Basic understanding of urodynamics

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Abstract

Urodynamic investigations can provide an explanation for lower urinary tract symptoms, such as incontinence. A careful history and examination should be performed prior to urodynamic testing. Some urodynamic investigations are non-invasive, such as flow studies, while the majority used in the diagnosis of urinary symptoms are invasive, involving urethral catheterisation and placement of an abdominal pressure catheter. Bladder and abdominal pressures are measured during filling and voiding. Urodynamic equipment calculates detrusor pressure by subtracting abdominal from bladder pressure (pves − pabd = pdet). Urodynamics should be performed in accordance with standards published by the International Continence Society. Terminology used for lower urinary tract symptoms should also comply with International Continence Society standards. There is little morbidity associated with urodynamics, apart from a low risk of urinary tract infection and occasional discomfort. However as they are invasive, all clinicians referring patients for urodynamics should appreciate their use and application for clinical management.

Keywords comprehension; cystometry; urodynamics

Introduction

Urodynamics is the term that encompasses a number of tests used in the investigation of women with lower urinary tract symptoms (LUTS). Some are non-invasive, such as flow studies, but the majority are invasive, requiring urethral catheterisation and placement of an abdominal pressure catheter in the vagina, rectum or stoma. Urodynamic investigations should not be performed blindly, but should be carried out to inform management and answer a specific question. This is termed the "urodynamic question". Particular tests are used to answer specific urodynamic questions. For example, flow studies are performed if the patient is complaining solely of voiding dysfunction, whereas cystometry, filling and voiding, is performed if the symptoms are those of incontinence. Prior to attending for urodynamic testing patients should be given an information leaflet about what to expect during testing and any questions should be answered.

The International Continence Society (ICS) sets definitions and standards for urodynamic investigation. It publishes standardisation reports that are available online and should be adhered to. Non-invasive urodynamic tests, such as uroflowmetry, do not have any associated morbidity. Invasive tests, involving urethral catheterisation, have a recognised risk of urinary tract infections of between one and 10%. Most centres do not advocate the prophylactic use of antibiotics for cystometry apart from in specific indications, for example renal transplant patients.

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Background

Before embarking on urodynamic investigation, the urodynamic question should be identified, i.e. what are the symptoms that require diagnosis. The type of urodynamic investigation required to provide a diagnosis will be determined by the urodynamic question. For the majority of women attending gynaecology clinics the question will be one concerning storage symptoms, such as incontinence or urinary urgency, hence filling and voiding cystometry will be the appropriate test.

Urodynamic question

The urodynamic question is formulated from a careful history, examination and completion of a frequency/volume chart (for at least three days). It is also vital that urine dipstick is performed before urodynamics to exclude urinary tract infections and diseases, such as bladder cancer, which can present with LUTS.

A urodynamic history should include information concerning urinary symptoms, their duration and their effect on quality of life. The degree of incontinence, its provocation and the number of pads used should be noted, as should any coexisting voiding difficulties. Relevant past medical history, including surgery, and neurological diseases should be included, as well as parity and obstetric history. The patient's drug history should be taken prior to urodynamic investigation as some medication, for example, diuretics can affect urinary symptoms such as frequency. The frequency/volume chart will contain information about voiding frequency, as well as voided volumes. On its own it can be used as a diagnostic tool, e.g. to differentiate between nocturnal frequency and nocturnal polyuria.

Urodynamic investigations

Urodynamic investigations include:

Non-invasive

Uroflowmetry (with or without measurement of residual urine): flow studies are used to investigate voiding dysfunction. The two most common flowmeters use either a rotating disc or a weight transducer. The flowmeter measures the volume of urine voided and the flow rate (ml/sec). Flow pattern is recorded and is an important diagnostic tool, with patterns suggestive of obstruction, detrusor underactivity and straining.

The normal female maximum flow rate should be more than 15 ml/sec with a "bell shaped" curve and no residual urine, measured by ultrasound scanning after voiding (Figure 1). Ideally more than one flow should be performed to diagnose voiding dysfunction, as the initial flow can be affected by anxiety about voiding into a flowmeter.

Also ideally the voided should be of reasonable volume, similar to the voided volumes recorded on their bladder diaries.

Invasive

Standard cystometry (filling and voiding)

Filling cystometry — filling cystometry involves the placement of a urethral catheter with either an internal or external

pressure transducer. Bladder pressure (pves) is recorded while the bladder is filled naturally or by means of a pump. Normal saline is usually used as the filling medium. An abdominal catheter is used to record abdominal pressure synchronously; this can be placed rectally, vaginally or in a stoma. Urodynamic equipment records vesical and abdominal pressure (pabd) and calculates the detrusor pressure (pdet) from these (pves – pabd = pdet).

Voiding cystometry – uroflowmetry provides information about voiding patterns and flow rates; however, additional information concerning voiding pressures is obtained with voiding cystometry. This additional information enables more accurate diagnosis of voiding dysfunction.

Filling and voiding cystometry – practical points

Equipment checks

Before the test commences various checks should be performed on the urodynamic equipment to ensure good quality control. The vesical and abdominal lines should have been zeroed to atmospheric pressure and, if external transducers are used, the external transducers should be at the ICS agreed reference level, the superior aspect of the symphysis pubis, during the test.

Urinalysis

This should be performed prior to cystometry, as coexisting urine infection could be exacerbated by catheterization and bladder function can be altered by infection.

At the start of cystometry

The patient is catheterized with either a double lumen catheter or two single lumen catheters. One line is for pressure measurement the other is for filling the bladder with fluid. The abdominal line can be placed rectally, vaginally or in a stoma. If a water filled system is used, the lines are flushed to remove any air bubbles that might be in the system. Pressure recordings of the abdominal and vesical lines should be within the ICS normal accepted range (see below). An initial cough check should be performed to check that the lines are recording accurately. When all of these checks have been performed the test can start.

Filling speed

There is no universally agreed filling speed, but a filling speed of 50 mls/min is most commonly used. Faster filling rates can affect bladder function and slower rates may be required in someone with irritative symptoms or a neurogenic bladder.

Filling position

There is no ICS recommended filling position, but, in order to reproduce symptoms, filling is best performed in the upright position, sitting or standing.

During the test

During the test close monitoring of pressure and repetition of the cough test, once a minute, is necessary to ensure that quality is maintained during the test.

It may be helpful to annotate events during the test to aid interpretation, e.g. change in position.

The bladder capacity recorded during cystometry, cystometric capacity, should be similar to those on the frequency/volume chart, i.e. normal for the patient. Filling is stopped when the patient feels their bladder is full. During filling there should be a dialogue with the patient, so that bladder sensation can be noted with cystometric measurements. The volume at which the first desire to micturate (FDM) and strong desire to micturate (SDM) are felt should be noted. Additional symptoms, such as urgency, should be recorded along with any provocation that caused them. To reproduce symptoms various provocative manoeuvres should be performed, including running taps to provoke urgency, and coughing, while sitting and standing, to demonstrate incontinence. For patients whose incontinence is caused by exercise, short exercise regimes, including star jumps, can be performed in addition. The cause of any observed incontinence should be recorded, for example detrusor overactivity incontinence or urodynamic stress incontinence. The degree of provocation needed to produce stress incontinence is worth noting to

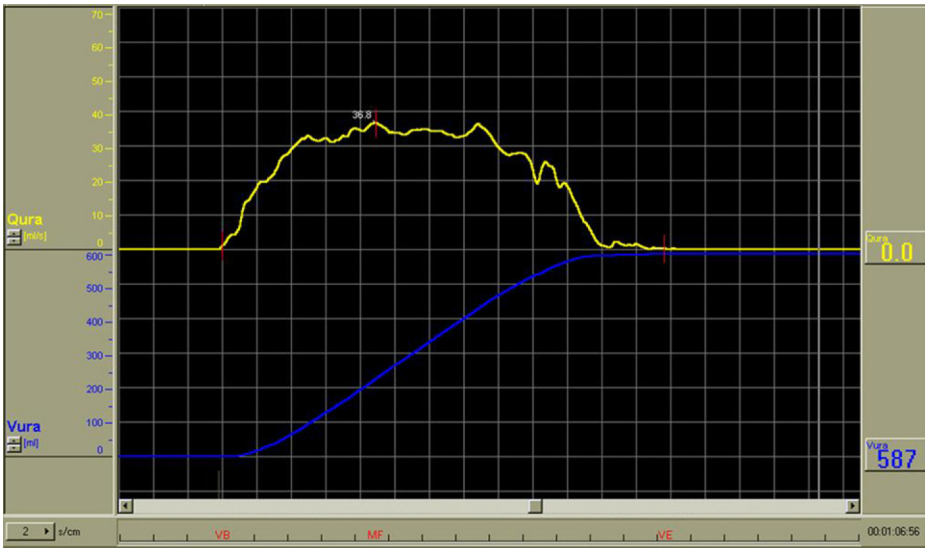

Figure 1 This uroflowmetry trace shows a normal flow curve.