

# Urinary Incontinence

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**Urinary Incontinence (UI) affects over 13 million people in the United States.<sup>1</sup>** Most women suffer in silence and do not seek help. Affected women may feel too embarrassed to discuss this issue with their healthcare provider or may be uninformed about treatment options.

## EPIDEMIOLOGY AND IMPACT OF URINARY INCONTINENCE

Prevalence estimates of UI in women range from 11%-72%.<sup>3-5</sup> Potential explanations for these variations include varying definitions of UI (i.e. frequency of UI episodes, degree of bother, symptom severity), differing study methods to determine UI (i.e. random survey, self-reporting, personal interview, clinical exam), the dynamic nature of incontinence symptoms, and the study population.<sup>6</sup> In addition, because many women feel embarrassed, it is likely that UI is overall underreported. A recent literature review estimated that 1 out of every 4 women have UI.<sup>7</sup>

The prevalence increases with age, ranging from 20-30% in young adult women, 30-40% in middle-aged women, and 40-50% in older women.<sup>8</sup> It is up to 6 times higher in younger women compared to men; older women are twice as likely to experience UI compared to older men.<sup>1,8</sup> Despite these differences, women are less likely to seek help compared to men.<sup>2</sup> It is estimated that only 25% of women will seek care.<sup>9</sup>

UI leads to embarrassment, humiliation, a loss of self-esteem, social isolation and depression.<sup>10, 11</sup>

Direct costs are estimated to be over \$16 billion (1995 dollars) per year in the US<sup>12, 13</sup> and over \$26 billion if other costs of care are included, such as protective garments and treatment of related complications.<sup>14</sup> It is estimated that women with UI pay \$750-\$900 annually in out-of-pocket for supplies, laundry and dry cleaning.<sup>15, 16</sup>

## RISK FACTORS FOR URINARY INCONTINENCE

The cause of UI is likely comprised of a variety of risk factors including predisposing, inciting, promoting and decompensating factors. Predisposing factors

alone may be significant enough to cause UI or increase the risk of developing UI when other inciting or promoting factors are present. Inciting factors may cause UI due to injury to the continence mechanism. Promoting factors contribute to the development of UI by continuously prolonged deterioration of the continence mechanism. These increase a woman's risk of experiencing UI. Decompensating factors are not sufficient to cause incontinence but may "tip" a woman with other risk factors towards experiencing UI. These factors may be temporary or permanent. The most well studied ones include age, obesity and parity. (Table 1)

Vaginal delivery is generally considered a major cause for the development of UI. However, the exact relationship between UI and vaginal delivery is not well understood and studies in the literature are inconsistent.<sup>8, 17</sup> Borello-France et al reported that in primiparous women, cesarean delivery before labor was not entirely protective against pelvic floor disorders, including UI.<sup>18</sup> Furthermore, in one study, half of women who reported UI had no symptoms at 1 year postpartum, but 19% of women without symp-

toms reported UI 5 years later.<sup>19</sup> Pelvic floor injury following childbirth is not always associated with UI, UI usually does not occur immediately after vaginal delivery, and women who have not experienced childbirth or have delivered by cesarean delivery may also develop UI—these facts all strongly point to additional causes.

UI can also be caused by several transient or reversible conditions. A useful mnemonic is "DIAPPERS"<sup>20</sup>: 1) Delirium or acute confusion; 2) Infection (symptomatic urinary tract infection); 3) Atrophic urethritis; 4) Pharmaceutical agents; 5) Psychological disorder (depression, behavioral disturbance); 6) Excess urine output (excess fluid intake, diuretics); 7) Restricted mobility; and 8) Stool impaction. Identifying a woman's modifiable factors may be the greatest opportunity for preventing UI.

## EVALUATION OF URINARY INCONTINENCE

The goals of an evaluation for a woman presenting with UI are to 1) provide a clinical diagnosis of type of UI; 2) determine factors that may contribute to symptoms or that may require further evaluation; 3) assess for

Table 1. Risk factors for urinary incontinence<sup>8</sup>

Predisposing factors	<ul style="list-style-type: none"> <li>• Familial predisposition</li> <li>• Gender</li> <li>• Race</li> <li>• Anatomic, neurological and muscular abnormalities (i.e. spina bifida, injury to spinal cord)</li> </ul>
Inciting factors	<ul style="list-style-type: none"> <li>• Pregnancy, childbirth, parity</li> <li>• Pelvic surgery</li> <li>• Radiation therapy</li> </ul>
Promoting factors	<ul style="list-style-type: none"> <li>• Obesity</li> <li>• Constipation</li> <li>• Chronic lung disease and smoking</li> <li>• Neurological diseases (i.e. stroke, Parkinson's disease, depression, multiple sclerosis)</li> <li>• Urinary tract infection</li> <li>• Occupational and recreational stresses</li> <li>• Drugs/medications (i.e. alpha-adrenergic blockers, anticholinergic agents, diuretics, psychotropics, sedative-hypnotics, narcotics, sympatholytics, ACE inhibitors, alcohol, caffeine)</li> </ul>
Decompensating factors	<ul style="list-style-type: none"> <li>• Age</li> <li>• Dementia</li> <li>• Physical disability</li> <li>• Comorbidities (i.e. diabetes, vascular insufficiency, congestive heart failure)</li> <li>• Changes in environment (accessibility of restroom)</li> <li>• Drugs/medications</li> </ul>

coexisting pelvic floor disorders such as pelvic organ prolapse or fecal incontinence; 4) establish baseline severity to aid in counseling, recommendations, and treatment effects; and 5) determine the impact of UI on quality of life.<sup>21</sup> The initial evaluation should include a history and general assessment, a symptom assessment, a physical examination and baseline tests.

## HISTORY

**Incontinence symptoms:** The nature and duration of UI should be detailed, including leakage, frequency, severity and volume of urine loss, activity at the time of urine loss, sensations of urge, and how bothersome these symptoms are to the patient. A woman who leaks large volumes daily may have a greater problem that requires a more complete evaluation compared to a woman who leaks only rarely when she is doing high impact sports. Women are also asked about other pelvic floor symptoms including sensation of vaginal bulging or pressure, nocturia, hematuria, recurrent urinary tract infections, voiding problems, anal incontinence, and defecatory dysfunction.

**Medical history:** including prior treatments for UI and pelvic floor disorders, medical problems, medications, and mobility issues that may exacerbate UI as well as acute and reversible causes of UI.

**Patient functioning:** including sexual and bowel function.

**Patient goals and expectations of treatment** should be assessed at the initial visit. This will help to guide further evaluation.

## EXAMINATION

The physical examination includes a complete evaluation of the abdomen and pelvis. Abdominal examination is performed to rule out any masses. Detailed pelvic examination is performed to assess for pelvic organ prolapse, pelvic floor muscle function, estrogen status, and to rule out pelvic masses. External genitalia are examined to evaluate for irritative or inflammatory skin conditions. Rectal examination to assess anal tone and pelvic floor function is performed. A neurological examination includes assessment of sensory and motor function of S2-4, which innervate to the pelvic organs. This also includes testing of lower extremity movement and strength.

A cough stress test to evaluate for leakage at the time of cough is helpful to

confirm a diagnosis of stress incontinence. To rule out urinary retention, a post-void residual can be assessed using either direct catheterization or by ultrasonography. This should be performed within 10 minutes of voiding to prevent a false positive finding. Although based on limited evidence, the consensus is that a postvoid residual volume less than 50 mL is considered normal and a volume greater than 100-200 mL is considered abnormal.

## BASELINE TESTS

A clean catch urinalysis is recommended to exclude urinary tract infections. A negative dipstick urinalysis has a specificity of 97%-99%. In women where there is a clinical suspicion, urine should be sent for culture and sensitivity. It is suggested that for women with a long-standing history of UI who have a positive dipstick urinalysis, a urine culture should also be sent before assuming that their UI is solely due to a urinary tract infection.

A voiding diary can provide further information that can aid in the diagnosis of UI. Patients record information about voiding or UI episode time, volume, frequency, fluid intake, and activity at the time of any UI episode. Three-day diaries are as predictive as 7-day diaries in detecting abnormal voiding patterns. The voiding diary can be particularly helpful for patients who have difficulty describing their voiding or UI patterns.

The pad test is another test less commonly used that can help document the severity of UI. Patients are instructed to wear perineal pads for 24 hours, changing them when necessary. Wet pads are placed in a zip-lock bag and returned to the office within 72 hours to be measured. These weights are compared to the weight of a dry, control pad. An increase greater than 8 grams within 24 hours is considered abnormal.

## URODYNAMIC TESTING

Urodynamic testing is warranted if the diagnosis is still uncertain such as: if there are discrepancies between the patient's history, voiding diary and examination, surgery is considered, the patient has an elevated postvoid residual, the patient has a neurologic condition that may complicate treatment, significant pelvic organ prolapse, or multiple prior surgical attempts at correction. A urodynamic study is defined as any test that evaluates the function of the

lower urinary tract. Often, urodynamic studies incorporate a variety of measures that assess the functional parameters of the bladder, including bladder pressure, capacity, sensation during bladder filling and emptying. They can be helpful in distinguishing between different types of UI.

Briefly, complex urodynamic testing begins with asking the patient to void in a specialized commode that plots the volume of urine passed over time. This provides information on flow time, peak flow rate and time to peak flow increase with the volume voided. Next, the bladder is filled to capacity, usually with fluid at room temperature, and the bladder and urethral pressures are recorded during this filling phase. During the filling phase, the detrusor should not contract, and the pressure within the bladder should stay relatively low in a normally compliant bladder. If a detrusor contraction is noted during the filling phase, this is highly suggestive of detrusor overactivity, which causes urge urinary incontinence (See next section). At various times during the filling phase, the patient is asked to cough to evaluate for stress incontinence. A large capacity bladder with decreased sensation would indicate a hypotonic bladder. Tests of urethral function are also performed to evaluate urethral pressures during filling and emptying phases. Finally, testing usually concludes with the patient voiding while the bladder, abdominal and urethral pressures are measured.

There have been limited large scale trials assessing the utility of urodynamic testing. Recently, a multicenter randomized surgical trial for stress incontinence completed by The Urinary Incontinence Treatment Network (UITN), a National Institutes of Health-sponsored network, suggested that incontinence detection may be highly variable depending on technique.<sup>22</sup> Further research is needed to evaluate if specific populations will benefit from urodynamic testing to improve treatment outcomes.

## TYPES OF URINARY INCONTINENCE, PATHOPHYSIOLOGY AND TREATMENTS

The International Continence Society (ICS) defines UI as "the complaints of any involuntary leakage of urine".<sup>23</sup> This definition may include symptoms (subjective, qualitative patient report), signs (physician observations of urine loss), or urodynamic study observations. The 3 most common types of UI are **stress urinary in-**

Table 2. Three most common types of urinary incontinence<sup>23</sup>

Type of UI	Symptom	Sign	Urodynamic finding
Stress urinary incontinence	Involuntary leakage on effort, exertion, orValsalva	Observation of urine leakage with exertion orValsalva	Involuntary leakage of urine during increased abdominal pressure in the absence of detrusor contraction
Urge urinary incontinence	Involuntary leakage accompanied by urgency	Not defined by ICS	Sudden, compelling desire to void during filling of bladder with fluid
Mixed urinary incontinence	Involuntary leakage associated with both exertion and urgency	Not defined by ICS	Urodynamic observation of both SUI and UUI during the same test

continence (SUI), urge urinary incontinence (UUI), and mixed incontinence (MUI) a combination of SUI and UUI. (Table 2) Although there are many extant theories for incontinence, most are based on expert opinion or observational evidence which have not necessarily been proved or disproved by rigorous scientific method.

### STRESS URINARY INCONTINENCE

SUI, the most common type, is the complaint of involuntary leakage with effort or exertion. It often occurs during sneezing, laughing, lifting and walking. These activities result in an increase in intra-abdominal pressure, causing the bladder pressure to exceed the maximum urethral pressure ultimately resulting in the loss of urine. This occurs in the absence of a detrusor contraction.

There are multiple theories for how SUI may develop. Two more recent complementary theories include the “integral theory”<sup>24</sup> and the “hammock theory.”<sup>25</sup> The “integral theory”<sup>24</sup> describes 3 opposing vaginal muscle forces stretching the vaginal membrane and endopelvic fascia, which helps to secure urethral closure during increased intra-abdominal pressure. The “hammock theory”<sup>25</sup> theorizes that the anterior vaginal wall provides a hammock-like support for the urethra that is critical to maintain urethral closure. Injury to connective tissue supports may cause dysfunction of the continence mechanism.

Any treatment for UI should start with counseling regarding non-surgical interventions. Lifestyle interventions that may decrease SUI include weight loss in overweight and obese women<sup>26</sup> and decreasing caffeine intake. Well designed randomized clinical trials have shown that supervised pelvic floor muscle training (“Kegel exercises”) is effective in treating or at least improving any type

of UI symptoms (SUI, UUI, MUI).<sup>27</sup> To maximize the effectiveness of pelvic floor muscle exercises, women should be counseled on how to do them correctly, regularly and for an adequate duration. Women may need referral to a physical therapist for evaluation and supervised training sessions.

Vaginal devices (pessaries) and urethral inserts are also non-surgical options for SUI. Specialized pessaries called “continence dishes” provide support for the anterior vaginal wall and urethra to minimize SUI symptoms. Women need to undergo a pessary fitting to find the correct fit and most women (89%) can be fitted successfully.<sup>28</sup> These may be a good option for women who want to avoid surgery, need to defer surgery, or complete childbearing.

Medications for SUI include alpha-agonists, which increase urethral tone have been shown to have a modest effect in small trials.<sup>29</sup> Serotonin and norepinephrine reuptake inhibitors are being investigated for their role for SUI.

When behavioral and pharmacologic interventions do not improve symptoms, surgery may be offered. The decision to undergo surgery should be a shared decision between the patient and her healthcare provider, as only the individual patient can weigh potential risks and benefits of surgical treatment. Although many surgical procedures have been described to treat SUI, few randomized trials inform treatment. We will review the most common procedures.

The Burch colposuspension and suburethral fascial sling are two well established procedures and for many years, they were considered to be equally effective. A recent trial conducted by the UITN ran-

domized 655 women to undergo either a fascial sling or Burch for SUI and reported that fascial slings were associated with higher cure rates of SUI at 24 months (66% vs 49% P<.001), but were associated with more urinary tract infections, voiding difficulty and postoperative UUI.<sup>30</sup>

The advent of minimally invasive mid-urethral tension free slings introduced first as the “tension-free vaginal tape” or TVT<sup>TM</sup> (Gynecare, Sommerville, NJ) in 1996 marked a major shift in the surgical treatment of SUI. It is proposed that the mid-urethral sling stabilizes the vagina and urethra during times of increased intra-abdominal pressure, reinforcing the “vaginal hammock”. In a randomized trial comparing the TVT to Burch, similar objective cure rates were reported at 2 years between the two procedures: 63% and 51%, respectively, assuming women who were lost to follow up as failures; or 78% and 68% respectively, carrying the last observed result forward at 2 years.<sup>31</sup> The procedure includes placing 2 needles vaginally through 2 paraurethral tunnels, then into the retropubic space, and exiting the retropubic space through 2 small suprapubic skin incisions. No fixation sutures are required and the sling is ultimately held in place by fibrosis. (Figure 1) Minimal dissection is required, and the procedure can be done under local anesthesia as an outpatient with minimal patient morbidity and recovery time. Other approaches to the mid-urethral sling have been developed, but there is limited randomized trial data comparing various approaches. These include

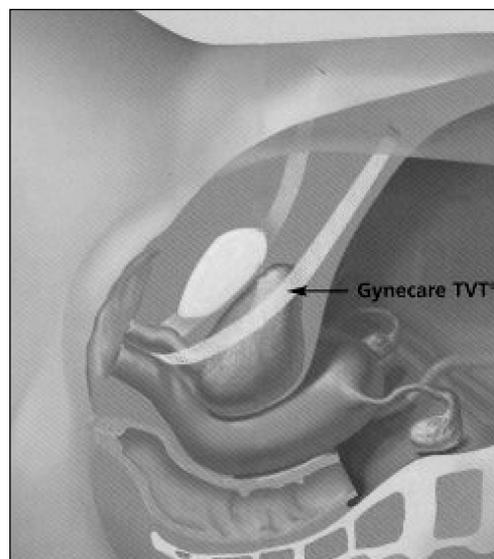


Figure1. Mid- urethral sling TVT<sup>TM</sup> (Gynecare, Ethicon Inc, Sommerville, NJ)

the transobturator approach, “needle-less slings”, and adjustable slings.

Another surgical option is injection of a urethral bulking agent, such as GAX™ collagen (Bard Inc., Covington, GA) at the bladder neck. Complications are rare and cure rates range from 20%-30%, but 50%-60% report marked improvement. Although improvement is reported to last from 3 months to years, most patients report relief ranging from 3-12 months and will require more than one injection.<sup>32</sup>

## URGE URINARY INCONTINENCE

Micturition involves the interaction of muscular, neurologic, and psychologic systems. During bladder filling, the normal detrusor relaxes to allow filling without resistance. As a person becomes aware of bladder distention, urination is voluntarily delayed through cortical centers in the frontal lobe until one can reach the restroom. The detrusor muscle then contracts in coordination with urethral relaxation in response to cholinergic signals from the pelvic nerves. This results in bladder emptying.

## DISRUPTION OF THESE COMPLEX INTERACTIONS RESULTS IN UUI.

Inappropriate contraction of the bladder causes UUI, often referred to as detrusor overactivity or “overactive bladder”. This may be caused by changes at the tissue and cellular levels, injury to the spinal cord, stretch injury to the pudendal nerve during labor, or neurologic problems. Many women may experience bothersome urgency and frequency without actually experiencing UUI.

The treatment includes behavioral therapy, bladder training, pelvic floor muscle therapy, and anti-cholinergic therapy. Behavioral techniques include lifestyle changes, including fluid and dietary modification, scheduled voiding, and pelvic floor reeducation. The overall goal is to train the bladder to store larger volumes of urine and control urgency by using pelvic muscles to inhibit detrusor activity. Fluid management may involve restriction if intake is high. Patients are also asked to restrict intake of known bladder irritants, including caffeinated foods and beverages.

The goal of bladder training and/or scheduled voiding is to increase the bladder's capacity. Patients are asked to schedule voiding if they have problems with frequency. The patient can also delay voiding for as long

as possible when a feeling of urgency occurs by using a variety of distraction techniques or quickly contracting the pelvic muscles to inhibit voluntary bladder contraction and reinforce detrusor inhibition. As discussed, pelvic floor muscle training has been shown to improve symptoms for all types of UI.

Acetylcholine is the primary neurotransmitter involved in a detrusor contraction, therefore, anti-cholinergic medications help to reduce detrusor overactivity. There are many brands on the market. The efficacy of anti-cholinergic treatment alone ranges from 9%-56%. Because they all have the same mechanism of action, efficacy is comparable among the different types of anti-cholinergics. Many pharmaceutical companies focus on minimizing side effects by increasing selectivity for the bladder. The most common side effects include dry mouth, constipation and central nervous system effects.

Surgical treatment for refractory UUI includes sacral neuromodulation. In the past, patients with refractory UUI were limited to radical procedures such as urinary diversion or cystectomy. Sacral neuromodulation offers a less invasive alternative. The technique stimulates the sacral nerves to modulate the neural reflexes influencing bladder and pelvic floor function. It is being applied in the treatment of UUI, urinary urgency and frequency, and urinary retention. This implantable system is comprised of a lead with 4 electrodes, an extension cable, and a programmable impulse generator. The lead is usually implanted into the S3 sacral nerve root, and the impulse generator is placed in the upper buttock region. The procedure is usually done in 2 stages. After implantation of the lead, if the patient's symptoms improve (defined as  $\geq 50\%$  improvement in one bladder parameter), the generator is placed approximately one week later. Both stages are done on an outpatient basis. In one prospective, multi-center study, 68% of patients with refractory UUI and 56% of patients with urgency/frequency reported successful outcomes at 5 years.<sup>33</sup>

## CONCLUSION

UI will affect 30% of all women at some point in their lives. It is associated with distressing psychosocial stigma and substantial medical costs to both the individual and society. Psychological and social effects of UI may prevent women from seeking attention.

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## Disclosure of Financial Interests

The author has no financial interests to disclose.

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