Postoperative urinary retention in females

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INTRODUCTION

Postoperative urinary retention (POUR) refers to impaired voiding after a procedure despite a full bladder that results in an elevated postvoid residual [1]. It is a subtype of female voiding dysfunction, which is defined by the International Continence Society and the International Urogynecological Association as an "abnormally slow and/or incomplete micturition based on symptoms and urodynamic investigations" [2]. This topic will review the etiology, diagnosis, and management of POUR in female patients.

INCIDENCE

The incidence of POUR in the general surgical population (female and male) is reported from 4 to 13 percent [3-5]. In two studies, the incidence of POUR after cesarean delivery done with epidural anesthesia ranged from 23 to 28 percent. Estimates of POUR after pelvic surgery range from 2 to 43 percent [6].

RISK FACTORS

Meta-analysis and observational studies have identified the following perioperative risk factors for POUR in the general population (female and male) [1,3,7]:

- Age over 50 years (doubles the risk of POUR [1])

- History of preexisting urinary retention
- Concurrent neurologic disease
- Administration >750 mL of intravenous fluid
- Duration of surgery >2 hours
- Intraoperative anticholinergic medication use (eg, atropine, glycopyrrolate)
- Use of regional anesthesia
- History of prior pelvic surgery
- Incontinence surgery or radical pelvic surgery

Some risk factors can be lessened. For example, an indwelling bladder catheter is placed for individuals with epidural or patient-controlled anesthesia or in patients with a vaginal pack. Individuals at risk for constipation are counseled about maintaining a bowel regimen, as constipation can worsen voiding dysfunction.

CAUSES

Both anesthesia and surgery can disrupt normal voiding physiology [8]. POUR following pelvic surgery in female patients is typically caused by bladder (detrusor) dysfunction, urethral obstruction, or failure of pelvic floor relaxation (table 1).

Abnormal bladder function — A description of normal bladder physiology can be found in the following illustration (figure 1). In contrast, abnormal bladder function results from multiple causes including:

Preexisting voiding dysfunction — Patients with preexisting voiding dysfunction will often have worsening of their symptoms following surgery due to the effects of anesthesia, surgical intervention and tissue edema, medications, lack of ambulation, and pain. Preoperative urinary retention (postvoid residual [PVR] >150 mL) is a risk factor for failed voiding trials after pelvic floor surgery [9]. An exception to this observation is repair of advanced pelvic organ prolapse (POP) where restoration of normal pelvic anatomy improves the passage of urine [10].

Female patients with preoperative voiding dysfunction are counseled about the increased risk of POUR and may be taught clean intermittent catheterization prior to surgery.

Anesthetic agents — Conduction anesthesia (epidural, spinal, and combined spinal/epidural) blocks the sensory and motor nerve impulses of the sacral spinal cord, which suppresses the micturition reflex, decreases detrusor contractions, and

increases bladder capacity. A spinal injection of bupivacaine results in seven to eight hours of neural blockade. The bladder will start to regain function once the spinal block regresses to S2 or S3 sacral segments, although a full return to normal function occurs 1 to 3.5 hours after the ability to ambulate returns [1,11]. The addition of opioids to epidural anesthetics increases the risk of POUR [12].

A 2009 meta-analysis involving more than 18,000 patients reported higher rates of POUR with conduction blockade as compared with general anesthesia (23 versus 17 percent) in a general surgery population [1]. Peripheral nerve blocks were associated with a lower incidence of POUR (<5 percent) due to the agent's confinement to the region of injection and the short half-life [1].

Nerve injury secondary to surgery — Lower urinary tract dysfunction resulting from surgical nerve injury varies with the type of procedure. Lower urinary tract dysfunction has been reported in 20 percent of patients following radical hysterectomy and in 68 percent of patients following a low anterior resection [13]. The main nerves at risk are the parasympathetic and sympathetic nerves in the pelvic and hypogastric plexus, respectively.

Compared with radical hysterectomy, hysterectomy for benign disease has a lower risk of POUR because nerve injury is less likely [14]. The incidence of POUR is similar for total versus supracervical hysterectomy and for open versus laparoscopic approaches [15].

Cystotomy — Cystotomy is a common complication of gynecologic surgery which can mimic voiding dysfunction (see "Urinary tract injury in gynecologic surgery: Identification and management"). Female patients with cystotomy can have a variable presentation: The patient may be unable to void, void only small volumes, or void successfully with enough urine to "pass" a simple voiding trial. A female with an unrecognized cystotomy may lack voiding sensation, suprapubic pain, or an elevated PVR. The patient may complain of abdominal fullness, and physical examination may detect a fluid wave, fluid leakage across the incision site, or blood-tinged urine. Late findings include signs of peritoneal inflammation, ileus, genitourinary fistula, and sepsis.

Cystotomy can mimic voiding dysfunction because the perforation can act as a one-way valve that allows bladder filling. Upon voiding, the detrusor contraction forces the urine into the lower pressure peritoneal space rather than down the urethra, and the patient may have a very weak or absent urinary stream. Hysterectomy for

benign disease is associated with cystotomy rates of 0.9 to 2.9 percent, depending on the route of surgery [16-18]. Bladder perforation at the time of retropubic sling surgery occurs in 2 to 5 percent of procedures [19-21].

Cystotomy can be differentiated from urinary retention by irrigating the bladder with 75 mL to 100 mL of sterile saline through a bladder catheter and then attempting to withdraw the same amount of fluid. In a patient with a cystotomy, the volume withdrawn will be much lower than the volume instilled. The diagnosis can also be made by retrograde cystography or cystoscopy. Cystoscopy is often performed at the time of hysterectomy, incontinence surgery, and POP surgery to detect cystotomy, identify intravesical placement of sutures or mesh, and confirm ureteral patency [22].

Bladder overdistention injury — Acute prolonged bladder overdistention is defined as ≥120 percent of a normal bladder capacity for ≥24 hours [23,24]. Unlike chronic bladder distension, which often evolves slowly, bladder wall ischemia can occur as early as 30 minutes during acute overdistention.

Animal models have demonstrated that acute urinary retention with bladder overdistention can result in tissue ischemia from increased vesical pressure and reduced blood flow. Tissue ischemia induces elevation of intracellular Ca^{2+}, which affects smooth muscle contractility [25]. A subsequent decrease in intravesical pressure from catheterization increases blood flow, and oxygen tension leads to reperfusion. Reperfusion insult can occur through generation of reactive oxygen species, the production of oxidative stress, and release of inflammatory mediators such as tumor necrosis factor alpha [26]. This reperfusion injury and subsequent bladder inflammatory response may contribute to ongoing bladder dysfunction, as demonstrated by reduced oxidative impacts in the setting of an oxidase blocking agent [27].

Postoperative agents used for analgesia — Postoperative epidural analgesia (continuous infusion or patient-controlled) is associated with a higher rate of POUR than systemic analgesia via pump, intravenous or intramuscular routes (14.7 percent versus 3.1 percent, respectively) [1]. The incidence of POUR with epidural opioids increases when the epidural is continuous versus patient-controlled [28].

Urethral obstruction — Several etiologies of urethral obstruction can result in POUR:

Mechanical

Self-limited obstruction — Self-limited, typically transient causes of urethral obstruction include vaginal hematoma, vaginal packing, and tissue edema.

Sling obstruction — Incontinence procedures work by compressing the midurethra (midurethral slings) or the bladder neck (fascial slings and retropubic suspensions) during increases in intraabdominal pressure. Postoperatively, most patients have a slower urinary stream [29,30]. Obstruction caused by an incontinence sling may result in an even slower urinary stream, incomplete bladder emptying, and elevated PVR, which may persist for years [21,29-32]. Surgical lysis of sling may be required for treatment (see 'Persistent postoperative voiding dysfunction' below). We do not perform urethral dilation following synthetic sling placement because of concerns that it may increase the risk of urethral mesh erosion and lack of data supporting efficacy [33,34].

The incidence of POUR and subsequent treatment vary with the type of incontinence procedure. The procedures, ranked from lowest to highest rates of postoperative voiding dysfunction, are transobturator midurethral slings, retropubic midurethral slings, Burch urethropexy, and fascial slings [19,21,31,32,35-37].

Urethral foreign body — Symptoms of a foreign body in the urethra include pain with urination and a slow urinary stream that is prolonged and interrupted [38,39]. It is often not associated with gross hematuria. The diagnosis is made by direct visualization of the eroded sling or suture during cystoscopy and urethroscopy.

Pelvic organ prolapse — Significant anterior and/or apical POP can result in mechanical obstruction of the urethra and urodynamic evidence of voiding dysfunction [40]. In female patients with less severe forms of anterior/apical POP, the prolapse may be unrecognized at the time of an incontinence repair and, as a result, the urethra/bladder neck may become further kinked or obstructed by the incontinence repair. POP coexists with pelvic floor disorders, and the majority of studies involving individuals with advanced POP report increased rates of voiding dysfunction by symptoms, PVRs, and urodynamic investigations [41-44]. (See "Pelvic organ prolapse in women: Diagnostic evaluation", section on 'Urinary tract evaluation'.)

Urethral injury — Urethral injury (perforation) by suture or sling material can occur during surgery or develop over time. Symptoms of a foreign body in the urethra include pain with urination and a urinary stream that is slow, prolonged,

and interrupted [38,39]. Gross hematuria is often absent; however, gross hematuria following surgery should be immediately evaluated. The diagnosis is made by direct visualization of the sling or suture during cystourethroscopy.

Delayed urethral erosions by synthetic transurethral slings can develop years postoperatively [45]. Over time, foreign material in the urethra obstructs urine flow and can result in stone formation, recurrent urinary tract infection, and elevated PVR. A urethral perforation or foreign body requires surgical reconstruction of the urethra and removal of the causative agent. Possible etiologies of urethral erosion include excessive sling tension and postoperative transurethral dilation [33]. (See "Transvaginal synthetic mesh: Management of exposure and pain following pelvic surgery".)

Constipation — Constipation has been associated with incomplete bladder emptying in healthy children and adult females [46,47]. Besides the mass effect, rectal distention by stool may result in a recto-vesicourethral reflex: Rectal distention causes decreased bladder pressure and increased urethral tone [48].

Failure of pelvic floor relaxation — Failure to relax the striated muscles of the urethra and pelvic floor during normal voiding results in dysfunctional voiding and POUR, which can worsen after pelvic surgery [2]. These individuals typically use abdominal straining (Valsalva maneuver) to overcome the urethral outlet resistance [30]. The diagnosis is made with urodynamic testing. In a study of 76 female patients with urethral obstruction confirmed by video-urodynamics, nearly half had a functional obstruction of an otherwise normal urethra (failure of pelvic floor relaxation) [49].

CLINICAL PRESENTATION AND DIAGNOSIS

Symptoms associated with POUR include a slow urine stream, straining to void, a feeling of incomplete bladder emptying, suprapubic pressure or pain, need to immediately re-void, and position-dependent micturition.

We typically perform a retrograde voiding trial in patients with symptoms or risk factors for POUR. POUR is diagnosed by an elevated postvoid residual (PVR) volume (more than 100 mL) with bladder catheterization or ultrasound (see 'Retrograde voiding trial' below). The clinician may palpate the bladder on examination. However, bimanual examination only has a sensitivity of 14 percent for detecting a

bladder volume of greater than 50 mL [50]. The diagnosis rarely requires urodynamic testing.

In general, voiding symptoms, with the exception of slow urine stream, have poor sensitivity and specificity for predicting an elevated PVR in female patients [51,52]. In fact, those with an elevated PVR may void often due to their diminished bladder capacity and resulting urinary frequency. Obstructive voiding symptoms are also poorly correlated to urodynamic evidence of obstruction [53-55].

VOIDING TRIALS

Voiding trials, either retrograde or spontaneous, are performed to confirm adequate voiding and minimal postvoid residual (PVR). We suggest the retrograde method because it is more predictive of need for continued catheterization in randomized trials [56,57]. In addition, retrograde voiding trials were preferred by patients, had a greater ease of use in the outpatient setting, required fewer catheterizations, and took less time [57].

Retrograde voiding trial — In a retrograde voiding trial, the bladder is retrograde filled through the catheter with 300 mL of sterile saline or until patients say they are at maximum capacity (whichever occurs first). The bladder catheter is removed, and the patient is asked to void within 15 minutes. Success is typically defined as a PVR of 100 mL or less or the ability to void two-thirds or greater of the total bladder volume (total bladder volume = voided volume + PVR).

However, measurement of the PVR may not be a necessary component of the voiding trial. In a nonblinded randomized trial of 150 females who underwent pelvic reconstructive surgery and a retrograde voiding trial, rates of voiding trial failure, days of postoperative catheterization, and postoperative voiding dysfunction were similar whether or not the PVR was measured [58]. For those in the PVR group, success was defined as PVR of 100 mL, or less than half the voided volume if the PVR volume was greater than 200 mL. Success for the non-PVR group was defined as voiding at least 150 mL, or more than half of the instilled volume.

Spontaneous voiding trial — A spontaneous voiding trial consists of removing the bladder catheter after ensuring the bladder is completely empty. Patients are instructed to wait to void until they have a strong urge to void or four hours have passed. They are then prompted to void into a measuring collection device (hat).

The voided volume is measured and the PVR is obtained by a straight catheterization or ultrasound within 15 minutes of the completed void.

Success is typically defined as a PVR of 100 mL or less, or the ability to void two-thirds or greater of the total bladder volume (total bladder volume = voided volume + PVR). Patients are typically given two voiding trials in succession and they have to pass the second trial to go home without catheterization.

There is no standardized PVR for spontaneous voiding trials. Consensus exists that a PVR of 50 mL to 100 mL is normal, PVR greater than 200 mL is abnormal, and PVR between 100 mL and 200 mL requires clinical correlation [50,59].

Ultrasound assessment of bladder volume is easy to perform but has the following limitations:

- Measurements vary with body habitus
- Surgical incision may preclude placement of the transducer
- Volume models that make assumptions about the bladder shape may not be accurate for a specific patient
- The presence of ascites will lead to overestimation of bladder volume

MANAGEMENT

Unsuccessful voiding trial — Patients with unsuccessful retrograde voiding trials should undergo a physical examination to rule out self-limited causes of urethral obstruction. Patients with self-limited obstruction may need continued drainage with an indwelling catheter or clean intermittent catheterization (CIC) until the obstructing process resolves. (See "Placement and management of urinary bladder catheters in adults".)

Those with no evidence of obstruction on examination are taught CIC or have an indwelling bladder catheter placed. These female patients may be discharged home with short interval (days) follow-up in the office. A retrograde voiding trial may be repeated in the outpatient setting. Urodynamic testing is not indicated initially.

Medical therapy does not appear to be helpful in treating postoperative urinary retention [60].

Clean intermittent catheterization — If the need for catheterization continues following the immediate postoperative period, CIC is preferred for patients who have the mental capability, hand coordination, and body habitus to perform the procedure [61]. Clean (nonsterile) technique for intermittent catheterization has lower complication rates compared with indwelling urethral or suprapubic catheterization [62-70]. Systemic antimicrobial agents are not used in either short- or long-term catheterization settings as prophylactic antibiotic use has not been proven helpful and promotes the development of resistant bacterial strains [71-76]. These issues are discussed in detail separately. (See "Placement and management of urinary bladder catheters in adults".)

Frequency — Patients are instructed to record both their voided volumes and postvoid residual (PVR) volumes; this combined volume should not exceed the functional bladder capacity, or 400 to 600 mL, whichever is smaller. This often requires four to five catheterizations daily and varies based on fluid intake patterns and volume [77]. Patients who do not have normal bladder sensation may need to catheterize themselves at least once overnight to avoid an overdistention injury. Catheterization continues until PVRs are consistently less than one-third of the voided volume and total bladder volumes are not causing overdistention. If there is a concern that CIC cannot be performed four to six times a day, then an indwelling catheter should be placed.

Duration — The duration of bladder drainage through CIC or an indwelling catheter is based on clinical experience and the specific etiology. Individuals who cannot sense their bladder filling and who have undergone a radical pelvic procedure will often require bladder drainage for up to six months before an assessment can be made about the permanence of the dysfunction. In this case, CIC is a preferred modality for bladder emptying since sensory and motor function can be assessed over time.

Antibiotic prophylaxis — We do not use antibiotic prophylaxis for individuals with CIC or indwelling catheters as it has not been shown to be helpful. In a multicenter trial comparing nitrofurantoin prophylaxis with placebo for females with urinary retention after pelvic reconstructive surgery, rates of culture confirmed urinary tract infections were similar for the two groups within the first six weeks of surgery (17.3 versus 17.1 percent, relative risk 1.01, 95% CI 0.50-2.04) [78]. The study included individuals with both CIC and indwelling urinary catheters. Median duration of catheter use was four days.

Persistent postoperative voiding dysfunction — Female patients with persistent voiding dysfunction undergo a repeat examination. Office examination includes assessment of the pelvic floor tone and muscles to confirm appropriate pelvic floor relaxation, which is essential for efficient voiding and defecation. Female patients with significant pain or discomfort during examination may benefit by pelvic floor physical therapy that emphasizes pelvic floor muscle elongation and relaxation.

Examination of pelvic muscle tone — Our approach to the pelvic examination includes assessment of muscle tone and pain in both passive and contracted states, in the dorsal lithotomy position.

For the passive examination, we explain to the patient and set expectations by saying:

- "I am going to examine the muscles of your pelvic floor. You will feel pressure just like when I press on your thigh." While saying this, press firmly on the patient's anterior thigh.
- "I can press firmly and you feel pressure but not pain. However, if you had a cramp in your leg, that amount of pressure would be painful because the contracted muscle cannot extend."
- "I will do the pelvic examination and push on the pelvic muscles in the same way." Place one or two digits of your right hand approximately 8 cm into the vagina. Then press firmly on the muscles of the patient's right pelvic floor starting with the muscle attachment to the pubic bone at 12 o'clock and rotate to the coccyx. Firm pressure should be applied. Assess for excessive/imbalanced muscle tone and pain at each pressure point. The examination is then performed on the left side of the pelvis.

If the examination above is not painful, then the examination is repeated while the patient contracts the pelvic floor.

- To instruct the patient to contract the pelvic floor, we place our left hand lateral to the patient's right knee, and ask the patient to abduct the knee into the palm of our left hand. This maneuver mimics the pelvic floor contraction that occurs when the patient stands.
- The examination above is repeated.

Patients who have asymmetric muscle tone or frank pain are referred for pelvic floor muscle therapy.

Examination for prolapse — In contrast to the above examination, digital vaginal examination for prolapse is performed with the patient in the **standing** position. Anterior or apical prolapse can cause bladder neck or urethral obstruction and resultant urinary retention. If prolapse is found on examination, a pessary can be used to reduce the prolapse and resolve the voiding dysfunction.

Incision of midurethral sling — In the absence of prolapse, persistent voiding dysfunction may be due to urethral obstruction from an over-tight incontinence sling. Urethral obstruction caused by an incontinence sling is treated with midline incision of the sling. This may be done in the office with local anesthetic [79]. The patient is prepped and draped and the sling is identified either by palpation of the anterior vaginal wall or by using a female urethral sound. A midline transvaginal incision is made over the sling and, with the aid of a right angle clamp, the sling is isolated from the surrounding tissue. The sling, which is often folded, is completely transected across the midline and the incision is closed. In our experience, the amount of release created with complete transection of the sling is minimal, on the order of 1 or 2 mm. Success rates following the procedure vary from 86 to 100 percent [79-81].

The optimal time to perform the sling transection is unclear, but some advocate for earlier intervention to limit potential detrusor muscle damage and to make sling identification easier (ie, before tissue ingrowth and scarring) [34]. In our practice, we perform a synthetic sling lysis no less than two weeks postoperatively and fascial sling lysis one to two months following initial surgery due to differences in spontaneous resolution.

Role of urodynamic testing — If no obstruction is noted on examination or the patient's symptoms are inconsistent with the medical and surgical history, postoperative urodynamics may be used to answer specific questions regarding the bladder contractility, urethral tone, and urethral obstruction. If an individual is completely unable to void, a pressure-flow study is often helpful. Urodynamic testing allows identification of patients who have occult urethral obstruction; these individuals maintain a normal PVR because their detrusor contraction is strong enough to overcome the increased urethral resistance created by the sling. Urodynamic testing that specifically measures the urethral pressure profile will be able to identify urethral obstruction and locate the position of the obstruction in

the urethra. Pressure-flow studies measure the maximal bladder pressure and the maximal flow rate once a patient has had the bladder filled to capacity. One common nomogram defines obstruction in female patients as a maximum flow rate of ≤15 mL/sec with a simultaneous detrusor pressure >20 cm H_2O [82].

Urodynamic testing is less helpful for the vague symptoms of urgency/frequency without signs of retention. It is also not indicated for most patients who have detrusor acontractility or hypocontractility following radical pelvic surgery, as nerve injury is typically the cause. In these patients, the use of urodynamics does not change the treatment plan, which is CIC until the patient can adequately void or enough time has passed that full recovery is unlikely (>6 to 8 months). In the settings of radical hysterectomy and pelvic exenteration, the symptoms may never resolve.

New onset voiding dysfunction remote from surgery — Female patients can develop dysfunctional voiding or urinary retention months to years after the initial surgery due to urethral erosion or pelvic organ prolapse (POP) [83]. These patients may complain of pelvic pressure, pain, or overt prolapse. However, their symptoms may also be vague and nonspecific.

Female patients who initially void normally and then develop voiding symptoms months or years after surgery must be examined for POP, mesh erosion if applicable, and occult urethral obstruction. Physical examination evaluates organ prolapse, urethrocystoscopy diagnoses urethral perforation or foreign body, and multichannel urodynamic testing diagnoses occult obstruction. Urethral erosion can occur after insertion of an incontinence sling. Management of these complications is discussed elsewhere. (See "Transvaginal synthetic mesh: Management of exposure and pain following pelvic surgery", section on 'Management'.)

COMPLICATIONS OF UNTREATED URINARY RETENTION

Inadequate treatment of postoperative voiding dysfunction can result in acute overdistention injury, long-term bladder (detrusor) muscle hypertrophy, and overactive voiding symptoms.

Overdistention injury — Acute bladder overdistention injury occurs when the bladder is filled to volumes greater than 400 to 600 mL, or greater than 120 percent

of capacity. Patients at risk for voiding dysfunction undergo a retrograde voiding trial prior to discharge to identify overdistention. (See 'Risk factors' above.)

Patients who have had an overdistention injury are treated with an indwelling catheter or clean intermittent catheterization (CIC) to avoid further injury. Those who are performing CIC are at risk of a repeated bladder distention if they are not diligent about catheterization frequency, which is typically required four to six times a day and possibly once overnight [84]. If the CIC frequency is inadequate, then an indwelling catheter is the treatment of choice to avoid further overdistention.

The duration of bladder drainage through CIC or an indwelling catheter is based on clinical experience and the specific etiology. Individuals who cannot sense bladder filling and who have undergone a radical pelvic procedure will often require bladder drainage for up to six months before an assessment can be made about the permanence of the dysfunction. In this case, CIC is a preferred modality for bladder emptying since sensory and motor function can be assessed over time.

Detrusor overactivity and incontinence — Patients who have urethral obstruction from an incontinence procedure may have a normal postvoid residual because their overactive detrusor contraction overcomes the urethral resistance created by the incontinence procedure [80,85]. Over time, the patient may develop new symptoms of urinary urgency, with or without incontinence. If the obstruction remains unrecognized, these patients can develop irreversible bladder dysfunction. The diagnosis is made by measuring the peak detrusor pressure associated with the maximal urinary flow during multichannel urodynamic testing. An elevated urethral pressure profile can also suggest the diagnosis. Ultrasound measurement of bladder wall thickness to diagnose bladder wall hypertrophy has not been standardized and has mixed results in predicting detrusor overactivity [86-88].

A retrospective analysis of 15 patients who underwent urethrolysis for a fascial sling obstruction assessed patient response to removal of the obstruction [89]. The individuals who remained symptomatic after urethrolysis had a longer delay from the initial surgery to urethrolysis compared with those whose symptoms resolved (31 versus 9 months).

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Urinary incontinence in adults".)

SUMMARY AND RECOMMENDATIONS

- Diagnosis of postoperative urinary retention (POUR) is made by performing a retrograde voiding trial and obtaining an elevated postvoid residual (PVR) volume (more than 100 mL) via bladder catheterization or ultrasound. We prefer the retrograde voiding trial to the spontaneous voiding trial because the retrograde method is more predictive of need for continued catheterization in randomized trials. (See 'Retrograde voiding trial' above.)
- Multiple risk factors exist for postoperative voiding dysfunction. (See 'Risk factors' above.)
- Causes of postoperative voiding dysfunction include bladder muscle dysfunction (eg, anesthesia, pain medications), urethral obstruction, and failure of pelvic floor relaxation. Urethral obstruction (such as with midurethral incontinence slings) or urethral perforation requires surgical intervention. Dilation of the urethra following a synthetic sling placement has been associated with mesh erosions into the urethra and is not recommended. (See 'Urethral obstruction' above.)
- Symptoms associated with POUR include a slow urine stream, straining to void, a feeling of incomplete bladder emptying, pelvic pressure or pain, need to immediately re-void, and position-dependent micturition. The clinician may palpate the bladder on examination. The diagnosis rarely requires urodynamic testing. (See 'Clinical presentation and diagnosis' above.)
- Diagnostic evaluation includes examining the patient, treating reversible causes of dysfunction, and ruling out delayed complications. Patients may require bladder drainage with clean intermittent catheterization (CIC) or an indwelling catheter to prevent overdistention injury. Urodynamic testing is not typically used to evaluate patients in the immediate postoperative period but may be helpful in patients who present months from surgery. (See 'Unsuccessful voiding trial' above.)
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Cystotomy, which can mimic voiding dysfunction, is differentiated from urinary retention by irrigating the bladder with 75 mL to 100 mL of sterile saline through a bladder catheter and then attempting to withdraw the same amount of fluid. (See 'Cystotomy' above.)

- If the need for catheterization continues, we suggest CIC rather than an indwelling urethral or suprapubic catheter (**Grade 2C**). (See "Placement and management of urinary bladder catheters in adults".)
- Acute overdistention injuries occur when the bladder is filled to greater than 120 percent of its regular capacity (eg, >400 to 600 mL) and are associated with ischemia and reperfusion damage to the bladder wall. (See 'Overdistention injury' above.)
- Patients who have undergone an incontinence procedure and have an "obstructed" urethra may still have a normal PVR. Urodynamic testing that includes pressure-flow studies and urethral pressure profiles is helpful in making the diagnosis. If voiding obstruction remains unrecognized, these patients can develop detrusor overactivity and new symptoms of urinary urgency, with or without incontinence. (See 'Detrusor overactivity and incontinence' above.)
- Patients with persistent postoperative voiding dysfunction undergo a repeat examination to assess for pelvic muscle spasm or pain, new prolapse, or urethral obstruction from a sling. Intervention depends on the cause. Those whose symptoms are inconsistent with their medical and surgical history undergo postoperative urodynamics. (See 'Persistent postoperative voiding dysfunction' above.)
- Patients who develop voiding symptoms months or years after surgery must be examined for pelvic organ prolapse, mesh erosion if applicable, and occult urethral obstruction. (See 'New onset voiding dysfunction remote from surgery' above.)
- Inadequate treatment of postoperative voiding dysfunction can result in acute overdistention injury, long-term bladder (detrusor) muscle hypertrophy, and overactive voiding symptoms. (See 'Complications of untreated urinary retention' above.)

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Topic 17173 Version 15.0

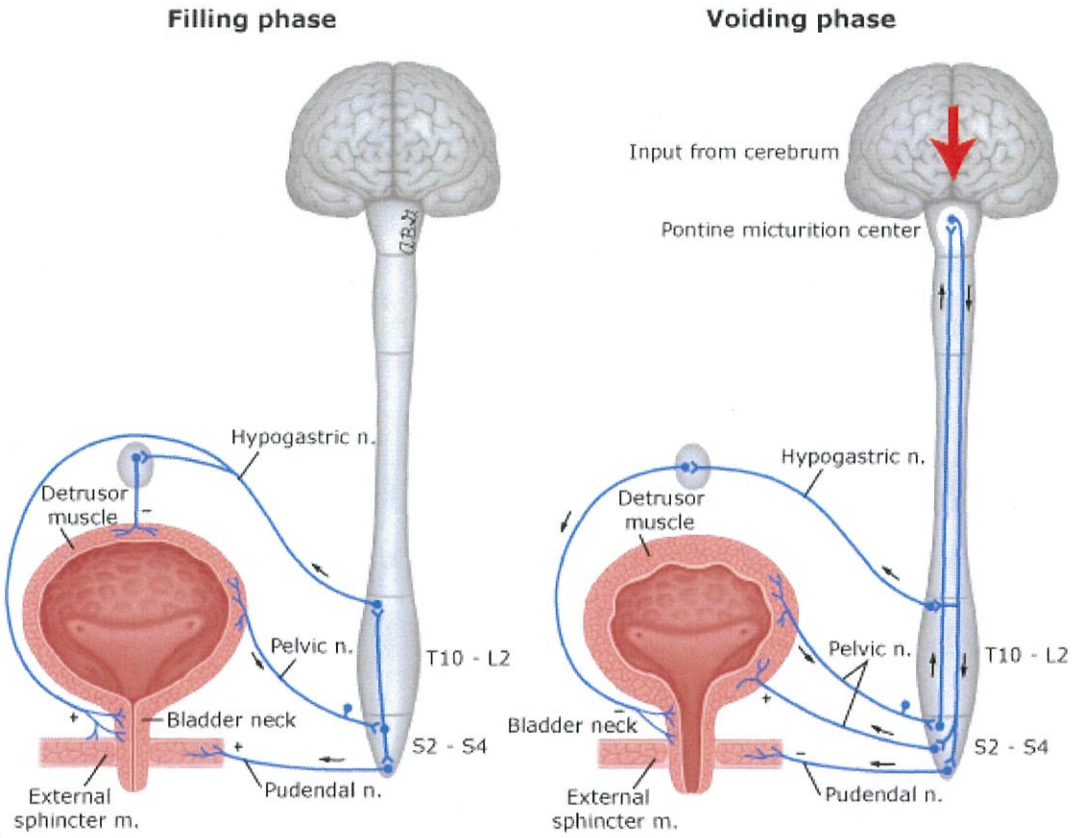
GRAPHICS

Etiology of postoperative voiding dysfunction in women

Detrusor	Urethra/pelvic floor
▪ Failure to sense bladder filling • Anesthesia/narcotics • Nerve injury ◦ Surgical ◦ Acute overdistention injury • Missed cystotomy	▪ Mechanical obstruction of the urethra • Incontinence procedures • Pelvic organ prolapse • Urethral perforation/foreign body • Constipation/pelvic mass
▪ Failure to contract bladder • Anesthesia/narcotic • Nerve injury • Preexisting voiding dysfunction	▪ Functional obstruction of the urethra • Failure to relax the pelvic floor

Graphic 98686 Version 1.0

Coordination of the central and peripheral nervous systems for normal urinary voiding



The coordination of the central and peripheral nervous systems during bladder filling and voiding required for normal urinary continence.

Graphic 65433 Version 3.0

Contributor Disclosures

Elizabeth R Mueller, MD, MSME, FACS Other Financial Interest: Butler-Snow [Urinary incontinence procedures]; Ethicon [Urinary incontinence procedures]. All of the relevant financial relationships listed have been mitigated. **Linda Brubaker, MD, FACOG** Grant/Research/Clinical Trial Support: National Institutes of Health [Prevention of lower urinary symptoms]. Other Financial Interest: Journal of the American Medical Association [Women's health]; Female Pelvic Medicine and Reconstructive Surgery [Female pelvic medicine and reconstructive surgery]. All of the relevant financial relationships listed have been mitigated. **Kristen Eckler, MD, FACOG** No relevant financial relationship(s) with ineligible companies to disclose.

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