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## Medical evaluation and management of male and female voiding dysfunction: a review

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A significant workforce shortage of urologists available to serve the US population has been projected to occur over the next decade. Accordingly, much of the management of urologic patients will need to be assumed by other specialties and practitioners. Since primary care physicians are often first to evaluate common urologic complaints, it makes sense that these physicians are in an excellent position to intervene in the management of these patients when appropriate. One of the most common complaints in urology is voiding dysfunction. The incidence of voiding dysfunction increases with age, with conservative estimates showing that over 50% of elderly patients suffer. Despite this high prevalence and its negative impact on quality of life, however, few seek or receive treatment, as many do not readily disclose these impactful yet personal symptoms. We sought to summarize the typical presentation, evaluation, assessment and therapeutic options for both male and female patients presenting with voiding dysfunction.

**Key words:** urology, urinary incontinence, referral and consultation, urination disorders, disease management.

### INTRODUCTION

Voiding dysfunction is a term used to describe the many conditions resulting from impairment within the lower urinary tract, including the bladder, prostate (in men), and urethra. This is a widespread problem that is estimated to affect over half of the elderly population in this country [1]. It is estimated that 5% of men between the age of 20-44 and 17% of women over the age of 20 suffer from voiding dysfunction such as incontinence, which makes up a large percentage of this dysfunction [2, 3]. However, due to the fear of disclosing these embarrassing symptoms, this value is often underestimated. Furthermore, voiding dysfunction is costly, with incontinence alone estimated to cost \$19.5 billion in 2000 [4]. Since that time, the prevalence of voiding dysfunction has continued to increase. In addition to this widespread problem, the physicians who historically have managed these patients, namely urologists, are suffering from an impending workforce shortage. There has been a decreasing supply of urologists relative to population growth over the last ten years which will only continue to widen in the future [5]. Given that the average patient age managed by urologists is one of the highest among specialties, it is essential that other clinicians carry a primary role in the treatment of voiding dysfunction as well. Hence, familiarity with the signs and symptoms, evaluation and

treatment options, as well as recognition of when a urology referral is necessary, are critical so that patients may receive timely and effective treatment.

### MALE VOIDING DYSFUNCTION

#### MALE STRESS URINARY INCONTINENCE (SUI)

Stress urinary incontinence (SUI) is an involuntary loss of urine during physical exertion or physical activity [6]. Men who have undergone surgical treatment or radiation therapy for prostatic conditions, such as an enlarged prostate or cancer, have an increased risk of developing SUI [7]. Men who undergo multiple prostatic treatments have a substantially higher risk of developing SUI when compared to those who have only undergone a single treatment modality.

#### Pathophysiology

SUI occurs when the urethral resistance cannot overcome the increased intravesical pressure, which primarily comes from the abdomen. In the male patient, significant risk factors for SUI include increasing age and prior prostate procedures [8]. SUI is usually the result of post-surgical or post-radiation changes in the lower urinary tract. The internal sphincter is located at the juncture of the bladder neck and prostate, and is therefore

susceptible to damage during endoscopic procedures, while the external sphincter is made up of the musculature of the pelvic floor. This disease process

is thought to be due to injury to the internal urinary sphincter and a lack of mobility of the external sphincter [9].

*Table 1*

This table provides a brief summary of voiding dysfunctions diagnoses, how to identify via history taking, and when urologic referral is indicated

Condition	Clinical History	Indication for Urologic Referral
<b>Stress Urinary Incontinence (SUI)</b>	Urinary incontinence with Valsalva maneuvers (e.g. coughing, laughing, sneezing, running)	1. Inadequate clinical improvement following pelvic floor muscle therapy 2. Patient preference for surgical intervention
<b>Over Active Bladder (OAB)</b>	Sudden compelling desire to void $\pm$ urinary frequency	1. Inadequate clinical improvement follow behavioral modifications (fluid management and minimization of bladder irritants) + failure to respond to 1 or 2 OAB medications 2. Concern for incomplete bladder emptying 3. Patients with neurogenic bladder (e.g. multiple sclerosis, Parkinson's disease, spinal cord injury) 4. Patients with gross or microhematuria
<b>Urge Urinary Incontinence (UII)</b>	Urinary incontinence associated with urgency (not able to make it to the bathroom in time)	1. Inadequate clinical improvement following behavioral modifications (fluid management and minimization of bladder irritants) + failure to respond to 1 or 2 OAB medications 2. Concern for incomplete bladder emptying 3. Patients with neurogenic bladder (e.g. multiple sclerosis, Parkinson's disease, spinal cord injury) 4. Patients with gross or microhematuria
<b>Lower Urinary Tract Symptoms (LUTS) from Benign Prostatic Hyperplasia (BPH)</b>	Irritative voiding symptoms (urinary frequency, urgency, urge incontinence and nocturia) and obstructive voiding symptoms (weak urinary flow rate, straining, urinary retention, overflow incontinence)	1. Failure to respond to 1 or 2 BPH medications 2. Patient preference for surgical intervention 3. Concern for incomplete bladder emptying or retention 4. Renal impairment 5. Patients with gross or microhematuria 6. Abnormal digital rectal exam or elevated prostate specific antigen
<b>Overflow Urinary Incontinence and Detrusor Underactivity</b>	Symptoms of storage, such as nocturia, urgency, and frequency, or a lack of any urge to void at all which may cause overflow incontinence	1. Upon diagnosis for proper testing and management
<b>Interstitial Cystitis (IC)/Bladder Hypersensitivity</b>	Increased discomfort (sensations of pressure, pain, or spasms of the suprapubic or urethral regions) with bladder filling and immediate relief with voiding [47, 48]	1. Inadequate clinical improvement following behavioral modifications (heat and cold to area of discomfort, minimization of causative agents) 2. Inadequate clinical improvement following first line medications 3. Patient preference for surgical intervention
<b>Dysfunctional Voiding (DV)</b>	Urinary storage symptoms (nocturia, urgency, frequency) along with incontinence throughout the day	1. Inadequate clinical improvement following lifestyle modifications 2. Patient preference for surgical intervention
<b>Bladder Neck Dysfunction (BND)</b>	Hesitancy, pelvic discomfort, frequency, urgency, hesitancy and sense of incomplete emptying or impaired stream	1. Inadequate clinical improvement following first line medication (alpha-adrenergic antagonists)

### Clinical presentation

Men with SUI usually describes leakage of urine with physical activity or Valsalva maneuvers such as coughing, laughing or lifting anything heavy. Often, they wear pads or diapers to conceal the leakage. SUI generally does not pose a significant medical issue but has a negative impact on quality of life and independence, and poses a financial burden due to the cost of daily pads or diapers [9].

### Assessment and diagnosis

Obtaining a detailed voiding and leakage history from the patient is the first step in identifying SUI in men. Differentiating SUI from urge urinary incontinence (UII), overflow urinary incontinence, or mixed urinary incontinence may be difficult, but remains critical since treatments differ. These are usually distinguished by careful history taking. Occasionally, urodynamic study and/or cystoscopy from an urologist are necessary

to confirm the diagnosis. It is critical to uncover the duration of symptoms and severity, as well as to assess whether the patient is distressed. Those who are not troubled by their leakage rarely require treatment. Severity can be evaluated by the number of pads or diapers used per day if the patient is using such, with pad weight further helping quantify the degree of leakage, as some patients are more fastidious about changing. When performing an exam of the abdomen and external genitalia, the patient's bladder should be full. Urinary leakage demonstrated when the patient bears down (Valsalva maneuver) is pathognomonic for SUI. However, demonstration of SUI in the office, although helpful, is not required for nonsurgical or surgical intervention.

### **Nonsurgical treatment**

Once reversible causes are excluded, nonsurgical options are the first line of therapy for the management of SUI before surgical intervention. Lifestyle interventions are the first step, with recommendations for decreasing caffeine intake, promotion of weight loss, and encouragement for smoking cessation [9]. If lifestyle modifications do not succeed, further treatments include daily pelvic floor muscle therapy regimens such as Kegel exercises. As many patients are not able to correctly perform Kegel exercises, a pelvic floor physical therapist may be helpful for those patients, aiding them in identifying the precise muscles required for training [10]. Overall, Kegel exercises have been shown to decrease the severity of leakage and improve quality of life scores for those patients suffering from SUI [11]. Medical therapies, such as with antimuscarinic medications, have shown limited success in treating SUI [12] and are most effective in patients with mixed incontinence. If a patient has tried these therapies for at least a year without improvement, surgical management for SUI can be considered.

### **Surgical treatment**

Men with SUI impacting their quality of life can opt for surgical treatment after failing nonsurgical treatment. There are three surgical options for the management of SUI in men. The least invasive is a bulking agent injected near the bladder neck, meant to improve urethral coaptation. Short term success rates are poor at 43% [13]. The success of this procedure is dependent on urethral pliability to accommodate the bulking agent. Another option is to increase the urethral resistance via a male

sling. The short-term results have been variable, at 42.9-79% continence depending on the sling type, with the long-term durability undetermined [14]. Lastly, the artificial urinary sphincter is currently the gold standard for the treatment of male SUI. Although the short-term success rates are excellent with the artificial urinary sphincter at 82%, this implantable device has a higher risk of reoperation rate within 8 years [15]. Critically, the patient has to be willing and able to work the device on his own.

### **LOWER URINARY TRACT SYMPTOMS (LUTS) AND BENIGN PROSTATIC HYPERPLASIA (BPH)**

Lower Urinary Tract Symptoms (LUTS) describe symptoms related to the lower urinary tract, including the bladder, prostate, and urethra. These symptoms are classified into obstructive and irritative to help identify the cause. Irritative symptoms include urinary frequency, urgency, urge incontinence and nocturia. Obstructive symptoms often include weak urinary flow rate, straining to urinate, urinary retention, and overflow urinary incontinence. In men the most common cause of LUTS is Benign Prostatic Hyperplasia (BPH), which can have either irritative or obstructive voiding symptoms.

### **Pathophysiology**

There are many theories to the cause of LUTS from BPH, but most agree that the hyperplasia of the prostatic cells within the prostatic urethra is responsible for some of the urinary symptoms [16]. In particular, obstructive symptoms are thought to be due to compression of the urethra caused by hypertrophy of the prostate. As for the irritative symptoms, it is believed to be due to the prostate obstructing the bladder outlet with resultant hypertrophy of the bladder wall muscle.

### **Clinical presentation**

The clinical presentation of BPH is variable, but most men present with complaints of LUTS. These men are usually over 50, with concerns including both obstructive and irritative symptoms of varying severities. The risk of developing BPH increases with age and can be high as 70% in men over the age of 75 [17]. The most commonly reported symptoms include nocturia, daytime frequency, and a feeling of incomplete voiding. The development of symptoms is gradual, over several years, which may make these symptoms challenging to notice.

### Assessment and diagnosis

The first step in evaluation is a detailed history querying the duration and progression of the patient's urinary symptoms. Physicians should also assess the impact of LUTS on the patient's quality of life. Both goals can be accomplished using International Prostate Symptoms Score (IPSS) questionnaire. Next, a urinalysis is needed to rule out infection and hematuria. A physical exam should include a digital rectal exam (DRE) to check the prostate enlargement, as well as a discussion regarding prostate cancer screening including blood PSA testing. Elevated PSA results should prompt a urology consult. Non-invasive testing including urinary flow rate and a post-void residual (PVR) ultrasound scan can be helpful in assessing the severity. Low flow rates and high PVR values both increase the suspicion for BPH. In complicated clinical scenarios where neurogenic bladder dysfunction or overactive bladder may be occurring concurrently with BPH, a urodynamic evaluation is helpful. In these cases, seeking a urological consultation is immensely beneficial for patient management. BPH is a clinical diagnosis, and the decision to treat is based on the severity of symptoms, evidenced by a high PVR volume, UTI, and extent of negative impact on QOL experienced by the patient. Accordingly, BPH is mostly a disease affecting QOL, but it can lead to more serious medical complications such as urosepsis, bladder stones, and renal insufficiency due to chronic outlet obstruction.

### Non-surgical treatment

The first line of treatment for LUTS from BPH is non-surgical therapy. Depending on the most prominent symptoms, patients may also be advised to undergo behavioral modifications. For example, patients with prominent nocturia may be counseled to limit their fluid intake after dinner to decrease symptom severity. For medications, alpha-blockers are the first line therapy and the most common treatment modality for the management of BPH [18]. A significant side effect is hypotension, which can limit its use. Patients unable to take alpha-blockers or who fail treatment can be started on 5-alpha reductase inhibitors. Patients on both these medications for their treatment of BPH are considered to be on maximal medical therapy. Newer studies have suggested that Tadalafil may be helpful in patients with LUTS, with a mechanism similar to that of alpha-blockers [19]. Patients considering further intervention will need to be referred to an urologist.

### Minimally invasive therapy (MIT)

MITs have become very popular in the treatment of BPH because they are outpatient procedures. MIT is reserved for patients that are failing medical therapy or considering coming off medical therapy. These therapies aim to decrease the amount of prostatic obstruction to the urethra. Some of the common minimally invasive therapies include a urethral lift procedure (UroLift) and steam therapy (Rezum). These are newer technologies with limited long term data, compared to older MIT such as transurethral needle ablation (TUNA), which is no longer recommended and transurethral microwave therapy (TUMT), which has been shown to have higher reoperations rates than other options. MITs are outpatient procedures, requiring no general anesthesia and are associated with less sexual side effects, such as retrograde ejaculation, which can be prominent in the surgical therapies [20]. These advantages make MIT a very desirable option for a patient suffering from BPH.

### Surgical therapy

Surgical therapy is reserved for those who have failed medical therapy, or who are unwilling to continue medications or use other therapies. There are several surgical therapies available for BPH, with the gold standard being TURP. TURP is now considered size independent, though larger prostates above 80-100 grams, are often considered for other procedures. Alternatively, Holmium laser enucleation of the prostate (HoLEP) is a promising procedure that can treat any size prostate endoscopically. Other techniques include ablative procedures, such as the Green Light, Diode laser ablation of the prostate, and Aquablation which uses high velocity water jets to ablate prostatic tissue. Another option is the transurethral incision of the prostate (TUIP), which is recommended for prostates below 30 grams. The decision for which type of surgery is discussed between the urologist and the patient based on patient characteristics and preference.

### OVERACTIVE BLADDER (OAB), URINARY URGE INCONTINENCE (UUI)

Overactive active bladder (OAB) syndrome represents an array of symptoms including urinary urgency, frequency, and urge incontinence (UUI). UUI is defined as the sudden, involuntary loss of urine associated with feelings of urgency to void. The hallmark OAB syndrome is urinary urgency and may be accompanied by UUI [21]. Men with

these symptoms should also be evaluated for BPH since LUTS and OAB often overlap. Urinary tract infections, prostatitis, and cystitis should be ruled out with urine cultures before starting treatment for OAB.

### **Pathophysiology**

The pathophysiology of idiopathic OAB syndrome is poorly understood and currently thought to be multifactorial [22]. Some neurologic conditions, such as multiple sclerosis and Parkinson's disease, can cause bladder overactivity and be mistaken for idiopathic OAB syndrome. It is important to rule out these conditions before initiating treatment for OAB. Additionally, patients with bladder outlet obstruction from BPH can also have symptoms that can be mistaken for OAB and must be ruled out. Other causes of urinary symptoms that mimic OAB include bladder cancer, non-infectious cystitis, and prostatitis. All should be ruled out before beginning treatment of OAB.

### **Clinical manifestation**

Men with OAB will often describe episodes of a sudden need to void without much warning, often struggling to make it to the bathroom before the initiation of voiding. OAB can be divided into two separate subtypes – dry and wet. Patients with dry OAB have severe urgency but deny episodes of urinary incontinence. Conversely, wet OAB is urinary urgency commonly associated with incontinence. Wet OAB comprises 33% of OAB cases [23].

### **Assessment and diagnosis**

Men with OAB will report some degree of urinary urgency that is affecting their daily life. It is important first to confirm that the patient is experiencing UUI, rather than SUI or mixed incontinence. A detailed history, including duration and severity of symptoms, is important. Severity can be assessed by the number of pads used per day if the patient is using pads. A bladder diary documenting fluid intake, urine output, and voiding episodes can be given to the patient to complete before future office visits and can be helpful for decision making. OAB symptoms in men over 50 present a challenging situation for the clinician due to the increased risk of concomitant BPH, and the large amount of overlapping symptoms between the two conditions. Patients that have bladder outlet obstruction from BPH and OAB syndrome should be evaluated by an urologist.

### **Nonsurgical treatment**

Management of OAB syndrome begins with non-surgical intervention. Behavioral modification is the first step. Patients should be adequately counseled on avoiding bladder irritants such as caffeine, alcohol, artificial sweeteners, as well as preventing dehydration or overhydration. Modifications in behavior are often effective in reducing the symptoms of OAB and UUI [24]. The role of a pelvic floor physical therapist in this clinical situation may be helpful, but it is not as well established for men as it is in women.

Most experts agree that BPH should be treated before the initiation of medical therapy for OAB [25]. Treating BPH first is done to avoid the risk of causing urinary retention, a side effect of many OAB treatments. Occasionally, pharmacotherapy for BPH can also lead to symptomatic relief of OAB. These clinical situations can be difficult, and a referral to a specialist is warranted.

Men who continue to have isolated OAB syndrome after behavioral modification, in the absence of BPH or neurologic bladder dysfunction, are candidates for pharmacologic therapy. Two main classes of OAB medications exist – antimuscarinics and beta-3 agonists. No conclusive evidence supports the use of one OAB medication over the other, although each has a different side effect profile which should be considered when deciding. Bladder diaries should be obtained before and after the initiation of medical therapy to judge the effectiveness of the medication. The efficacy of the drug requires a minimum of 4-6 weeks before alternative therapies are considered.

### **Surgical treatment**

Men with isolated OAB that have failed nonsurgical treatment should be referred to an urologist. Posterior tibial nerve stimulation (PTNS), an outpatient procedure performed by an urologist, is offered on a weekly basis for 6 weeks. This is a minimally invasive form of neuromodulation that has been proven effective in the treatment of OAB, working as well as medications but with less side effects [26].

Other surgical treatments available include intradetrusor Botox® injections and sacral neuromodulation therapy (Interstim®). Intradetrusor Botox injections can be performed in the office without anesthesia while implantation of the Interstim devices requires a procedure with sedation or general anesthesia in the operating room setting.

#### OVERFLOW URINARY INCONTINENCE AND DETRUSOR UNDERACTIVITY (DUA)

Detrusor underactivity (DUA) is a cause of urinary incontinence due to overflow. DUA occurs due to incomplete emptying of the bladder due to decreased contractile strength. This can have significant impacts on quality of life, with both voiding and storage symptoms present. DUA and overflow incontinence condition is seen more prevalently in the elderly population, with some studies showing that 48% of men over the age of 70 are affected by this condition [27]. The presence of bladder outlet obstructions can further complicate this condition.

#### Pathophysiology

The pathophysiology of detrusor underactivity is poorly understood, in part due to the many possible causes of this condition, such as myogenic, neurogenic, or idiopathic. Underactivity may be the result of poor detrusor muscle function or poor neurological control with problems possible at any point in the neurological pathway [28]. It is currently thought that age, diabetes, and other neurological risk factors such as stroke or neurodegenerative disease all confer a high risk for DUA. Current research is assessing the possibility of urothelial dysfunctions role in the DUA process [29]. This work suggests that impaired signaling and sensory transduction from the urothelium itself may play a role in DUA.

#### Clinical manifestation

There are no specific symptoms associated with this disorder. The symptoms seen with DUA mimic those of bladder outlet obstruction and overactive bladder [30]. Patients may present with symptoms of storage, such as nocturia, urgency, and frequency. It is also possible patients may lack any urge to void at all, and may present with DUA and overflow incontinence in this manner as well. Generally speaking, these patients have a weak stream with incomplete emptying if they can void. A further complication is added in patients with a neurological disease which alters sensation.

#### Assessment and diagnosis

Diagnosis of this condition can be difficult, as test results often have very similar findings in detrusor underactivity and bladder outlet obstruction. Utilizing flow rate and PVR testing is inadequate for this reason. Urodynamics is the only accepted

method to diagnose detrusor underactivity, with results showing low pressure and low flow indicative of underactivity [28, 30, 31].

#### Treatment

Overall this is a significantly under-researched condition. These patients should be referred to an urologist both for testing to confirm the diagnosis, as well as management. Treatment options attempt to prevent complications and improve contractile strength. Currently, there is a lack of any data showing medications as beneficial. As many of these patients have concurrent bladder outlet obstruction, there have been attempts to relieve this obstruction in hopes of improving DUA symptoms. This approach has shown poor results, with many patients having unsatisfactory outcomes after prostate reducing procedures [32]. Electrical stimulation of the bladder via an implantable device has also been a topic of interest for these patients. In the very limited patients who have undergone this procedure, there have been significant increases in voided volume and a reduction in PVR volume [33], though this may not work well in all patients [34]. *Other approaches to treatment include placement of a suprapubic catheter to drain the bladder, or urinary diversion to avoid complications.*

### FEMALE VOIDING DYSFUNCTION

#### FEMALE STRESS URINARY INCONTINENCE (SUI)

#### Pathophysiology

SUI occurs when urethral resistance is overcome by increased intra-abdominal pressure, and should be thought of as “activity related incontinence”. In female patients, SUI is the result of poor mucosal coaptation (intrinsic sphincter deficiency), lack of peri-urethral support structures (Hammock hypothesis), or a combination of factors [35]. Risk factors for developing SUI include pregnancy and childbirth, increasing age, obesity, previous pelvic surgery, and chronic cough.

#### Clinical presentation

Women with SUI will complain of urinary incontinence while coughing, laughing, or sneezing. Women may also complain of incontinence during a spectrum of physical activities (e.g., brisk walking to high impact jumping). Although it does not pose a medical threat to most patients, SUI can have a negative impact on a woman’s quality of life [36].



### Assessment and diagnosis

While obtaining a clinical history, some women may offer a clear history of SUI and others may need help determining if they experience SUI, urgency urinary incontinence, or mixed urinary incontinence (both stress and urgency incontinence). “What are you doing when you leak?” is an effective way to start the conversation. History should include duration of incontinence, severity (number of pads per day), and degree of bother. SUI that is not bothersome often does not require clinical intervention. A limited pelvic exam to demonstrate leakage while a patient coughs or bears down can help solidify the diagnosis, but it is not required for non-surgical treatments.

### Non-surgical treatment

SUI can be managed with non-surgical interventions. Women who perform daily pelvic floor muscle therapy (PFMT) regimens (e.g. Kegel exercises) report significant improvement in validated SUI bother scores and quality of life metrics [37]. If woman interested in following a PFMT regimen at home, proper Kegel technique should be reviewed in the office or patients should be referred to a pelvic floor physical therapist for proper instruction. While many women may recognize the term “Kegel exercise,” nearly half of women do not perform Kegel exercises correctly [38]. In addition to PFMT, vaginal inserts provide mechanical support at the level of the urethra and subsequently reduce the severity of SUI. Although continence pessaries are to be managed by a specialist, women can be instructed to use an over the counter product that is inserted like a tampon (Poise® Impressa®). These easily accessible products are best for use during situations when women increase their physical activity level (e.g. trip to the gym). Non-surgical management options for SUI are associated with minimal risk and should be offered to all patients with bothersome SUI before pursuing specialty referral.

### Surgical treatment

Women with SUI who have failed non-surgical treatment or who do not wish to pursue non-surgical treatments should be referred to a specialist. Surgical treatments available include peri-urethral bulking agents and various types of urethral slings. Injection of peri-urethral bulking agents is meant to improve urethral coaptation. Documented efficacy rates for peri-urethral bulking agents vary from 22-66%, with only short term

improvement in SUI [39]. Urethral slings offer superior success rates with short term success ranging from 62 to 97% [40]. Urethral slings can be made of polypropylene mesh, a biologic graft, or autologous fascia. Urethral slings remain the gold standard for the surgical management of SUI.

### OVERACTIVE BLADDER (OAB)/URGENCY URINARY INCONTINENCE (UII)

The hallmark of OAB syndrome is urinary urgency. OAB is usually accompanied by frequent urination with or without UII. Women with OAB should not have a urinary tract infection or other obvious lower urinary tract pathology to explain their urinary urgency.

### Pathophysiology

The pathophysiology of idiopathic OAB is not well understood and the etiology of OAB symptoms in most women is likely multifactorial. A number of neurologic conditions can promote bladder spasms (overactive detrusor muscle), including multiple sclerosis, Parkinson’s disease, suprasacral spinal cord injuries, and previous cerebrovascular accidents. OAB symptoms can also manifest in patients with mechanical bladder outlet obstruction (e.g. pelvic organ prolapse), bladder cancer or non-infectious cystitis (e.g. radiation cystitis, painful bladder syndrome/interstitial cystitis).

### Clinical presentation

Women with OAB suffer from a sudden need to void and “not enough warning time” to get to the bathroom. They often report frequent urination during the daytime and nocturia. Approximately one third of women with OAB syndrome will also complain of UII episodes when they cannot get to the bathroom in time [41]. The prevalence of UII is approximately 50% in OAB patients with diabetes [42].

### Assessment and diagnosis

Women with OAB must report some degree of urinary urgency that is bothersome to them. Some women may also offer a clear history of UII and other women may need help determining if they experience UII, SUI, or mixed urinary incontinence. “What are you doing when you leak?” is a good way to start the conversation. The history should include duration of symptoms, the severity of their incontinence (number of pads per day) if they complain of UII, and degree of bother.

### Non-surgical treatment

Treatment of women with bothersome OAB and UUI should start with non-surgical interventions. The treatment algorithm should always include behavioral modifications, which may dramatically improve OAB symptoms and UUI. These women should be counseled to minimize their intake of bladder irritants and to avoid dehydration or over-hydration. If a patient cannot provide a reliable fluid intake history, then a 3 day bladder diary is helpful to identify bladder irritants, capture instances of fluid mismanagement, and document just how frequently these women are voiding and having episodes of UUI [43]. Beyond behavioral modifications, women can participate in PFMT regimens with or without the guidance of a pelvic floor physical therapist.

Those who continue to have bothersome symptoms following behavioral modification are candidates for pharmacologic therapy. There are two classes of OAB medications, anti-muscarinics and beta-3 agonists, with no conclusive evidence favoring one OAB medication over another. Common side effects associated with anti-muscarinic medications include dry mouth, dry eyes, and constipation. The most common side effect associated with a beta-3 agonist is an increase in blood pressure. Patients should be counseled that a medication trial of 3-4 weeks is required before efficacy is determined.

Finally, women who experience suboptimal efficacy with an OAB medication alone are candidates for percutaneous tibial nerve stimulation (PTNS) with a pelvic floor specialist. PTNS is conducted in the office and patients can continue to use an OAB medication during their treatment course.

### Surgical treatment

Women with OAB who have failed non-surgical treatment should be referred to a urologist. Surgical treatments available to address OAB and UUI include bladder Botox® injections and sacral neuromodulation (Interstim®). Bladder botox injections can be performed in an office setting, while implantation of the Interstim® device requires a minimum of sedation in an operating room setting.

#### INTERSTITIAL CYSTITIS (IC)/BLADDER HYPERSENSITIVITY

### Pathophysiology

While the pathophysiology of interstitial cystitis (IC) is not well understood, this diagnosis is often made in patients with chronic bladder pain

in the absence of other known etiologies. This disease often coexists with other chronic pain syndromes such as irritable bowel syndrome and fibromyalgia and is thought to be analogous to these chronic pain conditions. However, this terminology is a misnomer as often there is no evidence of inflammation within the bladder, nor is this disease associated with abnormalities within the interstices of the bladder. While little is known about IC and its hypersensitivity symptoms, neurologic upregulation of pain sensation and increased activation of bladder sensory neurons seem to play a significant role in its development [44, 45]. Disruption in the molecular integrity of the glycosaminoglycan layer of the bladder mucosa which protects the bladder from certain irritants may further exacerbate the condition [46, 47].

### Clinical presentation

The chief complaints and presenting symptoms of an IC patient are highly variable and subjective. However, the most consistent feature that patient's present with are increased discomfort with bladder filling and immediate relief with voiding [47, 48]. Other general concerns consistent with IC and bladder hypersensitivity include sensations of pressure, discomfort or spasms of the suprapubic or urethral regions. Other irritative symptoms such as frequency, urgency, and nocturia are also common. Some patients may even be able to identify an inciting event that may trigger or worsen their symptoms such as a UTI, consumption of certain foods, or during the luteal phase of the menstrual cycle [49].

### Assessment and diagnosis

The goal of diagnostic assessment is to exclude other treatable conditions and identify characteristic features of IC. Assessment includes a thorough history taking, physical examination, and urinalysis. History should be focused on voiding symptoms and characteristics of the bladder discomforts. Two standardized questionnaires, namely the IC Symptom and Problem Index and the Genitourinary Pain Index can be used to assess the severity of patient symptoms [50, 51]. The physical exam should include a pelvic examination and a digital rectal examination to rule out any other underlying disorders. Urinalysis can be used to rule out STI, UTI, or hematuria. Symptoms characterized by bladder discomfort upon bladder filling are a hallmark for IC after all other possible etiologies have been excluded.

### Non-surgical treatment

Like most conditions, lifestyle modifications and non-surgical treatment options should be pursued first. Behavioral modifications include the application of cold or heat locally over the area of discomfort and avoidance of any food or activities that may exacerbate IC symptoms. For IC and hypersensitive bladder, analgesics such as phenazopyridine can be used as a short-term relief to minimize pain and maximize function during an episodic flare-up. For longer-term medications, amitriptyline is often suggested as the first-line oral medication [52]. Other recommended medications include pentosan polysulfate sodium or antihistamines such as hydroxyzine or cimetidine [53]. If these oral medications do not work, other alternative therapies including bladder hydrodistention, intravesical instillation with dimethyl sulfoxide, intradetrusor injection of botulinum toxin and sacral neuromodulation can be considered. Observational studies assessing the efficacy of these therapeutic options remain scarce and among small sample sizes only [54-57]. Larger, prospective, randomized studies are required to further investigate the durability and safety of these treatments.

### Surgical treatment

After all else fails, there is an option to pursue surgery for the amelioration of bladder discomfort and symptoms secondary to IC or hypersensitivity. Urinary diversion involves diverting urine from the bladder into a continent catheterizable urine pouch or an incontinent urostomy, with the possibility for removal of the bladder at the same time. As such, symptomatic relief can potentially be obtained as bladder filling and distention is no longer possible. These complex reconstructive surgeries can reliably relieve hypersensitivity and irritative symptoms, but pelvic pain may sometimes persist even if a cystectomy is performed [58, 59].

## DYSFUNCTIONAL VOIDING (DV)

### Pathophysiology

Dysfunctional voiding (DV) is a disorder caused by dyssynergic striated sphincteric activity at the level of striated urethral sphincter-pelvic floor complex (SUS-PFC). Individuals with this disorder do not have any association with any apparent neurological disease or injury. The DV disorder is considered habitual, as the result of a child learning the wrong habits to contract the

SUS-PFC during voiding as opposed to relaxing it. These habits may form in part due to a response to urgency, pelvic discomfort, or with inappropriate toilet training.

### Clinical presentation

Patients with DV often present with urinary incontinence throughout the day. They may also present with LUTS such as frequency, urgency, nocturia and nocturnal enuresis [60]. Storage symptoms are the most common presenting symptom and may sometimes be the only symptom [61].

### Assessment and diagnosis

The American Urological Association Symptom Score (AUASS) can be used to assess the severity of a patient's DV, with authors deriving a cutoff of 6 for girls and 9 for boys to diagnose DV. Other authors have also created different scoring systems, namely the "wetting and functional voiding disorder" scoring system by Akbal *et al.* and 14-item Likert scale questionnaire by Afshar *et al.* as aids to diagnose patients with DV [62, 63]. Besides this, uroflow and urodynamics studies are also essential to diagnose DV. Repeated demonstration of a staccato, interrupted pattern on uroflow is classic for DV as urinary sphincters do not relax entirely during voiding. The definitive test to diagnose DV is visualizing bladder outlet obstruction secondary to dyssynergic external sphincteric activity on urodynamics testing [64].

### Non-surgical treatment

Lifestyle modifications for DV include hypnosis, bladder retraining, and biofeedback to the pelvic floor with conservative urotherapy. All have the primary goal of enabling the patient to relax the bladder outlet during voiding. Anticholinergic medications such as  $\alpha$ -adrenergic blockers may also serve to relax the bladder neck. In certain situations, some patients may even benefit from sphincteric injection with botulinum toxin [65]. In refractory cases of DV, sacral neuromodulation with the Interstim device or percutaneous tibial nerve stimulation has proved to be a safe, durable and efficacious method in treating DV [66-68].

## BLADDER NECK DYSFUNCTION (BND)

### Pathophysiology

Primary bladder neck dysfunction (BND) refers to a functional impedance of urinary flow at

the level of the bladder neck. BND, however, develops when the bladder neck hypertrophies, becomes less elastic and increasingly more obstructive, which impedes urine flow. It is hypothesized that there is a neurological component linked to this disorder as studies have shown a relative increase in the density of neuropeptide Y immunoreactive nerves and exaggeration of the sympathetic nervous system in the bladder neck [69, 70]. Additionally, others have also noted the aberrant orientation of detrusor and bladder neck muscle fibers resulting in the narrowing of the bladder neck [71].

### Clinical presentation

Patients with BND often present with a combination of symptoms, with the most common being hesitancy, pelvic discomfort, frequency, urgency, hesitancy and sense of incomplete emptying or impaired stream. Occasionally, patients may have a history of constipation or previous UTI or encopresis [72].

### Assessment and diagnosis

Urodynamic studies are often required to make the definitive diagnosis of BND. On video urodynamics, patients present with inadequate or delayed bladder neck funneling during voiding, quiet pelvic floor throughout voiding, diminished uroflow despite adequate detrusor contraction and prolonged opening time [73, 74]. Additionally, electromyography (EMG) can be done together with the video urodynamics to show a prolonged pelvic floor EMG lag time (> 6 seconds) to reinforce the diagnosis further [75]. If ultrasound studies are obtained, there may be evidence of bladder wall thickening and elevated post-void residual volume. Overall, evidence of diminished urine flow rates in the presence of high voiding detrusor pressures is the hallmarks of obstruction.

### Non-surgical treatment

Biofeedback therapy with pelvic floor manipulations, timed voiding, and anticholinergic

medications do not seem to be effective in treating BND as the autonomic nervous system primarily controls the bladder neck. To date,  $\alpha$ -adrenergic antagonists have remained the first-line medical therapy for BND [76]. Tamsulosin seems to be the most tolerable  $\alpha$ -blocker with similar efficacy among children.

### Surgical treatment

Patients with delayed treatment for BND may develop worsening detrusor dysfunction such that they become resistant to medical therapies such as  $\alpha$ -blocker. In such cases, surgical management, such as the transurethral incision of the prostate or bladder neck, may be warranted [77, 78]. Due to the more invasive fashion of these treatment alternatives, there is an increased risk of sexual dysfunction such as retrograde ejaculation.

### CONCLUSION

Voiding dysfunction is a common complaint in both men and women, and although it can be difficult for patients to talk about due to the intimate anatomy and nature of this condition, it nonetheless has major quality of life implications and carries a great cost to society. As the workforce shortage in urology grows, it is vital that other practitioners, namely primary care, step in to provide the proper care to these patients. Accordingly, these clinicians should be able to recognize the varying conditions associated with voiding dysfunction, evaluate and treat these patients with first-line therapies, and be able to identify which patients require a referral to an urologist.

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*O scădere a forței de muncă a urologilor este prevăzută în Statele Unite în decadele viitoare. În lumina acestor date managementul unor afecțiuni urologice va fi preluat de către medici din alte specialități. Medicii de familie sunt prima linie de intervenție și cel mai probabil ei vor trata aceste afecțiuni. Una dintre cele mai frecvente afecțiuni urologice este pierderea involuntară de urină. Incidența acesteia crește odată cu vârsta, considerându-se că mai mult de 50% dintre pacienții în vârstă suferă de această afecțiune. În ciuda prevalenței înalte și al impactului negativ asupra calității vieții puțini pacienți doresc să se trateze*

*întrucât pușini recunosc simptomele. Scopul acestui review este de a prezenta evaluarea și abordarea terapeutică a incontinenței urinare la pacienții de gen feminin și masculin.*

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