

SOGC Committee Opinion on Urodynamics Testing

This committee opinion has been prepared by the Sub-Committee on Urogynaecology and approved by the Executive of the Society of Obstetricians and Gynaecologists of Canada.

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Abstract

Objective: To provide a description of the components of urodynamic testing for the evaluation of urinary tract dysfunction and the indications for these tests.

Options: Urodynamic testing is useful in investigating of urinary incontinence.

Evidence: A search of PubMed and the Cochrane Library identified the relevant literature. The evidence obtained was rated using the criteria developed by the Canadian Task Force on Preventive Health Care.

Key Words: Urodynamics, urodynamic testing, urinary incontinence

Values: This is a consensus opinion of the Society of Obstetricians and Gynaecologists of Canada Sub-Committee on Urogynaecology.

Benefits, Harms, and Costs: Urinary incontinence is a pervasive problem that can be treated effectively once properly diagnosed.

Summary Statements and Recommendations

1. Urodynamic testing is an objective tool that helps to clarify confusing or complex urinary tract symptoms.
2. Urodynamic testing is not recommended prior to
 - (a) conservative management of urinary incontinence. (III-C)
 - (b) primary surgery for stress incontinence when the diagnosis is clear. (III-C)
3. Urodynamic testing is recommended
 - (a) when the diagnosis remains uncertain after an initial history and physical examination. (III-C)
 - (b) when patient symptoms do not correlate with objective physical findings. (III-C)
 - (c) if the patient fails to improve with treatment. (III-C)
 - (d) in a clinical trial setting. (III-C)
4. Significant controversy exists about the use of urodynamics in the clinical setting. A Cochrane review found no evidence that urodynamic testing prior to treatment affected outcomes and recommended larger prospective trials.

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INTRODUCTION

Urodynamic testing is part of an advanced investigation of urinary tract function done in an effort to explain abnormal bladder function. While it is generally accepted that urodynamic testing is not universally indicated, it is also well established that urodynamic testing is an indispensable tool in the hands of an expert such as a urogynaecologist or a urologist.

Urodynamic testing involves a number of tests performed in an attempt to qualify and quantify the lower urinary tract activity during two phases of bladder function: (1) bladder filling and storage and (2) bladder emptying.

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The rationale for the development and use of urodynamic testing stems from the belief that the patient may be an unreliable witness to her own bladder dysfunction.¹ Between 11% and 16% of women with symptoms suggestive of stress incontinence have been found to have detrusor instability on urodynamic testing, and up to 22% of women with urgency/frequency symptoms are found to have pure genuine stress incontinence rather than detrusor instability on urodynamic testing.^{2,3}

Thus, the primary role of urodynamics is as an investigative tool that provides information about the physiologic function of the lower urinary tract and assists in categorizing and quantifying voiding problems. The primary goal of urodynamics is to reproduce patient symptoms during the performance of the study.

The terminology for urodynamics and its individual components comes from the International Continence Society.^{4,5} The International Continence Society undertook a radical review of definitions and terminology in 2002 but as yet has not provided numerical guidelines for urodynamics values.⁶

NORMAL BLADDER FUNCTION

In order to interpret abnormal results from urodynamic testing, it is necessary to understand normal bladder function. In 2005, Cole and Dmochowski⁷ described five components necessary for normal bladder filling and emptying:

- Normal bladder compliance
- Bladder stability
- Competence of the ureteral-vesical junctions
- Competent closed vesical outlet at rest and during times of increased intra-abdominal pressure
- Appropriate bladder sensations

They also described three components of normal bladder emptying:

- Coordinated contraction of bladder smooth muscle of adequate magnitude
- Synergistic lowering of resistance at the level of the smooth and striated urethral sphincter
- Absence of obstruction

ABBREVIATIONS

ISD	intrinsic sphincter deficiency
LPP	leak point pressure
PVR	post-void residual
SUI	stress urinary incontinence

COMPONENTS OF URODYNAMICS

In this document, we discuss five common components of urodynamics:

1. Uroflowmetry
2. Post-void residual
3. Bladder function
 - (a) cystometry
 - (b) pressure flow study
4. Urethral function tests (urethral pressure profile and abdominal leak point pressure)
5. Electromyography

Uroflowmetry

Uroflowmetry measures volume of urine passed per unit of time (mL/sec). The act of voiding involves a combination of detrusor contractility and relaxation of outlet resistance. Uroflowmetry is indicated in women with voiding difficulties such as slow stream or incomplete voiding. It is also considered a screening study for bladder outflow obstruction and detrusor contractility problems. Patients should arrive with a full bladder and are asked to void freely into a container that is connected to a computer that records a number of variables electronically. There is currently no consensus as to the normal ranges of these variables. The following are commonly accepted normal values.⁸

Flow pattern: should be bell shaped and smooth

Voided volume: > 200 mL

Q_{max}: between 20 and 36 mL/second, is the maximum flow rate

Flow time: between 15 and 30 seconds from initiation of flow to completion

Q_{ave}: this is the average flow rate and should be greater than 15 mL/second

Post-Void Residual

The PVR volume is a catheterized or scanned bladder volume after voiding. The indications for this study are the same as for uroflowmetry. There is considerable variability in published definitions of normal PVR, but most experts would agree that a residual volume of between 100 and 150 mL should be considered normal.⁹ Physiologically normal voiding involves emptying approximately 75% to 80% of total bladder volume.

Combining uroflowmetry and PVR yields a specificity of 70% for demonstrating evidence of voiding dysfunction and is considered to be valid as a screening test.¹⁰ When abnormal results are found, pressure-flow studies (voiding

cystometrogram) are indicated to differentiate between outflow obstruction and an under-active detrusor.

Cystometrogram

Cystometry is conducted to study the storage and voiding phases of micturition. Cystometry may consist of either single channel or multi-channel pressure recordings. Multi-channel recordings permit the clinician to isolate the detrusor component of the bladder pressure and are therefore more accurate at identifying detrusor overactivity. The goal is to reproduce a patient's clinical symptoms in order to reach a diagnosis and guide therapy. The goals of filling cystometry are to distinguish detrusor instability from stress incontinence and to evaluate bladder compliance and sensation.

Stress incontinence is defined as the complaint of involuntary leakage on effort or exertion.

Detrusor overactivity is an urodynamic observation characterised by involuntary detrusor contractions during the filling phase of cystometry, which may be spontaneous or provoked as with sneezing or coughing.⁴

Filling Cystometry

Filling cystometry evaluates the passive filling component of bladder function. This helps to distinguish detrusor overactivity from stress incontinence. Bladder compliance and sensation can also be evaluated. The filling medium can be sterile water, normal saline, or contrast material. Contrast material is indicated for video-urodynamics. Filling rates vary, depending upon the purposes of the testing.

The parameters documented during filling cystometry include the following (there are no standardized norms, but what follows are acceptable normal ranges)⁵:

1. Volume at first sensation (100–200 mL)
2. Volume at normal desire to void (150–350 mL)
3. Volume at urgency (250–500 mL)
4. Maximum cystometric capacity (300–600 mL)
5. Compliance (change in volume divided by change in pressure)
6. Presence or absence of involuntary detrusor contractions

Compliance refers to the volume and pressure relationship of bladder filling (change in volume/change in pressure).¹¹ A normal bladder can increase its volume with minimal changes in intravesical pressure. Normal bladder compliance is defined as an increase in detrusor pressure of no greater than 15 cmH₂O during filling. Low compliance is diagnosed when >15 cmH₂O pressure is found as the bladder is filling, combined with low bladder capacity and no evidence of instability. Increased bladder compliance is

demonstrated when the detrusor pressure increases minimally with a bladder capacity above normal limits.

Pressure-flow studies

Voiding cystometry is designed to find an explanation for abnormal voiding symptoms or uroflow and an abnormal PVR by distinguishing between underactive detrusor and outlet obstruction.¹² Impaired detrusor contractility is diagnosed when a low detrusor pressure accompanies a normal relaxed urethra and a slow urine flow rate. With bladder outlet obstruction, high detrusor pressure is associated with a high urethral pressure and a slow urine flow rate.

Urethral Function Tests

Urethral function tests are designed to measure urethral pressures and bladder pressures at the time of leaking and are indicated to diagnose intrinsic sphincter deficiency. ISD is urinary incontinence that occurs when the intrinsic urethral sphincter mechanism fails to maintain normal mucosal coaptation, at rest or with minimal exertion. The commonly accepted urodynamic parameters indicating ISD are an LPP of < 60 cm of water or a urethral closure pressure of < 20 cm of water. Stress incontinence associated with ISD is a more severe form of incontinence that has traditionally been treated with sling procedures or periurethral bulking injections rather than abdominal retropubic procedures such as the Burch. Patients with SUI associated with ISD are at greater risk of surgical failure than patients with a lack of extrinsic urethral support. The urethral pressure profile is performed using a catheter equipped with a pressure measuring mechanism (e.g., pressure port or microtransducer) for both the urethra and the bladder. One microtransducer is slowly withdrawn through the urethra while the other remains in the bladder measuring bladder pressure. The maximum urethral closure pressure is calculated by subtracting the bladder pressure from the highest urethral pressure. The functional urethral length is the length of the urethra within which the urethral pressure exceeds the bladder pressure. Maximum urethral closure pressures are measured at rest as well as during stress (cough).

The leak point pressure is used to assess intrinsic sphincter function during either cough or valsalva and is considered by some authorities to be more reliable than urethral pressure profiles.¹³ A valsalva leak point pressure (bladder pressure created by a valsalva manoeuvre that causes a visible urine leak) of < 60 cmH₂O suggests ISD.¹⁴ The valsalva leak point pressure is affected by bladder volume, patient position, and catheter size. There are no universally accepted standards, and this test is not validated in women with pelvic organ prolapse. The valsalva leak point pressure is typically performed with a bladder volume of 200 mL, in a 45° upright position, using an 8 mL micro-tip catheter.¹³

The urethral pressure point and the leak point pressure are independently used as indicators of ISD; however, as they measure different things, there is little agreement between these two tests.^{13,15,16} The urethral pressure point is generated by the passive or resting resistance of the urethra, while the leak point pressure is measured during a dynamic manoeuvre that increases bladder pressure. There is currently no gold standard for measuring urethral function.

Electromyography

Surface electromyography evaluates pelvic floor muscle activity during bladder filling and emptying. Normally, as the bladder fills, there is gradual increase in electromyography activity, known as the guarding reflex.^{17,18} As voluntary voiding occurs, it is normally preceded by electromyography silence, representing relaxation of the urethral striated sphincter and the pelvic floor muscles. Electromyography is used mainly in the context of research.

INDICATIONS FOR URODYNAMIC TESTING

The indications for undertaking urodynamic testing are controversial. It is generally accepted that urodynamic testing is not necessary prior to conservative management of urinary incontinence by such means as pessary, pelvic floor exercises, biofeedback, bladder training, or the use of anticholinergic drugs. Suggested indications include the following:

- The diagnosis remains uncertain after initial history and physical exam.
- The patient's symptoms do not correlate with objective physical findings.
- The patient fails to improve with treatment.
- Clinical trials.
- Surgical intervention is planned.

The last indication is by far the most controversial.

CONTROVERSIES OF URODYNAMICS

Urodynamic testing has a number of pitfalls: (1) lack of standardization of values and parameters being evaluated, (2) the artificial testing settings may not represent what happens to the patient during normal daily activities, (3) inconsistent reproducibility within the same patient, (4) the wide range of physiologic values in normal asymptomatic patients (5) false negatives; the absence of a specific abnormality during urodynamic testing does not necessarily exclude its existence, and (6) not all abnormalities found during urodynamic testing are clinically significant.^{19,20}

EFFECTIVENESS OF URODYNAMICS

Patient symptom history is not by itself an accurate tool for diagnosing or distinguishing between stress or urge urinary incontinence.²¹ A Cochrane review performed in 2002 to determine if treating according to urodynamic-based diagnosis led to improved outcomes when compared to treatment based on history and examination, found insufficient evidence to draw any reliable conclusions.²²

WHAT DO THE EXPERTS SAY?

Numerous governing bodies have provided opinions on the indications for urodynamic testing. In 1996, the Agency for Healthcare Research and Quality recommended in their practice guidelines that in the management of urinary incontinence, multichannel urodynamic testing be reserved only for women with "complicated diagnostic situations or involved therapeutic plans."²³

In 2003, the Society of Obstetricians and Gynaecologists of Canada made similar recommendations in their guideline entitled "The evaluation of stress incontinence prior to primary surgery." They suggested that preoperative urodynamic testing was not necessary in women with pure stress incontinence that could be objectively demonstrated in whom all appropriate preoperative investigations have been performed.²⁴ The American College of Obstetricians and Gynaecologists agree with the Agency for Healthcare Research and Quality and SOGC in their 2005 practice bulletin.²⁵

The International Continence Society, for their third annual International Consultation on Incontinence, make two recommendations for clinical practice.²⁶ They suggest that non-invasive urodynamics, such as an urolog, post-void residual, and uroflowmetry, are recommended for all incontinent patients. Invasive urodynamic studies, however, are not necessary prior to treatment when the type of incontinence is clear and there are no complicating factors involved.

In 2003, the Royal College of Obstetricians and Gynaecologists in the United Kingdom recommended that "prior to performing irreversible bladder-neck surgery, it would appear to be beneficial to have assessed objectively the type of incontinence and the presence of any complicating factors."²⁷

SUMMARY

Controversies remain with respect to the indications for urodynamic testing. Urodynamics is an objective tool that is invaluable, when used by experts trained in its interpretation, in clarifying confusing or complex urinary tract symptoms. It is also invasive and can be embarrassing for

patients. It is not cost-effective to apply a universal policy of urodynamic testing. Experts agree that it is not necessary to perform urodynamic testing on patients prior to instituting conservative management but that it is necessary to perform these tests on any patient undergoing repeat incontinence surgery. To date, no published studies have demonstrated that the performance of urodynamic testing improves clinical outcomes; however, it is undoubtedly true that urodynamic testing is an indispensable tool in the evaluation of urinary tract complaints. Further research is needed to better elucidate the most appropriate patient criteria for urodynamic testing.

Recommendations were made according to the guidelines developed by the Canadian Task Force on Preventive Health Care.²⁸

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