Good Urodynamic Practice

Keys to Performing A Quality UDS Study

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KEYWORDS

• Urodynamics • Videourodynamics • Transducer catheters • Plausibility • Artifacts

KEY POINTS

- The clinician should identify the clinical questions that the urodynamics (UDS) study is intended to answer, properly design the study to answer those questions, and be able to adapt the study as necessary.
- The UDS study should be performed interactively and with continuous communication with the patient to confirm that their symptoms have been reproduced.
- Careful observation of signals is important to assess their qualitative and quantitative plausibility, such that artifacts can be recognized and corrected during the study.
- The quality and results of the UDS study are operator-dependent and are only as good as the clinician who performs and interprets the study.
- A well-done UDS study may be invaluable in the diagnosis of lower urinary tract conditions, or assessing prognosis and response to therapy, or directing management; however, a poorly done study may be misleading and potentially harmful.

INTRODUCTION

Urodynamics (UDS) is a collection of measurements of bladder, urethral, and pelvic floor muscle function with or without fluoroscopy (videourodynamics or VUDS) in an attempt to evaluate and diagnose functional, and sometimes anatomic, disorders of the lower urinary tract. The goal of performing UDS studies in many cases is to reproduce a patient's lower urinary tract symptoms while making precise measurements to identify the underlying causes for their symptoms.[1] In other cases, UDS are performed to assess prognosis or the results of prior therapy or to direct optimal therapy. UDS studies are invasive, uncomfortable, and potentially morbid. It is therefore imperative to optimize the quality of the study to maximize the useful information that can be obtained. When possible, UDS should be performed interactively with the patient, which includes confirmation with the patient throughout the study that their symptoms or conditions have been reproduced during the test.

COMPONENTS OF UDS

UDS comprises different components that can be used individually or collectively to gain information about urine storage and evacuation. In performing a quality study, a working knowledge of each component and their role is important to understand.

Postvoid Residual

Postvoid residual (PVR) is an assessment of bladder emptying and can be performed by ultrasound/bladder scan or catheterization. An elevated PVR

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can be an indication of a bladder-emptying problem, but cannot distinguish the cause of the problem, such as bladder outlet obstruction (BOO) or detrusor underactivity or a combination of both. PVR can be assessed using ultrasound, either in real-time or by portable bladder scan, or via catheterization. In obese patients or those with ascites, or prior lower abdominal surgery, bladder scan is inaccurate and real-time ultrasound or catheterization is preferred.[2,3]

Uroflowmetry

Uroflowmetry is a noninvasive measurement of the rate of urine flow over time. It can also be used to assess bladder emptying but cannot be used alone to diagnose the cause of an abnormality. For example, a low maximum flow and plateaued pattern on uroflowmetry cannot distinguish between BOO and impaired detrusor contractility. Other patterns are easily recognized but are also not completely diagnostic: a superflow pattern implies decreased urethral closure forces but may be due to volitional abdominal straining, whereas a saw-toothed pattern suggests Valsalva voiding but may be due to intermittent voluntary or involuntary contraction of the external sphincter or pelvic floor (Fig. 1). It is imperative in all circumstances to query the patient as to whether their usual voiding pattern or behavior was accurately reflected on the noninvasive uroflowmetry study.

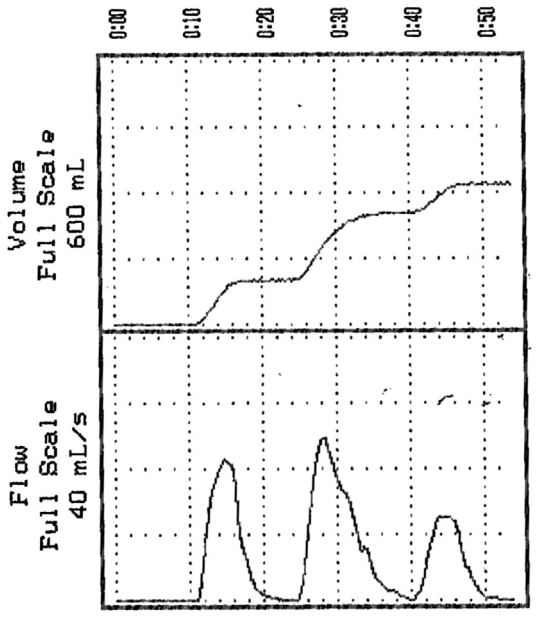

Fig. 1. Uroflowmetry pattern suggestive of Valsalva voiding or pelvic floor dysfunction.

The most commonly used uroflowmeters are mass flow meters, such as those that use a gravimetric method or a rotating disc method. Uroflowmeters that use a gravimetric meter operate by measuring the accumulated weight of the collected fluid or by measuring the hydrostatic pressure at the bottom of a collection cylinder. Rotating disc instruments use the voided fluid directly on a rotating disc to increase the inertia of the disc. The power required to keep the disc rotating at a constant rate is measured and is proportional to the mass flow rate of the fluid.[4]

Filling Cystometry

Filling cystometry is a measurement of the pressure/volume relationship during bladder filling. It is performed using measurements of intravesical pressure (Pves) and intra-abdominal pressure (Pabd) to calculate the detrusor pressure (Pdet = Pves – Pabd). The key features of bladder storage function obtainable with filling cystometry include sensation, cystometric bladder capacity, compliance, and presence of involuntary detrusor contractions or detrusor overactivity (DO).[5] Leak point pressures, an assessment of urethral function, are also assessed during filling cystometry. These features will be discussed in greater detail later.

Pressure-Flow Study

The relationship between bladder pressure and urine flow rate is measured during bladder emptying.[6] The pressure-flow study is currently the only method of diagnosing BOO and/or impaired detrusor contractility (or detrusor underactivity). There are 3 fundamental voiding states that can be diagnosed by the pressure-flow study, which include obstruction, impaired detrusor contractility, and normal.[5] During the pressure-flow urodynamic study (PFUD), several parameters are assessed: detrusor contractility, coordination of the detrusor and outlet, bladder emptying, and the presence or absence of UDS obstruction.

Electromyography

Electromyography (EMG) is the measurement of the electrical signals produced by the depolarization of muscle membranes.[6] EMG studies can be performed using either surface electrodes or needle EMG, which is more invasive, to measure electrical activity from the pelvic floor muscles. EMG is measured throughout the UDS study during both the filling and the emptying phases. The EMG tracing is used to assess the coordination or discoordination of the external urethral sphincter and the detrusor contraction.