

# Evaluation and Treatment of Urinary Incontinence in Women



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## KEYWORDS

• Urinary incontinence • Pelvic floor disorder • Evaluation • Treatment

## KEY POINTS

- Urinary incontinence (UI) is a common disorder that disproportionately affects women.
- Careful history taking and physical examination are often sufficient for correct diagnosis, and invasive testing is generally not needed in cases of uncomplicated UI.
- A cough stress test is critical to the correct diagnosis of stress urinary incontinence.
- Treatment options are broad and include lifestyle changes, pelvic floor exercises, medications, office-based minor procedures, and surgery.

## INTRODUCTION

### *Epidemiology, Economic Impact, and Quality of Life*

Urinary incontinence (UI) is a common diagnosis, broadly defined as the involuntary loss of urine. The prevalence of UI in men and women varies widely, ranging from 15% to 75%, but disproportionately affects women more than men.<sup>1</sup> Notably, the prevalence of UI has increased over the last decade in both, with suspected attribution to increasing rates of both obesity and diabetes.<sup>2</sup> The economic impact of UI has seen steady growth since the 1990s, with annual direct costs estimated more than \$16 billion.<sup>3</sup> The indirect costs of UI are also notable as one study has pointed out that, of all workers treated for UI, 23% of women missed work (compared to 8% of men) and had an average total annual work absence of 28.7 hours (between inpatient and outpatient treatment services).<sup>4</sup>

UI has significant social, physical, and psychological implications on patients' general wellbeing.<sup>2,5</sup> Women with UI are three times more likely to have concurrent major depression.<sup>5</sup> Patients reporting UI have noted increased stress levels associated with

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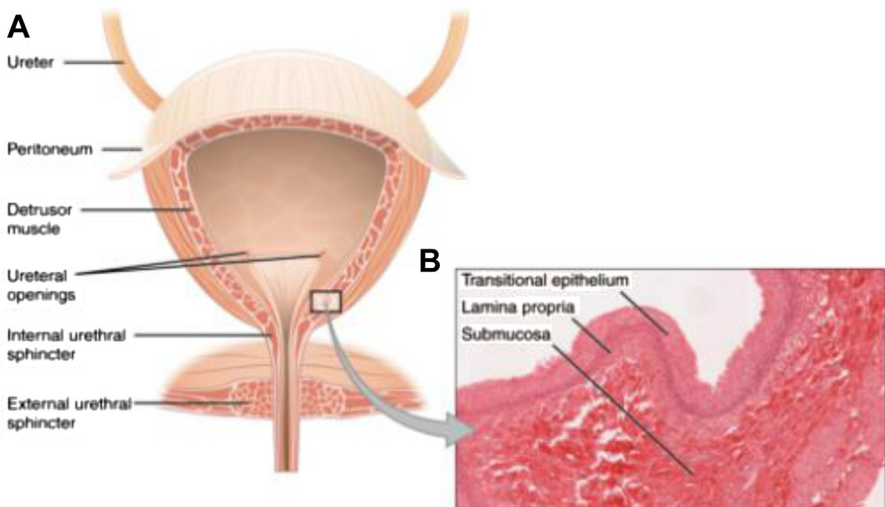
their symptoms, significant discomfort in normal social situations, and interference with their daily activities.<sup>6</sup> Patients express concerns about having accidents outside of the home and even disruption of work meetings due to frequent bathroom trips. UI can predispose patients to skin irritation, pressure ulcers, and falls (particularly in geriatric populations and those with nocturnal incontinence).<sup>7</sup> These risks have been indicated as one of the factors that lead families to seek nursing home care for those affected.<sup>7</sup>

## NORMAL PHYSIOLOGY AND PATHOGENESIS

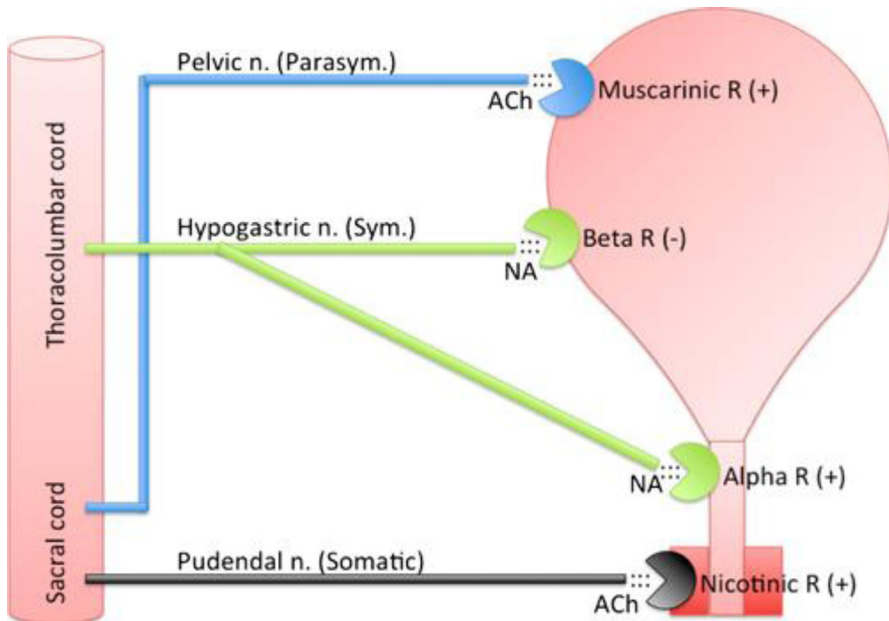
### *Physiology*

The lower urinary tract is comprised of the bladder, an organ composed of mucosa and layers of smooth muscle (detrusor muscle), and the urethra (Fig. 1).<sup>8</sup> The urethra contains two sphincters: the internal urethral sphincter (IUS) and the external urethral sphincter (EUS). The IUS is primarily composed of smooth muscle and  $\alpha$ -adrenergic receptors and receives sympathetic innervation, while the EUS is primarily composed of striated muscle which allows for voluntary contraction via somatic innervation. The detrusor muscle of the bladder is innervated by both the sympathetic ( $\beta$ -adrenergic receptors) and parasympathetic (cholinergic receptors) nervous system. Sympathetic stimulation results in bladder filling via detrusor relaxation and sphincter contraction while parasympathetic stimulation causes bladder emptying through detrusor contraction and sphincter relaxation (Fig. 2).

Most individuals remain continent throughout their lifetimes, so complaints of UI should be thorough evaluated.<sup>9</sup> Normal age-related changes in the urinary tract, however, can contribute to the development of incontinence in otherwise healthy individuals. These include the following:



**Fig. 1.** The lower urinary tract. Anatomy of the lower urinary tract: (A) bladder and urethra and (B) cross-section of the bladder wall. (From Betts JG, Young KA, Wise JA, Johnson E, Poe B, Kruse OK, Johnson JE, Womble M, DeSaix P. (eds). *Anatomy and Physiology: Gross anatomy of urine transport*. Houston, Texas. OpenStax. 2013; with permission. Accessed 3/17/21: <https://openstax.org/books/anatomy-and-physiology/pages/25-2-gross-anatomy-of-urine-transport>.)



**Fig. 2.** Autonomic innervation of the bladder. Autonomic innervation of the bladder: Sympathetic stimulation at Beta ( $\beta_3$ ) receptors in the detrusor muscle and alpha ( $\alpha_1$ ) receptors in the urethra results in bladder filling via detrusor relaxation and sphincter contraction. Parasympathetic stimulation at muscarinic ( $M_3$ ) receptors in the detrusor muscle causes bladder emptying through detrusor contraction and sphincter relaxation. (From Hu HZ, Granger N, Jeffery ND. Pathophysiology, Clinical Importance, and Management of Neurogenic Lower Urinary Tract Dysfunction Caused by Suprasacral Spinal Cord Injury. *J Vet Intern Med.* 2016;30(5):1575-1588. <https://doi.org/10.1111/jvim.14557> with permission.)

- Detrusor hyperactivity
- Decreased bladder capacity and contractility
- Hypoestrogenic state in postmenopausal women
- Urethral hypermobility

Women who have recently given birth, particularly via vaginal delivery, commonly experience transient incontinence secondary to normal physiologic changes in pregnancy. Some women will experience persistent UI even after the postpartum recovery period which ranges from 6 to 12 months.<sup>10</sup> In the elderly, sources of UI outside of the urogenital tract should also be ruled out before more invasive evaluations.<sup>9</sup> These can include delirium, infections, depression, stool impaction, decreased mobility, drug effects, and syndromes associated with increased urinary output (hyperglycemia, hypercalcemia, congestive heart failure).<sup>7</sup>

### **Types of Incontinence**

The most encountered types of incontinence include stress, urgency, overflow, and mixed UI (**Box 1**). *Stress urinary incontinence* (SUI) is defined as the involuntary leakage of urine with physical exertion, coughing, laughing, or sneezing.<sup>11</sup> Urine leakage occurs due to increased intraabdominal pressure and an inability to maintain the normal pressure gradient between the bladder and urethra.<sup>12</sup> SUI is more common

**Box 1****Differential Diagnosis of Urinary Incontinence in Women**

Stress urinary incontinence

Urgency urinary incontinence

Overflow urinary incontinence

Mixed urinary incontinence

Anatomic causes

Genitourinary fistulas

Urethral diverticulum

Congenital urethral anomalies

Functional/Transient causes

Infection

Drug effects

Restricted mobility

Dementia/delirium

Excessive urine production secondary to medical comorbidities (DM, CHF, etc.)

among women and is often associated with a history of pelvic floor weakness secondary to vaginal delivery, trauma, or surgery.<sup>9,12,13</sup>

*Urgency urinary incontinence* (UUI) is the complaint of involuntary leakage of urine accompanied by or immediately preceded by urgency.<sup>11</sup> The underlying mechanism associated with UUI is detrusor overactivity and most commonly does not have an identifiable cause, but can result from neurogenic or myopathic bladder dysfunction.<sup>12,13</sup> *Overactive bladder* (OAB) is a term commonly used to describe the symptoms associated with urinary urgency incontinence and has recently become the preferred term to describe the spectrum of urgency urinary disorders. It should be noted that a diagnosis of OAB does not require the presence of UI and must be made in the absence of a urinary tract infection (UTI).<sup>12</sup> Patients who report voiding greater than eight times in 24 hours meet the accepted frequency threshold for OAB and their symptoms are often also accompanied by nocturia, which occurs in the absence of a UTI or other urinary pathology.<sup>11,12,14</sup> OAB can be further subdivided to “wet” and “dry” to describe those with or without associated UI.

*Overflow urinary incontinence* is the involuntary loss of urine associated with bladder overdistention.<sup>11</sup> The underlying cause of overflow incontinence is usually related to bladder outlet obstruction or inadequate detrusor contraction.<sup>13</sup> This type of incontinence is more common among men and is often the result of urinary retention due to outlet obstruction associated with prostatic hypertrophy.<sup>12</sup> When overflow incontinence does occur in women, it is most associated with outlet obstruction secondary to severe pelvic organ prolapse (POP), excessive tension after a UI surgical procedure, or detrusor underactivity of unknown etiology.<sup>12,15</sup>

Patients can also present with combined symptoms of both stress and UUI, defined as *mixed urinary incontinence*. In patients who report equally bothersome symptoms of SUI and UUI, urodynamic testing can be helpful in determining the best treatment method<sup>13</sup> (further described below). Though less common, anatomic and functional causes of UI should also be considered when evaluating patients with complaints of urinary leakage (see **Box 1**).

## **Subjective Evaluation and Diagnostic Testing**

A thorough history and physical examination are critical to the appropriate diagnosis of patients with complaints of UI. A careful assessment of reported symptoms is important in determining the type of incontinence as the type dictates further clinical testing. Additionally, it is essential to determine the impact of patients' symptoms on their lifestyles, as this will help guide management strategies. A study evaluating patient-centered treatment goals among women with pelvic floor disorders (of which UI is included) reported that these conditions are associated with decreased quality of life and increased cost expenditures more so than substantial morbidity or mortality.<sup>16</sup> Setting patient-centered goals is a simple, quick task that physicians can discuss during visits to help guide treatment and prioritize outcomes most important to patients.

### **History**

The evaluation of incontinence should begin with a thorough discussion of symptoms. **Table 1** reviews common complaints reported by patients. The provider should also evaluate the duration, frequency, and severity of these symptoms, as well as their impact on emotional well-being and daily function. It can be difficult for patients to quantify the amount of urinary leakage they are experiencing; asking if they require the use of mini liners, pads, or adult diapers, and how many times per day they are changing these protective garments can help provide an initial measure of incontinence severity.

While some complaints are subjective, several simple questionnaires exist to help determine symptom severity. Short forms of the Incontinence Impact Questionnaire (IIQ-7) and the Urogenital Distress Inventory (UDI-6) have been developed and validated to aid in quickly assessing the life impact and distress that incontinence has on a patient.<sup>17</sup> These can be helpful in both the initial assessment of patients and as tools to measure symptom improvement at subsequent visits.

Other factors to consider include past surgeries, injuries, obstetric history, number of vaginal versus cesarean deliveries, use of forceps or vacuum during vaginal delivery, weight of largest child at birth, menopausal status, history of UTIs, night-time awakenings to urinate or wetting the bed, type of fluid intake, and current medication use. Reviewing a patient's intake of alcohol or caffeine and use of over-the-counter medications such as antihistamines or nasal decongestants is also important, as these agents can also contribute to UI symptoms.<sup>9</sup>

In women, the presence of POP should be assessed as this can be associated with or the primary source of incontinence.<sup>12,18</sup> Women with pelvic prolapse may complain of vaginal pressure and may report the need to "splint" (replace the prolapsed tissue or put pressure inside the vagina) to urinate or pass bowel movements.

### **Urinalysis**

A urinalysis (dipstick) should be performed in all patients with urinary complaints of frequency, urgency, or incontinence to rule out infection as the source of symptoms.<sup>19</sup> A urine dipstick positive for leukocyte esterase and nitrites suggests the presence of a UTI and in this situation, urine should be sent for culture and appropriate antibiotics initiated.<sup>20</sup> If incontinence symptoms are not improved after treatment, further workup is indicated.

It is worthwhile to note that among the elderly population the presence of asymptomatic bacteriuria increases with age and can make the concurrent evaluation of incontinence more complicated.<sup>21</sup> Asymptomatic bacteriuria in female patients is defined as two (2) consecutive clean-catch urine samples growing at least  $10^5$  CFU/mL of no more than 2 species of microorganisms. This must occur in the absence

Stress Incontinence	Urgency Incontinence	Overflow Incontinence
1. Leakage with coughing, laughing, sneezing	1. Strong sensation of needing to void that can't be ignored	1. Constant leakage or dribbling
2. Leakage with high impact exercise	2. Inability to reach the toilet before leakage occurs	2. Unknowingly leaking urine
3. Coital incontinence	3. Leaking large amounts of urine	

of an indwelling urinary catheter with the second positive specimen collected within 7 days of the first culture. This process is benign and, in most cases, does not result in a UTI; thus, antibiotic treatment is not indicated<sup>22</sup> and further evaluation for another source of incontinence is warranted.

While the presence of red blood cells on a urine dipstick in the setting of a UTI can be normal, if infection is not present, follow-up urine microscopy is indicated.<sup>23</sup> Guidelines vary for cut-off values of the number of red blood cells per high-power field (RBCs/HPF) and range from 2 to 25 RBC/HPF.<sup>24</sup> A 2019 systematic review noted that only a small proportion of women with microscopic hematuria will be diagnosed with a urologic malignancy and thus, routine cystoscopy to evaluate for bladder cancers in the setting of microscopic hematuria is not currently recommended for most women.<sup>24</sup>

### **Voiding diary, pad test**

A voiding diary is a helpful, noninvasive tool to objectively quantify patients' voiding, and incontinence patterns (Fig. 3). Voiding diaries can range from 24 hours to a week. Patients are instructed to document the amount of urine output with each void, episodes of urine leakage, amount of urine leakage, circumstances under which urine leakage occurred (stress, urge, both), whether changing of pads was necessary, and the amount/type of fluid consumed during the day. The data obtained from these diaries have been validated as accurate for evaluating incontinence.<sup>12</sup> While patients who record 24 hours of data can provide a reliable picture of their symptoms, those who provide more data (48–72 hours) may provide a more complete assessment of their incontinence and be able to avoid more invasive testing.<sup>25</sup>

Some patients find it difficult to differentiate between excessive vaginal discharge and UI. In these cases, a pad test can be helpful in distinguishing between the 2. The patient is given pyridium (phenazopyridine), which will stain the urine orange, and instructed to wear a pad. If the pad is saturated with orange color, the presence of urine leakage is confirmed.

### **Physical examination**

The physical examination can aid in the exclusion of certain contributing factors to UI and should include both a pelvic examination and neurologic evaluation. Patients should be instructed to avoid urinating just before their examination and present with a full bladder. With the patient in lithotomy position, the examination should start with the vulva to evaluate for signs of postmenopausal atrophy (thinning of vaginal tissues, loss of architecture, labial fusion). Atrophy of the urogenital tissues occurs due to the loss of estrogen production and can result in stress urinary incontinence (SUI) secondary to decreased urethral support. Visual inspection of the urethra in combination

Date:	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Time	Urinate in toilet Amount	Had urine loss beyond control	Amount of urine loss 1, 2, 3 or 4	Description of Urine Loss, enter S, U or B	Pad Change	Fluid Intake amount and type of fluid
12 AM						
1 AM						
2 AM						
3 AM						
4 AM						
5 AM						
6 AM						
7 AM	8 oz					8oz coffee
8 AM		✓	2	U	✓	
9 AM						
10 AM	6 oz					
11 AM						
NOON						12oz Coke
1 PM	4 oz					
2 PM						
3 PM						4oz Tea
4 PM						
5 PM						
6 PM						8oz Water
7 PM		✓	3	S	✓	
8 PM	8 oz					
9 PM						
10 PM						
11 PM						

Time out of bed: \_\_\_\_\_ AM                      Time to bed: \_\_\_\_\_ PM

**Fig. 3.** 3-day voiding diary. University of Virginia Female Pelvic Medicine and Reconstructive Surgery Clinic, Three-day voiding diary. Column 3: 1 = < ½ teaspoon or slight moisture, 2 = ½ teaspoon – 1 tablespoon or wetted underwear, 3 = 1 tablespoon - less than 1/3 cup or wetted outerwear, 4 = ¼ cup or more, soaked outerwear. Column 4: S = stress, U = urge, B = both.

with palpation of the bladder neck through the anterior wall of the vagina is helpful in evaluating the presence of urethral masses or diverticula. Vaginal support should be evaluated for the presence of cystocele, rectocele, or uterine prolapse/enterocele.<sup>26</sup> If present, an attempt should be made to reduce the prolapsed tissue to determine

if the severity of the presence of incontinence symptoms is being masked<sup>20</sup>. Leakage of urine that occurs only after the reduction of pelvic prolapse is considered occult SUI.<sup>27</sup> The vaginal walls should also be inspected for the presence of fistulae. If a fistula is suspected, it is important to differentiate whether the connection is between the ureter and the vagina or the bladder and the vagina; this can easily be accomplished with a double dye test.<sup>12</sup> Pelvic floor muscle strength should be evaluated during the pelvic examination, as well.

Performing a rectal examination is also helpful in the evaluation of UI. Assessment of rectal tone, presence of fecal impaction, or rectovaginal fistulas can all aid in the appropriate diagnosis of UI. Fecal impaction and constipation may lead to UI secondary to increased pressure from the stool on the bladder. This pressure can lead to decreased bladder filling and SUI, or inappropriate bladder contraction and urinary urgency. Finally, evaluation of the motor and sensory function of the lower extremities and perineum can help determine if incontinence is due to neurologic pathology. Sacral dermatomes 2 through 4 contain the parasympathetic neurons responsible for controlling micturition and their motor and sensory function can be easily evaluated via the assessment of the bulbocavernosus reflex.<sup>20,28</sup> Lightly brushing the labia majora with a soft Q-tip should elicit contraction of the external anal sphincter muscles if this neural pathway is intact. Loss of this reflex may indicate the presence of a lower motor neuron lesion and should prompt the examiner to inquire about the presence of fecal incontinence or defecatory dysfunction symptoms.

### **Cough stress test**

A cough stress test should be performed in all patients with complaints of UI. In a lithotomy/supine position, the patient is instructed to Valsalva or forcefully cough, and visualization of urine leakage from the urethra is indicative of a positive test. Immediate urine loss with cough suggests SUI, while delayed leakage is more likely to be associated with UUI.<sup>9</sup> If the test is negative, it should be repeated with the patient in a standing position or after retrograde-filling the bladder. If the standing cough stress test is also negative and the pretest probability for SUI remains high, further evaluation via multi-channel urodynamics is indicated. This is particularly important to evaluate occult incontinence, leakage of urine that occurs only after the reduction of pelvic prolapse, to assure that surgical intervention corrects both the POP and the concomitant UI.<sup>29</sup>

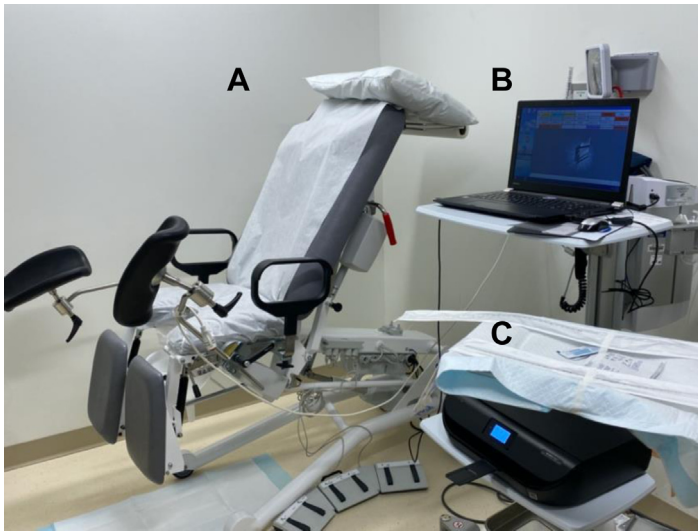
### **Postvoid residual urine volume**

A postvoid residual (PVR) is the volume of urine remaining in the bladder after spontaneous urination. Once a patient has voided, a PVR can be obtained by performing an in and out catheterization of the bladder or by ultrasound. A PVR can be helpful in the evaluation of patients who describe urinary retention, symptoms suggestive of bladder outlet obstruction, or overflow incontinence. A PVR of less than 50 mL is considered normal, while greater than 200 mL suggests insufficient bladder emptying.<sup>9</sup> An elevated PVR in the absence of POP is abnormal in women and an evaluation of bladder emptying with a pressure-flow urodynamic study is indicated.<sup>19</sup>

### **Multi-channel urodynamic studies and cystoscopy**

A multichannel urodynamic study gathers data during both the filling and voiding phases of urination and assesses urethral function (Fig. 4A).<sup>30</sup> The study measures intravesical pressure (Pves), intra-abdominal pressure (Pabd), detrusor pressure (Pdet), urethral pressure (Pura), urinary flow rate (Q), and sphincter electromyography (EMG). When used together they can diagnose dysfunction of the bladder, urethra, and pelvic floor. The urodynamic study, such as anorectal manometry, attempts to





**Fig. 4.** Multi-Channel Urodynamic Study Equipment. University of Virginia, Multi-Channel Urodynamics procedure room: (A) examination chair with urine collection system, (B) software to collect data, (C) catheters for bladder filling and pressure monitoring.

reenact voiding patterns to better understand the etiology of the patient's complaints. There are 5 components of a urodynamic evaluation:

- *Complex uroflowmetry* is the test first performed. The patient is asked to come in with a full bladder and empties into a funnel connected to a calibrated scale that calculates the urinary flow rate over time to assess possible obstructive or functional voiding abnormalities.
- *Complex cystometry* is completed by placing catheters in the bladder and vagina (see Fig. 4B). The patient's bladder is slowly filled with water to assess bladder capacity and compliance. In addition, the testing determines abnormalities of detrusor activity and sensation which are consistent with urge incontinence.
- *Urethral pressure profilometry* evaluates the intraluminal urethral pressure along its length by slowly pulling a pressure catheter through the urethra. Though not diagnostic, very low closure pressures are associated with severe forms of SUI.
- *Pressure-flow study* is the last test performed in the urodynamic evaluation for which the patient is asked to empty the bladder with pressure catheters in place to assess the bladder pressure required to void. This study evaluates the relationship of the bladder pressure against the flow rate to help establish causes of voiding dysfunction.
- EMG is performed by placing bilateral EMG pads in the perianal region to evaluate the contractile activity and innervation of the perineal muscles involved with voiding. Muscular overactivity may indicate a possible cause of voiding difficulty.

It is not currently recommended that urodynamic testing be used in the initial evaluation of uncomplicated UI, as it does not provide superior data over an in-office physical examination.<sup>31,32</sup> Women should be referred for urodynamic studies if their physical examination does not support their symptoms (negative cough stress test with a complaint of SUI), if they have a past medical history of multiple incontinence

surgeries, or if their incontinence symptoms do not improve with treatment or surgery.<sup>20</sup>

Cystoscopy directly visualizes the urethra and bladder and can be easily performed in the office setting. Cystoscopy can be helpful in the evaluation of patients with microscopic hematuria, concern for bladder outlet obstruction, or concern for fistula.<sup>12</sup>

### ***Associations with Gastrointestinal Disorders***

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Constipation and fecal incontinence have been associated with UI.<sup>33</sup> As space in the pelvis is limited, when stool volume increases, distention of the bowels can result in increased pressure on the bladder and UI symptoms may develop. Increased pressure on the bladder may inhibit complete bladder filling and patients may experience stress or overflow incontinence. Patients may also experience urge incontinence symptoms secondary to inappropriate bladder contraction as a result of increased pressure on the bladder. These are conditions that affect 50% of nursing home residents and even with appropriate treatment, are persistent problems due to dementia and immobility.<sup>34</sup> In patients who report constipation or fecal incontinence, inquiry of concurrent UI is worthwhile.

### ***Treatment***

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#### ***Lifestyle modifications: weight loss, timed voids, fluid restriction, and pelvic floor exercises***

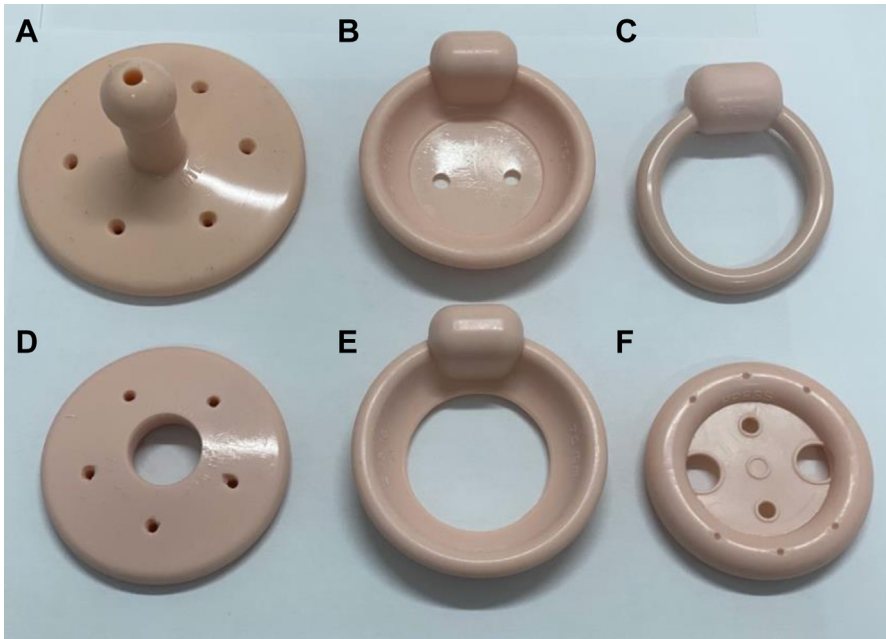
For women with stress, urge, or mixed incontinence, weight loss, timed voiding, and fluid restriction have been proven as effective treatments.<sup>20</sup> In a randomized controlled trial, behavioral therapy (education, bladder training with scheduled voids, and pelvic floor exercises) resulted in a 50% decrease in the number of incontinence episodes as recorded in a voiding diary.<sup>35</sup> Timed voiding can be used to help prevent excessive bladder fullness, particularly in cases of SUI, or to increase the time between voids by establishing a voiding schedule in those patients with urgency incontinence.

Obesity is a well-established risk factor for SUI.<sup>33</sup> Studies have shown that even moderate weight loss (an 8% reduction in body weight) is associated with a 47% decrease in weekly incontinence episodes.<sup>36,37</sup> Patients should also be counseled on limiting their daily fluid intake to 48 to 64 fluid ounces per day and decreasing or eliminating caffeine from their diet as both have been associated with all types of UI.<sup>20,38-40</sup> If patients with incontinence are waking up to void during sleeping hours (nocturia), counseling regarding decreasing, or eliminating fluid intake before bed can be a helpful strategy.

Pelvic floor exercises, or Kegel exercises, aim to strengthen the levator ani muscles of the pelvic floor and voluntary periurethral muscles.<sup>12,20</sup> In women with mild to moderate stress, urge, or mixed incontinence, this approach to symptom management can be an effective first-line treatment.<sup>41</sup> Pelvic floor exercises can be performed alone or in combination with biofeedback (pressure catheter and myographic monitoring that provides visual or auditory cues to the patient that they are performing exercises correctly) or electrical stimulation (intravaginal electrodes which activate muscles), though studies have shown that these modalities may not provide additional benefit over pelvic floor exercises alone.<sup>42,43</sup>

#### ***Pessaries***

Pessaries have been used for centuries to treat POP; more recently, pessaries have been developed specifically for the treatment of SUI (Fig. 5).<sup>44</sup> Incontinence pessaries are placed inside the vagina and provide mechanical support to the bladder neck and



**Fig. 5.** Pessaries. Variety of pessaries: (A) Gellhorn, (B) incontinence dish with support, (C) incontinence ring, (D) Shaatz, (E) incontinence dish without support, (F) ring with support.

urethra conferring continence through elevation of the bladder neck and/or obstruction.<sup>12,45</sup> Pessaries are a reasonable treatment option for patients who are not ideal surgical candidates or for use as a temporizing option until surgery is scheduled. Studies have shown that in women who have been successfully fit for incontinence pessaries, over 50% were satisfied with the results and continued use greater than 6 months.<sup>46</sup> With appropriate use and fitting, complications associated with pessary use (vaginal erosions, bleeding, infection, urinary retention, etc.) are negligible. Patients who are able to perform their own pessary maintenance should remove the device, wash it with mild soap and water, and reinsert it at least every 3 months. These patients should also be seen in the clinic once a year to assure proper fit. Alternatively, patients who do not want to manage and care for their pessaries are followed up in the clinic every 3 to 5 months for a pessary check. At this visit, the pessary is removed, and a speculum examination is performed to check for vaginal erosion caused by vaginal atrophy. If vaginal erosion is identified, the pessary is not replaced, and the patient is prescribed topical estrogen cream for 3 to 4 weeks to heal the erosions. Subsequently, the pessary can be reinserted.

### **Pharmacotherapy**

Based on current recommendations, pharmacologic therapies should be reserved for the treatment of OAB or UUI, as no effective options exist for treating stress or overflow incontinence.<sup>20</sup> The primary drug categories used for the treatment of UI are antimuscarinic and beta-agonist agents (Table 2). Antimuscarinic agents work by blocking parasympathetic signaling and inhibit involuntary detrusor contraction. Beta-agonist agents relax the detrusor muscle, allowing for increased bladder capacity via the activation of Beta-3 receptors in the detrusor. A systematic review of

Drug Category	Drug Name	Mechanism of Action	Side Effects
Antimuscarinics	Oxybutynin (Ditropan), Tolterodine (Detrol), Trospium (Santura), Solifenacin (Vesicare), Darifenacin (Enblex), Fesoterodine (Toviaz)	Blocks parasympathetic muscarinic receptor signaling (bladder M2, M3 receptors), inhibiting involuntary detrusor contractions	Dry mouth, blurry vision, dizziness, palpitations, constipation, headache, fatigue, cognitive changes
Beta-agonists	Mirabegron (Myrbetriq)	Activation of beta-3 receptors relaxes the detrusor muscle of the bladder and results in increased storage capacity	Hypertension, tachycardia, headache, diarrhea

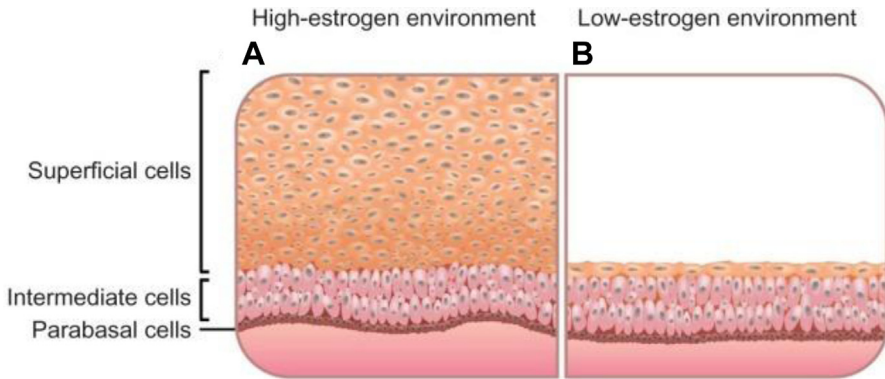
antimuscarinics for the treatment of urgency incontinence has shown moderate improvements compared with placebo,<sup>47</sup> and long-term compliance with these medications is low due to side effects. Additionally, there is concern that long term use of antimuscarinic medications may increase the risk for dementia.<sup>9,20,48</sup> The beta-agonist agent, Mirabegron, is a newer medication (released in 2012) that has shown similar efficacy to antimuscarinic medications for the relief of urgency incontinence.<sup>9,49</sup> Given the drug's milder side effect profile, this may be a good option for patients who do not tolerate antimuscarinic agents.

Antidepressant medications such as Duloxetine and Imipramine have been used to treat UI, but efficacy and compliance among patients is minimal.<sup>20,48</sup> Genitourinary syndrome of menopause (GSM), the normal thinning of the vulva, vagina, urethra, and bladder that occurs among postmenopausal women, is due to a lack of estrogen, and results in loss of normal architecture and support. Vaginal estrogen has shown benefit in decreasing UI among postmenopausal women with this syndrome. It is safe and can be an effective stand-alone or adjunctive therapy option (Fig. 6).<sup>20,50</sup>

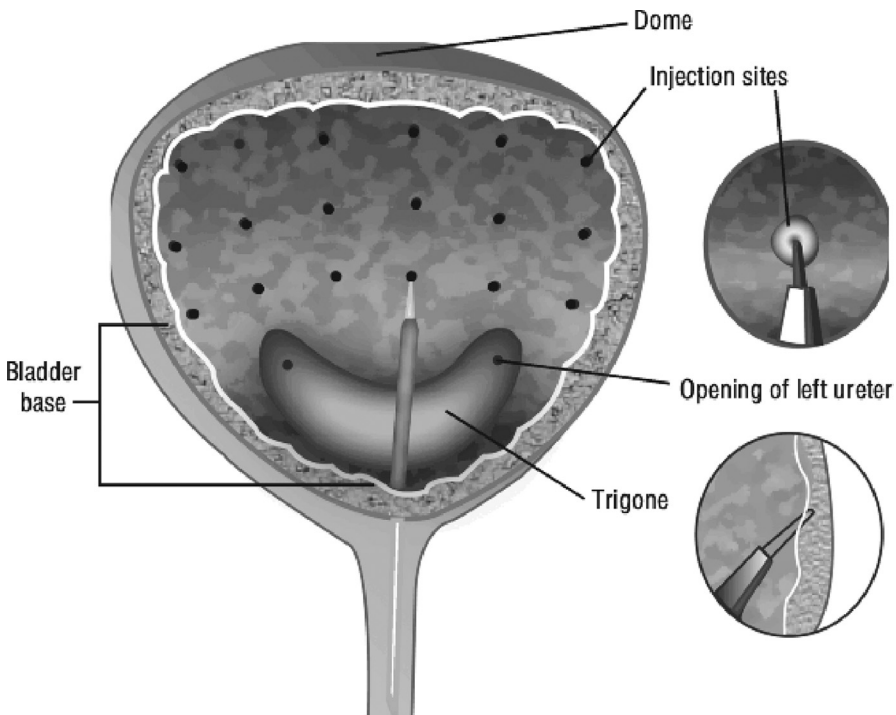
### **Botox and neuromodulation**

Third-line treatments for UI include intradetrusor injection of onabotulinumtoxin-A (Botox), sacral neuromodulation (SNM), and percutaneous tibial nerve stimulation. Botox acts by blocking the presynaptic release of acetylcholine from motor neurons, thus reducing the strength of muscle contractions. Botox is FDA approved for patients suffering from OAB or urgency incontinence who have failed conservative management. In a study comparing the use of antimuscarinic therapy to Botox injections, patients in both treatment groups were found to have similar reductions in incontinence episodes per day, but more patients in the Botox group reported complete resolution of incontinence.<sup>51</sup> Botox injections can be completed in the office setting or the operating room, and effects typically last 6 months; patients should be counseled about possible postprocedure side effects including UTI, urinary retention, and the possible need for temporary self-catheterization (Fig. 7).<sup>20</sup>

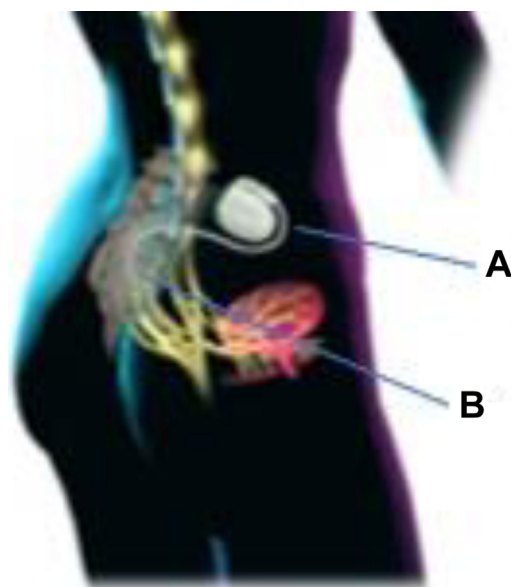
SNM is an additional third-line treatment of refractory urge incontinence, nonobstructive urinary retention, and fecal incontinence (Fig. 8). The two-stage procedure involves placement of a lead through the S3 foramen which stimulates sacral nerves that inhibit parasympathetic motor neurons, there-by reducing bladder contractions.<sup>20</sup> Similarly, percutaneous tibial nerve stimulation involves afferent nerve stimulation that



**Fig. 6.** Effect of the loss of estrogen on vaginal and urethral tissues. Estrogen effect on tissues: (A) Appearance of mucosal tissues under high estrogen environment (pre-menopausal state of use of topical estrogen) – superficial cell layer is plump and well supported. (B). Appearance of musical tissues under low estrogen environment. (From Reiter S. Barriers to effective treatment of vaginal atrophy with local estrogen therapy. *Int J Gen Med.* 2013;6:153–158. <https://doi.org/10.2147/IJGM.S43192> with permission.)



**Fig. 7.** Intra-detrusor injection of Botox. Intradetrusor Botox injections: a rigid cystoscope is placed into the bladder and the bladder is partially distended with saline. A catheter with an injection needle tip is then inserted through the cystoscope to inject Botox into the detrusor muscle of the bladder. Care is taken to avoid the trigone of the bladder. (From Allergan FDA Botox Highlights of Prescribing Information (2018). [https://www.accessdata.fda.gov/drugsatfda\\_docs/label/2018/103000s5307lbl.pdf](https://www.accessdata.fda.gov/drugsatfda_docs/label/2018/103000s5307lbl.pdf).)



**Fig. 8.** Sacral Neuromodulation Device. Sacral neuromodulation device placement: The procedure is completed in 2 stages; a permanent electrode (*B*) is placed in the lower back and leads are placed through S3 foramen so that appropriate stimulation of the sacral nerves is obtained. After a test period, the second stage is completed to connect a permanent indwelling battery (*A*) to the electrode. (Courtesy of Medtronic, Fridley, MN.)

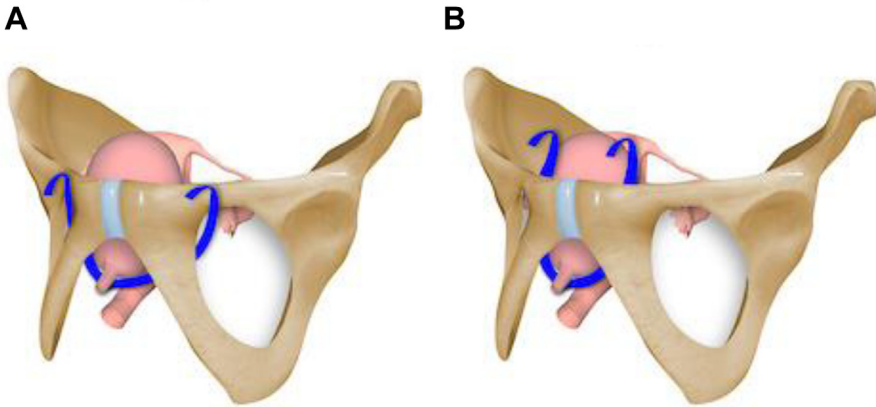
reduces parasympathetic motor output but is an office-based treatment that requires weekly treatment of 12 weeks followed by maintenance treatments every 3 to 4 months.<sup>20</sup>

In a randomized controlled trial comparing the effectiveness of intradetrusor Botox injection and SNM among women with refractory UUI, Botox resulted in slightly reduced rates of daily incontinence episodes, but with high risk of UTI and need for temporary self-catheterization.<sup>52</sup> While SNM may provide less efficacious results, for women who are not willing to self-catheterize, it may be a reasonable alternative treatment option.

## **Surgery**

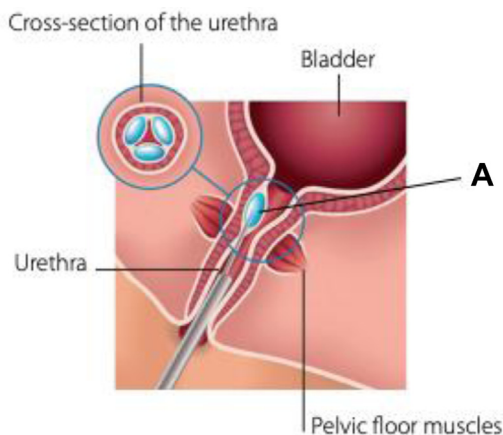
### **Sling procedures**

UI is most often initially managed with the conservative treatments described above, but for women with stress or mixed UI who do not achieve adequate symptom relief with these interventions, or for those who decline conservative management, surgical intervention is indicated. The goal of surgical management is to restore appropriate bladder neck support and is most commonly achieved with placement of a synthetic mid-urethral mesh sling (**Fig. 9**).<sup>12,20,53</sup> In a study comparing cure rates of mid-urethral slings to pelvic floor physical therapy, patients in the surgery group reported 90% improvement compared with 64% in the physical therapy group.<sup>54</sup> Mid-urethral slings are most placed via the retropubic or transobturator technique, with both shown to be equally effective and with similar patient satisfaction rates.<sup>55</sup> The retropubic technique is associated with greater morbidity (bladder perforation, greater intraoperative blood loss, and voiding dysfunction) while the transobturator technique is associated with more groin pain.<sup>20</sup>



**Fig. 9.** Mid-urethral Slings: (A) Transobturator placement, (B) Suprapubic placement. (From Alila Medical Media. Available at [https://www.alilamedicalmedia.com/media/412e5516-b6d3-4ae4-9242-4f40d94e641f-mid-urethral-sling-transobturator-versus-retropubic?hit\\_num=2&hits=4&page=1&per\\_page=100&prev=b6446b48-4ce1-4a87-b604-f8eeec067ecd&search=%22mid-urethral%22+sling](https://www.alilamedicalmedia.com/media/412e5516-b6d3-4ae4-9242-4f40d94e641f-mid-urethral-sling-transobturator-versus-retropubic?hit_num=2&hits=4&page=1&per_page=100&prev=b6446b48-4ce1-4a87-b604-f8eeec067ecd&search=%22mid-urethral%22+sling); with permission)

Among patients who are not candidates for mesh slings or decline this option, the autologous fascial sling (usually created from the rectus sheath or fascia lata of the quadriceps muscle) and Burch colposuspension procedures represent effective alternative surgical options. A 2007 study comparing these 2 procedures showed the superiority of the autologous fascial sling.<sup>56</sup> However, the autologous fascial sling is associated with greater morbidity including higher rates of UTIs, urge incontinence, voiding dysfunction, and need for surgical revision. Due to these complications, the procedure is not among the more common surgeries used for the treatment of UI.<sup>56</sup>



**Fig. 10.** Injection of Urethral Bulking Agents. Urethral bulking agents: (A) a cystoscope is used to visualize the mucosa of the urethra and inject bulking agents circumferentially into the urethra to rebuild normal urethral closure. (From Bulkamid Urethral Bulking System, A Minimally Invasive Treatment For Stress Urinary Incontinence. Available at [https://www.accessdata.fda.gov/cdrh\\_docs/pdf17/P170023C.pdf](https://www.accessdata.fda.gov/cdrh_docs/pdf17/P170023C.pdf)).

### **Urethral bulking agents**

In women with refractory stress incontinence after surgery or those who cannot undergo surgery, agents can be injected into the tissues surrounding the bladder neck and proximal to the urethra to increase urethral resistance and thus decrease urinary leakage (Fig. 10). Meta-analysis of several studies has demonstrated that urethral bulking agents are significantly less effective than surgery in the treatment of SUI.<sup>57</sup>

### **SUMMARY**

Given the prevalence and quality of life impact of UI, it is important to query and discuss even minor symptoms with patients. With appropriate evaluation and diagnosis, UI can be well-managed. There are a variety of treatment options available. Should conservative interventions fail, more invasive therapies may be effective.

### **CLINICS CARE POINTS**

- UI is a common diagnosis with prevalence rates as high as 75% in the general population.
- Initial evaluation of uncomplicated UI should include a pelvic examination, urinalysis, cough stress test, and postvoid residual. Voiding diaries are helpful for the objective quantification of UI patterns.
- It is important to evaluate for concurrent symptoms of constipation or fecal incontinence during the evaluation of UI. Patients with chronic constipation or fecal impaction are at higher risk of UI secondary to increased pressure of stool on the bladder. Those with both urinary and fecal incontinence should be evaluated for loss of sacral innervation.
- Consideration of urodynamic testing is warranted in cases of complicated UI or negative cough stress test with symptoms suggestive of stress incontinence.
- In overweight or obese patients, moderate weight loss can improve continence.
- Conservative interventions such as timed voiding, pelvic floor strengthening exercises, and fluid restriction can improve incontinence symptoms. In postmenopausal women, the use of topical estrogen can often provide symptom relief.
- Antimuscarinic and beta-agonist medications used to treat UI are effective but poorly tolerated.
- Midurethral slings are both safe and effective for the management of refractory SUI.

### **DISCLOSURES**

The authors have nothing to disclose.

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