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·*Clinical Experience*·

Pressure-flow studies in patients with benign prostatic hyperplasia: a study comparing suprapubic and transurethral methods

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Abstract

Aim: To compare the use of the suprapubic puncture method versus the transurethral method in pressure-flow studies in patients with benign prostatic hyperplasia. **Methods:** Twenty-three men with benign prostatic hyperplasia underwent both suprapubic and transurethral pressure-flow studies during a single session. Standard pressure-flow variables were recorded in all patients with both methods, enabling calculation of obstruction using commonly used grading systems, such as the urethral resistance algorithm, the Abrams-Griffith (AG) number and the Schäfer linear nomogram. **Results:** There were statistically significant differences between the methods in the mean values of maximum flow rate ($P < 0.05$), detrusor pressure at the maximum flow ($P < 0.01$), urethral resistance algorithm ($P < 0.01$), AG number ($P < 0.01$) and maximum cystic capacity ($P < 0.01$). Of the men in the study, 10 (43.5%) remained in the same Schäfer class with both methods and 18 (78.3%) in the same AG number area. Using the transurethral method, 12 (52.2%) men increased their Schäfer class by one and 1 (4.3%) by two. There were also differences between the suprapubic and transurethral methods using the AG number: 4 (17.4%) men moved from a classification of equivocal to obstructed and 1 (4.3%) from unobstructed to equivocal. **Conclusion:** The differences between the techniques for measuring intravesical pressure alter the grading of obstruction determined by several of the commonly used classifications. An 8 F transurethral catheter significantly increases the likelihood of a diagnosis of bladder outlet obstruction when compared with the suprapubic method. *(Asian J Androl 2006 Nov; 8: 731–735)*

Keywords: urodynamics; pressure-flow study; suprapubic; transurethral; benign prostatic hyperplasia; bladder outlet obstruction

1 Introduction

Benign prostatic hyperplasia (BPH) is a common disease in elderly men. Delineation of the essence of BPH is debated. The use of diagnostic testing in the evaluation of suspected outlet obstruction and in the prediction of the success of treatment is controversial. Studies show that approximately 20–30% men with BPH are not obstructed and that 50–80% have detrusor instability [1, 2]. Symptoms, prostate size, free uroflowmetry parameters and the amount of post-void residual urine are associated with obstructive voiding but the correlation with the grade of obstruction is weak [3, 4]. Urodynamic study with pressure-flow analysis is considered the gold standard to quantify the degree of bladder outlet obstruction (BOO) [3].

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During pressure-flow studies intravesical pressure can be measured using either transurethral or suprapubic lines. The transurethral method is generally used, but the suprapubic route has the theoretical advantage of leaving the urethra untouched during the measurements and, therefore, might preclude any artifacts produced by instrumentation [5].

The purpose of the present study is to compare the two urodynamic methods of measuring intravesical pressure in a group of men undergoing investigation for BPH, and to identify which urodynamic variables are affected by the presence of an 8 F urethral catheter during the voiding phase and, consequently, whether there are any changes in the grading of BOO using the commonly recognized grading systems.

2 Patients and methods

2.1 Patients

Pressure-flow studies were performed on 23 men (mean age 69.3 years, range 57–77 years) attending our unit for the assessment of BPH. All men had prostatic enlargement on clinical examination but normal levels of prostate specific antigen. The results of urine analysis were negative before investigation. Both suprapubic and transurethral measurements were undertaken on all patients in a single session. Each patient was asked to ensure that he had a full bladder he they attended. On arrival, patients were randomized to receive either the suprapubic procedure or the transurethral procedure, or vice versa. Before every examination, the examiners explained the process to patients and obtained their informed consent to participate in the study.

2.2 Transurethral method

An 8 F double-lumen pressure catheter was introduced into the bladder transurethrally under sterile conditions and a 6 F single-lumen pressure catheter was introduced into the rectum. Fluid-filled lines with external pressure transducers and Dantec Menuet equipment (Dantec, Copenhagen, Danmark) were used. The bladder was filled with saline at 20ºC (40 mL/min) and all pressure-flow studies were performed with the patient standing. The required variables were recorded simultaneously and the electronic calculations were subsequently carried out.

2.3 Suprapubic method

The bladder was filled with saline (approximately 300–400 mL) until the patient felt abdominal distention and wanted to urinate. The midline was then infiltrated with local anesthetic (1% plain lignocaine). A 14 F puncture needle was inserted into the bladder and a 14 F double-lumen catheter was passed through the needle and then the needle was withdrawn over the line. A three-way tube was used to connect the 14 F catheter, the bladder piezometer tube and the delivery tube. A 6 F single-lumen pressure catheter was also introduced into the rectum. Following the introduction of the suprapubic line, the patient voided and the suprapubic pressure-flow variables were recorded.

2.4 Variables choices and diagnosis standards of bladder outlet obstruction

Maximum flow rate (Q_{max}), detrusor pressure at maximum flow (Pdet, Q_{max}) and maximum cystic capacity (MCC) were recorded manually from the pressure-flow tracing. The urethral resistance algorithm (URA), Abrams-Griffiths number (AG) and Schäfer linear nomogram were calculated. The diagnosis standards of BOO were formulated according to the standardization of the International Continence Society [6, 7].

2.5 Data processing

The paired t-test was used to determine the level of statistical significance for any difference between methods, with $P < 0.05$ assumed to indicate significance.

3 Results

There were no complications during the study. The pressure-flow data from the recordings are shown in Table 1. There were significant differences between the mean values of the two methods for Q_{max}, Pdet, Q_{max},

Table 1. Mean values for continuous variables from the pressure-flow study. Q_{max}, Maximum flow rate; Pdet, Q_{max}, detrusor pressure at maximum flow; URA, urethral resistance algorithm; AG, Abrams-Griffiths number; MCC, maximum cystic capacity; †mean ± SD; *paired t-test.

Variable†	*P value**	Press flow data	
		Suprapubic	Transurethral
Q_{max}	< 0.05	8.23 ± 3.44	7.04 ± 3.28
Pdet, Q_{max}	< 0.01	83.43 ± 34.35	94.00 ± 32.34
URA	< 0.01	70.14 ± 27.83	81.53 ± 28.43
AG number	< 0.01	66.97 ± 35.57	79.91 ± 34.50
MCC	< 0.01	195.61 ± 117.25	129.00 ± 106.42

Table 2. Percentage of patients falling into each class for each method. AG, Abrams-Griffiths number.

Classification	Class	Suprapubic (%)	Transurethral (%)
AG number	< 20	4.3	0
	⩾ 20 and ⩽ 40	26.1	13.0
	>40	69.6	87.0
Schäfer nomogram	0~I	4.3	4.3
	II	26.1	8.7
	III~VI	69.6	87.0

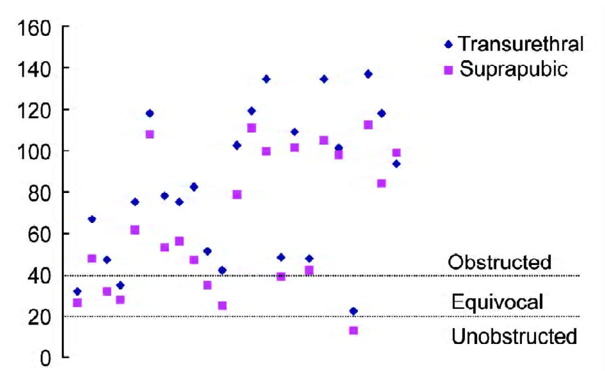

Figure 1. The change of the Abrams-Griffiths number in individual patients between the two methods.

MCC, URA and AG number.

The percentage of patients in each class of the two nomograms is given in Table 2. Of men in the study, 10 (43.5%) remained in the same Schäfer class with both methods and 18 (78.3%) in the same AG number area. Using the transurethral method, 12 (52.2%) men increased their Schäfer class by one and 1 (4.3%) by two. There were also differences between the suprapubic and transurethral methods using the AG number: 4 (17.4%) men moved from a classification of equivocal to obstructed and 1 (4.3%) from unobstructed to equivocal. Therefore, 5 (21.7%) men moved from one area of the nomogram to a more obstructive region (Figure 1).

4 Discussion

The precise identification of patients with BOO as a result of BPH has become relatively more important. Pressure-flow studies are the only urodynamic tests that allow differentiation between a Q_{max} secondary to obstruction and an impaired Q_{max} secondary to suboptimal detrusor function [8]. Indeed, pressure-flow analysis has been generally accepted as the gold standard in measuring outcome and certainly in quantifying the grade of BOO [3, 5], and it has been verified significant for both diagnosis before surgical treatment and evaluation after operation, such as before and after transurethral resection of prostate [9, 10]. Therefore, it is very important to get precise results from the examination. Pressure-flow studies are invasive, requiring the insertion of recording devices into the bladder and into the rectum. The results obtained should be precise as far as possible to offset patient discomfort and cost [8]. Currently, the transurethral route is used most widely for the simultaneous recording of pressure and flow during voiding. However, there is the theoretical possibility that a urethral pressure line could interfere with pressure and flow recording from the urethra and bladder. An alternative technique is to use a suprapubic catheter. Clearly, such a technique would avoid any influences of urethral instrumentation and catheterization on detrusor pressure and flow rate, although it would obviously make the investigation of pressure-flow studies more invasive [11].

Does the transurethral catheter significantly influence the recording of measurements? Which method should we choose? There have been few formal studies on either method and the opinions are discordant. Klingler *et al.* [12] noted an increase in obstruction grade when transurethral pressure-flow studies are performed with larger tubes within the urethra. Von Garrelts [13] reported that catheters with an outer diameter of 1.1–5.0 mm impeded flow but did not affect voiding pressures. Smith [14] found that the use of a urethral catheter (size not stated) compared with a suprapubic catheter and produced a small increase in voiding pressure in a normal 33-year-old man. In a group of boys 3–15 years old, Griffiths and Scholtmeijer [15, 16] found that the combination of a 8 Ch. and 3.5 Ch. catheter had a more obstructive effect than a 3.5 Ch. catheter alone, whereas in only 3.5% of 111 young girls 4–15 years old did an 8 Ch. catheter had an obstructive effect. Neal *et al.* [17] studied the effect of a large (combined 4 and 10 Ch. catheters) versus a small (1.1 mm diameter epidural line) catheter assembly on detrusor pressure and flow in 20 men before prostatectomy and 10 men after prostatectomy. They found that detrusor pressure at maximum flow was significantly greater and the maximum flow rate was significantly smaller in the large catheter study than in the small catheter study, suggesting that this probably occurred because the larger catheter caused obstruction. Yalla *et al.* [18] measured voiding pressures in 10 men and found no significant change when comparing a 10 with a 5 F catheter. Zhang *et al.* [19] concluded that a 7 F urethral catheter appears to have a significant impact on maximum flow rate through studying 44 men with lower urinary tract symptoms. Trumbeckas *et al.* [20] also confirmed that a catheter of 7 F slightly diminishes maximum flow rate.

Recent studies investigate how to choose the techniques in pressure-flow studies. Madsen *et al.* [8] divided 25 patients into transurethral groups (4 F catheter was used) and suprapubic groups. Although the studies showed that the reproducibility of the test did not depend on whether the intravesical pressure is measured by transurethral catheterization or suprapubic puncture, they suggest that there is a physiologic difference between the two tests. Similar to the present study, in the study by Walker *et al.* [5] standard pressure-flow variables were measured in 35 patients using both methods. The study by Walker *et al.* [5] demonstrates that there are differences in the classification of obstruction between the suprapubic and transurethral (10 F catheter was used) routes, and that the transurethral method tends to indicate greater obstruction.

In the present study, there were significant differences in both the recorded variables and the grade of obstruction between the suprapubic and transurethral (using an 8 F urethral catheter) methods. The artificial obstruction increases the urethral resistance with urethral stricture and interrupts urination. This influences not only maximum flow rate and detrusor pressure but also maximum cystic capacity, because the urethral catheter's stimulation potentizes the patient's micturition desire and shortens the time to their urgent desire. This probably affects the results for both diagnosis before surgical treatment and evaluation after operation, such as before and after transurethral resection of prostate.

In conclusion, the differences between the methods for measuring intravesical pressure alter the grading of obstruction determined by several of the commonly used classifications. An 8 F transurethral catheter does significantly increase the likelihood of a diagnosis of BOO when compared with the suprapubic method. We advocated the suprapubic method because of its precision. If the transurethral method is used, we suggest a catheter smaller than 8 F is needed. Whichever method chosen, the examiners should make the patients understand the process and obtain their consents.

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