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CLINICAL ARTICLE

Preoperative urodynamic predictors of short-term voiding dysfunction following a transobturator tension-free vaginal tape procedure

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ABSTRACT

Objective: To determine whether preoperative urodynamic parameters can predict the development of short-term voiding dysfunction (VD) after a transobturator tension-free vaginal tape (TO-TVT) procedure. *Methods:* In a prospective study between April 2005 and April 2007, 341 women were randomized to receive "inside-out" or "outside-in" TO-TVT. The present secondary analysis included women who had completed a preoperative symptom questionnaire, had a voided volume of 100 mL or more on preoperative uroflowmetry, and underwent standardized postoperative voiding assessment. VD was defined as a requirement for postoperative catheterization. Univariate and multivariate analysis were done by SPSS 17. *Results:* The inclusion criteria were met by 224 women, of whom 17 (7.6%) had postoperative VD. On univariate analysis, there were no differences in preoperative parameters among those with and those without VD: residual urine volume ($P=0.485$), peak flow rate on or below 5th centile ($P=0.272$), average flow rate on or below 5th centile ($P=0.142$), detrusor pressure at opening ($P=0.955$), maximum urethral closure pressure at 30 cm H_2O or less ($P=0.855$) and functional urethral length ($P=0.173$). None of the variables analyzed was an independent risk factor on multivariate analysis. *Conclusion:* Preoperative urodynamic parameters did not predict the development of short-term voiding dysfunction after a TO-TVT procedure.

1. Introduction

Stress urinary incontinence (SUI) is increasingly recognized as a problem of epidemic proportions for women worldwide. Pelvic floor muscle training is usually the first line of management and is effective in about two-thirds of these women. For those requiring surgical treatment, a mid-urethral sling (MUS) is currently the first choice in most health centers worldwide. Postoperative voiding dysfunction is often considered by women as an unsatisfactory outcome after a MUS procedure. Voiding dysfunction primarily affects a patient's quality of life, but if persistent it may also have a negative long-term effect on the lower and upper urinary tracts. A recent meta-analysis of MUS for the management of SUI found no significant differences in patient-reported cure rates or outcomes at up to 1 year follow-up between transobturator tension-free vaginal tape (TO-TVT) and retro-pubic tension-free vaginal tape (RT-TVT) [1]. However, women in the TO-TVT group had a significantly lower incidence of bladder injuries and postoperative voiding dysfunction [1].

Several studies have identified factors associated with postoperative voiding dysfunction after a RT-TVT procedure, such as previous incontinence surgery, concomitant prolapse surgery, postoperative urinary tract infection, and peak urinary flow rate on preoperative uroflowmetry [2–4]. In addition, Cho et al. [5] recently showed that a preoperative peak flow rate (Q-max) of less than 15 mL/s was a predictor of postoperative voiding dysfunction after a TO-TVT procedure.

In the past 2 decades, preoperative urodynamic investigations have been considered by most gynecologists and urologists to be essential before continence surgery, with one of the main reasons being the ability of "uroflowmetry" to predict postoperative voiding dysfunction. Pressure-flow (or voiding cystometry) measurements have been successfully used to investigate men with possible bladder outlet obstruction; however, the utility of these parameters in women is uncertain.

The aim of the present study was to determine whether preoperative urodynamic parameters (either uroflowmetry or pressure flow, or a combination of both) can be used as predictors for the development of postoperative voiding dysfunction after a TO-TVT procedure.

2. Materials and methods

The present study was a secondary analysis of a prospective, single-blinded, randomized study of women undergoing MUS surgery in a tertiary urogynecology center between April 2005 and April 2007. During the study period, 341 women were randomly assigned to undergo MUS surgery with either "outside–in" TO-TVT (ARIS-

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Coloplast Corp., Minneapolis, MN, USA) [6] or "inside-out" TO-TVT (TVT-O Ethicon Inc., Somerville, NJ, USA) [7] by means of opaque sealed envelopes [8]. The study was approved by the South Glasgow Research Ethics Committee.

Women were included in the study if they had urodynamic SUI or mixed incontinence (with predominant, bothersome SUI symptoms), and had failed or declined pelvic floor muscle training. Women were excluded if they had concomitant surgery, utero-vaginal prolapse (POP-Q ≥ stage 2), predominant bothersome overactive bladder symptoms, or specific co-morbidities such as multiple sclerosis. Preoperative urodynamic assessment included free uroflowmetry, filling/voiding cystometry, and urethral pressure profilometry. Urodynamic testing was performed in accordance with ICS recommendations with a urethral catheter of 8 Fr, the patient in the sitting position, and a filling rate of 100 mL per minute. Urethral pressure profilometry was performed with patient in the supine position and a fluid-filled transducer adjusted to stay level with the symphysis pubis with a filling rate of 1 mL per minute.

Women were included in the present secondary analysis if they had completed the Birmingham Bowel Urinary Symptom Questionnaire (BBUSQ-22) [9] before and after the operation, and had a voided volume of 100 mL or more on preoperative free uroflowmetry.

As described previously [8], the TO-TVT procedures were performed by 2 urogynecologists and 3 general gynecologists who were experienced in both types of operation and had completed at least 20 operations of each type before the study. The operations were done under general anesthesia, and the TO-TVT tapes were adjusted to be tension-free.

At the end of the procedure, the bladder was filled with a standard volume of 100 mL of sterile water to facilitate postoperative voiding assessment. A urethral catheter was not routinely used postoperatively, and a cough stress test was performed only at the surgeon's discretion. All women underwent standardized departmental postoperative voiding assessment in which they were encouraged to void within 3 hours of the procedure, and the postvoiding residual urine volume (PVR) was assessed via a bladder scanner.

Satisfactory voiding was defined as emptying of at least 250 mL with a PVR of 100 mL or less on at least 2 assessments. Patients who did not meet the above criteria but who had a PVR of less than 50% of bladder capacity were instructed to do "double voiding" and were allowed up to 48 hours as an in-patient. The criteria for postoperative catheterization were complete urinary retention, a postoperative PVR of 250 mL or more, or unsatisfactory voiding for 48 hours. For the purpose of the present analysis, voiding dysfunction was defined as the requirement for postoperative catheterization.

Women were reassessed for voiding 24 hours after catheter insertion; those failing to meet the above criteria for satisfactory voiding were taught clean intermittent self-catheterization (CISC), or occasionally were discharged with a catheter for 5–7 days if unwilling or unable to perform CISC. Patients were followed-up by a specialist nurse until satisfactory voiding was achieved. Women with complete urinary retention lasting 1 week or longer were offered surgical release of the tape under general anesthesia.

Analysis was performed by using SPSS version 17 (SPSS, Chicago, IL, USA). The women were classified into 2 groups: those with and those without postoperative voiding dysfunction. Preoperative urodynamic parameters and preoperative urinary symptoms were analyzed as continuous or dichotomous variables via univariate analysis. Uroflowmetry parameters were plotted on a "Liverpool normogram" [10]. All clinically relevant parameters and those with a P value of less than 0.10 on the univariate analysis were entered into a multivariate logistic regression module to identify any independent risk factor of postoperative voiding dysfunction. The odds ratio (OR) was used as a basic measure of the relative risk and is expressed with the 95% confidence interval (CI). The level of significance was set at $P<0.05$.

3. Results

Among the 341 women in the original study, 224 (66%) met the inclusion criteria for the present secondary analysis. The mean age, body mass index (BMI, calculated as weight in kilograms divided by the square of height in meters), and parity were 51.4 years, 28.4, and 2.4, respectively. Twenty-six (11.6%) of the 224 women had undergone previous incontinence surgery.

Within 24–48 hours of the operation, 207 women (92.4%) achieved satisfactory voiding; and 17 women (7.6%) were diagnosed with postoperative voiding dysfunction, of whom 12 (5.4%) required catheterization (according to the protocol described in Materials and methods) for 24–36 hours postoperatively. A further 3 women (1.4%) required catheterization for 5–7 days and 1 woman (0.4%) required CISC for 1 year. Tape release was performed in 1 woman (0.4%) 6 weeks after the surgery. There were no major complications, and no patient had any over-distention of the bladder postoperatively in the ward.

The 17 women (7.6%) who had postoperative voiding dysfunction were compared with the 207 women (92.4%) who had satisfactory postoperative voiding dysfunction. There were no significant differences between these 2 groups in age ($P=0.155$; 95% CI, −8.82 to 1.41), BMI ($P=0.351$; 95% CI, −1.13 to 3.15), or history of 1 or more previous operations for incontinence ($P=0.983$; OR, 0.984; 95% CI, 0.212–4.568).

On univariate analysis, there were no significant differences between the 2 groups in preoperative urinary symptoms such as sensation of incomplete bladder emptying ($P=0.184$; OR, 0.478; 95% CI, 0.167–1.368), urgency ($P=1.00$; OR, 1.04; 95% CI, 0.386–2.802), urgency incontinence ($P=0.954$; OR, 1.17; 95% CI, 0.434–3.152), increased daytime frequency ($P=0.385$; OR, 1.605; 95% CI, 0.565–4.556), or nocturia ($P=0.547$; OR, 0.647; 95% CI, 0.237–1.767) .

Similarly, there were no significant differences between the 2 groups in various preoperative urodynamic parameters such as PVR ($P=0.485$), Q-max of 15 mL/s or less ($P=0.574$; OR, 0.707; 95% CI, 0.218–2.292), Q-max on or below the fifth centile ($P=0.272$; OR, 0.540; 95% CI, 0.616–5.573), average flow rate (Q-ave) of 10 mL/s or less ($P=.00$; OR, 0.937; 95% CI, 0.343– 2.561), Q-ave on or below the fifth centile ($P=0.142$; OR, 0.467; 95% CI, 0.169–1.290), maximum urethral closure pressure (MUCP) of 30 cm H_2O or lower ($P=0.855$; OR, 0.982; 95% CI, 0.268–3.597), detrusor pressure at peak flow ($P=0.725$; 95% CI, −6.59 to 9.47), detrusor pressure at opening ($P=0.955$; 95% CI, −5.57 to 5.26), and functional urethral length ($P=0.173$; 95% CI, −8.37 to 1.51).

Table 1 shows the multivariate logistic regression analysis for potential risk factors including relevant clinical symptoms and various urodynamic parameters. None of the variables analyzed was found to be an independent risk factor for postoperative voiding dysfunction after a TO-TVT procedure.

Table 1
Multivariate logistic regression analysis for potential independent predictors of short-term voiding dysfunction.

Risk factors	Adjusted odds ratio	95% CI	P value
Age	2.351	0.701–7.887	0.166
BMI	1.264	0 .410–3.893	0.684
Incomplete bladder emptying symptom	1.264	0.694–0.694	0.179
Q-ave ≤ 5th centile	2.265	0.562–9.124	0.250
Combined Q-max and Q-ave ≤ 5th centile	0.689	0.125–3.786	0.668
MUCP	0.783	0.189–3.245	0.736
Detrusor pressure at peak flow	0.684	0.070–6.650	0.744

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by the square of height in meters); MUCP, maximum urethral closure pressure; Q-ave, average flow rate; Q-max, peak flow rate.