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Bladder Outlet Obstruction in Women: Definition and Characteristics

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The prevalence of bladder outlet obstruction in women is unknown and most probably has been underestimated. Moreover, there are no standard definitions for the diagnosis of bladder outlet obstruction in women. Our study was conducted to define as well as to examine the clinical and urodynamic characteristics of bladder outlet obstruction among women referred for evaluation of voiding symptoms. Bladder outlet obstruction was defined as a persistent, low, maximum "free" flow rate of <12 mL/s in repeated non-invasive uroflow studies, combined with high detrusor pressure at a maximum flow ($p_{det.Qmax}$ >20 cm H_2O) during detrusor pressure–uroflow studies. A urodynamic database of 587 consecutive women identified 38 (6.5%) women with bladder outlet obstruction. The mean age of the patients was 63.9 ± 17.5 years. The mean maximum "free" flow, voided volume, and residual urinary volume were 9.4 ±3.9 mL/s, 144.9 ± 72.7 mL, and 86.1 ± 98.8 mL, respectively. The mean $p_{det.Qmax}$ was 37.2 ± 19.2 cm H_2O. Previous anti-incontinence surgery and severe genital prolapse were the most common etiologies, accounting for half of the cases. Other, less common, etiologies included urethral stricture (13%), primary bladder neck obstruction (8%), learned voiding dysfunction (5%), and detrusor external sphincter dyssynergia (5%). Symptomatology was defined as mixed obstructive and irritative in 63% of the patients, isolated irritative in 29%, and isolated obstructive in other 8%. In conclusion, bladder outlet obstruction in women appears to be more common than was previously recognized, occurring in 6.5% of our patients. Micturition symptoms relevant to bladder outlet obstruction are non-specific, and a full urodynamic evaluation is essential in making the correct diagnosis and formulating a treatment plan. *Neurourol. Urodynam. 19:213–220, 2000.* © 2000 Wiley-Liss, Inc.

Key words: bladder outlet obstruction; female; urodynamics

INTRODUCTION

The prevalence of bladder outlet obstruction in women is unknown and, in all probability, has been underestimated. In large retrospective reviews of women referred for evaluation of lower urinary tract symptoms, 2.7 to 8% had urodynamic evidence of bladder outlet obstruction [Rees et al., 1976; Farrar et al., 1979; Massey and Abrams, 1988]. However, no standard definitions exist for the diagnosis of bladder outlet obstruction in women. In men, the best method of studying voiding function quantitatively is by analyzing pressure-flow parameters of the micturition cycle [Griffiths et al., 1997]. Two urodynamic parameters, i.e., detrusor pressure at maximum flow ($p_{det.Qmax}$) and the maximum flow rate (Q_{max}), have been used by

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several nomograms for diagnosing bladder outlet obstruction [Abrams and Griffiths, 1979; Schafer, 1985; Griffiths et al., 1989]. These nomograms are not applicable to women since normal voiding detrusor pressure is significantly lower in women than in men. Many women void by way of pelvic relaxation or abdominal straining without generating significant detrusor pressures [Nitti, 1998]. Furthermore, failure to measure detrusor pressure may be owing to efficient outlet relaxation with transmission of detrusor pressure to stream energy. Recently, Chassagne et al. [1998] analyzed pressure-flow parameters of 35 “clinically obstructed” women. Maximum flow rate of $\leq$15 mL/s and $p_{det.Qmax}$ of >20 cm H_2O were found to be reasonable parameters for the urodynamic definition of bladder outlet obstruction. However, uroflow values were obtained during the detrusor pressure-uroflow studies with transurethral catheter in place. This may be associated with test-induced bladder outlet obstruction owing to urethral irritation and/or relative mechanical obstruction.

Our study was conducted to define as well as to examine the clinical, endoscopic, radiographic, and urodynamic characteristics of bladder outlet obstruction among women referred for evaluation of voiding symptoms. We defined bladder outlet obstruction in women by using both non-invasive “free” uroflow measurements and detrusor pressure-uroflow studies.

METHODS

A urodynamic database of 587 consecutive women referred for evaluation of voiding symptoms was reviewed. All patients underwent meticulous clinical evaluation that included a complete history and physical examination, urinary questionnaire, voiding diary, pad test, urine culture, non-invasive uroflowmetry, post-void residual urine volume, video urodynamics, and urethrocystoscopy. Voiding symptoms were classified as obstructive (i.e., hesitancy, weak or intermittent stream, incomplete emptying, straining to void) or irritative symptomatology (i.e., frequency, urgency, nocturia, and incontinence).

As no standard urodynamic definitions for bladder outlet obstruction in women have been established, we considered urodynamic evidence of obstruction as a persistent low maximum “free” flow rate of <12 mL/s in repeated non-invasive uroflow studies, combined with detrusor pressure at maximum measured flow rate ($p_{det.Qmax}$) of >20 cm H_2O in the detrusor pressure-uroflow study.

Before examination, all patients voided in private using a standard toilet. Residual urine volume was measured by ultrasound examination immediately after bladder emptying. Non-invasive uroflow measurements were repeated at least twice to ensure consistency. Multi-channel video urodynamics were performed according to the recommendations of the International Continence Society [Abrams et al., 1990] except for cystometry. Contrary to these recommendations, the patient was not instructed to try to inhibit micturition during the filling phase, but rather to report sensations to the examiner. Cystometrography was performed using radiographic contrast and a 7-F double-lumen catheter via constant infusion at a medium filling rate, with rectal pressure monitoring. Perineal surface electrodes were used for electromyography (EMG). At capacity, patients were asked to void, and pressure flow studies with simultaneous video fluoroscopy of the bladder outlet and EMG activity were performed. The site of the obstruction was defined as the narrowest point in the urethra during voiding cystourethrography.

TABLE I. Etiologies of Bladder Outlet Obstruction Among the Urodynamically Obstructed Women

	Urodynamically obstructed women	
Etiology	No.	%
Previous anti-incontinence surgery	10	26
Severe genital prolapse	9	24
Urethral stricture or narrowing	5	13
Primary bladder neck obstruction	3	8
Learned voiding dysfunction	2	5
Detrusor-external sphincter dyssynergia	2	5
Urethral diverticulum	1	3
Idiopathic	6	16
Total	38	100

At urethrocystoscopy, urethral obstruction was inferred by one of the following: 1) visible signs of a narrowed urethra, analogous to urethral stricture in men; 2) the urethra felt narrow because it "gripped" the cystoscope; or 3) the bladder neck and proximal urethra appeared to be compressed from without, analogous to benign prostatic hyperplasia in men.

Results were analyzed statistically by Student's *t*-test and χ^2 test. Values of $P <$ 0.05 were considered significant. Data are presented as mean ± SD or percentage according to the variables.

RESULTS

Incidence and Patient Characteristics

Five hundred and eighty-seven consecutive women were studied. Thirty-eight women (6.5% of the study population) met our criteria of bladder outlet obstruction. The mean age of the patients was 63.9 ± 17.5 years. Twenty-nine (76%) patients, 11 (38%) of whom were using hormone replacement therapy, were post-menopausal.

The etiologies of bladder outlet obstruction are presented in Table 1. Previous anti-incontinence surgery and severe genital prolapse were the most common etiologies, accounting for half of the cases. Other, less common, etiologies included urethral stricture or narrowing (13%), primary bladder neck obstruction (8%), learned voiding dysfunction (5%), and detrusor external sphincter dyssynergia (5%). Learned voiding dysfunction was suggested by a characteristic clinical history and intermittent "free" uroflow pattern and by the absence of any detectable neurological abnormality or anatomic urethral obsruction. A definitive diagnosis was made by the demonstration of typical external urethral sphincter contractions during micturition by EMG or fluoroscopy. Sixteen percent of the patients had no evidence of any anatomic, neurologic, or functional abnormality and were therefore defined as idiopathic bladder outlet obstruction.

Symptoms

Symptomatology was defined as mixed obstructive and irritative in 24 women, irritative only in 11, and isolated obstructive in three others (63, 29, and 8% of the urodynamically obstructed women, respectively). The most common symptom among women with obstructive symptomatology was a weak stream, followed by the feeling of incomplete emptying and straining to void.

Uroflowmetry

To avoid “test-induced dysfunctional voiding,” the non-invasive uroflow study was repeated at least twice to ensure consistency. Only the best “free” flow pattern was analyzed. The mean maximum flow rate, voided volume, and residual urinary volume were 9.4 ± 3.9 mL/s, 144.9 ± 72.7 mL, and 86.1 ± 98.8 mL, respectively.

Urodynamic Findings

Cystometry

Thirteen women (34% of the urodynamically obstructed women) had detrusor instability, three (8%) had sphincteric incontinence, and two others (5%) had mixed urinary incontinence. Mean bladder capacity was 375.0 ± 143.2 mL.

Detrusor Pressure–Uroflow Studies

The mean $p_{\mathrm{det.Qmax}}$ was 37.2 ± 19.2 cm H_2O, whereas the maximum detrusor pressure during voiding was 47.3 ± 21.7 cm H_2O.

Further analysis was carried out to compare uroflow parameters in non-invasive uroflowmetry versus pressure-flow studies with a urethral catheter in place. Maximum flow rates and residual urinary volumes were found to be significantly different in non-invasive uroflowmetry compared with pressure-flow studies (9.4 ± 3.9 vs. 5.6 ± 4.2 mL/s, $P = 0.0001$; and 86.1 ± 98.8 vs. 208.8 ± 143.7 mL, $P = 0.00004$, respectively), although the mean voided volumes in both techniques were similar (144.9 ± 72.7 vs. 153.3 ± 136.3 mL, respectively).

Definitive radiographic evidence of bladder outlet obstruction was found in only 13 patients (32% of the urodynamically obstructed women). In the remainder, imaging technique was insufficient to visualize adequately the urethra because technical problems were related to the air–soft-tissue interface, which occurs in the sitting position. Typical video urodynamic findings of bladder outlet obstruction are presented in Fig. 1.

Endoscopic Findings

All patients underwent diagnostic urethrocystoscopy. Two patients were found to have benign-appearing papillary lesions at the vesical neck. These were believed to be clinically insignificant and were not biopsied. One woman had a small papillary transitional cell carcinoma of the bladder that was resected. The bladder was moderate to severely trabeculated in one third of the patients.

Anatomic evidence of bladder outlet obstruction was found in 17 patients (45% of the urodynamically obstructed women): severe urogenital prolapse in nine, distal urethral stricture in two, mid urethral stricture in one, and proximal urethral stricture in one; in three others, the entire urethra was narrowed and one patient had bladder neck fibrosis. Two of the patients with urethral stricture had previous anti-incontinence surgery, and one other patient had previous urogenital trauma.

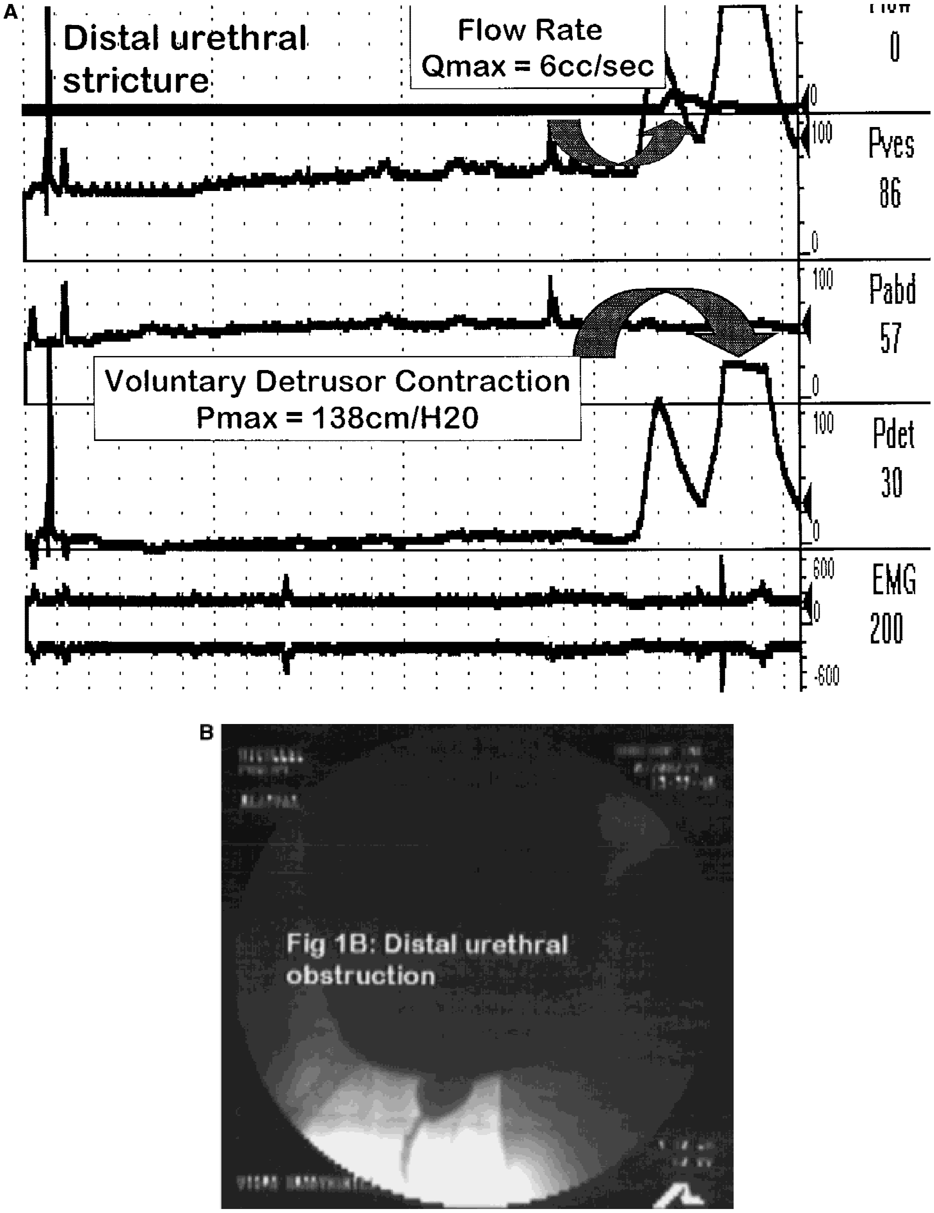

Fig. 1. **A:** Distal urethral stricture: urodynamic findings. **B:** Distal urethral stricture: fluoroscopy.

DISCUSSION

The prevalence of bladder outlet obstruction among women remains unknown. Bladder outlet obstruction was urodynamically diagnosed in 6.5% of our patients. This series is based on an application of a newly developed database of consecutive women and does not represent our entire experience. In fact, many of the most severe cases of bladder outlet obstruction were detected previously.

Previous retrospective reviews reported 2.7 to 8% prevalence rate of bladder outlet obstruction among women referred for evaluation of voiding symptoms [Rees et al., 1976; Farrar et al., 1979; Massey and Abrams, 1988]. The wide variation in reported prevalence rates may be owing to several factors. The most likely reason for this difference is the lack of standard definitions for the diagnosis of bladder outlet obstruction in women. Farrar et al. [1976] defined bladder outlet obstruction as Q_{max} <15 mL/s with a voided volume of ≥200 mL. In a small series of women with bladder neck obstruction, Diokno et al. [1984] proposed two urodynamic parameters, i.e., detrusor voiding pressure and peak flow rate, to diagnose obstruction. Similarly, Axelrod and Blaivas [1987] defined bladder neck obstruction as the presence of a sustained detrusor contraction of at least 20 cm H_2O, a Q_{max} of <12 mL/s, and radiographic evidence of obstruction at the bladder neck. Massey and Abrams [1988] proposed that two or more of the following parameters are required for diagnosis: Q_{max} <12 mL/s, $p_{det.Qmax}$ >50 cm H_2O, urethral resistance >0.2, and "significant" residual urine in the presence of a raised $p_{det.Qmax}$ or urethral resistance. In their retrospective series of 5,948 women, the incidence of bladder outlet obstruction was found to be 2.74%.

The availability and increased use of various treatment modalities, as well as new imaging techniques, have recently revived the clinical awareness and interest in female bladder outlet obstruction. Most recently, two studies endeavored to address this problem. Chassagne et al. [1998] prospectively studied 35 "clinically obstructed" and 124 control patients. Pressure-flow plot and receiver operator characteristic curves were constructed to determine optimal cut-off values for Q_{max} and $p_{det.Qmax}$. When both parameters were used simultaneously, the best cut-off values to predict bladder outlet obstruction were Q_{max} <15 mL/s and $p_{det.Qmax}$ >20 cm H_2O (sensitivity, 74.3%; specificity, 91.1%). No information was provided regarding the clinical criteria used to select the "clinically obstructed" patients. Furthermore, Q_{max} values were obtained during the pressure-flow studies with a transurethral catheter in place. Although a two "fill-and-void" technique was used, and the highest Q_{max} and lowest $p_{det.Qmax}$ values were selected, the use of transurethral catheter may be associated with test-induced urethral irritation and/or relative bladder outlet obstruction. We therefore decided to define bladder outlet obstruction in our study by using both non-invasive "free" uroflow measurements and detrusor pressure–uroflow studies.

Nitti et al. [1999] proposed video urodynamic criteria for diagnosing bladder outlet obstruction in women. Obstruction was defined as radiographic evidence of obstruction between the bladder neck and distal urethra in the presence of a sustained detrusor contraction of any magnitude. Strict pressure-flow criteria were not used. Twenty-three percent of their patients met the radiographic criteria for bladder outlet obstruction. Obstructed cases had significantly higher voiding pressures, lower flow rates, and higher post-void residual than unobstructed cases. However, in 11.8% of the patients, Q_{max} was >15 mL/s and in 10.5% of the patients $p_{det.Qmax}$ was <20 cm H_2O. The authors concluded that pressure-flow studies alone may fail to diagnose obstruction, whereas the use of video urodynamic criteria facilitates diagnosis of obstruction even when it is not clinically suspected.

We believe that differentiation should be made between screening for and diagnosis of bladder outlet obstruction in women. Screening studies should be simple and cost-effective. History-taking is generally considered as a screening tool. Unfortunately, when dealing with bladder outlet obstruction, the value of history-taking is limited. Only three of our obstructed patients (7.8%) had isolated obstructive symptoms. About one third had irritative symptoms, and all the others had a mixed obstructive and irritative symptomatology. Similarly, several previous studies showed that lower urinary tract symptoms in women are non-specific, and urodynamic assessment is essential in screening and diagnosing voiding difficulties [Farrar et al., 1979; Stanton et al., 1983; Dwyer and Desmedt, 1994]. Non-invasive uroflowmetry is widely used as a screening tool in male voiding disorders. However, measuring of flow in a urodynamic laboratory has it limitations. We endeavored to minimize these by providing our patients with complete personal privacy during voiding and by repeating the test in the patients with abnormal results. Only two abnormal results were considered as objective evidence suggesting voiding difficulty. Furthermore, we considered a maximum "free" flow rate of <12 mL/s to be abnormal, whereas previous studies usually used cut-off points of 15 to 20 mL/s [Farrar et al., 1979; Fantl, 1983; Dwyer and Desmedt, 1994; Clarke, 1997]. These measures facilitated minimization of artifacts associated with the testing environment. However, uroflow, without synchronous measurement of detrusor pressure during voiding, cannot distinguish between bladder outlet obstruction, impaired detrusor contractility, and normal. We therefore analyzed the pressure-flow parameters to distinguish between bladder outlet obstruction, i.e., low flow and a high detrusor pressure, and an underactive detrusor, i.e., a detrusor contractility of inadequate magnitude and/or duration to effect complete bladder emptying.

The site of the obstruction was localized by video urodynamics and urethrocystoscopy. In our study, radiographic evidence of bladder outlet obstruction was found in only one third of our urodynamically obstructed women. In the remainder, the imaging technique was insufficient to visualize adequately the urethra because of the technical problems related to the air–soft-tissue interface, which occurs in the sitting position.

Urethrocystoscopy may be used as an alternative diagnostic tool to identify the site of the obstruction as well as to exclude intra-urethral and intra-vesical pathologies. It is easy to perform and usually well tolerated by women. Endoscopic evidence of bladder outlet obstruction was found in 45% of our urodynamically obstructed women.

Clearly, as was previously claimed [Nitti et al., 1999], urodynamic definitions of bladder outlet obstruction will fail to diagnose patients with "normal" pressure-flow parameters, despite the existence of a relative obstruction. These patients may indeed be diagnosed by using simultaneous fluoroscopic imaging of the bladder outlet during voiding. However, the clinical significance of the abnormal radiographic findings in these patients remains unclear.

In conclusion, bladder outlet obstruction in women appears to be more common than was previously recognized, occurring in 6.5% of our patients. Micturition symptoms relevant to bladder outlet obstruction are non-specific, and a full urodynamic evaluation is essential in making the correct diagnosis and formulating a treatment plan. Further research is needed to determine the optimal diagnostic modalities and to establish standard definitions of this voiding disorder.

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