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Practical urodynamics

Urodynamic diagnosis of female bladder outlet obstruction☆

CME Credits

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1. Introduction

Female bladder outlet obstruction (BOO) remains a controversial topic in terms of definition and diagnosis. It is a condition that is far less common in women than in men and has an estimated incidence of 2.7–8%.[1,2] The etiology for organic BOO or anatomic BOO (but not including functional BOO) is more diverse in women because of various anatomical or iatrogenic changes affecting vaginal support, the urethra, and/or the bladder. Some changes such as prolapse are related to aging, whereas other changes are related to urethral pathology or previous surgeries (e.g., sling procedure, urethropexy). Furthermore, the urethral anatomical sites for BOO can be further subcategorized by extrinsic compression, urethral wall conditions (e.g., fibrosis, urethral diverticulum), or luminal factors (e.g., stricture disease).[3] Owing to the complexity of etiology and nonspecific voiding symptoms, the diagnosis of female BOO requires a high index of suspicion and recourse to a variety of modalities, and includes a thorough history, questionnaires, noninvasive flow and residual assessment, physical examination, cystoscopy, imaging, and urodynamic or videourodynamic studies.

2. Urodynamic diagnosis of female BOO

Urodynamic diagnosis for male BOO is based on the concept of high pressure–low flow voiding dynamics. This hallmark to diagnose obstruction is the same in women, although voiding pressure, flow rate, and other criteria for male BOO do not seem to always apply to women. In addition, when BOO is diagnosed in women, the site of obstruction must be confirmed by a voiding imaging study, either during a voiding cystourethrogram focusing on lateral voiding views of the bladder neck and urethral regions, or confirmed by videourodynamics, when available.

A nomogram would ideally assist in the interpretation of pressure–flow data. Reliable normative data exist in younger patients, but has not been reported in older women because so few patients are symptom-free in that age group.[4] The best attempt at a nomogram originated from Groutz and Blaivas[5] who used voiding information from two separate events: (1) a noninvasive flow for maximum flow rate (Qmax) and (2) maximum detrusor pressure during voiding (Pdet.max) that was obtained during invasive testing. Since its publication, the nomogram has been used in several studies and in general has been found to overestimate obstruction.[6]

Because of the challenges posed by a nomogram in the absence of definitive normative values in older women, other scientists considered a different approach that uses cut-off values that are based on receiver operating characteristic (ROC) curves to define Qmax and detrusor pressure at maximal flow rate (PdetQmax) values beyond which a diagnosis of BOO should be entertained.[7] Therefore, if Qmax drops below 12 mL/second while at the same time the PdetQmax rises above 25 cmH_2O, the pressure–flow relationship threshold has been reached and calls into question the presence of BOO. If the Qmax drops lower or PdetQmax rises higher than these threshold values, the likelihood of BOO increases. In fact, in several studies of BOO patients, voiding pressures can reach the range of 30–50 cmH_2O with concomitant Qmax values at 10 mL/second or less. In addition to these cut-off values, Nitti and coworkers[8] recommend using videourodynamics to determine the site of obstruction and exclude dysfunctional voiding in nonneurogenic patients.

Despite a large body of literature, the definition of BOO remains elusive at times and no consensus exists to precisely determine BOO in women. Some of the most challenging situations arise when the patient is unable to void during the study or voids by straining only. In these instances, a diagnosis of BOO cannot be reached urodynamically and other factors need to be considered to establish a diagnosis.

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3. Urodynamic testing to evaluate for BOO in routine practice

Urodynamic study standardization documents have been published, including good urodynamic practice guidelines.[9] The Urinary Incontinence Treatment Network (UITN) also published urodynamic testing and interpretation guidelines for a urodynamic study (UDS) in women with stress urinary incontinence.[10] Our current procedure for the UDS was inspired by the UITN experience because we were a participating site. After a noninvasive flow test has been completed, our procedure entails the placement of a 6 Fr double-lumen urethral catheter. This small catheter reduces the effect of catheter size on voiding parameters. Once in place in the bladder, the catheter is placed to drainage to measure the post-void residual. A 10 Fr rectal balloon catheter is also positioned to measure abdominal pressure. The filling rate is 50 mL/minute, but can be reduced to 25 mL/minute, or even 10 mL/minute in women with low volume early detrusor overactivity or small bladder capacity. Women can be standing for stress efforts, but are always in a sitting position to void. Annotations during filling and voiding phases conform to International Continence Society (ICS) recommendations. The accuracy of catheter placement and recording is verified several times during filling, and verified prior to and after voiding by having the patient cough. During these coughs, a parallel tracking of the tracings on the vesical and the abdominal pressure lines should be present. A set of standardized instructions are delivered to the patient during the test so that all studies can be compared in between patients. A fill-void process is repeated if the first run is inconclusive or affected by a patient's apprehension of experiencing discomfort during voiding. Electromyography (EMG) patches are commonly used to document pelvic floor relaxation and exclude dysfunctional voiding. A noninvasive flow is sometimes repeated at the end of the study, after refilling the bladder to a comfortable volume and removing all catheters. This is important when the patient has been unable to void with the catheter in place or when a noninvasive flow could not be obtained at the start of the procedure because the patient arrived with an already empty bladder.

To illustrate the variety of underlying pathology leading to BOO in women, we selected a series of imaging studies that suggested a BOO site. We also give a brief history.

4. Case reports

4.1. Case 1

After undergoing placement of a tension-free vaginal tape in 2005, this patient reports having had dryness initially. However, after a few years, she noticed the gradual onset of voiding dysfunction that required straining to void, a feeling of incomplete emptying, and a worsening of urgency with occasional urge incontinence. Her lateral voiding cystourethrogram identified a significant distortion and kink in the mid-urethra[11] with proximal urethral and bladder neck ballooning (Fig. 1).

4.2. Case 2

After a series of office urethral dilations in her 20s, this woman experienced frequent urinary tract infections that were particularly related to intercourse. Her cystogram revealed very tight distal narrowing with a largely globular and distended urethra proximal to the narrowed site (Fig. 2). Urethral dilation under anesthesia corrected the obstruction and resolved her recurrent urinary tract infections.[12]

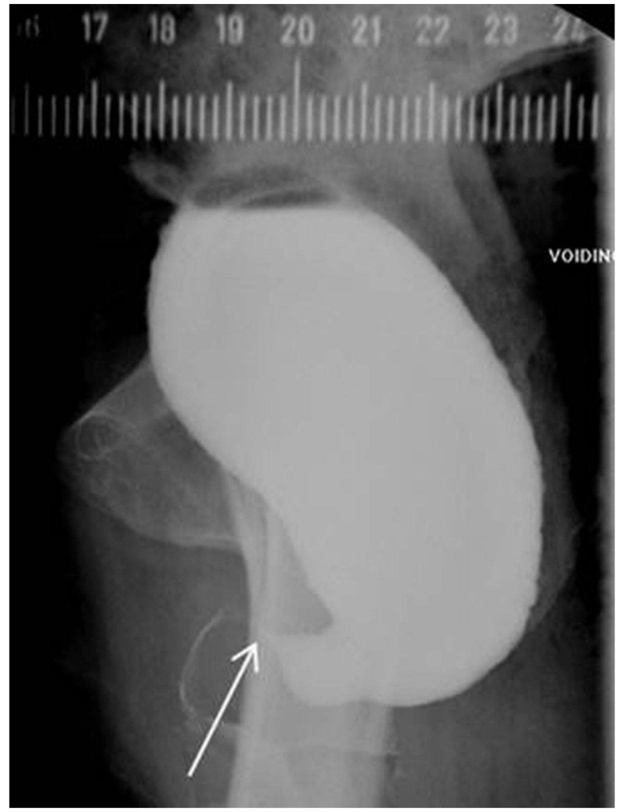

Fig. 1. Mid-urethral kink from suburethral tape, with proximal urethral and bladder neck ballooning.

4.3. Case 3

After undergoing the placement of a suburethral tape, this woman initially experienced retention, followed by voiding dysfunction that included slow stream, straining, incomplete emptying, and frequent urinary tract infections. Her urethra on the voiding cystourethrogram indicated a proximal distortion due

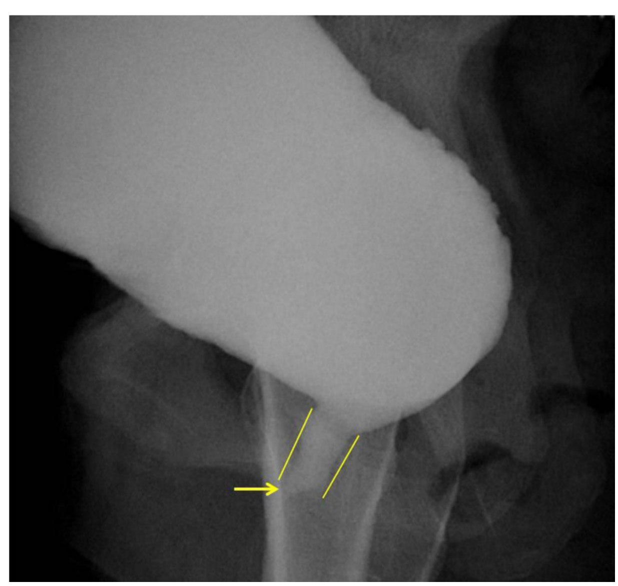

Fig. 2. Distal urethral narrowing from intramural fibrosis with largely distended urethra proximally.

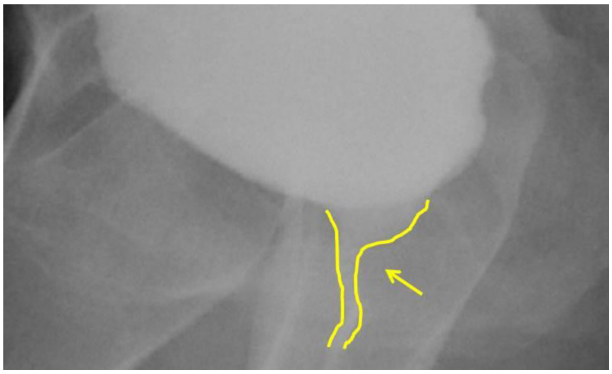

Fig. 3. Suburethral tape migration or improper placement kinking the proximal urethra with wide open bladder neck and bladder trabeculations.

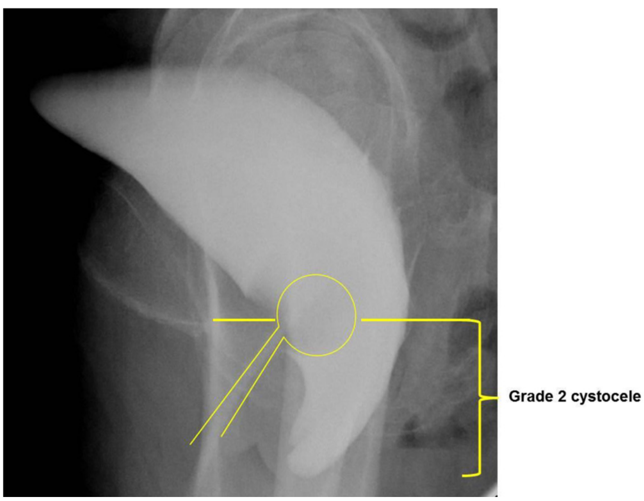

Fig. 4. Well supported urethra after Burch suspension and secondary cystocele creating an obstruction at the urethro-vesical junction.

to the tape that had migrated proximally, which was confirmed during its surgical removal (Fig. 3).

4.4. Case 4

After undergoing a Burch bladder neck suspension, this woman did well for several years, until she noticed a vaginal bulge, which was accompanied by the need to reduce the bulge or voiding standing at times to empty her bladder better. She also noticed an increase in urinary frequency and nocturia, and she frequently had to double void. Her cystogram demonstrated a well-supported urethra with a verticalized trigone from an associated cystocele that resulted in obstruction at the urethrovesical junction (Fig. 4).

5. Discussion

The urodynamic diagnosis of BOO in non-neurogenic women remains challenging because of the diversity of conditions that potentially leads to BOO in women, the large variety of presenting symptoms, and the lack of a well-established age-based nomogram. An imaging study during voiding is paramount to confirm the diagnosis by establishing the site of obstruction along the urethra. Such findings are crucial prior to considering any surgical correction.

Conflicts of interest

The authors declare that they have no financial or non-financial conflicts of interest related to the subject matter or materials discussed in the manuscript.

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