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Original Article

Predictors of persistence of preoperative urgency incontinence in women following pelvic organ prolapse repair

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ABSTRACT

Objective: To investigate the predictors of persistence or resolution of preoperative urgency urinary incontinence (UUI) in women following transvaginal mesh (TVM) repair for advanced pelvic organ prolapse (POP).

Material and methods: Patients with advanced POP undergoing TVM repair between 2008 and 2013 in a tertiary hospital were recruited. All patients underwent evaluation including a structured urogynecological questionnaire, voiding diary, pelvic examination using the POP-quantitation system, and urodynamic testing before and after surgery, and intraoperative cystoscopy. Patient demographics, lower urinary tract symptoms, urodynamic findings, and severity of prolapse were analyzed between women with and without preoperative UUI.

Results: Of 174 patients who underwent TVM repair, 49 (28.2%) had preoperative UUI; after operation, 23 (13.2%) were found to have postoperative UUI and 13 (7.5%) developed *de novo* UUI. For those 49 patients with preoperative UUI, 10 (20.4%) had persistent UUI and 19 (38.8%) developed *de novo* stress urinary incontinence postoperatively. The prevalence of preoperative bladder outlet obstruction, preoperative maximal cystometric capacity (MCC) < 300 mL, preoperative severe bladder trabeculation, and duration of POP symptoms > 60 months were significantly higher in patients with persistent UUI than without it. Logistic regression demonstrated that preoperative MCC < 300 mL, severe bladder trabeculation, and duration of POP symptoms > 60 months were associated with persistent UUI after prolapse repair.

Conclusion: For women with identified preoperative risk factors, including MCC < 300 mL, severe bladder trabeculation, and POP symptoms > 60 months, preoperative counseling should consist of a discussion about persistent UUI symptoms following TVM repair and the development of *de novo* stress urinary incontinence.

Introduction

Pelvic organ prolapse (POP) is a common condition that can impair a woman's quality of life. Because of distortion in the lower urinary tract, severe POP causes signs of bladder outlet obstruction (BOO) [1], detrusor overactivity (DO) [2], bladder trabeculation [3], reduced maximum urine flow rates, and elevated postvoid residual volumes [4]. Women with POP present with a variety of lower urinary tract symptoms (LUTS), such as overactive bladder syndrome (OAB), urinary incontinence, and voiding difficulty [5]. According to an International Continence Society (ICS) and International Urogynecological Association joint report, OAB is defined as urinary urgency, usually accompanied by frequency and nocturia, with or without urgency urinary incontinence (UUI) [6]. OAB, especially OAB with UUI affects health-related quality of life and interferes with daily activities [7]. The overall prevalence of OAB is similar in men and women, but OAB with UUI occurs more often in women [8]. Thus, both POP and OAB are commonly encountered together in women. Several authors have reported that vaginal surgery for POP significantly reduced OAB in elderly women [9,10]; however, which factors determine the persistence or disappearance of UUI in women with POP after surgery still remains unclear. This study was conducted to investigate the predictors of persistence or

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resolution of preoperative UUI in women after transvaginal mesh (TVM) repair of advanced POP.

Materials and methods

From November 2008 to January 2013, consecutive patients with advanced POP who underwent TVM repair but without concomitant anti-incontinence surgery in a tertiary hospital were recruited. We reviewed the patient's characteristics and outcome retrospectively in January 2014 (at least 12 months after surgery). Inclusion criteria included women who received TVM repair due to Stage 3 or 4 prolapse as defined by the ICS POP-Quantification (POP-Q) system [11]. Patients who had preoperative stress urinary incontinence (SUI), had undergone anti-incontinence surgery, did not undergo urodynamic and cystoscopic testing, and patients without the ability to complete the questionnaire were excluded. The present study was approved by the Ethics Committee of the hospital (Chang Gung Memorial Hospital in Taiwan) (No. 103-0813B).

The preoperative evaluation of patients with severe POP in this retrospective cohort study included general and obstetric histories, a voiding diary, 1-hour pad test, pelvic examination applying the POP-Q system, and multichannel urodynamic testing and a pessary test [12]. Patients were interviewed by answering a structured urogynecologic questionnaire regarding the presence of LUTS, as described by Liang et al [13], in which LUTS was defined based on the ICS definitions [14]. In addition to the items on LUTS, we asked the patients if they experienced any POP symptoms including a protruding vaginal mass and bearing down sensation. A single investigator performed diagnostic cystoscopy to evaluate the bladder for the presence and severity of trabeculation during surgery using the grading system of Liang et al [3]. The patients were divided into two trabeculation groups: Group 1 included Grades 3 and 4 with severe bladder trabeculation, and Group 2 included Grades 0–2 with no to moderate trabeculation.

The TVM procedures included the use of the Perigee/Apogee (AMS, Inc., Minnetonka, MN, USA), and Prolift systems (Ethicon, Piscataway, NJ, USA). Anterior vaginal wall mesh used Perigee or anterior Prolift; posterior vaginal wall mesh referred to Apogee or posterior Prolift. Anterior vaginal wall mesh was performed for the anterior compartment prolapse; anterior and posterior vaginal wall mesh procedures were done for the treatment of anterior, posterior, and apical compartments prolapse. Additional surgical procedures for prolapse repair included vaginal hysterectomy and posterior colporrhaphy.

Postoperative follow-up examinations were done at 1 month, 6 months, and 1 year after surgery, and annually thereafter. At the 6-month follow-up, postoperative urodynamic studies were performed on all patients. The same questionnaires and pelvic examinations were done at 6 months and 12 months after surgery.

UUI was the complaint of involuntary urine leakage accompanied by or immediately preceded by urgency [14]. A diagnosis of persistent UUI was made if the patient had UUI following TVM repair. SUI was the complaint of involuntary urine leakage on effort or exertion, or on sneezing or coughing [14]. DO was diagnosed when a patient had involuntary detrusor contractions during filling cystometry that did or did not lead to urinary leakage [14]. BOO was defined as a maximum flow rate of < 12 mL/s by the instrumented uroflometry (voided volume in excess of 100 mL), with the detrusor pressure at a maximum flow > 20 cm of water [9]. The terminology used in this article conforms to the recommendations of the ICS and International Urogynecological Association, unless otherwise stated [14].

Parameters were compared between patients with and without preoperative UUI, including LUTS, urodynamic variables, cystoscopic bladder trabeculation, POP symptoms, and severity of POP. Analyses were performed using the unpaired two-tailed Student *t* test for normally distributed continuous data, the Mann–Whitney *U* test for continuous data that did not fit a Gaussian curve, and Fisher's exact test for categorical data. The urodynamic data were compared using paired *t* tests. Multivariable logistic regression was done to determine independent predictors of persistent UUI after TVM repair; the involved parameters encompassed age, parity, body mass index, duration of POP, diabetes mellitus, ICS Stage 4, preoperative voiding difficulty, preoperative protruding vaginal mass and bearing down sensation, trabeculation, preoperative BOO, preoperative MCC < 300 mL, preoperative RU > 100 mL and preoperative DO. Odds ratios (OR) with 95% confidence intervals (CI) were calculated as appropriate. All statistical analyses were performed by using SPSS for Windows (version 17; SPSS Inc., Chicago, IL, USA). Probability values < 0.05 were regarded as statistically significant.

Results

We identified 183 patients from the medical records who met the criteria for inclusion. Nine patients were lost follow-up within 12 months. The mean follow-up period was 26 months (range, 12–50 months). Of the 174 women who underwent TVM procedures, 49 (28.2%) had preoperative UUI and 23 (13.2%) had postoperative UUI, including 10 (5.7%) with persistent UUI and 13 (7.5%) exhibiting *de novo* UUI. At the 1-year follow-up, all patients with UUI were treated with anticholinergics and improved their lower urinary tract symptoms. The mean age, prevalence of preoperative DO, and maximal cystometric capacity (MCC) < 300 mL were significantly higher in patients with UUI than without it (Table 1). Among the eight patients (4.6%) who had vaginal mesh erosions, six underwent an excision of the exposed mesh, and the other two were treated with topical estrogen cream. Nine of 174 (5.2%) patients who had undergone TVM had recurrent Stage 2 POP (7 cystocele and 2 rectocele) at the 12-month follow-up, but all required no prolapse repair.

Forty-nine patients with POP and preoperative UUI were treated surgically with one or more transvaginal procedures (Table 2). The POP-Q analyses of the 49 patients showed no prolapse greater than Stage 2 after surgery. Of the 49 patients with preoperative UUI, 10 (20.4%) had persistent UUI and 19 (38.8%) developed *de novo* SUI

Table 1
Characteristics of women with pelvic organ prolapse (POP) with and without preoperative urgency urinary incontinence (UUI).

	UUI ($n = 49$)	No UUI ($n = 125$)	p
Age (y)	67.8 ± 10.3	63.9 ± 10.0	0.024
BMI (kg/m^2)	25.9 ± 4.5	25.1 ± 2.7	0.921
Parity	4.5 ± 1.4	4.3 ± 1.5	0.217
Duration of POP (mo)	40.1 ± 32.9	37.6 ± 28.1	0.672
DM	6 (12.2)	17 (13.6)	0.812
Duration of POP > 60 mo	19 (38.8)	33 (26.4)	0.109
ICS Stage 4	22 (44.9)	52 (41.6)	0.692
Preop voiding difficulty	25 (51)	55 (44)	0.403
Protruding vaginal mass	44 (90)	118 (94.4)	0.927
Bearing down sensation	42 (85.7)	106 (84.8)	0.514
Severe preop trabeculation	24 (49)	52 (41.6)	0.377
Preop BOO	7 (14.3)	15 (12)	0.683
Preop MCC < 300 mL	16 (12.8)	16 (32.7)	0.002
Preop RU > 100 mL	16 (32.7)	33 (26.4)	0.409
Preop DO	8 (16.3)	7 (5.6)	0.032

Data are presented as mean ± standard deviation or *n* (%).
BMI = body mass index; BOO = bladder outlet obstruction; DM = diabetes mellitus; DO = detrusor overactivity; ICS = International Continence Society; MCC = maximal cystometric capacity; Preop = preoperative; RU = residual urine.

Table 2
Surgical procedures of women with pelvic organ prolapse.

	UUI + No UUI (Total $n = 174$)	UUI ($n = 49$)	No UUI ($n = 125$)
Anterior vaginal wall mesh Perigee ($n = 74$) Anterior Prolift ($n = 39$)	113 (64.9)	30 (61.2)	83 (66.4)
Anterior and posterior vaginal wall mesh Perigee + Apogee ($n = 40$) Anterior + Posterior Prolift ($n = 21$)	61 (35.1)	19 (38.8)	42 (33.6)
Concomitant procedures			
Vaginal hysterectomy	149 (85.6)	42 (85.7)	107 (85.6)
Posterior colporrhaphy	22 (12.6)	5 (11.0)	17 (13.6)

Data are presented as *n* (%).
UUI = urgency urinary incontinence.

after surgery; 26 (53.1%) patients had no postoperative urinary incontinence.

Prevalence of preoperative BOO, preoperative MCC < 300 mL, preoperative severe bladder trabeculation, and duration of POP symptoms > 60 months were significantly higher in patients with persistent UUI than without it (Table 3). Multivariable logistic regression demonstrated that preoperative MCC < 300 mL (OR = 10.8, $p = 0.022$), preoperative severe bladder trabeculation (OR = 19.6, $p = 0.008$), and duration of POP symptoms > 60 months (OR = 9.077, $p = 0.040$) were associated with persistent UUI after POP repair. There was no significant difference in the prevalence of risk factors between patients with and without *de novo* SUI after surgery. Nineteen patients had symptoms of SUI, but only seven had objectively confirmed SUI and were successfully treated by transobturator tape procedures at the 1-year follow-up.

Discussion

The prevalence of UUI in women with severe POP was 28.2% and the incidence of *de novo* UUI was 7.5% after prolapse repair, a figure lower than previously reported [15]. Lensen et al [15] reported a *de novo* UUI occurrence of 21% for women undergoing POP surgery without concomitant anti-incontinence procedures. While patients with UUI were an average of 4 years older than the patients without it, we could not attribute UUI to be principally generated by the aging process; more than 80% of patients with similar stages of POP were postmenopausal, and the vast majority were aged ≥ 65 years. However, in women older than 65 years, both UUI and mixed urinary incontinence were reported the most prevalent types of urinary incontinence [16]. In these elderly women, increased bladder sensation, decreased bladder capacity, and increased DO were observed [16]. Urodynamic results in the current study showed lower MCC and a higher prevalence of DO in women with preoperative UUI compared to those without it. Severe POP can cause urethral kinking or external compression and thus BOO, which promotes uninhibited detrusor contractions [17]. We found that 8.6% (15/174) of patients were diagnosed with DO. Previous authors have reported that DO was a strong predictor of postoperative persistence of urgency and UUI [18], but we did not observe any correlation between DO and UUI.

POP can cause BOO, and this is often regarded as an important mechanism for the development of UUI and other OAB symptoms in POP patients [19]. Several previous studies have reported that OAB symptoms improved after successful treatment of POP [16,19–21]. Basu and Duckett [21] found that 53% (22/40) of patients having nonmesh procedures for prolapse surgery experienced resolution of their OAB, and maximal flow rate was a significant predictor of improved OAB symptoms after surgery. Long et al [17] observed that women with POP experienced improvement of their OAB symptoms after TVM repair and preoperative DO was the only significant predictor of symptom relief. They suggested postoperative OAB improvement after mesh repair is related to the release of urethral obstruction. In our study, UUI related to POP was totally obviated in 80% (39/49) of women with severe prolapse after surgical correction. Nguyen and Bhatia [2] reported 63% (24/38) resolution of UUI among 38 patients with severe POP after prolapse correction surgery. Foster et al [10] reported a significant reduction of urgency and frequency symptoms 6 months after vaginal reconstructive and obliterating surgeries and a similar significant reduction in urgency and UUI at 1 year after surgery.

Our data demonstrated that the prevalence of BOO was 12.6% ($n = 22$) among the 174 patients studied, and patients with persistent UUI had a greater prevalence of BOO than those without it did. We also found that women with more severe bladder trabeculation had significantly greater UUI than did patients with no to moderate trabeculation. BOO caused by severe POP results in hypertrophy of the bladder muscle and development of trabeculation [3,22]. Previous investigators reported that bladder trabeculation on voiding cystography was strongly associated with UUI in a population of community dwelling elderly women [23]. Gowda et al [24] observed that bladder trabeculation was associated with ICS Stage 4 anterior vaginal wall prolapse as well as with DO and UUI. Our results showed that longer durations of POP symptoms

Table 3
Characteristics of women with and without postoperative urgency urinary incontinence (UUI) among the 49 women with preoperative UUI.

	Postop UUI ($n = 10$)	No postop UUI ($n = 39$)	*p*
Age (y)	68.5 ± 11.1	68.0 ± 10.1	0.88
BMI (kg/m^2)	23.6 ± 2.2	25.3 ± 3.0	0.09
Parity	4.7 ± 1.6	4.6 ± 1.6	0.91
Duration of POP (mo)	56.8 ± 40.2	40.2 ± 42.8	0.27
DM	1 (10)	5 (12.8)	1.0
Duration of POP > 60 mo	7 (70)	12 (30.8)	0.033
ICS Stage 4	7 (70)	15 (38.5)	0.090
Preop voiding difficulty	7 (70)	18 (46.2)	0.29
Protruding vaginal mass	9 (90)	36 (92.3)	0.912
Bearing down sensation	8 (80)	32 (82.1)	0.434
Severe preop trabeculation	7 (70)	8 (20.5)	0.005
Preop BOO	4 (40)	3 (7.7)	0.025
Preop MCC < 300 mL	7 (70)	9 (23.1)	0.008
Preop RU > 100 mL	6 (60)	10 (25.6)	0.06
Preop DO	1 (10)	6 (15.4)	1.0

Data are presented as *n* (%).
BMI = body mass index; BOO = bladder outlet obstruction; DM = diabetes mellitus; DO = detrusor overactivity; ICS = International Continence Society; MCC = maximal cystometric capacity; POP = pelvic organ prolapse; Preop = preoperative; RU = residual urine.

and higher prevalences of severe bladder trabeculation and MCC < 300 mL resulted in persistent UUI symptoms after prolapse repair. However, whether trabeculation is related to bladder dysfunction with irreversible changes at the cellular level or a sign of reversible compensation due to urethral obstruction is not clear [25].

Our results showed TVM procedure is effective in treating patients with severe POP, with 12-month recurrent rate at around 5%, compatible with what prior literature had indicated [26]. Long et al [26] reported Perigee/Apogee and Prolift system had an overall success rate of 96% for the treatment of POP. In this study, the incidence of *de novo* SUI following TVM repair of POP in women with UUI was 32.7% (16/49), which was compatible with previous studies [27]. A recent study reported a high incidence of *de novo* SUI of up to 43% (74/172) at 12 months after vaginal prolapse repair where no mid-urethral sling procedure was performed in comparison with an incidence of 27.3% (45/165) in patients undergoing concomitant mid-urethral sling procedures [28]. However, routinely performing a prophylactic anti-incontinence procedure during prolapse repair regardless of the presence or absence of demonstrable incontinence is unjustified because the prophylactic procedure exposes many women to unnecessary morbidity. We did not find a meaningful predictor for the occurrence of *de novo* SUI in women with preoperative UUI after TVM repair.

Limitations of the present study include its retrospective study design and small case number. The strengths of this analysis include that all patients underwent a TVM repair, although some women needed more than one compartment repaired, cystoscopy performed by a single investigator, urodynamic testing performed at a single laboratory, and the assessment of patient-reported urologic symptoms with a structured questionnaire. Furthermore, this study produced results that could be potentially beneficial in providing preoperative patient counseling. The assessment and clarification of preoperative patient expectations, including discussing the possibility of persistent symptoms postoperatively is critical in achieving adequate patient satisfaction.

In conclusion, following POP repair, 20% of women with preoperative UUI had persistent postoperative UUI. For women with identified preoperative risk factors of MCC < 300 mL, severe bladder trabeculation, and POP symptoms > 60 months, preoperatively counseling them on probable persistent UUI symptoms postoperatively and development of *de novo* SUI after surgery are advisable.

Conflicts of interest

The authors have no conflicts of interest relevant to this article.

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