

Impaired Detrusor Contractility and the Treatment of Female Stress Urinary Incontinence

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Abstract

Introduction and hypothesis: Little conclusive data exists regarding Urodynamic (UD) variables predictive of voiding dysfunction after synthetic Midurethral Sling (MUS) placement. This study aims to evaluate outcomes of MUS in female patients with Impaired Detrusor Contractility (IDC), Valsalva Voiding (VV), or both. We propose that there would be no direct relationship between these variables and urinary retention requiring Clean Intermittent Catheterization (CIC) or reoperation at 6 wk follow up.

Methods: Retrospective chart review was performed for all MUS procedures at a single institution, 1/2010-present. Subjects with complete pre-operative UD records and 6 wk follow up were included. The primary outcome measure was urinary retention requiring CIC or re-operation at 6 wk follow up.

Results: 187 women who underwent MUS from January 2010 to present had complete UD and ≥ 6 wk follow up data. Average age was 56.7 years. Pre-operative UD identified 64 (34.2%) IDC subjects. At 6-wk follow up, no new subjects in this group required CIC for obstruction or reoperation. No subjects without IDC required CIC or reoperation for urinary retention; however there were 2 reoperations in this group: persistent stress incontinence and vaginal extrusion. Pre-operative UD identified 50 (26.7%) VV subjects. One patient in this group required reoperation; however sling removal was for vaginal extrusion. In the group with both IDC and VV (n=23) no subjects required reoperation.

Conclusions: Neither IDC nor VV appear to be risk factors for post-operative urinary retention or reoperation after MUS and have little predictive value for outcomes after MUS.

Keywords: Detrusor underactivity; Sling; Urinary incontinence; Valsalva

Introduction

Over the last two decades, synthetic midurethral sling surgery has evolved to become what many consider the gold standard for the treatment of stress urinary incontinence. When first introduced as the Tension-free Transvaginal Tape (TVT), the Midurethral Sling (MUS) heralded a minimally invasive procedure for urethral hypermobility, leading to dry rates upwards of 90%. Since then, various studies have examined the success of different MUS types including retropubic, transobturator, and single incision slings. However, there are still many unknowns regarding the outcome, success, and complications that follow placement of MUS. These dilemmas are even more concerning when a patient presents with stress urinary incontinence and concurrent impaired detrusor contractility, supporting the need for preoperative urodynamic study. Nevertheless, the utility of urodynamics testing before sling surgery for stress incontinence remains under investigation [1,2]. Some experts suggest that subjective assessment of the outcome by the surgeon may be difficult and some patients may continue to have problems interfering with their quality of life after what is considered to be a surgical success [3,4]. In addition, a recent study by the Urinary Incontinence Treatment Network confirmed that in uncomplicated female patients with stress urinary incontinence undergoing midurethral sling procedure an office visit evaluation was not inferior to urodynamic testing in outcome measurement one year following surgery [5].

Voiding dysfunction after midurethral sling placement could be the reason for the discrepancy between patient satisfaction and the surgical outcome [6]. Some experts believe that preoperative voiding patterns can be closely related to voiding dysfunctions postoperatively [7]. Most anti-incontinence surgeries can potentially cause increase in the resistance of the urethra and lead to bladder outlet obstruction,

straining, or retention postoperatively. Some of these voiding dysfunction has historically been explained by preoperative detrusor underactivity or valsalva straining [8-11].

Little conclusive data exists regarding Urodynamic (UD) variables predictive for voiding dysfunction after synthetic Midurethral Sling (MUS) as a more widely used contemporary surgical technique for stress urinary incontinence. This retrospective review study aims to examine a large database of urodynamics data, along with surgical results, in order to find associations between testing results and patient outcomes of MUS in female patients with Impaired Detrusor Contractility (IDC), Valsalva Voiding (VV), or both.

Materials and Methods

IRB approval (PRO00005869) was obtained through the Houston Methodist Hospital IRB. Retrospective chart review was performed for all MUS procedures at a single institution, 1/2010-5/2012. 187 patients met the criteria to be included in the study and their charts were evaluated. All patients underwent a urological and gynecological examination prior to the procedure. Urodynamics evaluation including a voiding cystometry and electromyography was performed in a sitting position. Noninvasive uroflowmetry was also recorded. All data was

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examined manually and the best pattern was accepted and analyzed. The aim of the study is to identify whether urodynamic findings, such as a low voiding pressure, are risk factors for urinary retention requiring CIC or re-operation at 6-wk follow up. Our inclusion criteria included all adult women over the age of 18 years, patients who underwent urodynamics testing prior to midurethral sling surgery (with or without concurrent pelvic organ prolapse surgery), and patients with a minimum of 6 weeks follow up after midurethral sling surgery.

Patients with chronic urinary tract infection, bladder pain or irritative storage symptoms; neurogenic illness or neurogenic bladder; and history of previous midurethral sling surgery were excluded.

A commonly used equation to estimate the isometric bladder pressure, Bladder Contractility Index (BCI) which is calculated and derived from Schaefer nomogram [12].

Bladder Contractility Index (BCI= $P_{det}Q_{max}+5*Q_{max}$) was used.

Based on this formula one can divide the bladder contractility to three classes: strong 150, normal 100-150, and weak<100 [13,14]. Therefore, in our study impaired detrusor contractility (IDC) was defined as BCI<100. Valsalva Voiding was defined as $\Delta P_{abd} >10$ cm/H₂O during voiding. The primary outcome measure was urinary retention requiring CIC or re-operation at 6-wk follow up. Categorical analysis using the Chi square statistic calculated the relative risk (RR) regarding the primary outcome in relation to BCI<100, presence of VV, and both.

Results

236 patients underwent MUS from January 2010 to May 2011. 187 subjects had complete UD and ≥ 6 wk follow up data and their demographics are shown in Table 1. Average patient age was 56.7 years. Sling procedures were: Transobturator Tape (TOT) Monarc (American Medical Systems) (125), TOT-O “in-to-out” (2), SPARC (23), TVT (Gynecare) (12), and MiniArc (25) (Table 2). Pre-operative urodynamics identified 64 (34.2%) subjects with Impaired Detrusor Contractility (IDC) defined as BCI<100. At 6 wk follow up, one patient in this group needed clean intermittent catheterization. This is an 82 year female with VLLP of 40 cm/H₂O preoperatively and had an indwelling Foley catheter in place prior to surgery. She underwent a

BCI	# Patients (%)	Mean age
<100	64 (34.2)	61.42
Between 100-150	67 (35.8)	57.73
>150	56 (30)	51.02
Total	187 (100)	56.72

Calculated bladder contractility based on Schaefer nomogram [12] and mean age of each group is shown in this table.

Table 1: Bladder Contractility Index.

	#patients (%)	CIC	PVR>150	New LUTS	SUI	Reoperation
BCI<100	64 (34.2)	1**	0	5	2	0
Valsalva Voiders (VV)	50 (26.7)	0	0	2	3	0
BCI<100 and VV	23 (12.3)	0	0	2	1	0
BCI>100	123 (65.8)	0	0	5	6	2*

BCI: Bladder Contractility Index; VV: Valsalva Voiders ; CC: Clean Intermittent Catheterization; PVR: Post-Void Residual; LUTS: Lower Urinary Tract Symptoms; SUI: Stress Urinary Incontinence

*One patient needed sling removal for vaginal extrusion and one patient underwent anti-incontinence (Coaptite injection) procedure.

**patient had an indwelling catheter prior to surgery and underwent vulvectomy

Table 2: Post-operative outcomes following mid-urethral sling placement.

vulvectomy and a mini arc sling. In the IDC group no subjects had a large PVR. 5 patients experienced new LUTS and two patients still had stress urinary incontinence. No subjects without IDC (BCI>100) required CIC or reoperation for urinary retention; however there were 2 reoperations in this group for: persistent stress incontinence (1) and vaginal extrusion (1). Pre-operative urodynamics identified 50 (26.7%) valsalva voider (VV) subjects (all confirmed by two independent reviewers reviewing the graph and the pattern of UDS). In this group no patient required CIC or experienced a large PVR. However, two patients complained of new LUTS and stress urinary incontinence. One patient in this group required reoperation and the sling was removed; however sling removal was for vaginal extrusion, not urinary retention. In the group with both IDC and VV (n=23) no subjects required CIC, reoperation, or experienced large PVR. Two patients in this group experience new LUTS and one patient had persistent stress urinary incontinence.

Discussion

Thom reported an estimated prevalence of urinary incontinence in older women from 17 to 55% and in younger adults ranging from 12 to 42% with stress urinary incontinence being more prominent cause in younger adults and mixed urinary incontinence in older women [15,16]. Normal voiding patterns for women encompasses a wide range of patterns with some voiding without any detrusor contraction, and solely by relaxing their pelvic floor and their urethra while others by valsalva maneuvers. Conventionally there has been a concern for obstruction when these women undergo anti-incontinence surgery. Traditionally anti-incontinence procedures would commonly include Burch procedure or pubovaginal sling. It is believed that these patients have a weaker bladder contractions causing difficulty voiding postoperatively and thus requiring longer catheterization period [9-11].

Iglesia et al and Miller et al have shown that despite the high efficacy of pubovaginal sling; patients who preoperatively are valsalva voiders or have a weak detrusor contraction are at risk for urinary retention and have a higher failure rate [10,11]. Bhatia et al also showed that women undergoing Burch procedure with preoperative detrusor underactivity or valsalva voiding were 12 times more likely to require prolong postoperative urinary catheterization [9].

However, other experts report that preoperative urodynamic testing and assessing the mechanism of voiding prior to placement of pubovaginal sling cannot predict voiding dysfunction outcomes following surgery [17]. Lemack et al. [17] in Stress Incontinence Treatment Efficacy Trial reported that in their series of 655 patients randomized to Burch colposuspension versus pubovaginal sling 57 patients (8 in Burch arm and 49 in PVS) developed voiding dysfunction postoperatively. The statistical analysis of preoperative urodynamic parameters showed that there were no urodynamic findings associated with increased risk of voiding dysfunction in either group. Authors concluded that in this prospective randomized and selective group, voiding pressures and abdominal straining was not associated with any increased risk of postoperative voiding dysfunction.

Contemporary anti incontinence procedures include synthetic mesh which has increased significantly since year 2000. Currently there are 62 slings approved by FDA for SUI, including 7 single-incision mini-slings [18]. Thus, the trend has been to increase the number of retropubic and transobturator midurethral slings in the United States making them the most commonly and widely used means of anti-incontinence surgery at this point [19]. Controversy exists whether preoperative voiding patterns such as impaired detrusor contractility or

Valsalva voiding will affect patients' outcomes following the midurethral tension free slings. Duckett et al. [6] in 2008 reported their experience with 500 patients prospectively undergoing a tension free vaginal tape alone or in combination with prolapse surgery. Authors concluded that voiding by other than a detrusor contraction, preoperative pressure flow rate less than 15 ml/s, and general anesthesia were associated with early postoperative voiding dysfunction defined as needing a catheter of clean intermittent catheterization early in the postoperative period. Wang et al. [20] reported their experience with 79 tension free vaginal tape (TVT) dividing them into two groups of patients with or without dysfunctional voiding (as defined by a free Qmax of ≤ 12 ml/s and a Pdet Qmax of ≥ 20 cm/H₂O) [21]. They showed a higher improvement by 25% in the group without dysfunctional voiding (DV). In their series three out of four women who had their tension free tape released in the office were in the DV group as well as both women who needed their tape released in the operating room.

Other commonly used midurethral slings with similar success outcome [22,23] are the transobturator tension free slings. Richter et al. [22] report a 2.7% rate of voiding dysfunction (including need for a catheter) in the retropubic tension free sling versus 0% in the transobturator sling group ($P=0.004$). The mechanism of voiding or any preoperative risk factors in this group of patients was not mentioned.

Literature does not have sufficient data regarding outcomes of patients with preoperative patterns other than detrusor contractility undergoing these contemporary midurethral slings. Based on previous traditional anti-incontinence procedures and the thought that a retropubic sling causes more urethral obstruction possibly due to a vertical projection of the slings [24,25] many may assume a similar outcome with the contemporary midurethral slings. In our study urodynamic parameters such as Bladder Contractility Index and Valsalva voiding as predictors of impaired detrusor contractility neither impaired detrusor contractility by themselves or combined did not predict urinary retention or reoperation after mid urethral slings.

Our study is limited by its small sample size and being a retrospective in nature. A larger prospective investigation with a long follow-up is needed to further investigate predictive urodynamic factors that may be associated with obstructive symptoms after mid urethral slings.

Conclusions

Neither impaired detrusor contractility nor Valsalva voiding appear to be risk factors for post-op urinary retention or reoperation after midurethral slings. Thus study suggests that IDC and VV will join the ranks of other urodynamic variables that have little predictive value for outcomes after MUS.

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