

Urinary Incontinence

429 OB/GYN Team

Sources: Dr. Iqbal Turkistani's lecture, BRS Obstetrics & Gynecology 2ed by E. P. Sakala, Essentials of Obstetrics & Gynecology 4ed by Hacker & Moore, and atlasofpelvicsurgery.com

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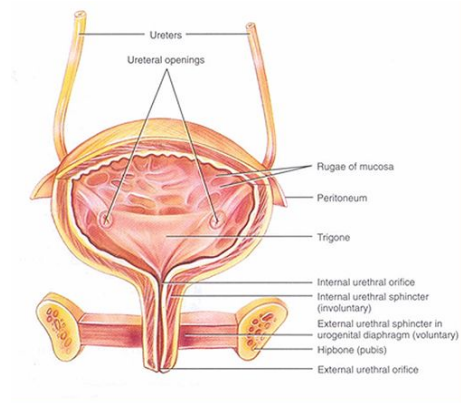
Basic Anatomy Of The Lower Urinary Tract (Lut) In Women

- The LUT is composed of the bladder and urethra in a functional unit serving the two purposes of storage and voiding during the micturition cycle
- These structures are supported by the pelvic floor



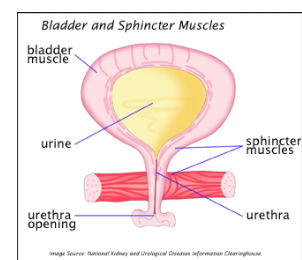
The Urinary Bladder

- Is a hollow, muscular organ which acts as a compliant reservoir for urine
- The bladder wall is composed of several layers:
 - a. The **Detrusor**: Is a complex network of smooth muscle fibers and elastic tissue
 - i. **Allows the bladder to expand without pressure during bladder filling** and is
 - ii. Responsible for bladder **contraction** during voiding
 - b. The **Trigone**: Is a small muscular triangular area, lying at the posterior wall of the bladder, next to the bladder neck.
 - i. Functions to **prevent reflux** of urine to the upper urinary tract during voiding.
 - ii. The two ureters enter the bladder at the superior angles of the trigone.
 - iii. At the lower most apex of trigone is the opening of the bladder neck to the urethra.
 - c. Urothelium: The epithelial lining of the detrusor
 - i. Is smooth at trigone & folded into rugae on the rest of the bladder when empty



The Urethra And Sphincters

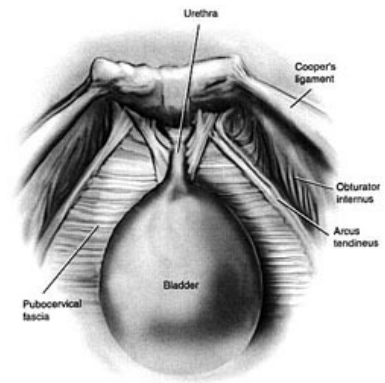
- The female urethra is a fibromuscular tube that's **3-5 cm long**
 - Consists of outer layer of striated muscle fibres, and an inner layer of smooth muscle fibres, lined by the mucosa, submucosal vessels and connective tissues.
- The Urethral Sphincters: Two mechanism to control urine flow:
 - The **smooth muscle sphincter (bladder neck and proximal urethra)**
 - **Physiological** but not anatomical sphincter
 - Under involuntary control
 - Keeps the bladder and upper urethra **closed during the storage phase**
 - The **Striated Sphincter**:
 - **Intrinsic** sphincter: striated musculature, which is part of the outer wall of proximal urethra
 - **Extrinsic** sphincter: bulky skeletal muscle group lateral to the urethra at the level of the middle segment in female
- Mucosa and submucosa: Urothelium lining the urethra, beneath is a vascular plexus → helps form water tight seal



The Pelvic Floor

The pelvic organs are supported and maintained in the correct position by the "Pelvic Floor"

- This is mainly composed of the **LEVATOR ANI** group of muscles
 - Constant activity (like postural muscles) → closes the lumen of the vagina eliminating any opening within the pelvic floor
- Lined by the endopelvic fascia: a continuous mass of tissue with various thickened parts
 - The largest being the **arcus tendineus fascia pelvis**
 - The endopelvic fascia attaches the vagina to the pelvic sidewall
- Urogenital hiatus: the opening within the levator ani through which the urethra & vagina pass
- The constant activity of levator ani muscle (like that of postural muscle) → closes the lumen of the vagina eliminating any opening within the pelvic floor
- The interaction between the pelvic floor muscles and supportive ligaments is critical for pelvic organs support; the ligaments can sustain the load of the pelvic organs for a short period of time, they ultimately fail to hold the vagina in place if they are not assisted by the pelvic floor muscle musculature.
 - This happens when the muscles are damaged or paralyzed.



Physiology Of Micturition Cycle

- The micturition cycle is composed of and alternates between a storage phase & a voiding phase
- A normal micturition cycle requires a coordination and adequate interplay between the reservoir and outlet functions of the LUT structures including:
 1. The detrusor muscle
 2. The urethral smooth muscle
 3. The striated urethral sphincter
 4. The pelvic floor muscles (PFM)

1] Filling And Storage:

- Bladder **accommodation** during filling is primarily **passive**
 - It depends on the "**elastic passive phenomenon**", dependent on the elastic properties and viscoelastic properties of the bladder wall and an increase in the outlet resistance by the striated sphincter.
- Continence is maintained during **increases in intra abdominal pressure** by the **intrinsic competence** of the bladder outlet (bladder neck and proximal / mid urethra) and the **pressure transmission ratio** to this area with respect to the intravesical contents.

2] Emptying And Voiding

- Can be voluntary or involuntary
- Involves **inhibition of the spinal somatic and sympathetic reflexes** and **activation of the vesical parasympathetic pathways** → relaxation of the outlet musculature → contraction of the smooth musculature
- **COMPLETE EMPTYING** will occur with further facilitation of detrusor contraction by other **peripheral reflexes**

Innervation of LUT:

1. **Parasympathetic fibers (from S2-S4)** stimulate **detrusor contractions** that promote micturition. Uncontrolled cholinergic stimulation, found with acute cystitis and radiation injury, leads to incontinence.
2. **Sympathetic fibers from T10-T12 & L1-L2** enhances the following response that promotes urinary continence.
 - A. **α -Adrenergic** contracts the bladder neck and urethra.
 - B. **β -Adrenergic** relaxes the detrusor muscle of the bladder.

Urinary incontinence (UI)

- Involuntary loss of urine, Incidence \uparrow with age and parity.
- Urine leakage (incontinence) occurs when the pressure in the bladder (expulsive force) exceeds that within the urethra (closure force).

Classification of UI:

1. Urgency Urinary Incontinence (UUI): 22%

- Involuntary leakage occurs with a strong, sudden, and uncontrollable desire to urinate as result of involuntary detrusor contraction.

2. Stress Urinary Incontinence (SUI): 49%

- Involuntary leakage on effort or exertion or on sneezing or coughing, as a result of insufficient urethral closure pressure.

3. Mixed Urinary Incontinence: 29%

- Stress urinary incontinence (SUI) & Urgency urinary incontinence (UUI)

4. Irritative Incontinence

- Urinary urgency, frequency and dysuria due to infection (cystitis), neoplasm (bladder tumor), or foreign body in the urinary bladder.

5. Overflow Incontinence

- Leakage occurs when intravesical pressure exceeds urethral pressure, and stop when pressures are equal, bladder never empties detrusor contractions do not occur.

6. Bypass Incontinence

- Results when the normal mechanism of the urethral sphincter is bypassed, usually by a fistula.

OVERACTIVE BLADDER (OAB):

- Symptoms of urgency, with or without "urge incontinence" usually with
 - Frequency (> 8 micturitions per day time) and nocturia (> 2 micturitions at night)
- Urgency urinary incontinence (UUI) and mixed urinary Incontinence are only part of OAB

DETRUSOR OVERACTIVITY (DO):

- Is a urodynamic OBSERVATION characterized by **involuntary detrusor contractions during the filling phase**
- Not all OAB patients show DO
- DO can be found on urodynamic studies without complaints by the patient of OAB symptoms

Types

1. Urgency incontinence (UI)

- **Definition:** The complaint of **involuntary leakage**, accompanied by or immediately preceded by urgency. Can be associated with **small** losses of urine between normal micturitions **OR** large volume losses with **complete bladder emptying**.
- **Cause:**
 1. **Overactive detrusor muscle** that contracts inappropriately during the filling phase (only type of incontinence in which detrusor muscle contraction take place)
 2. Coughing, sneezing, exercise, feeling cold, touch, or hearing running water → induce detrusor contraction → complete emptying
- **Symptoms** caused by the overactive bladder are typically:
 1. Frequency → emptying the bladder more often than 8 times a day
 2. Urgency → strong compelling desire to urinate that is difficult to postpone
 3. Urge incontinence → unpredictable loss of volume
 4. Nocturia → Nighttime frequency which disrupts the sleeping pattern, resulting in tiredness that may affect all aspects of life
- **Etiology:**

Urge incontinence is mainly secondary to OAB.

 1. **Idiopathic Detrusor Overactivity**
 - **MAJORITY** of cases
 - Pathophysiology of DO is not fully understood / no objective causes are found.
 2. **Neurogenic Detrusor Overactivity**
 - In this case, there is an objective evidence of neurological disease
 - E.g. multiple sclerosis, upper motor neuron lesions, peripheral nerve lesions following pelvic surgery.
- **Physical examination:** Normal.
- **Diagnosis:** Confirmed by all of the following in **cystometrogram**:
 1. Involuntary bladder contraction associated with leakage.
 2. Normal residual volume and sensation.
 3. ↓ Urge-to-void volume.
- **Management** (only medical no surgical):
 1. **Anticholinergics**: like oxybutynin, panthline, to suppress parasympathetic stimulation → ↓ tone of detrusor muscle
 2. **β-agonist**: flaxoxate to relax detrusor muscle
 3. **NSAIDs** (ibuprofen): inhibit bladder contraction
 4. **Bladder training** (kegel exercises): to help patient control the bladder.
 5. **Behavioral modification**: reducing fluid intake and avoiding fluids during evening hours.
 6. **Electrical stimulation**

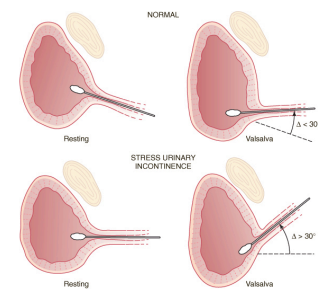
However several explanations have been proposed:

- ↓ Supra-pontine inhibition
- ↑ Afferent activity
- ↑ Sensitivity of detrusor to Ach

2. Stress incontinence (SUI)

- **Definition:** Involuntary leakage of urine in response to physical exertion, sneezing, or coughing as a result of variable combination of:
 - **Intrinsic urethral sphincter muscle weakness**
 - **Anatomical defect** in urethral support → weakness of pelvic diaphragm → loss of bladder support and descent of proximal urethra

- Change of **urethrovesical angle** results in stressful activities producing a greater increase in intravesical pressure than in urethral pressure.
 - Spurts loss of urine, during the brief time that the intravesical pressure exceeds the urethral pressure.
- Detrusor muscle contractions do not occur → bladder does not empty completely.
 - Leading to insufficient closure pressure in the urethra during physical effort, e.g. lifting, coughing, sneezing, and running.
- Etiology: Multifactorial
 1. **Pregnancy** → Damage to the pudendal nerve during childbirth
 2. **Vaginal delivery** → Pelvic floor and sphincter denervation
 3. **Pelvic surgery** → Damage to the pelvic nerve (autonomic) during extensive pelvic surgery can denervate the urethra
 4. **Neurological**: central or peripheral causes neurological problems can disrupt the continence mechanism.
 5. **Lifestyle**: ↑ abdominal pressure, Stretching of perineal muscles
 6. Promoting causes: aging and co-morbidities.
- Clinical findings:
 1. Hx of urine loss because of coughing, sneezing, laughing, or physical activity
 2. **No loss of urine when patient is supine or sleep (unique to stress type)**
 3. Cystocele or urethrocele, anterior vaginal wall prolapsed (maybe)
- Diagnosis: Includes all of the following tests:
 1. Urine **culture** to rule out infection
 2. **Cystometrogram** is **NORMAL**: no involuntary detrusor contraction, residual volume, bladder capacity, and sensation all are normal.
 3. **Stress test**: Urinary leakage **seen** with voluntary stress
 4. **Positive cotton-tipped test** (Q-tip or Bonney), which shows poor anatomic support, the angle of Q-tip will change more than 30 degree when intraabdominal pressure is high
 5. **NORMAL neurologic** examination
- Management:
 - Medically:
 - **Estrogens** improve urethral closing pressure, vaginal epithelial thickness and vascularity, and possible reflex urethral functions
 - **Kegel exercise**: strength the pelvic floor muscles.
 - **ERT therapy**: dilates periurithral venous plexus → ↑ resting urethral pressure.
 - **Intravaginal devices**: large pelvic diaphragms, tampons, weighted vaginal cones, and vaginal pessaries (for pts unfit for surgery).
 - Surgically:
 - **Abdominal retropubic urethropexy (success rate 85-95%)**
 - Elevation of urethrovesical angle (urethropexy), is the definitive treatment, to restore normal anatomy,
 - Vaginal approach: Anterior vaginal repair (Kelly's plication); for correction of cystocele but less effective for correction of stress incontinence.
 - **Tension-free vaginal tape (TVT)**: the procedures utilize a synthetic prolene mesh placed at the level of the mid-urethra through small vaginal or abdominal incisions.



So the intra-abdominal pressure will distribute through bladder, urethra, and bladder neck equally.

Figure 1

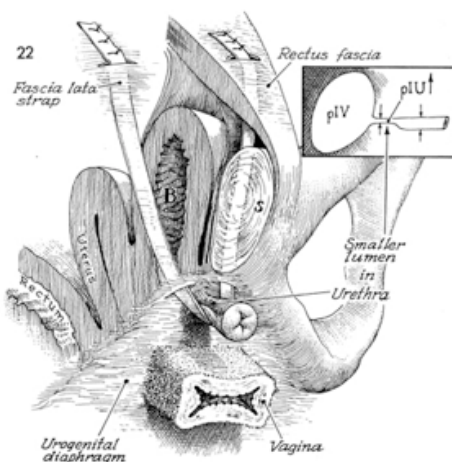
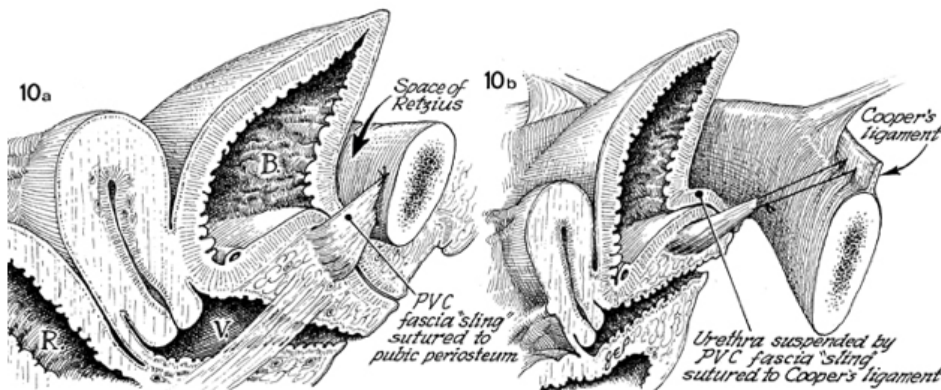


Figure 1 shows the “Goebell-Stoeckel Fascia Lata Sling” operation for urinary incontinence.

Figure 2 shows abdominal retropubic uropexy. The retropubic urethropexy is performed extraperitoneally (in the space of Retzius) by placing sutures in the fascia lateral to and on each side of the bladder neck and proximal urethra and elevating the vesicourethral junction by attaching the sutures to the symphysis pubis (Marshall-Marchetti-Krantz procedure; picture a) or to Cooper's ligament (Burch procedure; picture b).

Figure 2



3. Mixed incontinence

The complaint of involuntary leakage associated with urgency and also with effort, exertion, sneezing and coughing.

Evaluation

1. History:

A. Urological Symptoms

1. How often? DAY/ NIGHT
2. How much urine do you leak?
3. Stream / incomplete emptying

B. Other associated symptoms:

1. Childhood enuresis
2. Dysuria
3. Perineal discomfort / vaginal prolapse
4. Sexual problem
5. Rectal soiling
6. Quality of life assessment:
(How much does leakage of urine interfere with your everyday life - on a scale of 0-10?)

OBS/GYN History

Menstrual, pelvic surgeries, pregnancy, delivery, pelvic radiotherapy.

Medical History:

- Medical Conditions:
- a. Chronic cough
 - b. Constipation
 - c. Cardiac problem/failure
 - d. Renal failure
 - e. Endocrine problem
 - f. Neurological problem (Parkinson, multiple Sclerosis, spinal injury)
- Drugs:
- a. Sedatives
 - b. Diuretic,
 - c. Anticholinergics,
 - d. Anxiolytics,
 - e. Alcohol, Caffeine, Tobacco

2. Physical Examination:

General Exam:

- Height, weight & BMI (Obesity, is a risk factor for UI)

Abdominal Exam

- Scars, distended bladder, masses

Neurological exam

- Concentrating on sacral segment

Perineal/Genital Examination:

- Perineal skin for excoriation and erythema due to incontinence
- Stress test → cough
- Extra urethral incontinence → urine leakage through channels other than urethra e.g. urogenital fistula (urethro-vaginal, vesico-vaginal, vesico-uterine)
- Assess bladder neck mobility, and presence of pelvic organ prolapse (POP) especially with cough/strain

Vaginal Exam

- Assess pelvic muscle function for resting tone and patients ability to perform a pelvic floor contraction

Rectal exam

- Anal tone, pelvic floor function and the consistency of stool.

3. Investigations:

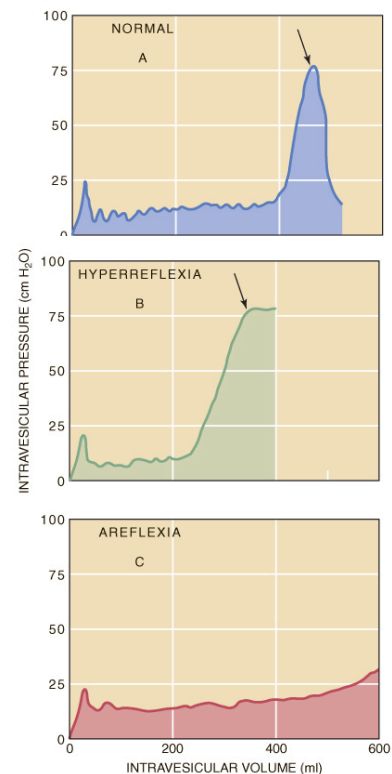
1. Standard Urine Analysis; reagent strip to rule out UTI and microscopic haematuria
2. Biochemical tests
 - a. Renal function
 - b. Prior to surgery
3. Postvoid Residue (PVR)
 - a. Ultrasound or catheterization
 - b. If > 30% of total bladder capacity (50-100 ml): Significant
4. Pad test (1 hr / 24 h. test): Quantify urine loss
 - a. > 1 g = +ve 1 hr test
 - b. > 4 g = +ve 24 hr test
5. Urodynamic test

The only way to **precisely define** bladder and urethral function

Allow characterization of pathophysiological aspects of the various symptoms

Help to determine the prognosis and guide choice of therapeutic strategy

- a. **Uroflowmetry:** measures urine flow rate. Indicates outlet bladder obstruction.
- b. **Cystometry:**
 - i. It measures contractile force of the bladder when voiding
 - ii. Cystometry consists of distending the bladder with known volumes of water or carbon dioxide and observing pressure changes in the bladder function during filling. The most important observation is the presence of a detrusor reflex and the patient's ability to control or inhibit this reflex



Other tests:

1. Urethrocystoscopy: Urethroscopy is useful to detect bladder stones, tumors, diverticula, or sutures from prior surgeries.
2. Urethral Pressure Measurements: to detect intrinsic sphincteric deficiency (ISD) by measuring the urethral closing pressure
3. Uroflowmetry records rates of urine flow through the urethra when the patient is asked to void spontaneously.
4. Voiding Cystourethrogram: fluoroscopy is used to observe bladder filling, mobility of urethra and bladder base, and anatomic changes during voiding. Detects any bladder trabeculation, vesicoureteral reflux, funneling of bladder neck, bladder and urethral diverticula, and outflow obstruction

Summary

	Irritative	Stress	Urge	Overflow	Bypass
Amount	<i>Small</i>	<i>Small</i>	<i>Large</i>	<i>Small</i>	<i>Small</i>
Description	<i>Complete emptying</i>	<i>In spurts</i>	<i>Complete emptying</i>	<i>Dribbling</i>	<i>Dribbling</i>
Duration	<i>Moderate, over several seconds</i>	<i>Brief, with stress</i>	<i>Moderate, over several seconds</i>	<i>Continuous</i>	<i>Continuous</i>
Symptoms	<i>Urgency, frequency, dysuria</i>	<i>None</i>	<i>Urgency & nocturia</i>	<i>Fullness & pressure</i>	<i>None</i>
Position	<i>Any</i>	<i>Upright & sitting but not supine/asleep</i>	<i>Any</i>	<i>Any</i>	<i>Any</i>
Associated event	<i>Coughing, exercise, bladder filling</i>	<i>Coughing, laughing, sneezing, physical activity</i>	<i>Coughing, exercise, running water, cold</i>	<i>None</i>	<i>None</i>
Cause	<i>Cystitis, tumor, foreign body</i>	<i>Intrabdominal press. ↑ transmitted to bladder more than urethra</i>	<i>Loss of voluntary bladder inhibition</i>	<i>Lower motor neuron lesion; systemic meds; urethral obstruction</i>	<i>Fistula, urethral diverticulum</i>
Residual volume	<i>Normal</i>	<i>Normal</i>	<i>Normal</i>	<i>Increased</i>	<i>Normal</i>
Sensation of fullness	<i>Decreased volume</i>	<i>Normal</i>	<i>Decreased volume</i>	<i>Increased volume</i>	<i>Normal</i>
Treatment	<i>Antibiotics Tumor resection Remove foreign body</i>	<i>Kegel exercises Estrogen Urethropexy Collagen injections TVT</i>	<i>Anticholinergics B-agonists NSAIDs Behavioral modification Kegel exercises Electrical stimulation</i>	<i>Intermittent catheterization Alpha-blockers Discontinue medications Relieve obstruction</i>	<i>Surgical repair</i>