstruction. Fifty of the 101 women underwent TVSI for clinically evident or urodynamically demonstrated bladder outlet obstruction following MUS. Eleven women were excluded from the analysis: nine women had concomitant autologous pubovaginal sling placement at the TVSI and two women had concomitant cystocele repair. Concomitant sling was performed in these nine unselected patients who, after counseling, requested such a procedure in consideration of minimizing the potential for recurrent SUI following TVSI. The remaining 39 women were separated into two groups for analysis. Group 1 included women who demonstrated preoperative bladder outlet obstruction as well as clinical or urodynamic evidence of SUI. Group 2 included women with bladder outlet obstruction without SUI. A comparative analysis of age, BMI, number of prior surgeries and type of pelvic surgeries, number of vaginal deliveries, and the incidence of postoperative urinary incontinence was performed. Patients were seen and examined at 1 week, 3 months, and at 12 months postoperatively. Postoperative SUI was assessed at last follow-up.

Pre- and postoperative symptom quantification as well as the diagnosis of SUI was collected via a combination of patient interview, physical examination, chart review, and symptom questionnaires. Preoperative and postoperative demonstration of SUI on physical examination and/or urodynamics evaluation which reproduced the patients' symptomatic complaint confirmed a diagnosis of SUI. Urodynamics were performed in accordance with ICS recommendations [15] with a 7F urethral catheter. Urodynamic BOO was defined as an isometric detrusor contraction in the absence of flow or by previously published parameters [11, 16]. A clinical diagnosis of BOO was made if the urodynamics were equivocal and there was a patient-reported subjective increase in urinary frequency/urgency, change in voiding habits including positional voiding, hesitancy and straining, in the setting of an elevated postvoid residual (PVR) following prior MUS. Statistical analysis was performed using a two-tailed student *t* test.

Transvaginal sling incision was performed by one of two surgeons (ER and RR) by a longitudinal incision in the anterior vaginal wall. Dissection was carried down to the level of the suburethral tape and lateral to the urethra. The tape was then incised on either side of the urethra; the portion of the sling traversing under the urethra was removed, followed by running closure of the vaginal wall and vaginal packing, which was removed on postoperative day 1. Concomitant retropubic urethrolysis was not performed.

Results

A total of 39 women were included in the analysis. Patient demographic information for both groups is provided in Table 1. The mean time from initial surgery to TVSI was 28.5 months (range, 2–120 months). The mean length of follow up from TVSI was 8 months (range, 1–24 months). SUI was diagnosed preoperatively by symptoms or on physical examination and confirmed on urodynamics in five patients. SUI was demonstrated on urodynamics but not by symptoms or physical examination in one patient, and the remainder had demonstrated SUI on physical examination or complained of the symptom of SUI but did not have urodynamic SUI.

Postoperative clinical outcomes are depicted in Tables 2 and 3. Overall, the incidence of SUI following TVSI in this cohort was 28.2% (11/39). Recurrence of SUI did not correlate to length of time from initial surgery to TVSI. Nine of 18 (50%) women in group 1 demonstrated postoperative SUI, while only 2/21 (10%) women in group 2 developed SUI. This difference in postoperative SUI was significant ($p<0.01$) between groups 1 and 2. A comparative analysis between groups 1 and 2 did not yield a significant difference in age ($p=0.11$), BMI ($p=0.49$), number of prior vaginal deliveries ($p=0.5$), or number of prior pelvic surgeries ($p=0.06$). There was no significant difference between the preoperative and postoperative postvoid residuals between the two groups ($p=0.09$ and $p=0.4$, respectively). Furthermore, the method of preoperative diagnosis of SUI (urodynamic SUI vs. no urodynamic SUI) did not impact the risk of postoperative development of SUI as the rate of recurrent SUI was equivalent in both groups (33%). We reanalyzed risk factors for those who developed SUI postoperatively (Group A) vs. those who were stress continent

Table 1 Preoperative demographics

	Group 1(BOO+SUI)	Group 2 (BOO only)
N	18	21
Mean BMI	27.8 (21.2–3.1)	27.8 (21.8–32.2)
Mean age (range)	53 (37–75)	58 (31–85)
Mean vaginal deliveries (range)	1.8 (0–4)	2.5 (1–7)
Mean prior pelvic surgeries (range)	1.6 (0–4)	1.6 (0–4)
Mean preoperative PVR (cc)	139.5	214.2
Mean postoperative PVR (cc)	47.5	43.2
Type of prior MUS		
Retropubic	13	12
Transobturator	3	5
Other/unknown	2	4

postoperatively (Group B). These data are seen in Table 4. No significant differences were seen between these groups.

Discussion

A significant cause of postoperative voiding dysfunction following antiincontinence surgery is iatrogenic BOO. Symptoms of BOO in the female may vary from de novo frequency and urgency to overt urethral obstruction and urinary retention requiring intermittent self-catheterization. With increasing numbers of women undergoing antiincontinence procedures, iatrogenic BOO is an important consideration in the evaluation of voiding dysfunction following MUS. It is important to recognize and consider the diagnosis of iatrogenic BOO very early in those patients with de novo symptoms following antiincontinence surgery. Prolonged BOO may result in long-term changes to the detrusor which may be irreversible [17]. Delayed treatment of BOO is associated with poorer outcomes [12].

BOO and/or voiding dysfunction following MUS is an established risk factor occurring in up to 20% of patients postoperatively [18]. When recognized, a certain portion of these patients require intervention commonly in the form of TVSI. The risk of subsequent SUI following TVSI is not well defined. Furthermore, the management of this potential adverse outcome is inconsistent, with some authorities routinely performing concomitant antiincontinence surgery at the time of urethrolysis and others preferring to assess continence status after convalescence from urethrolysis [19]. In Klutke's original review of 600 patients who had undergone tension-free vaginal tape (TVT), 17 patients (2.8%) developed urinary retention or symptoms consistent with obstruction (including hesitancy, straining to void, or feeling of incomplete emptying) lasting more than 1 week from the date of the procedure and subsequently underwent transvaginal release of their sling [20]. Of these 17 patients, only one developed subsequent SUI requiring a redo TVT. In another review by McCrery and Appell, 87% of 46 patients with obstructive voiding preoperatively were cured with "aggressive" urethrolysis. SUI, generally mild, was noted postoperatively in 16% of patients [21]. Webster and colleagues reviewed their outcomes for women who underwent urethrolysis for obstruction following Burch colposuspension and noted that all women who were in total urinary retention preoperatively had the immediate ability to void following urethrolysis. Furthermore, only 1/16 (6%) developed recurrence of her SUI [22]. In all of these reports, patients underwent formal urethrolysis. Most recently Nitti and others described their early results for midline sling incision. In their review of 19 women who underwent midline sling lysis without formal urethrolysis, 17% developed recurrent SUI [14]. Only one patient in the series had preoperative SUI, and risk factors for its postoperative recurrence or persistence were not evaluated. SUI following TVSI is poorly defined with inconsistent results reported thus far.

Table 2 De novo symptoms following TVSI

Symptom	Number/total	Percent
Urgency	5/39	13%
Frequency	5/39	13%
SUI	2/39	5%
UUI	4/39	10%

Table 3 Symptom improvement following TVSI

Symptom	Improved or cured/total	Percent
Urgency	13/23	57%
Frequency	17/19	89%
Pad usage	3/14	21%
SUI	9/18	50%
UUI	11/19	59%
Retention	11/11	100%

Not all patients complained of all symptoms

Table 4 Post TVSI demographics

	Group A (SUI)	Group B (no SUI)
N	11	28
Mean BMI	27.7 (21.2–37.6)	27.9 (21.8–38.1)
Mean age (range)	52 (45–73)	56 (31–85)
Mean vaginal deliveries (range)	1.7 (0–3)	2.3 (1–7)
Mean prior pelvic surgeries (range)	1.4 (0–4)	1.8 (0–4)
Mean preoperative PVR (cc)	165.1	185.5
Mean postoperative PVR (cc)	66	34.5
Type of prior MUS		
Retropubic	7	18
Transobturator	2	6
Other/unknown	2	4

Recurrent SUI may occur postoperatively following TVSI in the short- and long term [13, 14]. Although this occurs in a minority of patients, it can be bothersome enough to warrant additional subsequent procedures for treatment. Concomitant antiincontinence surgery may be performed at the time of TVSI to minimize the probability of recurrent SUI but this risks creating persistent BOO as a result of the second procedure. Alternative strategies include sling incision with concomitant interposition of synthetic material or biological graft to maintain continence [23]. Clearly, treatment of this "potential" recurrent SUI at the time of TVSI would not be beneficial in all patients. However, if preoperative risk factors could be identified which predict for postoperative SUI following TVSI, then concomitant antiincontinence surgery could be selectively offered to those individuals most at risk for this outcome. In this study, preoperative SUI carried a 50% risk of recurrent postoperative SUI vs. a 10% risk of de novo SUI in patients without preoperative SUI and BOO. Other risk factors did not predict for such an outcome. Although somewhat counterintuitive, SUI does coexist in some females with BOO [24]. The pathophysiological explanation for the co-existence of these two apparently dichototomous conditions in the same individual is unclear. Whether persistent SUI in the setting of concomitant BOO following MUS or recurrent SUI following TVSI is due to a significant component of unrecognized intrinsic sphincter deficiency (ISD) prior to the initial MUS surgery is unknown. As a tertiary referral center, the patients in this study were largely referrals for management of postoperative voiding dysfunction and UDS prior to their initial MUS surgery were either not done or were unavailable. Therefore, we are unable to speculate on their preoperative urethral function with respect to the presence of ISD.

Risk factors associated with SUI in the general population include age, vaginal deliveries, obesity, and prior pelvic surgery. Interestingly, none of these variables in our analysis differed significantly between the two groups nor did they predict for recurrent incontinence in our analysis, suggesting that prior incontinence surgery may alter the pelvic milieu and alter the predictors of success. This may, in part, account for the 50% cure rate in stress incontinence seen in our analysis.

Several theories have been proposed to explain SUI and the mechanism by which surgery restores continence including alterations in the urethrovesical axis, alterations in urethral positioning, the hammock theory, and the integral theory [25, 26]. These theories may, in part, serve as an explanation as to the mechanism of postoperative continence in most patients following TVSI through the preservation of lateral urethral support or new scar formation contributing to postoperative continence.

An important limitation to this study is its retrospective nature. In addition, follow-up is relatively short and it is possible that more women will develop recurrent SUI in group 2 with time which could invalidate our conclusions. In addition, presence or absence of postoperative SUI was not confirmed with pad tests or urodynamics in all cases nor did we analyze patient reported outcomes with a validated questionnaire such as UDI-6/IIQ-7. Furthermore, these results are not necessarily transferable to those patients with BOO following other types of slings not placed at the midurethra. Finally, this study was limited to patients with BOO following MUS and results for slings placed and incised at the bladder neck may be different.

Conclusions

TVSI is a reasonable and effective treatment for iatrogenic BOO following MUS. Preoperative clinical SUI in the setting of BOO is a predictor for postoperative SUI following TVSI. Therefore, as part of preoperative counseling, a concomitant antiincontinence procedure may be considered in this select patient population and the risk to

benefit ratio of such remains to be investigated in future studies.

Conflicts of interest None.

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