The Urodynamic Evaluation of Lower Urinary Tract Symptoms in Men

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Urodynamic investigation is recommended when it influences the management of patients and is used before invasive therapies for lower urinary tract dysfunction. Urodynamics has been shown to improve symptomatic and objective outcomes after surgical treatment of bladder outlet obstruction (BOO) of which benign prostatic obstruction (BPO) is the principal cause. The diagnosis of BOO is made from pressure–flow studies (PFS) of micturition using the International Continence Society nomogram, which places patients in three categories: obstructed (BOO index [BOOI] ≥ 40); equivocal (no definite obstruction; BOOI 20–40); and no obstruction (BOOI ≤ 20). PFS are reliable and reproducible; however, they are invasive tests, and efforts to find sensitive and specific methods of diagnosing BPO without catheterization are under way. Promising noninvasive techniques include the penile compression release index, the condom catheter method, and the penile cuff technique. Uroflowmetry and the ultrasound estimation of residual urine remain useful screening tests. Due to its diagnostic and prognostic value, urodynamics is recommended to assess lower urinary tract symptoms before surgery to relieve BOO.

Introduction

Urodynamics may be performed for various reasons. In clinical research, the primary aim is to gather knowledge about the diseases encountered to ensure that medical practice is knowledge-based. For clinical urodynamic assessment, the main aim of urodynamics is to guide therapy and improve outcomes: its ability to do this must be judged from the evidence provided by trials and cohort studies. When a condition is first widely encountered, there is a phase in which clinical research is crucial in order to generate new knowledge. For example, following the widespread expansion in the indications for radical prostatectomy, when the reasons for postoperative urinary incontinence were imperfectly understood, many articles dealing with clinical research into the mechanisms and risk factors for incontinence were published. Once the etiology had been established, the debate shifted to whether routine clinical urodynamics should be limited to selected difficult cases or performed more widely. Because urodynamics remains the only way of objectively establishing the pathophysiological situation, urodynamic evaluation always remains necessary in, at least, the difficult cases.

Since the World Health Organization–sponsored International Consultation on BPH (benign prostatic hyperplasia) in 2000 [1], views have evolved about the urodynamic evaluation of lower urinary tract symptoms (LUTS) in men with possible benign prostatic obstruction (BPO). This report, based mainly on publications since 2000, updates this topic. Recent efforts to improve noninvasive methods of urodynamic measurement, so as to reduce patient burden and make urodynamic evaluation more practical, are reviewed more extensively.

Men in middle or old age present with LUTS that may be, but are not necessarily, related to prostatic changes such as benign or malignant enlargement and obstruction. LUTS may be caused by dysfunction anywhere in the complicated mechanical and neural control system that allows normal function and controls lower urinary tract function. According to most textbooks, the aim of urodynamics is to reproduce symptoms while making measurements that reveal their cause. Because the number of possible causes is in principle sizeable and urodynamics is currently quite limited in its power to reveal them, it is frequently useful to go beyond reproduction of the symptom to document the complete function of the lower urinary tract in filling and voiding phases. If cystometry is performed to ascertain the cause of incontinence, and if incontinence is indeed demonstrated during the filling

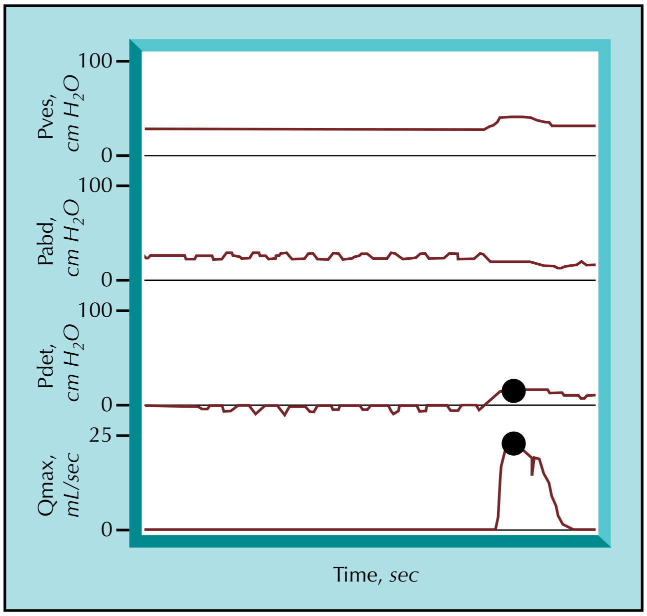

Figure 1. A typical pressure–flow study in an unobstructed individual. Satisfactory data quality is suggested by similar fine structure in the intravesical pressure (Pves) and abdominal pressure (Pabd) signals and by satisfactory cough tests before and after voiding. However, regular waves in Pabd indicate rectal contractions. The resulting periodically negative values for detrusor pressure (Pdet) should be viewed as artifacts. The circles mark the maximum flow rate (Qmax) and the Pdet at Qmax.

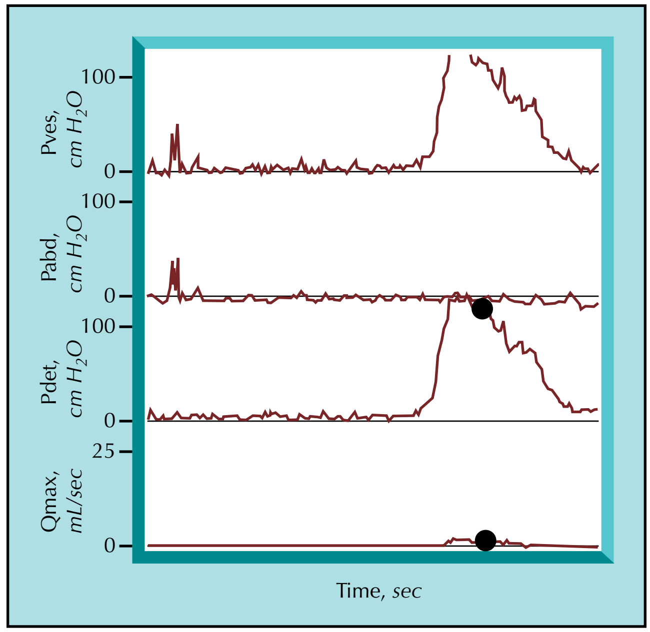

Figure 2. Pressure–flow study in an obstructed individual. Maximum flow rate (Qmax) is low and detrusor pressure (Pdet) at Qmax is elevated to more than 100 cm H2O (*circles*), indicating bladder outlet obstruction. The negative value of the abdominal pressure (Pabd) before voiding suggests a slight artifact, possibly due to incorrect setting of zeroes or leveling of the transducers. Pves—intravesical pressure.

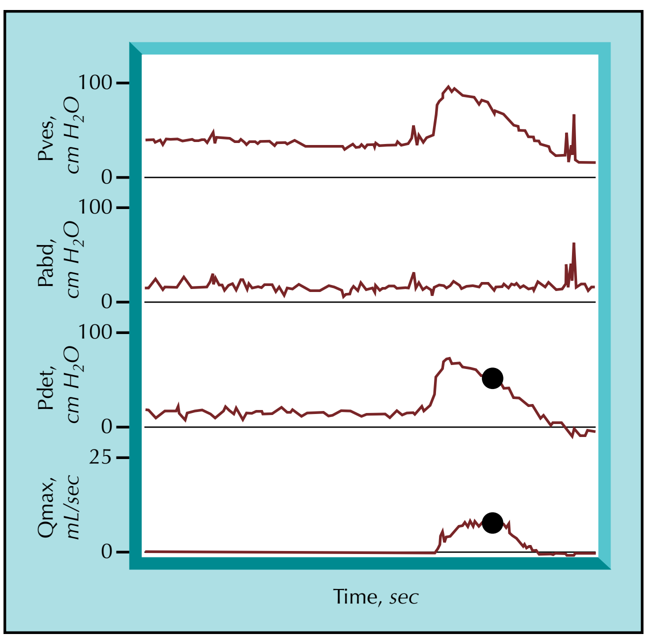

Figure 3. Pressure–flow study with intermediate values of maximum flow rate (Qmax) and detrusor pressure (Pdet) at Qmax (*circles*). Small rectal contractions are visible in abdominal pressure (Pabd) and therefore also in Pdet as downward deflections. Pves—intravesical pressure.

phase, it is still wise to complete filling and also examine the voiding phase because unsuspected abnormalities may contribute to incontinence or may reveal urethral obstruction, poor voiding, elevated residual urine, or possible neuropathy, and may change symptom interpretation, alter the presumed diagnosis, or change treatment choice.

For a comprehensive description of how urodynamics is performed and interpreted, the last International Consultation on BPH should be consulted [1]. This article focuses on the urodynamic assessment of voiding and the diagnosis of bladder outlet obstruction (BOO).

Diagnosing Bladder Outlet Obstruction

It is now accepted that, although symptomatic management of LUTS is important, obstruction associated with benign prostatic enlargement (BPE) is equally important, because it may lead to disease progression and occasionally cause harmful effects on the bladder and kidneys [2–4]. Thus, assessing BOO is an important part of the evaluation of men with LUTS. The currently accepted gold-standard measure of BOO is the pressure–flow study (PFS) of voiding [1,5]. In fact, a PFS provides the basis for the definition of obstruction and remains the only objective means of establishing BOO or ruling it out.

Pressure–flow studies

For a PFS, intravesical pressure (Pves) and abdominal pressure (Pabd), which is usually obtained intrarectally, are measured during voiding, simultaneously with the flow rate in the external stream. Detrusor pressure (Pdet) is calculated by subtracting Pabd from Pves. The results of three typical studies are shown in Figures 1, 2, and 3.

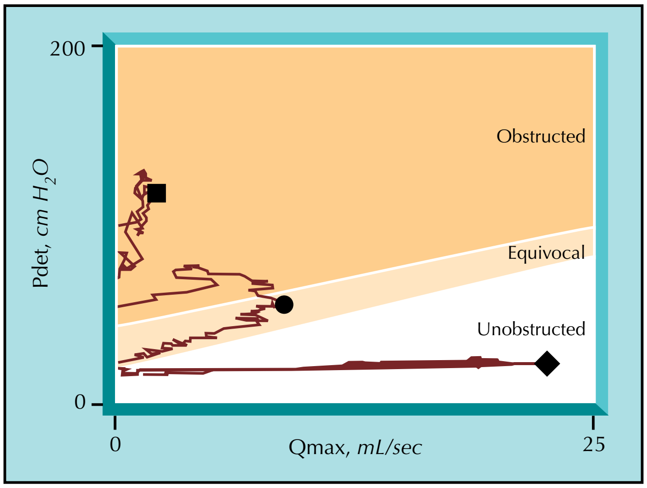

Figure 4. International Continence Society obstruction nomogram, showing the three pressure–flow curves from Figures 1, 2, and 3. Pdet—detrusor pressure. Qmax—maximum flow rate.

A PFS contains information about urethral resistance, such as possible obstruction, and detrusor contractility. Several fundamental classes can be distinguished. Urethral resistance classes include low Pdet and normal flow rate (unobstructed) and high Pdet and low flow rate (obstructed). Detrusor contractility classes include low Pdet and low flow rate, which indicates detrusor contraction (detrusor underactivity); and high flow rate at high Pdet, which indicates abnormally strong detrusor contraction.

Numerous ways of quantitating these descriptions have been suggested. The International Continence Society (ICS) recommends judging obstruction (in men) from the nomogram shown in Figure 4 [6]. A point representing the value of the maximum flow rate (Qmax) and the corresponding detrusor pressure (Pdet at Qmax) is plotted on the nomogram, and falls into one of three regions: unobstructed, obstructed, or equivocal, consistent with the urethral resistance classes just described. The equivocal gray zone allows for normal physiological variation and measurement errors.

Even without drawing the ICS nomogram, a patient can be placed in one of three zones by calculating the BOO index (BOOI) [7] (BOOI = Pdet at Qmax - 2 Qmax, with Pdet at Qmax in cm H_2O and Qmax in mL/sec): unobstructed (BOOI ≤ 20 cm H_2O); equivocal (BOOI = 20–40 cm H_2O); obstructed (BOOI ≥ 40 cm H_2O).

The Abrams–Griffiths nomogram referred to below is similar to the ICS nomogram. Other variables such as urethral resistance factor (URA) [6], passive urethral resistance relation (PURR), and detrusor-adjusted mean factor (DAMPF) [8], also provide a continuous classification of urethral resistance or obstruction. Partly because of the natural variability of voiding studies, they have not proved noticeably more useful in practice than the simple ICS nomogram.

Reliability of urodynamics in men with LUTS

Variability and reproducibility of measurements

In the last International Consultation on BPH [1], it was concluded that random variations of about 9 to 14 cm H_2O in pressure measurement, and about 0.4 to 2 mL/sec in Qmax occur. In repeated studies during the same session, there is usually a systematic decrease of up to 4 cm H_2O in Pdet and 0.4 mL/sec in Qmax. These variations have little clinical importance: they cause only 10% to 16% of patients to change classification on the ICS or similar nomogram, and in about 1% of patients the change is by only one class (from equivocal to unobstructed or obstructed to equivocal). A urethral catheter appears to be associated with slight changes in flow rate, although it is not certain that these changes are only caused by the catheter. A catheter of size 8 French gauge seems to be acceptable.

More recently, Klausner et al. [9] examined the effect of catheter size on assessment of BOO in 31 patients with LUTS suggestive of BPO. Using 5 French and 10 French catheters in random order, they observed that the 10 French catheter decreased Qmax and increased Pdet at Qmax, indicating a detectable obstructive effect over and above that of a 5 French catheter. On the Abrams–Griffiths nomogram, 10 of 31 patients (32%) were categorized as obstructed with the 10 French catheter but not with the 5 French. Overall, 17 of 31 patients went from a less-obstructed to a more obstructed category when the 10 French catheter was used. The authors' conclusion was that 10 French catheters should be avoided because of their obstructive effect. However, obstruction nomograms were developed on the basis of PFS using urethral catheters of various sizes up to 10 French. Therefore, results obtained with thicker catheters may be just as suited to the existing nomograms as those with thinner catheters.

Some centers perform PFS with their patients standing, and others with them seated. Unsal and Cimentepe [10] compared flow rates and residual urine in the two positions, in 44 men with LUTS suggestive of BPO and 44 healthy men. No significant position-dependent differences in the maximum or average free flow rate, or in PVR measured by ultrasound, were found. A limitation of these studies is that the observation order was not clearly described; as such, there may be a confounding order effect.

In 1999, Tammela et al. [11] reported on PFS of three consecutive voids in 216 men with symptoms possibly associated with BPO. All were measured with no catheter present in the urethra. The mean value of Pdet at Qmax decreased significantly in successive voids, from 71 to 66 to 63 cm H_2O. Correspondingly, the proportion of patients classified as obstructed by the Abrams–Griffiths nomogram fell from 67% to 64% to 59%.

Kranse and Van Mastrigt [12] studied 131 unselected male patients, observing less pronounced systematic variations from one PFS to the next, but considerable random variability. In 35% of patients, the classification of

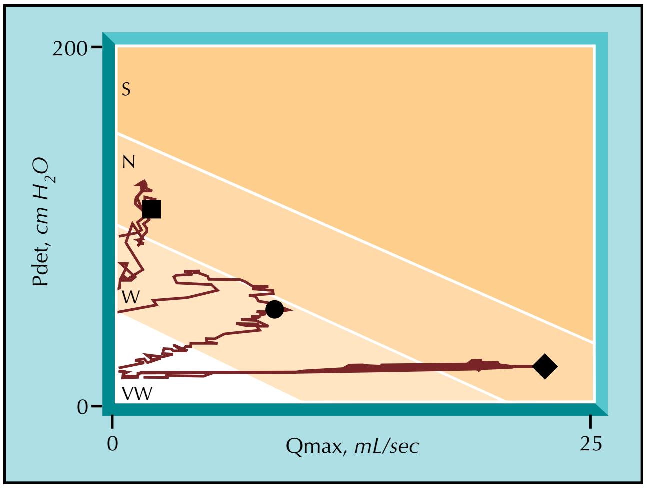

Figure 5. The voids of Figures 1, 2, and 3 classified for detrusor contractility by the Schäfer nomogram [8]. The position of the maximum flow point (*black dots*) in the four bands indicates the strength of the contraction. The strengths for these three voids are normal, normal, and weak, respectively. N—normal; Pdet—detrusor pressure; Qmax—maximum flow rate; S—strong; VW—very weak; W—weak.

obstruction based on the ICS nomogram changed among measurements. They investigated the possible causes of this variability by ingenious statistical methods and concluded that it was not due to random measurement noise but to real physiological changes in bladder and urethral function. Variability in PFS, therefore, was not a disadvantage, but reinforced their importance as the only means to study bladder outlet resistance, detrusor contractility, and physiological variations.

Using their results, if one amalgamates the unobstructed and equivocal classes on the ICS nomogram, as is often done, and takes the second test as the standard, then the sensitivity and specificity for obstruction of the first test are 81% and 83%, respectively, and the overall accuracy is 82%. These figures represent the intrinsic variability of obstruction. (Similar figures would be obtained if the first test were taken as the standard.) Similar calculations based on data from Sonke et al. [13] yield an overall accuracy of 83%, and sensitivity and specificity of 74% and 86%, respectively. These figures are very similar to those of Kranse and Van Mastrigt [12], despite criticism of the technical quality of the measurements (see editorial comments following Sonke et al. [13]).

Two recent studies have reported on the variability in men of other urodynamic variables. Ockrim et al. [14] compared variability of the observation of detrusor overactivity in 60 men with LUTS (mean age, 67 years) and 35 men with spinal cord injury (mean age, 39 years). In men with LUTS, the apparent prevalence of detrusor overactivity decreased from 72% to 63% to 48% in three successive filling cystometries, performed on the same occasion. Similarly, the mean maximum Pdet during detrusor overactivity decreased from 41 to 34 to 25 cm H_2O. Bladder volume at first, normal, strong desire to void and cystometric capacity increased significantly from the first to the third cystometry, by 14 to 25 mL. These observations of systematic changes in successive cystometries are consistent with those in neurologically normal women [15]. Unfortunately, the random intra-subject variations were not reported, but they are probably even larger than the systematic ones [15]. In contrast, in men with spinal cord injury, none of these variables changed significantly in successive cystometries, except possibly for maximum Pdet during overactivity, which showed a barely significant decrease of 4 cm H_2O (5%). Thus, for example, detrusor overactivity was observed in 100% of spinal-cord injured men in all three cystometries, whereas the mean cystometric capacity was 310, 308, and 307 mL, respectively. Similar consistent results were obtained by Ho et al. [16], who examined the reproducibility of two consecutive urodynamic studies in a neurologic population.

To summarize, in neurologically intact men, systematic and random variability of urodynamic variables are caused by real physiological changes in the behavior of the bladder and urethra. This variability is much less pronounced in those with serious neurological disease at the spinal level, suggesting that supraspinal control is responsible for much of the normal variability.

New interpretations of urodynamic measurements

Some new mathematical approaches to the interpretation of PFS, based on computer manipulation of urodynamic variables, have been proposed [17,18]. They are intended to reproduce more closely the underlying physiology than existing methods, but it is neither clear how well they succeed in this nor whether they will offer more reliable interpretation.

Detrusor contraction strength during voiding (an aspect of detrusor contractility) can be judged from another nomogram due to Schäfer [8] (Fig. 5). On the basis of Pdet at Qmax and Qmax, it classifies contraction strength in one of four classes, from very weak to strong (later subdivided to yield a finer graduation). Again, the same classification can be obtained by calculating the bladder contractility index (BCI) [19], also known as projected isovolumetric pressure (PIP); or the detrusor coefficient (DECO), which is almost identical [20]. BCI is calculated by adding Pdet at Qmax to 5Qmax, with Pdet at Qmax in cm H_2O and Qmax in mL/sec (BCI $\leq$ 50 cm H_2O is very weak; BCI = 50–100 cm H_2O is weak; BCI = 100–150 cm H_2O is normal; and BCI $\geq$ 150 cm H_2O is strong).

Detrusor contractility in men with LUTS

Impaired detrusor contractility may cause poor flow rate, incomplete emptying, and corresponding symptoms, even in the absence of urethral obstruction [1,21], and this is especially likely in the frail elderly [22].

A detrusor contraction of normal strength can produce either a high Pdet or a high flow rate (depending on the urethra), but not both at once. A weakly contracting detrusor can produce neither a high flow rate nor a high Pdet. Thus, to assess detrusor contraction strength both pressure and flow rate must be considered. It is particularly important to understand that a low Pdet does not necessarily represent a weak detrusor contraction unless the flow rate at that moment is also low. As described above, the simplest method of assessment is to calculate the BCI [19] or DECO [20] during voiding at the moment of maximum flow (BCI = Pdet at Qmax + 5Qmax, with Pdet at Qmax and Qmax in cm H_2O and mL/sec, respectively). BCI values below 50 represent weak or very weak contractions. Values of over 100 represent normal or strong contractions. Equivalently, the values of Pdet at Qmax and Qmax can be plotted on a nomogram that shows the strength categories (Fig. 5). Detrusor contraction strength can be estimated more reliably by measuring the isovolumetric Pdet during a mechanical stop test [20,23], eliminating the possibility of flow altogether.

Another aspect of contractility is the ability to sustain the detrusor contraction until the bladder is empty. Failure to do so leads to residual urine; indeed, Zhang et al. [24] have suggested that, in men with suspected BPO, residual urine volume is more closely related to a weak detrusor contraction than to urethral obstruction. The prevalence of weak detrusor contraction has not been much studied, but Thomas et al. [25] found that among a large series of 2066 neurologically intact men with LUTS, 224 men showed detrusor underactivity (defined as a Pdet at Qmax < 40 cm H_2O, with Qmax < 15 mL/sec). In a series of 196 patients with and without prostatic obstruction, treated or otherwise, no evidence suggested that detrusor contractility declined in long-term obstruction or that relieving the obstruction surgically improved the contractility [26].

Overall, however, research activity in the field of detrusor contractility remains limited, presumably because there is no obvious pharmacologic way to improve poor contractility. Discovery of a drug that noticeably improved detrusor contraction would revolutionize this field.

Why urodynamic pressure–flow studies are not more widely performed

Despite the above, urodynamic PFS are not widely performed in routine clinical practice. One reason is the perceived invasiveness and morbidity of urodynamics [27]. A second reason is the perceived lack of clinical utility in improving outcomes, such as by better patient selection. Assessment by methods of this sort is also strongly influenced by costs and reimbursement.

The objective morbidity of urodynamic studies is low [27–29], although temporary dysuria is common (33% to 76%). Bacteriuria is found in up to 8% and symptomatic infection in 0.5% to 4%. Mild macroscopic hematuria (6%) [27] and post-investigational urinary retention (5% in men with obstruction) [28] have also been reported. Subjective morbidity may be due to factors such as embarrassment, which might make the test not only unpleasant, but also unreliable. Scarpero et al. [30•] reported on the expectations and experience of 78 men and 88 women undergoing urodynamic testing. Men expected little or no embarrassment and most (90%) found the test better than they had expected or the same. More older than younger individuals found it better than expected. Thus, the patient population with prostate problems—predominantly older males—is the group that finds urodynamic testing the least troublesome.

Pressure–flow Studies: Relationship with Other Urodynamic Measurements

Due to the drawbacks of invasive urodynamics, attempts have been made to assess BOO noninvasively. Various methods have been used, including uroflowmetry and noninvasive bladder pressure measurements (via a penile cuff or a condom catheter).

What can reasonably be expected of noninvasive surrogate measures of obstruction? PFS themselves are not perfect. Repeated measurements in one subject provide variable results, especially in patients with an intact nervous system, who form the majority of those with LUTS. Clearly the association of any surrogate with obstruction can never be better than the association of one pressure–flow determination with another in the same patient. The intrinsic accuracy of classification appears to be about 80% [13,31], limiting sensitivity and specificity to about 80% if both are maximized simultaneously.

This section reviews various tests with the aim of obtaining the sensitivity and specificity of each test in predicting BOO, although frequently only a correlation coefficient is provided. As far as possible, positive and negative predictive values are avoided since they are affected by the prevalence of BOO, which may vary considerably across the studies assessed. It should be noted that the sensitivities and specificities quoted assume that PFS have 100% accuracy, which is not the case.

Male patients with LUTS are among the commonest presentations in the urology clinic. Although the symptoms are commonly associated with BPO, symptoms may be related to an aging bladder or a combination of BPO and aging. Other types of BOO, due to bladder neck hypertrophy or urethral stricture, may also cause LUTS.

Uroflowmetry

Conventional uroflowmetry

Uroflow measurement is the least invasive urodynamic assessment. It gives an objective and quantitative indication of voiding dysfunction. Its limitation is that it does not distinguish a low flow rate due to prostatic obstruction from low flow due to poor detrusor contractility [32]. Further, obstructed patients with high Pdet can maintain a normal flow rate. Uroflowmetry results show a considerable variation in Qmax measured on the same or different days [33].

The specificity of Qmax for BOO depends on a number of factors, including the volume voided and the value of Qmax used. In a large study, the specificity and sensitivity for BOO of Qmax of less than 15 mL/sec were 38% and 82%, respectively [34]. Thus, this value of Qmax is too nonspecific to be useful. For Qmax less than 10 mL/sec, the sensitivity and specificity were 70% and 45%, respectively. The limitation of this approach remains therefore the poor sensitivity of this value of Qmax (10 mL/sec). In general, the sensitivity and specificity of Qmax do not approach the limits set by the intrinsic variability of BOO. Single center smaller studies have suggested a higher specificity of up to 90% for this value of Qmax, in particular with multiple flows [35–37]. Therefore, for uroflowmetry to play a part in the diagnosis of BOO/BPO, the measurements need to be multiple. In this circumstance, the level of evidence 2 allows a recommendation, Grade B, for the reliable diagnosis of BOO, but only when Qmax is less than 10mL/sec.

Postvoid residual

PVR is often used in combination with uroflowmetry to assess patients presenting with LUTS, although the pathophysiology of elevated PVR is not generally well understood and its interaction with BOO and detrusor underactivity is complex. Elevated PVR (usually defined as PVR > 100 mL) is commonly observed in patients with BOO [38], although one third of such patients do not have significant residual urine [39]. Thus, in patients with BOO, PVR tends to decrease after surgery [40]. Like other urodynamic parameters, PVR is quite variable in any given subject. In one study, however, PVR greater than 100 mL showed values of sensitivity and specificity (75% and 91%, respectively) that approach the limit set by intrinsic variability of obstruction [41].

Elevated PVR may also reflect detrusor underactivity [24,42]. The interaction of BOO, (impaired) detrusor contractility, and PVR was recently investigated in 131 patients, showing only a weak correlation between BOO and PVR. This result is not surprising because elevated PVR is a consequence of BOO, and therefore not all patients with BOO will have developed an elevated PVR. By combining measurements of detrusor contractility and BOO, PVR may be reasonably accurately predicted [31]. PVR is most useful clinically in conjunction with other measurements, such as uroflowmetry [1].

Penile compression release index

Interruption of flow by manual pinching of the penis, followed by release, leads to a surge in flow followed by a steady state, just as in the cuff technique [43]. The penile compression release (PCR) index is defined as ([surge flow – steady-state slow]/steady-state flow x 100). The PCR index differed in obstructed, nonobstructed, detrusor underactivity, and detrusor overactivity groups, and a cut-off value of 100% could diagnose BOO with a sensitivity and specificity of 91% and 70%, respectively [43]. If a penile cuff was used to calculate the PCR, a cut-off value of 160% gave a sensitivity and specificity of 78% and 84% for BOO [44]. These values approach the limit set by the intrinsic variability of BOO.

Noninvasive urodynamic pressure measurement

Over the past decade, a number of ingenious ways have been described for measuring bladder pressure associated with voiding in a noninvasive way. The principle underlying these techniques is the measurement of isovolumetric bladder pressure; this allows a low free flow rate, due to obstruction, to be distinguished from a low flow rate due to detrusor underactivity. The penile cuff and the modified condom methods are the two principal approaches. Both rely on the assumption that there is a continuous column of fluid from the bladder through the urethra to the point where flow is interrupted, so that the fluid pressure at the point of measurement is the same as the pressure within the bladder, thereby recording its isovolumetric value.

Condom catheter method

For the external condom method [45], the patient voids through a condom catheter. At maximum flow, the catheter is blocked and the isovolumetric pressure is measured. In a study of 75 patients who underwent PFS and the condom method, there was a 25% technical failure rate. Several strategies for analyzing the data were used. The best method (also using Qmax) showed a sensitivity for BOO of 64% with a specificity of 79% [46]. These are rather disappointing values, markedly inferior to the limits set by the variability of real PFS.

In initial trials the isovolumetric pressure was not always attained, especially in obstructed patients, or those with low flow rates (< nearly 5 mL/sec) [47,48]. Recent improvements [49] have led to better reproducibility [50,51] so that this method now has an overall accuracy of 90% in diagnosing obstruction, although only when the obstructed and equivocal groups on ICS nomogram are combined. However, the accuracy of agreement is only 67% for ICS obstructed group alone [46], a value that should be compared with accuracies of 82% to 83% for PFS themselves. Pel and Van Mastrigt [47] showed that this method can be usefully applied in epidemiological studies of large populations to gain information about bladder and urethral function that would otherwise be inaccessible.

Penile cuff method

The penile cuff is a flexible inflatable cuff that is placed around the shaft of the penis [52]. Two methods of use have been suggested: the deflation and the interruption techniques. For the deflation technique [53], the penile cuff is used to occlude the urethra before voiding. The patient is instructed to void into a flowmeter and the cuff is deflated slowly by the patient (by pressing a button) when the urine is felt in the urethra. Once a flow rate of greater than 1 mL/sec is detected by the flowmeter, the cuff is deflated rapidly.

For the interruption technique, an automatically inflated penile cuff (modified pediatric blood pressure cuff) interrupts the flow after voiding has commenced [54]. The cuff pressure when the flow stops is presumed to be equal to the bladder pressure. Once the flow has stopped, the cuff is rapidly deflated and there is a surge of urine after which the inflation cycle can be repeated. Simultaneous invasive urodynamics showed that the isovolumetric detrusor pressure was reliably estimated by this method, although the mean cuff pressure (Pcuff) overestimated the bladder pressure by 14.5 ± 14 cm H_2O [54]. The test/retest variability was 0 (SD, 20.3 cm H_2O) in patients with a voided volume of at least 150 mL [55]. The interobserver agreement in the analysis of the results was good [56]. Most patients (80%) preferred the cuff to invasive urodynamics.

In order to diagnose BOO with this technique, a modification of the ICS nomogram has been suggested. Alternatively, a diagnostic parameter N (Pcuff – 6.4 x Qmax + 0.35 PCR) can be used, where N greater than 100 indicates obstruction. A further study of the outcome of transurethral resection of the prostate (TURP) using the modified ICS nomogram is in progress. Preliminary results show that preoperative assessment using the nomogram improves the outcome.

In conclusion, in spite of technical pitfalls [57] and the fact that it measures intravesical pressure and not Pves, noninvasive urodynamic pressure measurement, especially if combined with the PCR index and maximum free flow rate, promises to provide a reasonably reliable method of diagnosing BOO (Level 3 evidence). However it remains unclear whether the extra complications required are worth the relatively small improvement in diagnostic accuracy over uroflowmetry (no recommendation possible, as yet).

Predicting the Situation After Therapy

Predictive/prognostic value of urodynamics

BPE is a common condition among older men and may lead to BPO [58]. Clinical manifestation of BPO includes LUTS and impairment of urinary flow with a negative impact on quality of life. European and International BPH treatment guidelines have stated that watchful waiting is recommended for patients with mild symptoms, medical treatment for patients with mild to moderate symptoms, and BPO-related invasive therapy for those with moderate to severe symptoms [59]. Many authors are researching parameters that could accurately predict the results of these three treatment modalities, and thereby reduce the number of men who experience a negative outcome from BPO treatment.

A potentially important application for urodynamics is prognosis and prediction of the outcome of treatment or of no treatment. Adequate predictive power might guide choice of the best treatment or might help in counselling patients about the likelihood of success of any given treatment. Since the last international consultation on BPH [1], where it was suggested that urodynamics has some but not strong predictive value for the outcome of treatment, there has been considerable activity in this field. Two recent reviews by Homma [60] and Clemens [61] reinforced the view of the last consultation. A third review [62] concluded that conventional urodynamic studies are useful in providing preoperative information about detrusor function, and in excluding patients less likely to benefit from prostate surgery. Despite this, some regard the need for performing urodynamic evaluation routinely, before TURP, as still controversial [63]. However, the risk of operating on patients who will not benefit has to be balanced against the risk of not operating on patients who will benefit, although there may well be treatment methods as beneficial but less risky than TURP in unobstructed patients, such as drugs.

Although almost all evidence for the advantages of urodynamic studies before invasive therapy for BPO is Level 3, the quantity of evidence allows a Grade B recommendation.

Conclusions

Urodynamics is ultimately recommended in patients with LUTS suggestive of BPO. PFS remain the only means of establishing or ruling out the presence of BOO. Noninvasive methods of assessing obstruction are not yet able to fill that role, although some may ultimately be able to do so. The filling phase of micturition should also be assessed, as symptomatic detrusor overactivity may have a bearing on the outcome of treatment (Grade C recommendation). Patients being submitted to TURP, with its attendant risks, should have a definitive diagnosis of outlet obstruction (Grade B recommendation). If PFS are not planned prior to invasive treatment, then the patient should be made aware of the diagnostic limitations of uroflowmetry (Grade B recommendation). In the research setting, PFS of possible obstruction in men with LUTS are essential to reveal biological mechanisms, increase statistical power, and reduce the number of men at risk from novel treatments for BOO.

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Disclosures

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References and Recommended Reading

Papers of particular interest, published recently, have been highlighted as:
- • Of importance
- •• Of major importance

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