

The use of urodynamic studies to help sort out bladder problems

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Introduction

Urodynamic studies are performed as part of the clinical investigation of selected patients with lower urinary tract dysfunction. These studies provide the clinician with information about lower urinary tract function and allow a more scientific approach to the management of the individual patient. Although one might consider a simple ultrasound scan (to measure a post-micturition bladder residual) or a urine flow test study as being a form of 'urodynamic' investigation, the term 'urodynamic study' is usually reserved for the more complex filling and voiding pressure studies - i.e. a cystometrogram (CMG). These studies are usually combined with X-ray screening during the test and the data can be stored on video to enable playback at a later date. This latter study is referred to as a video cystometrogram (VCMG) and is the most common form of urodynamic investigation. More specialised urodynamic studies include ambulatory urodynamic studies (where the bladder is allowed to fill naturally with the patient's own urine), and upper tract studies (where the renal pelvis is filled directly via nephrostomy to investigate situations of equivocal pelvi-ureteric obstruction)¹. This editorial will concentrate on situations involving video-urodynamic studies.

The physiology of micturition and a urodynamic classification of dysfunction

The normal bladder is required to function not only as a reservoir for urine (storage phase of micturition) but it is also required to empty in a co-ordinated and efficient manner in socially acceptable situations (voiding phase of micturition). The properties required of a normal bladder during the storage phase are the accommodation of increasing volumes of urine at a low intravesical pressure, with normal sensation, a closed bladder outlet and no involuntary bladder contractions (detrusor instability). During the voiding phase, the bladder is required to generate a co-ordinated detrusor contraction of adequate magnitude and duration to enable emptying. This should be combined with the simultaneous relaxation of the smooth and striated urinary sphincters and there should be no anatomical obstruction.

Video-urodynamic studies are intended to evaluate all aspects of the two phases of micturition.

The questions posed during the storage phase of micturition are:

- is there normal or poor compliance
- normal, reduced or increased sensation
- a competent or incompetent bladder outlet
- the presence or absence of abnormal involuntary detrusor contractions?

During the voiding phase:

- is there a normal, low or high voiding pressure
- complete or incomplete emptying
- co-ordinated or dyssynergic voiding
- a normal or obstructed bladder outlet?

The International Continence Society (ICS)² has encouraged a classification of lower urinary tract dysfunction based on urodynamic investigation and this is summarised in the table.

When is urodynamic investigation indicated?

Situations where urodynamic evaluation can aid in the clinical management of the patient include the investigation of incontinence and troublesome symptoms of urinary frequency, urgency and suprapubic pain. Urodynamic studies are particularly important when lower urinary tract dysfunction is associated with upper tract abnormalities such as reflux and hydronephrosis. The prime objective of the study is to reproduce the clinical situation that is being investigated and it is often necessary to tailor the technique in order to obtain this pertinent information. Although incontinence and irritative urinary symptoms are foremost on the patient's mind, the prime objective of the clinician is to preserve renal function. Other goals of management include:

- the control of urinary infection
- adequate storage of urine at a low intravesical pressure
- efficient emptying at reasonable voiding pressures
- to provide, overall, a situation which is socially acceptable
- where possible, without the need for a catheter or urinary stoma

It is convenient to classify lower urinary tract dysfunction into neuropathic (secondary to a neurological condition) or non-neuropathic (where there is no overt neurological aetiology). Neurological conditions may be classified according to the level of neurological damage³. Peripheral nerve damage can occur following radical colo-rectal or gynaecological surgery and may result in an atonic bladder^{4,5}. When conditions such as multiple sclerosis affect the suprasacral region (i.e. above the sacral micturition reflex centre), the result is often an unstable bladder and unco-ordinated and inefficient emptying⁶. Conditions that occur above the pontine micturition centre such as with Parkinson's disease⁷ or following a stroke, often results in a lack of voluntary inhibition of micturition so that although co-ordinated voiding occurs, it happens without the patient being aware of it and results in incontinence. Traumatic spinal cord injuries may occur at any level

and the resultant dysfunction will depend on the level of the damage and the extent of the damage at that level⁸.

Non-neuropathic conditions that may require urodynamic evaluation include the evaluation of female incontinence. Urodynamic studies can determine the type of incontinence (urge-, stress-, mixed or continuous incontinence) and thereby help the clinician decide the most appropriate treatment strategy. It is certainly advisable to perform a full urodynamic assessment prior to continence surgery⁹ and also in situations where bladder reconstruction is being considered¹⁰. Urodynamic assessment may be indicated in certain situations of equivocal prostatic bladder outflow obstruction and can help differentiate between the high pressure/low flow scenario (where patients do well following prostate surgery), and the low pressure/low flow situation (where patients do not usually benefit from prostate surgery)¹¹. The management of other conditions such as the painful bladder¹² and the urge syndrome¹³ may also be helped by formal urodynamic evaluation.

The main indication for urodynamic evaluation in the paediatric patient is in the evaluation of the neuropathic bladder (particularly that caused by spina bifida). It is very important for the clinician to determine whether the patient has a 'hostile' bladder that may cause upper tract damage and renal impairment if left untreated and urodynamic studies form the basis for this assessment¹⁴. Urodynamic studies may also be helpful in children with diurnal incontinence, in children where primary empirical treatment has failed and also where there is a suspicion of severe dysfunctional voiding as evidence by residual urine, a thickened bladder wall and upper tract dilation¹⁵. Overall, however, urodynamic evaluation in children is rarely indicated before the age of five years.

Conclusion

The initial evaluation of a patient with symptoms of lower urinary tract dysfunction should include a full history and examination and baseline non-invasive tests.

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It is well-known that there is a poor correlation between symptomatology and bladder dysfunction¹⁶ and therefore in certain situations, patients may also warrant a formal urodynamic assessment. It is also well-known that treatment based on signs and symptoms alone is less effective than treatment based on urodynamic testing¹⁷. An exact diagnosis is especially important when invasive and potentially irreversible therapy is being considered. Armed with more detailed information about the function of the lower urinary tract, the clinician should be better able to advise on specific treatment measures and also be in a position to predict their likely outcome.

Table - The International Continence Society Classification

Storage Phase	Voiding Phase
Bladder function	Bladder function
Detrusor activity	Detrusor activity
- normal	- normal
- overactive	- underactive
Bladder sensation	- acontractile
- normal	
- hypersensitive	Urethral function
- hyposensitive	- normal
- absent	- obstructive
Bladder capacity	
- normal	
- high	
- low	
Compliance	
- normal	
- high	
- low	
Urethral function	
- normal	
- incompetent	

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