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ORIGINAL ARTICLE

Different urodynamic patterns in female bladder outlet obstruction: Can urodynamics alone reach the diagnosis?

Mostafa M. Elmissiry *, Amr G. Ali, Gaber A. Ali

Section of Female Urology and Voiding Dysfunction, Urology Department, Faculty of Medicine, Alexandria University, Alexandria, Egypt

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KEYWORDS

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ABBREVIATIONS

Q_{max}, maximum urinary flow rate;
$P_{det}Q_{max}$, detrusor pressure at Q_{max};
MVV, maximum voided volume;
P_{ves}, vesical pressure;

Abstract ***Objective:*** To define the different urodynamic patterns in female bladder outlet obstruction (BOO) and to assess whether urodynamics alone can be relied on for the diagnosis.

Patients and methods: This prospective study included 60 clinically obstructed women and 27 with stress urinary incontinence as a control group. All patients had pressure-flow studies and were divided into four groups. Group A (control group, 27 patients) and group B (22) had a maximum urinary flow rate (Q_{max}) of >15 mL/s and a detrusor pressure at Q_{max} ($P_{det}Q_{max}$) of <30 or >30 cm H_2O, respectively. Group C (20 patients) and group D (18) had a Q_{max} of <15 mL/s and a $P_{det}Q_{max}$ of >30 or <30 cm H_2O, respectively.

Results: The mean Q_{max} for groups A, B, C, and D were 21.8, 21.9, 10.8 and 9.9 mL/s, respectively, while the mean $P_{det}Q_{max}$ was 20.8, 40.4, 48.7, and 18.7 cm H_2O, respectively. The residual urine volume was <100 mL in groups A and B but >100 mL in groups C and D. When compared with group A, groups B–D had a significant difference in vesical pressure, groups B and C had a significant difference in $P_{det}Q_{max}$, while Q_{max}, the maximum voided volume and residual urine vol-

* Corresponding author. Address: Urology Department, Alexandria University, Azarita, 21113 Alexandria, Egypt. Tel.: +002 03 5441671; fax: +20 002 03 4860029.
E-mail address: mostafa_elmissiry@yahoo.com (M.M. Elmissiry).

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SUI, stress urinary incontinence;
PVR, postvoid residual urine volume;
PFS, pressure-flow study;
ROC, receiver operating characteristic

ume were significantly different in groups C and D. Group A was obviously unobstructed, group B might have early obstruction, group C had compensated obstruction, while group D can be considered to have late de-compensated obstruction.

Conclusions: BOO in females has three different urodynamic patterns, i.e. early, compensated and late obstruction. However, urodynamics should be combined with the clinical presentation and residual urine volume for an accurate diagnosis.

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Introduction

The diagnosis of BOO in females is still controversial. Many authors agree that a diagnosis based only on a pressure-flow study (PFS) is difficult [1–3]. Another factor that adds to the difficulty in diagnosis and underestimation of BOO in females is that patients might not present with the classical obstructive symptoms as their primary complaint, as they usually present with mixed irritative and obstructive symptoms [4,5].

The classical picture of obstruction by PFS is a low maximum urinary flow rate (Q_{max}) and a high voiding detrusor pressure ($P_{det}Q_{max}$). However, there are many suggested threshold values for the pressure-flow variables that are used to indicate BOO. The threshold for Q_{max} reported previously in women with BOO is <11–15 mL/s, while that for $P_{det}Q_{max}$ is >20–50 cm H_2O [5–11].

Furthermore, some investigators believe that low flow in the presence of a normal or low detrusor pressure might be an indication of relative obstruction [4]. There is an agreement that neither pressure-flow data only nor clinical symptoms alone are sufficient for diagnosing BOO in females [10].

In the present study, we tried to define different urodynamic patterns from a PFS in women with obstructive urinary symptoms, and correlated them with the clinical presentation and post-void residual urine volume (PVR) in a trial to devise a practical method to diagnose BOO in women.

Patients and methods

This prospective study included 87 women, 60 with obstructive LUTS and 27 age-matched women with stress urinary incontinence (SUI) as a control group. The mean (SD) age was 48.3 (14.28) years. Patients with UTI, neurogenic bladder, urinary stone disease, or malignancy were excluded from the study. The PFS was conducted in all patients using transurethral 6 F urodynamic catheters with a medium infusion rate of 40 mL/min. A free urinary flow was obtained first and the PVR was estimated before and after the end of the PFS.

Patients were divided into four groups using a threshold value of Q_{max} of 15 mL/s and a $P_{det}Q_{max}$ of 30 cm H_2O. We used these two thresholds in accordance with the study of Chassange et al. [11]. They showed that the best threshold for Q_{max} and $P_{det}Q_{max}$ derived from receiver operating characteristic (ROC) curves to define obstruction in women was 15 mL/s and 30 cm H_2O, respectively, with a sensitivity of $\approx$80% and a specificity of $\approx$70%.

Group A comprised 27 women with SUI, who had a Q_{max} of >15 mL/s and a $P_{det}Q_{max}$ of <30 cm H_2O, and was used as the control group. In group B, the 22 patients had a Q_{max} of >15 mL/s and a $P_{det}Q_{max}$ of >30 cm H_2O. In group C, the 20 patients had a Q_{max} of <15 mL/s and a $P_{det}Q_{max}$ of >30 cm H_2O. In group D, the 18 patients had a Q_{max} of <15 mL/s and a $P_{det}Q_{max}$ of <30 cm H_2O.

A statistical analysis was used to detect the difference between clinically obstructed and unobstructed groups, and the difference between the four groups. ROC curves were also plotted for all the urodynamic variables to calculate their sensitivity and specificity to detect BOO.

Results

The common causes of BOO in groups B–D included previous surgery for SUI (28 patients), and pelvic organ prolapse (19). Other causes included urethral stenosis diagnosed by a clinical examination and urethroscopy (seven patients) and the use of injectable agents for SUI (six). The mean (SD) Q_{max} for the clinically obstructed group (60 patients) was 13.3 (5.69) mL/s, and was 19.74 (9.08) mL/s in the clinically unobstructed group (SUI, 27 patients), with a significant difference ($P < 0.001$) (Table 1). The $P_{det}Q_{max}$ was also significantly different between these groups, at 26.36 (13.4) cm H_2O for the unobstructed and 38.2 (17.3) cm H_2O for the obstructed group ($P < 0.001$; Table 1).

Other variables that were significantly different in the clinically obstructed patients included the maximum voided volume (MVV), PVR and vesical pressure during voiding (P_{ves}) (all $P < 0.001$; Table 1).

The results from the individual groups B–D were compared with the control group A. The three groups were significantly different from group A for P_{ves} ($P < 0.001$), group B and C were significantly different from group A for $P_{det}Q_{max}$ ($P < 0.001$), and C and D for Q_{max}, MVV and PVR ($P < 0.001$; Table 1).

Table 1 The comparison between clinically obstructed and unobstructed women, and among the four groups, for the urodynamic variables.

Category	Q_{max} (mL/s)	MVV (mL)	PVR (mL)	$P_{det}Q_{max}$ (cm H_2O)	P_{ves} (cm H_2O)
Unobstructed	19.74 (9.07)	316.3 (119.5)	16.63 (12.84)	26.35 (13.40)	58.29 (21.04)
Obstructed	13.30 (5.69)	228.1 (124.6)	156.9 (44.29)	38.21 (17.33)	75.08 (21.53)
P	< 0.001	0.001	0.001	< 0.001	< 0.001
Group:					
A (unobstructed)	21.84 (6.5)	343.9 (89.3)	15.18 (3.90)	20.8 (6.3)	52.2 (18.0)
B (early BOO)	21.98 (9.5)	338.5 (116)	10.77 (2.60)	40.4 (9.6)†	73.6 (22.0)†
C (compensated BOO)	10.80 (3.5)*	207.7 (123)†	115.6 (69.9)†	48.7 (16.4)†	80.6 (20.7)†
D (late BOO)	9.95 (3.1)*	179.6 (105)‡	168.2 (49.3)†	18.6 (7.9)	60.1 (19.1)†

* $P < 0.05$.
† $P = 0.001$.
‡ $P < 0.001$.

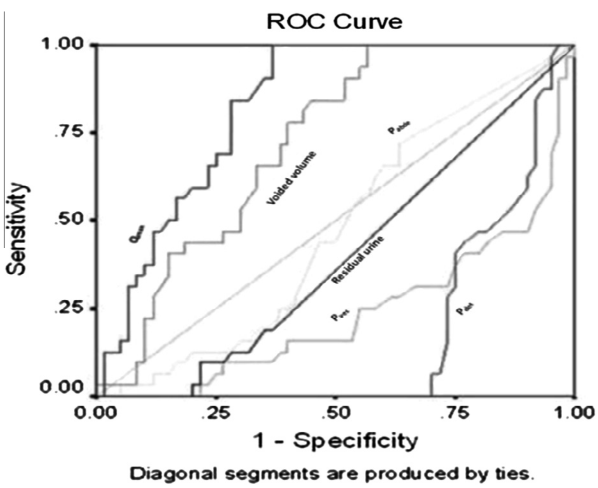

Figure 1 The ROC curve, showing the sensitivity and specificity of different urodynamic variables to detect female BOO.

From the ROC curves (Fig. 1), only Q_{max} and MVV had a higher sensitivity and specificity to detect BOO. A Q_{max} of < 15 mL/s had a sensitivity of 91% and a specificity of 72% to detect BOO, and an MVV of < 170 mL had 73% sensitivity and 68% specificity.

Discussion

Unlike in men, BOO in women is an uncommon diagnosis and in all probability has been underestimated. The reported prevalence rates of BOO among women with LUTS are 2.7–23% [12,13]. This wide variation in the reported prevalence might be due to the lack of standard diagnostic definitions or nomograms for the diagnosis of female BOO. Furthermore, women with BOO most commonly present with mixed obstructive and irritative urinary symptoms, due to the detrusor overactivity associated with BOO [14].

Controversy remains among investigators over a standardized urodynamic definition of BOO in women. Different threshold values for the pressure-flow variables indicating obstruction have been suggested and are < 11–15 mL/s for Q_{max} and > 20–50 cm H_2O for $P_{det}Q_{max}$ [5–9].

In a recent study to evaluate the predictive factors for BOO using a PFS in female patients with no anatomical obstruction, Kim et al. [15] found that the free Q_{max} and MVV were the most important factors. Other investigators recommended the use of a free Q_{max} and maximum P_{det} instead of Q_{max} and $P_{det}Q_{max}$, to avoid the adverse effect of the transurethral catheter [16]. Others stressed the use of video-urodynamics to improve the sensitivity of the PFS to diagnose BOO in women [17].

In the present study we used the two threshold values suggested by Chassange et al. [11] to define BOO in women, of 15 mL/s and 30 cm H_2O for Q_{max} and $P_{det}Q_{max}$, respectively (derived from ROC curves). We considered this to be logical, as women normally void with a high flow rate, and using a threshold of < 15 mL/s might miss some cases of obstruction. Similarly, women normally void under low pressure and using a threshold of > 30 cm H_2O might also miss cases of obstruction.

In PFS the diagnosis of BOO in females is based on a low flow and a high voiding pressure. A problem arises if the flow is normal with a high detrusor pressure (Group B) or if the flow is low with a concomitant normal or low detrusor pressure (Group D). Thus we believe that combining the clinical presentation and PVR with the urodynamic data can solve this problem. We found that women with LUTS can be stratified into four groups. Group A (unobstructed) has no obstructive symptoms, with a normal urinary flow rate and a normal voiding pressure, and no significant PVR (< 100 mL). Group B (early obstruction) has obstructive symptoms, although the urinary flow rate is normal and the PVR not significant, but they void with a high voiding pressure. Group C (compensated obstruction) has obstructive symptoms, a low urinary flow rate and high voiding pressure, with a significant PVR (> 100 mL). Group D (late decompensated obstruction) has obstructive symptoms, a low urinary flow rate and a low or normal voiding pressure, but with a significant PVR.

Other two variables might be important in detecting female BOO, i.e. P_{ves} and the MVV. In the present study the P_{ves} was significantly higher in the obstructed groups (B–D) than in the control group. Similarly, the MVV was significantly lower in the obstructed groups (B–D) than in the control group and it had a high sensitivity and specificity to detect BOO. Thus P_{ves} and MVV can help in the diagnosis of female BOO when there is controversy about the other variables.

In conclusion, BOO in females has three different urodynamic patterns, i.e. early, compensated and late obstruction. However, urodynamics should be combined with the clinical presentation and PVR to provide an accurate diagnosis.

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Conflict of interest

None.

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