Can Urodynamic Studies Identify Patients at Risk for Voiding Difficulty After Pubovaginal Sling? The "Voiding Quality Index"

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ABSTRACT

Objective: The value of urodynamics (UDS) as a predictor of voiding dysfunction after pubovaginal sling is controversial. We sought to determine whether individual urodynamic parameters or a "Voiding Quality Index" (VQI) can predict prolonged catheter time after sling.

Methods: Individual voiding parameters for the 75 patients who had preoperative urodynamics included maximum detrusor pressure (Pdet), voiding time (VT), maximum uroflow (Qmax), post-void residual (PVR), and abdominal straining. Each parameter was scored 1 if normal and 0 if abnormal; these urodynamic scores were added to calculate the VQI (range 0-5). Each patient had a suprapubic catheter and maintained a voiding diary. Individual voiding parameters and the VQI were compared statistically between groups who required a catheter for more than 14 days and those who did not. Informed consent was obtained from all patients and the study was conducted with Ochsner Institutional Review Board approval.

Results: Average catheter time for the 66 patients who completed the study was 11.1 days. Fifty patients voided within 14 days and were defined as being in the non-retention group (NR). Sixteen patients were catheter dependent at 14 days and were considered in the retention group (R). When each voiding parameter was individually analyzed between groups with respect to catheter time, the mean values in each group were not significantly different and offered no predictive value. When the VQI was analyzed between groups, the VQI was significantly lower for patients developing voiding difficulty (VQI-R = 3.81) than those who did not (VQI-NR = 2.31) p = .001.

Conclusion: No single urodynamic voiding parameter accurately predicts prolonged catheter time following sling. A combination of voiding parameters, the "Voiding Quality Index," may predict patients at risk for prolonged catheter time following sling.

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INTRODUCTION

The role of urodynamic testing in the evaluation of women with symptoms and signs of "uncomplicated" stress urinary incontinence (SUI) is debatable. A large part of this debate focuses on the shortcomings of urodynamics in evaluating the storage phase and impacting treatment, particularly if a pubovaginal sling procedure is performed. A successful outcome following sling surgery is not just dryness. Patients should be able to void without obstruction and pain. To this end, a more critical evaluation of the urodynamic voiding phase is needed.

The predictive value of urodynamics in the determination of voiding dysfunction following pubovaginal sling is unknown. Several reports have implicated detrusor pressure (1) and/or poor urinary flow (2) as risk factors for voiding dysfunction. The results vary, perhaps as a result of different testing techniques or data analysis. An objective measurement assessing the quality of the voiding cycle that combines all parameters of the voiding phase may provide a more accurate reflection of emptying capacity. A "Voiding Quality Index" (VQI) calculated by a cumulative grade of each voiding parameter may enhance the predictive value and be more useful in identifying patients at higher risk of postoperative voiding dysfunction. Our objective was to determine if the VQI, a combination of voiding parameters, can predict prolonged catheter dependence after pubovaginal sling.

METHODS

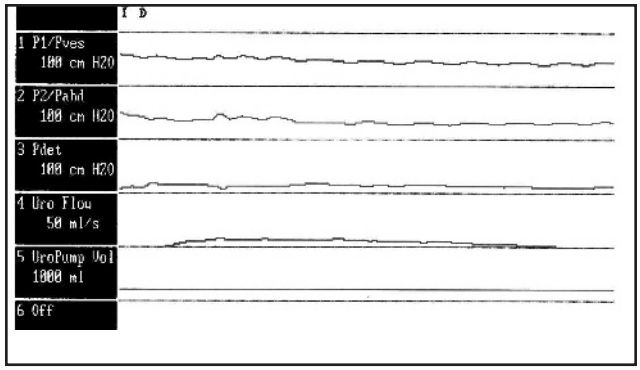
Seventy-five patients undergoing pubovaginal sling, as popularized by McGuire and Lytton (3) and Blaivas and Jacobs (4), were evaluated. Prior to surgery, multi-channel pressure-flow studies were performed. During surgery, a suprapubic tube was placed. Patients were required to maintain a voiding diary with residual urine assessment after each void. Resumption of "normal voiding" occurred when post-void residual (PVR) volumes were less than 50 cc after each void over a 24-hour period. Patients requiring suprapubic tubes for more than 14 days were

considered to have prolonged voiding difficulty and were identified as the retention group (R). Patients who were voiding without difficulty and maintaining residual urine volumes less than 50 cc were analyzed in the non-retention group (NR).

During the urodynamic filling phase, the Valsalva leak point pressure and the presence of detrusor overactivity (DO) were recorded. During the voiding phase, the following parameters were recorded individually: maximum detrusor pressure, voiding time, maximum flow rate, PVR, and presence of abdominal straining. Each voiding parameter was compared statistically between groups with respect to catheter time.

The VQI, an instrument derived to more objectively analyze the integrity of the voiding phase (Table 1), is calculated by assigning a value to each voiding parameter and adding these values together. Each voiding parameter was given a value of 1 if normal or 0 if abnormal, with possible total scores ranging from 0-5. Examples of the Voiding Quality Index are included in Figures 1 and 2. Statistical analysis was performed by t-test analysis of variance.

Figure 1. Example 1: Voiding Quality Index "2" (Max Pdet 18 cm/H_2O; Contraction time 32 sec; No abdominal straining; PVR 55 mL, Qmax 10 cc/sec)



Pdet = detrusor pressure; PVR = post-void residual; Qmax = uroflow

Figure 2. Example 2: Voiding Quality Index "4" (Max Pdet 40 cm/H_2O, Contraction time 79 sec; Positive abdominal straining; PVR 20 mL; Qmax 18 cc/sec)

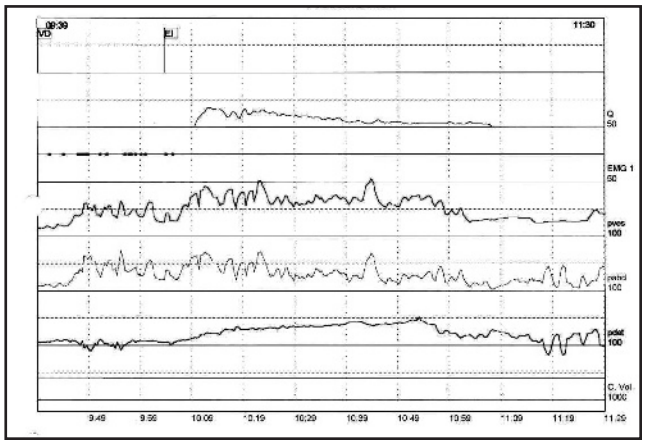


Table 1. Calculation of "Voiding Quality Index" (VQI).

"Voiding Quality Index" Parameter (Abnormal Value)	
Detrusor Pressure	(Impaired <20 cm H_2O)
Contraction Time	(Short <30 sec)
Uroflow	(Poor < 12 cc/sec)
PVR	(High > 30 mL)
Abdominal Straining	(Abnormal if present)

Each voiding parameter is given a score of 1 if normal and 0 if abnormal. Scores for all parameters are added to calculate VQI, with possible scores ranging from 0-5.

PVR = post-void residual

Patients completed a questionnaire designed to assess satisfaction with outcomes by judging whether they considered the surgery "very satisfactory," an "improvement," or "failure" based on the criteria in Table 2. Exclusion criteria included DO on preoperative urodynamics, elevated post-void residual urine (>30 mL), neurogenic bladder, or inaccurate completion of the voiding diary.

RESULTS

Sixty-six patients completed the study (mean age 61.5 years), while nine were excluded because of inadequate documentation. Multiple ancillary procedures included 17 anterior repairs, 6 vault suspensions, 5 hysterectomies, 5 anteroposterior repairs, and 1 posterior repair. There were no intraoperative sling-related complications.

The average catheter time following surgery was 11.1 days (range 1-106). The 50 patients who voided normally within 14 days were identified as the NR group and the 16 who experienced prolonged catheter dependence as the R group. Two patients who underwent sling incision at postoperative week 10 and 12, respectively, had good results. The other 14 resumed spontaneous voiding after 2 weeks. Table 3 shows the number of patients for each VQI score and number with urinary retention; a higher VQI score reflects better voiding quality.

When each voiding parameter was individually analyzed between groups with respect to catheter time, the mean values in each group demonstrated no predictive value. When analyzed between groups, the VQI was significantly lower for the patients who developed voiding difficulty (R) (Table 4).

Table 2. Questionnaire completed by patients to assess postoperative satisfaction.

Satisfaction Assessment

1) "Failure": Little or no improvement in symptoms after surgery. Wouldn't have same operation again. Would not recommend to a friend.
2) "Improved": Definite improvement, but still bothered by symptoms after surgery. Would probably repeat surgical procedure again. Not sure if would recommend to a friend.
3) "Very Satisfied": Very pleased with surgical outcome, little or no bother from symptoms after surgery. Would definitely repeat surgical procedure again. Would definitely recommend to a friend.

Table 3. Number of patients for each Voiding Quality Index (VQI) score and number with urinary retention.

VQI	Number of Patients	Number of Urinary Retention
0	2	2 (100%)
1	4	3 (75%)
2	9	3 (33.3%)
3	15	5 (33.3%)
4	18	2 (11.1%)
5	18	1 (5.6%)
Total	66	16 (24.2%)

Table 4. Individual voiding parameters and Voiding Quality Index in relation to catheter time.

	Non-retention (N = 50)	Retention (N = 16)	p value
Average Age (yrs.)	60.3	65.3	0.113
Max Pdet (cm H_2O)	28.4	25.9	0.463
Average Voiding Time (sec)	78.2	68.4	0.171
Q max (cc/sec)	16.6	14.7	0.292
Post-void residual (mL)	26.6	36.9	0.239
Abdominal Straining (+ present)	11 (22%)	8 (50%)	0.066
Average Voiding Quality Index "VQI"	3.84	2.31	0.001

Table 5. Patient satisfaction based on postoperative catheter time.

	Patient Satisfaction (average follow-up 18.7 months)	
Non-retention (NR) - 50	40 "very satisfied"	80%
	9 "improved"	18%
	1 "failure"	2%
Retention (R) - 16	8 "very satisfied"	50%
	5 "improved"	31%
	3 "failures"	19%

A questionnaire answered by these patients demonstrated an apparent discrepancy in the postoperative satisfaction (Table 5). Patients in the NR group were more likely to be satisfied.

DISCUSSION

Most pelvic surgeons would agree that a successful outcome after an anti-incontinence procedure is not achieved just by attaining dryness. Dryness must be achieved with minimal morbidity and normal urinary tract function. Voiding dysfunction following pubovaginal sling surgery can be a troublesome complication. Impaired contractility, Valsalva voiding, and decreased urinary flow rates have been associated with prolonged dependence on postoperative catheterization (5). Although most patients will resume normal voiding following anti-incontinence procedures, as many as 50% may experience some degree of postoperative voiding dysfunction (6). Thus, it is important to determine if preoperative urodynamic testing may predict postoperative voiding dysfunction by analyzing how patients void prior to surgery.

Carlson et al (7) reported on the value of urodynamics in women presenting with lower urinary tract symptoms (LUTS). Storage phase abnormalities were common in women with LUTS. Adding fluoroscopy detected additional voiding phase abnormalities in 33% of patients studied. This study revealed that women with LUTS are likely to have urodynamic abnormalities, particularly if fluoroscopic pressure-flow studies are performed. Voiding dysfunction may co-exist with stress urinary incontinence. Bradley and Rovner (8) reviewed the urodynamics in women with SUI and reported that 18% of women had urodynamic parameters for bladder outlet obstruction. The co-existence of voiding dysfunction and SUI is significant, as preoperative urodynamics may detect patients at risk for postoperative voiding dysfunction. Bhatia and Bergman (2,9) emphasized that urodynamics can be utilized to predict recoverability of normal voiding following Burch urethropexy. They demonstrated that uroflow and post-void residual urine cannot be relied upon to screen patients at risk for prolonged voiding difficulty (2). Patients voiding without detrusor contraction were at an increased risk. When the absence of a detrusor contraction was associated with impaired uroflow, the risk was magnified, as all patients exhibited voiding

dysfunction (9). Similar findings have been reported in patients undergoing pubovaginal sling (10). Women who void without a detrusor contraction or with a weak detrusor contraction (less than 12 cm H_2O) are at risk for prolonged catheterization or retention (1). Patients categorized as Valsalva voiders had decreased subjective and objective cure rates following pubovaginal sling (11,12). These patients were also more likely to require pad usage postoperatively than patients who were not categorized as Valsalva voiders (13). These findings suggest that the preoperative voiding mechanics may facilitate identification of patients who are likely to be less satisfied following sling procedures. We devised the VQI with the rationale that a more objective assessment of voiding, combining all individual voiding parameters, may enhance the predictive value in detecting postoperative voiding dysfunction. As reflected in Table 4, when each voiding parameter was compared statistically with respect to catheter time, there was no statistical difference. However, when the VQI was applied to the urodynamic findings in these patients, there was a statistically significant difference. The average VQI in groups with prolonged catheter dependence was significantly lower than in those who did not develop retention (Table 4). The rate of prolonged catheter dependence ranged from 75%-100% in patients with a VQI of 0-1, and was approximately 10% in patients with a VQI of 4-5.

Catheter dependence is not the only symptom of voiding dysfunction in many patients. Those with catheter dependence greater than 14 days were less satisfied (81%) compared to those who used a catheter less than 14 days (98%). Although catheter free, women may be highly bothered by urgency symptoms or obstructive symptoms after a period of prolonged catheter dependence. Thus, patients with abnormal voiding mechanics appear more likely to have voiding dysfunction after sling surgery.

We note several limitations of this study. Many ancillary procedures were performed, and all were done by a single surgeon. However, many sling procedures are accompanied by prolapse repairs, making this relevant to the pelvic surgeon. The main limitations to this study are that reference values for "normal" female voiding are not clearly established by the literature. The authors chose to use data directly retrievable from the pressure-flow analysis, and the use of this formula compensates for this lack of normative voiding data by utilizing multiple components of the voiding cycle. Also, these data have not been applied to "mid-urethral" sling procedures, which are associated with less postoperative voiding dysfunction (13). Despite these limitations, we feel that the data suggesting that a VQI may be a more accurate measure predicting postoperative voiding dysfunction are compelling.

Presently, there is not enough evidence to suggest that urodynamic testing is necessary to identify stress urinary incontinence that will improve following surgical repair. A clinical evaluation, including a positive stress test, appears sufficient (14). Recent findings have revealed the potential of urodynamics to identify patients at risk for voiding dysfunction after pubovaginal sling. As we continue to develop our understanding of how women void, this predictive value of urodynamic testing ultimately may become more standardized. Considerable research is warranted in this area before the use of routine urodynamic testing is devalued in these patients.

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