UROGYNECOLOGY UNIT
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FEMALE STRESS URINARY INCONTINENCE

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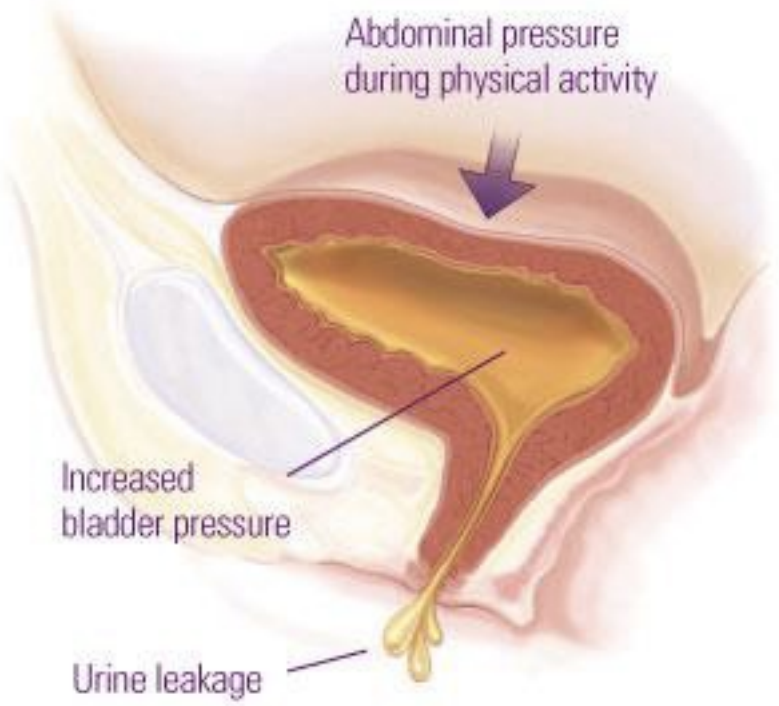
Definitions

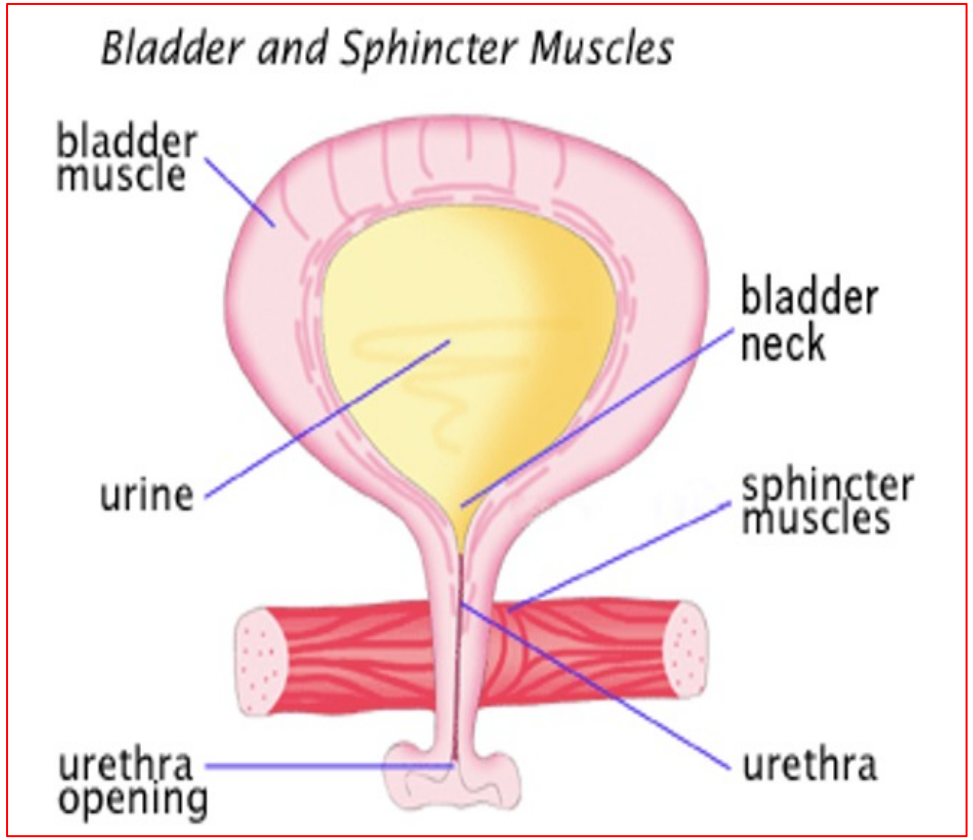
Urinary incontinence: is a condition in which involuntary loss of urine is a social or hygienic problem and is objectively demonstrable (ICS 2020) "The complaint of any involuntary leakage of urine".

Stress incontinence, also known as stress urinary incontinence (**SUI**) or effort incontinence is a form of urinary incontinence. It is due to insufficient strength of the closure of the bladder

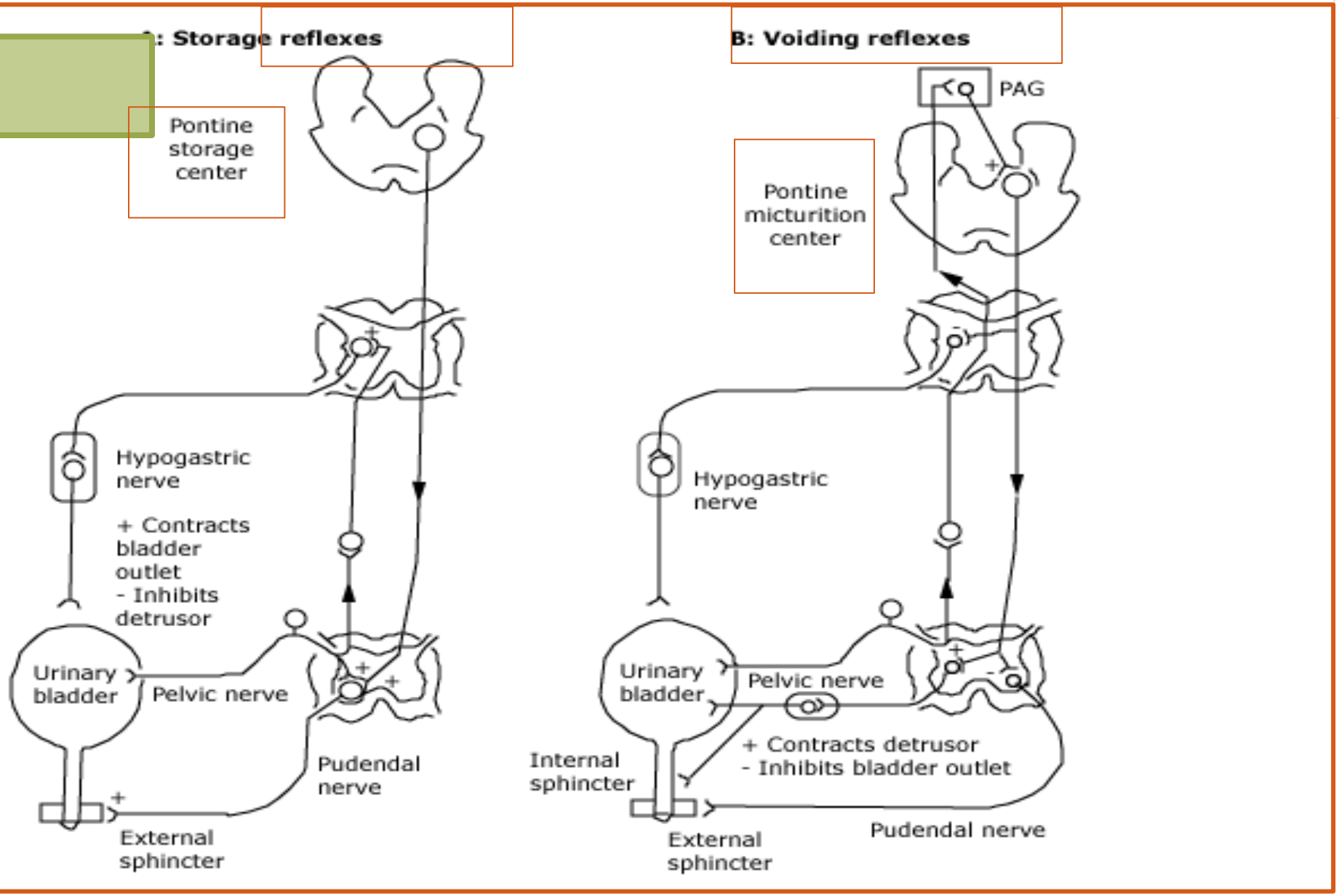


Normal continence Function

- Functional urethra is intra-abdominal
- Increased abdominal pressure transmitted equally to bladder and urethra.
- With increased stress urethro-vescial junction responds to stress by closing tight
- Bladder is a voluntary smooth muscle
- Inherent ability to maintain low pressure with filling-increase in volume-compliance.



Normal bladder function



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Impact on health

Urinary incontinence is not associated with increased mortality . However, incontinence can impact ***many other aspects of a patient's health:***

1- Quality of life – Urinary incontinence is associated with depression and anxiety, work impairment, and social isolation .

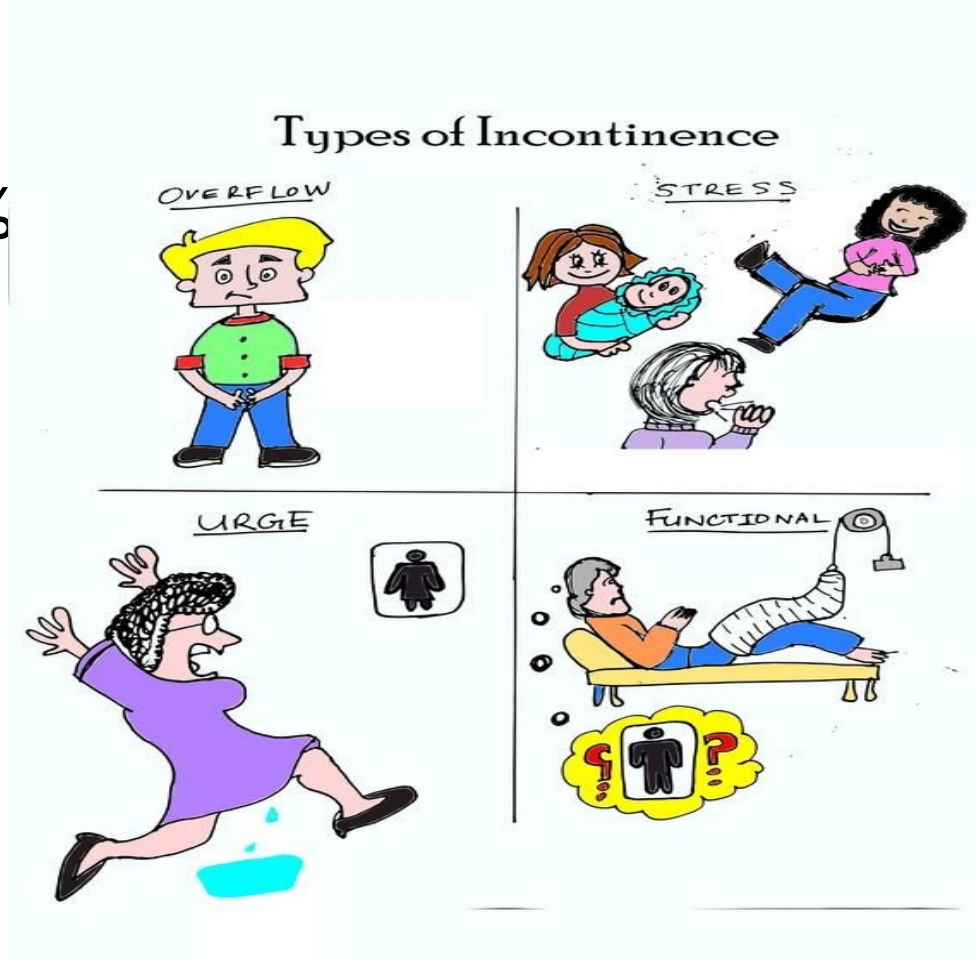
2- Sexual dysfunction – Incontinence during sexual activity (coital incontinence), which may affect up to one-third of all incontinent individuals, and fear of incontinence during sexual activity both contribute to incontinence-related sexual dysfunction .

3-Morbidity – include perineal infections (eg, candida or cellulitis) from moisture and irritation as well as falls and fractures that in turn increase overall morbidity, and health care costs .

4-Increased caregiver burden – 6%-10% of nursing home admissions in the United States are attributable to urinary incontinence.

Causes of urinary incontinence

1. Stress incontinence **50**%
2. Overactive bladder syndrome (urge) 25%
3. Mixed incontinence 25%
4. Overflow incontinence
5. Fistulae
6. Urethral diverticulum
7. Functional
8. Reversible causes



Prevalence

- Over all prevalence of UI ranged from 4.5 – 53% of women.
- SUI is most common type of urinary incontinence in women, (50%), followed by urge incontinence (OAB); 25%, and mixed incontinence (25%).
- Overflow incontinence , urinary fistulae , urethral diverticulum , functional and reversible causes(e.g. pregnancy) are uncommon causes of urinary incontinence.

Types of female urinary incontinence

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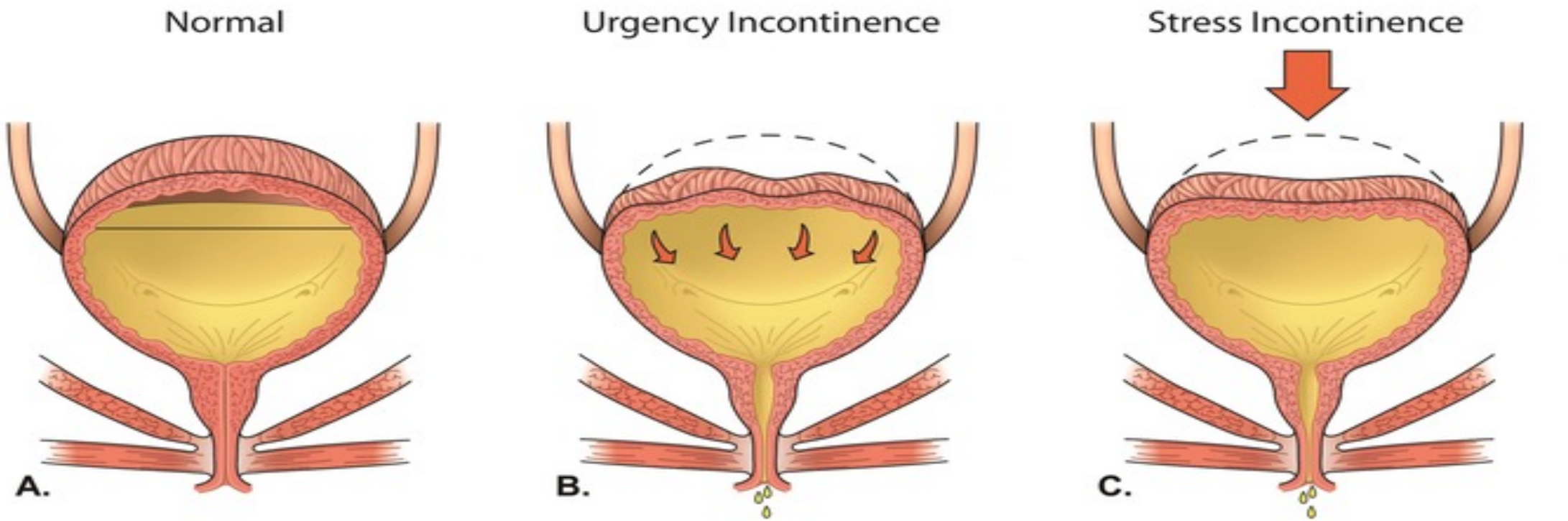
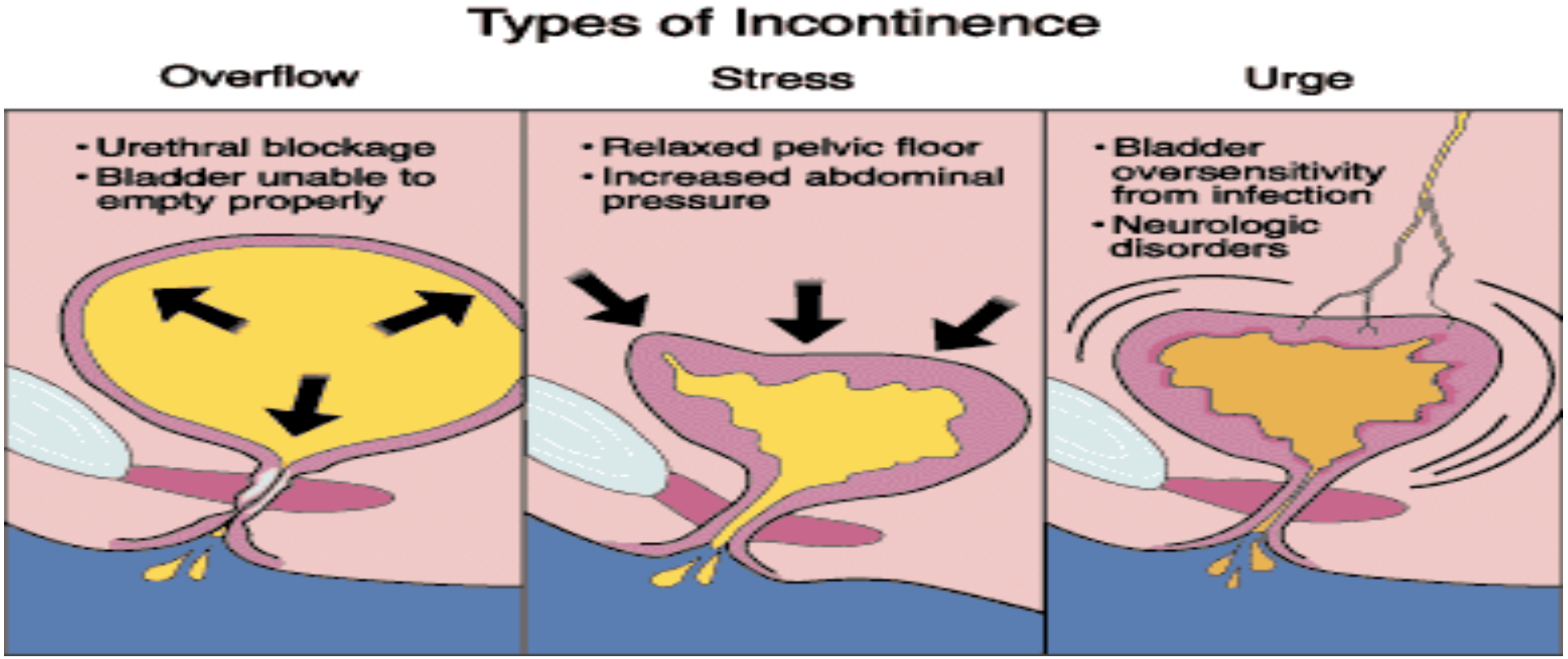


The bladder stays relaxed and the urethra stays contracted and closed until the patient is ready to void.

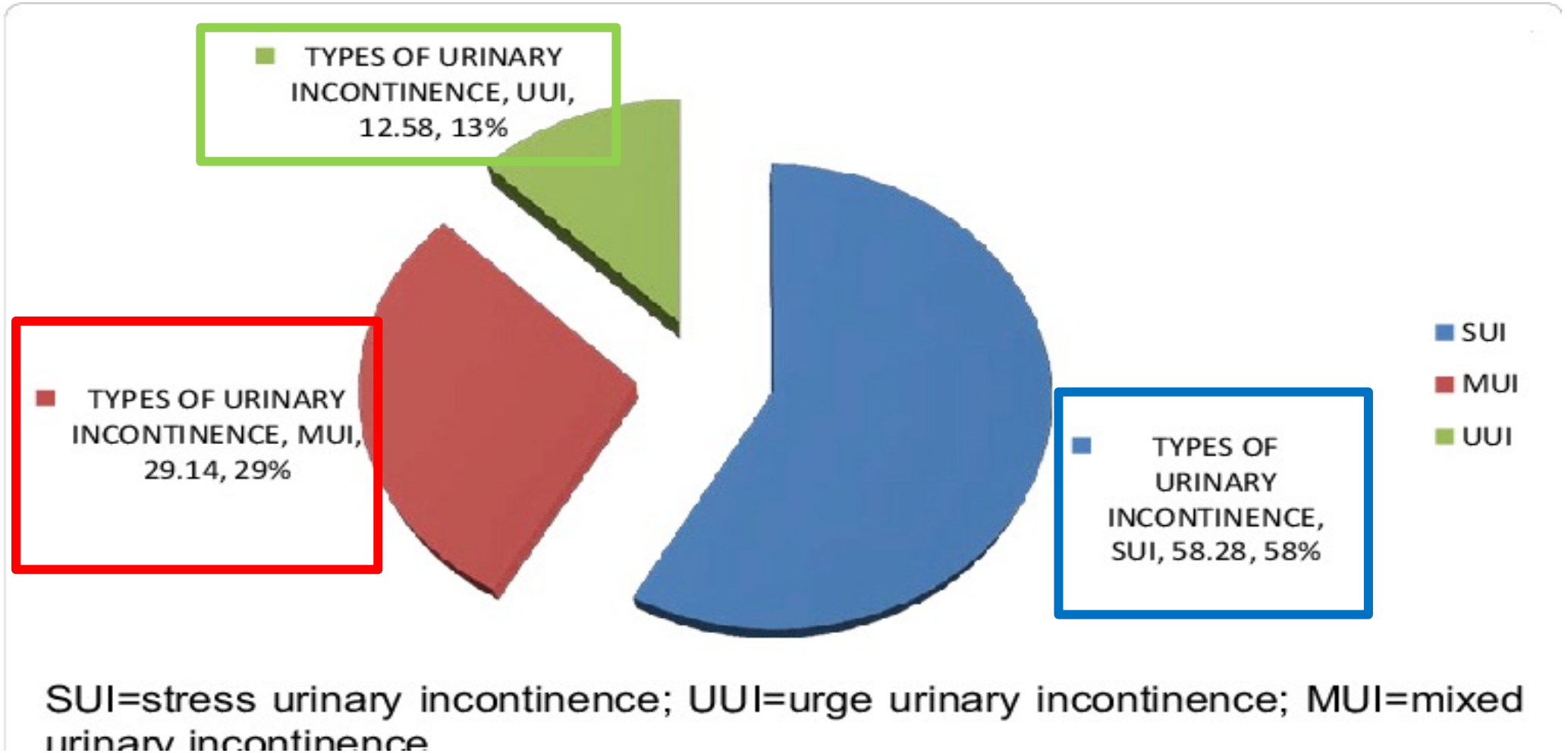
Bladder muscle contracts before the patient is ready to void.

Urethra is too weak to stay closed during increased intra-abdominal pressure.

Types of female urinary incontinence



Types of female urinary incontinence



SUI=stress urinary incontinence; UUI=urge urinary incontinence; MUI=mixed urinary incontinence

Stress Urinary Incontinence (SUI)

.Stress urinary incontinence(SUI) is defined by the international continence society (ICS) as:"*the complaint of involuntary leakage of urine on effort or exertion, or on sneezing or coughing*" .

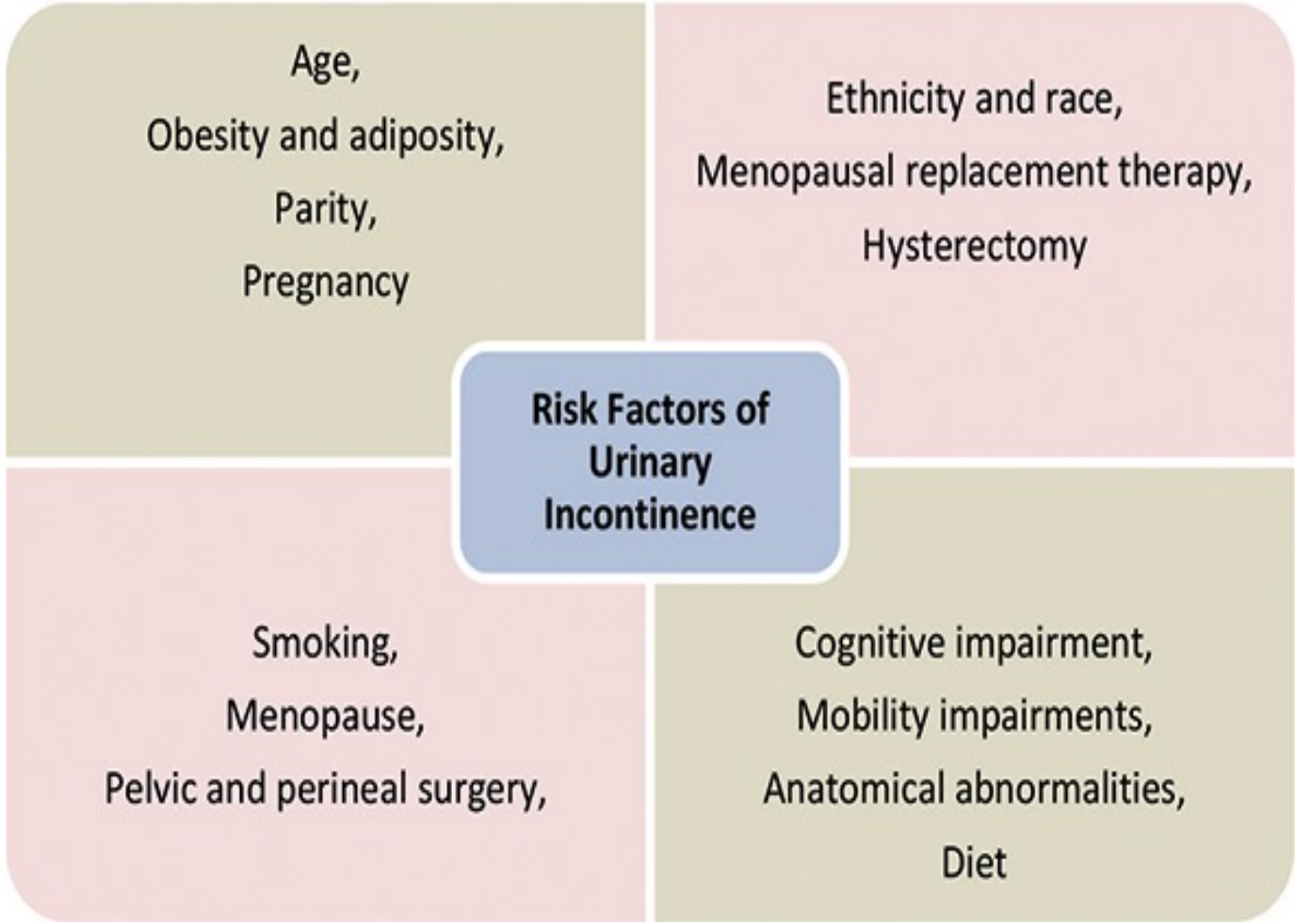
- Genuine stress urinary incontinence (GSUI): Urinary loss which occurs with sudden elevation of the intra abdominal pressure without detrusor contraction is called stress urinary incontinence

SUI-Symptoms

1. Involuntary leakage of urine on effort or exertion, or on sneezing or coughing
2. Usually small amounts
3. Pressure in the bladder exceeds the urethral pressure
4. No bladder contraction

SUI – Etiology (risk factors)

1. Pregnancy/Childbirth
2. Age
3. Obesity (BMI >40, 66%)
4. Chronic cough
5. Prolapse
6. Constipation
7. Smoking
8. Genetics



SUI – grading (severity)

- ***Grade 0*** **:** No leakage
- ***Grade 1*** **:** Incontinence with only severe stress, such as coughing, sneezing, and jogging (الهرولة)
- ***Grade 2*** **:** Incontinence with moderate stress, such as fast walk, going up and down the stairs
- ***Grade 3*** **:** Incontinence with mild stress such as standing

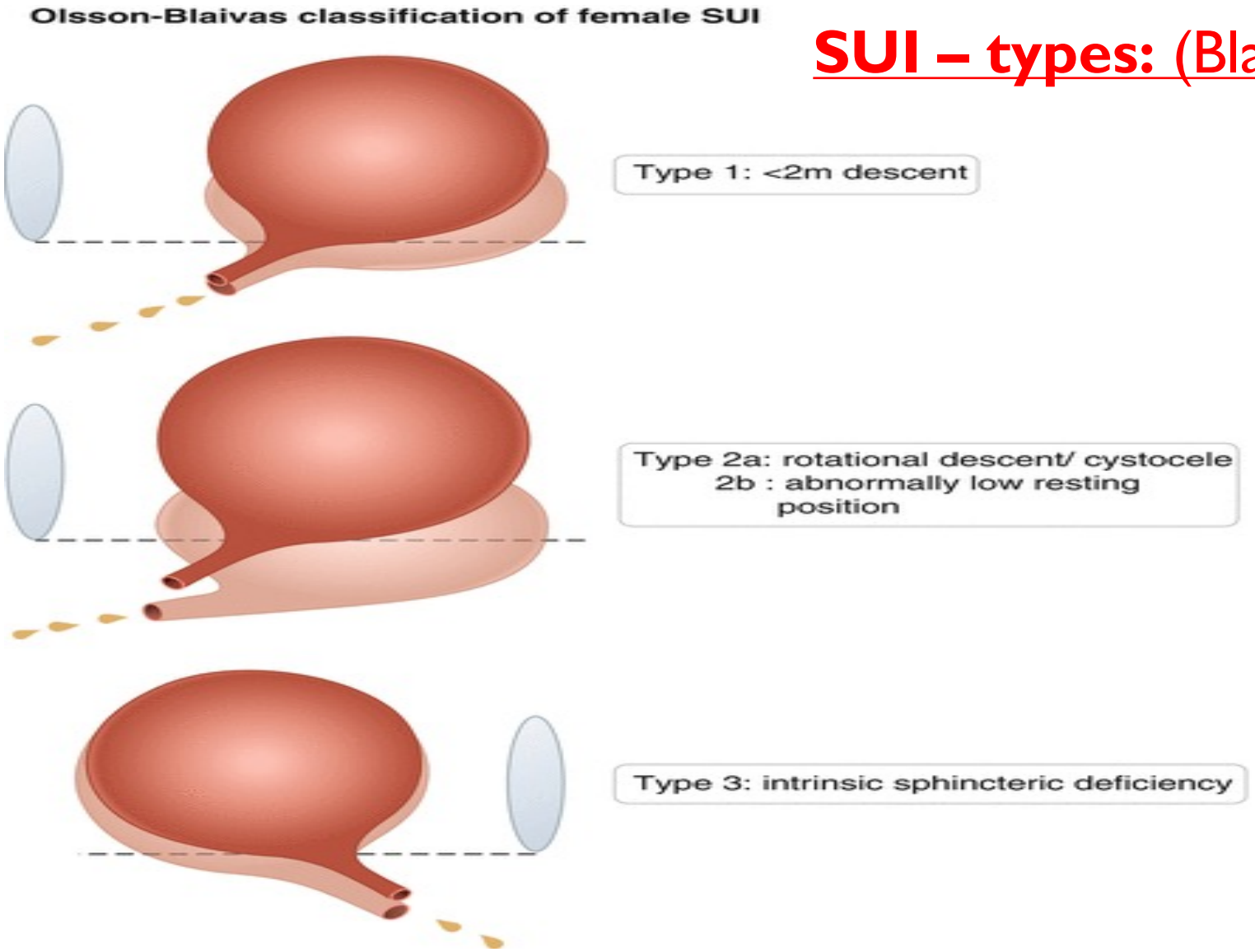
SUI – types (etiologic)

SUI -TYPE	DESCRIPTION OF DEFECT
Type 1 :	Incontinence due loss of posterior urethro-vesical angle alone
Type 2 :	Incontinence due loss of posterior urethro-vesical angle *plus* urethral hypermobility
Type 3 :	Incontinence due to ISD (intrinsic sphincteric deficiency)

SUI – types: Blaivas and Olsson

Types	During Rest		During Stress	
	Bladder base position (IMPS)	Bladder neck & Proximal urethra	Bladder base position	Bladder neck & Proximal urethra
Type 0	Normal position	closed	Rotational descent	No leakage
Type 1	Normal position	closed	Descent <2cm	Open leakage +ve
Type 2A	Normal position	closed	Rotational descent	Open Leakage
Type 2B	At or below	closed	Further descent	Open Leakage
Type 3 or ISD	Normal position	Open	No descent	Open and leakage

SUI – types: (Blaivas and Olsson)



Pathophysiology of SUI

A Historical Perspective

- Urethrocele is dislocation of urethra and it is the cause of incontinence (Mann's American System of Gynecology 19 cent.)
- Kelly invented cystoscope in (1914) :"The cystoscopic picture presents a gaping internal sphincter orifice which closes sluggishly" .
- Bonney (1923) attributed SUI to vesical neck funneling and he hypothesized cause of this is: (1)loss of elasticity of urethral and vesical sphincter.

(2)Incontinence caused by sagging of pubo-cervial muscle sheet which interfere with the sphincter mechanism.

Pathophysiology of SUI
A Historical Perspective

- Kennedy, 1923 suggested injury to the urethral sphincter as the principal etiology of SUI.
- Funneling of the bladder floor towards the urethra and flattening of urethrovesical angle of the bladder showed in sagittal image in cystogram (1937)
- SUI is now thought to be due to abnormality in urethra.
- On MRI of the pelvic floor SUI was associated with unequal movement of anterior and posterior wall of bladder neck and urethra in the presence of increased intra abdominal pressure..

Pathophysiology of SUI

Sphincteric Dysfunction Theory(1992)

SUI: the condition of ISD "intrinsic sphincteric defeciency": In this condition, the urethral sphincter is unable to generate enough resistance to retain urine in the bladder especially during stress.

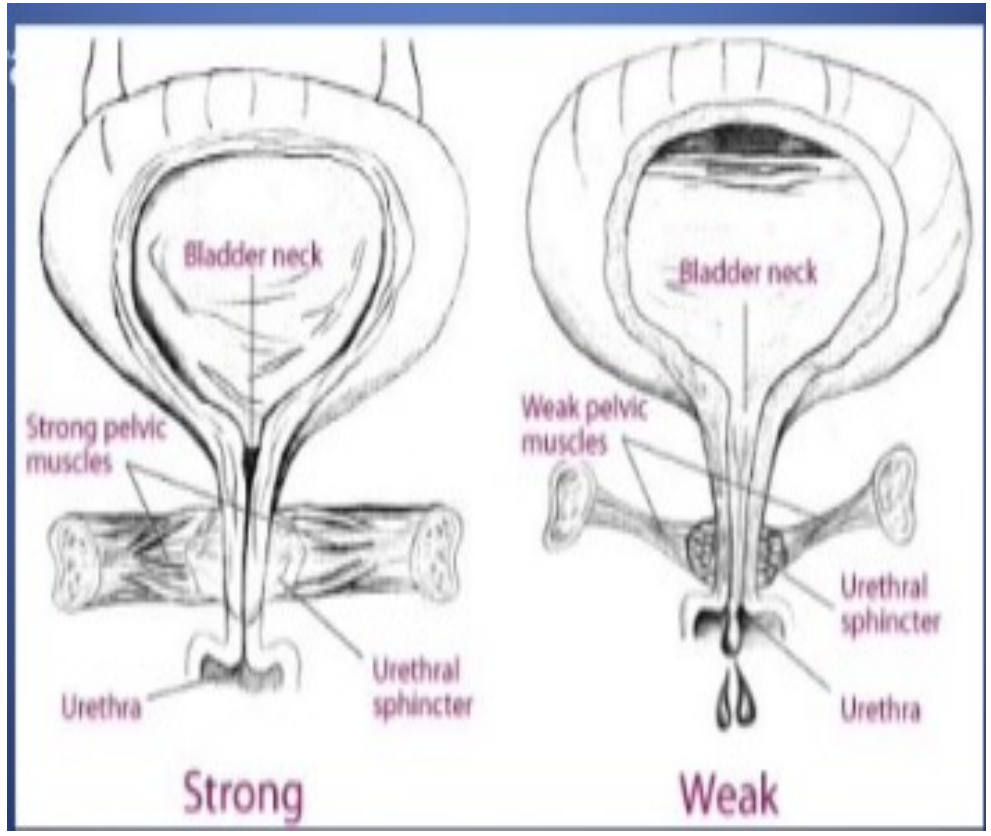
ISD – Etiology (Risk factors)

Risk Factors for Intrinsic Sphincteric Deficiency

Classification of Sphincter Weakness	Mechanism of Sphincter Weakness
Congenital	CNS dysfunctions/lesions
	Smooth muscle disorders
	Striated muscle disorders
Acquired	Childbirth
	Surgical therapy
	Radiation therapy
	CNS lesions
	Peripheral neuropathies
	Chronic catheter drainage
Other	Hypoestrogenism
	Aging

Pathophysiology of SUI
Hammock theory (1996)

- De Lancey (1996), proposed a consolidated theory: "He hypothesized that the pubo-cervical fascia provides a hammock like support for the vesical neck and thereby creates a backboard for the compression of proximal urethra during increased intra abdominal pressure.
- Loss of this support would compromise equal transmission of intra abdominal pressure.



Hammock theory of SUI

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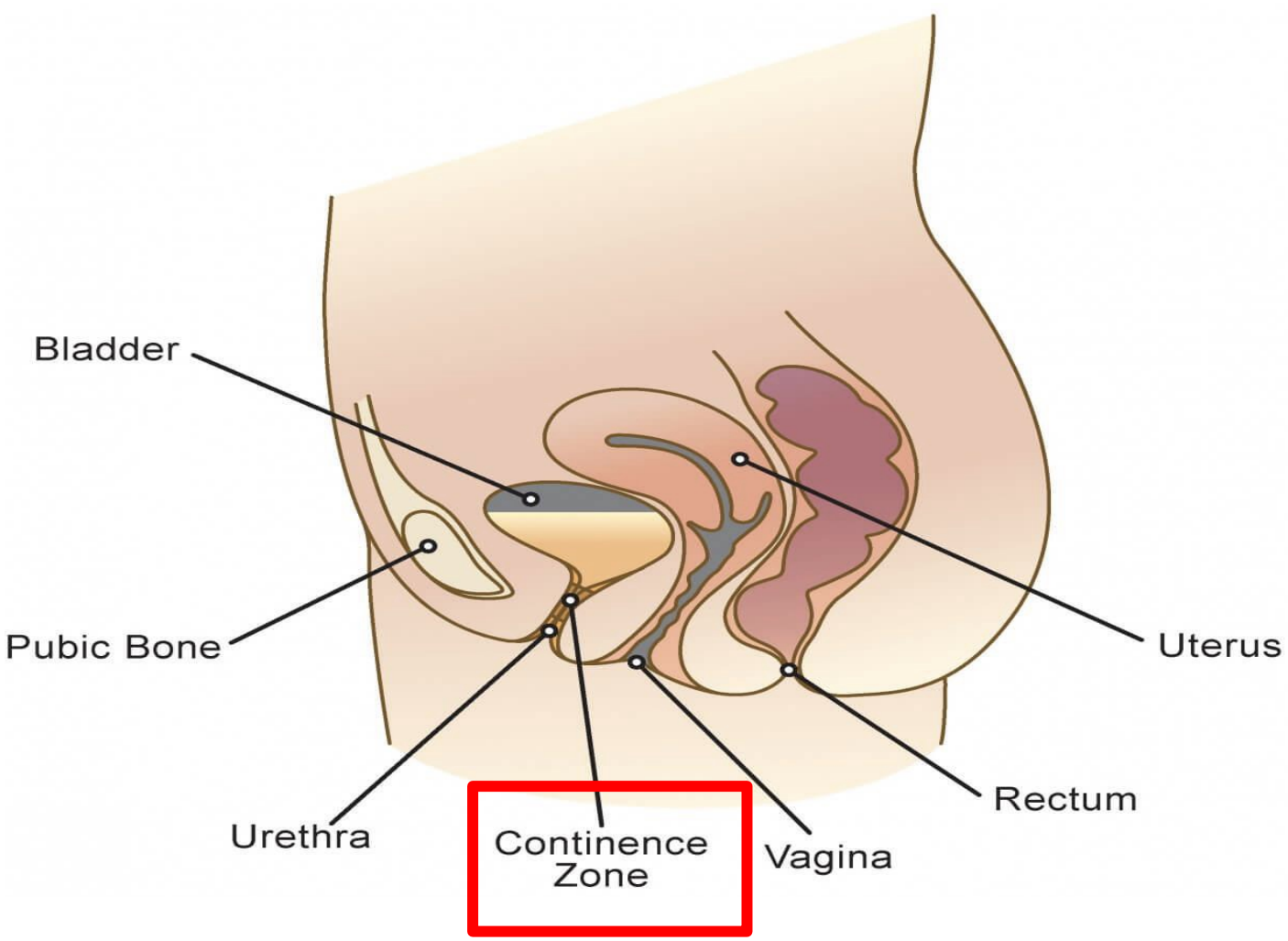
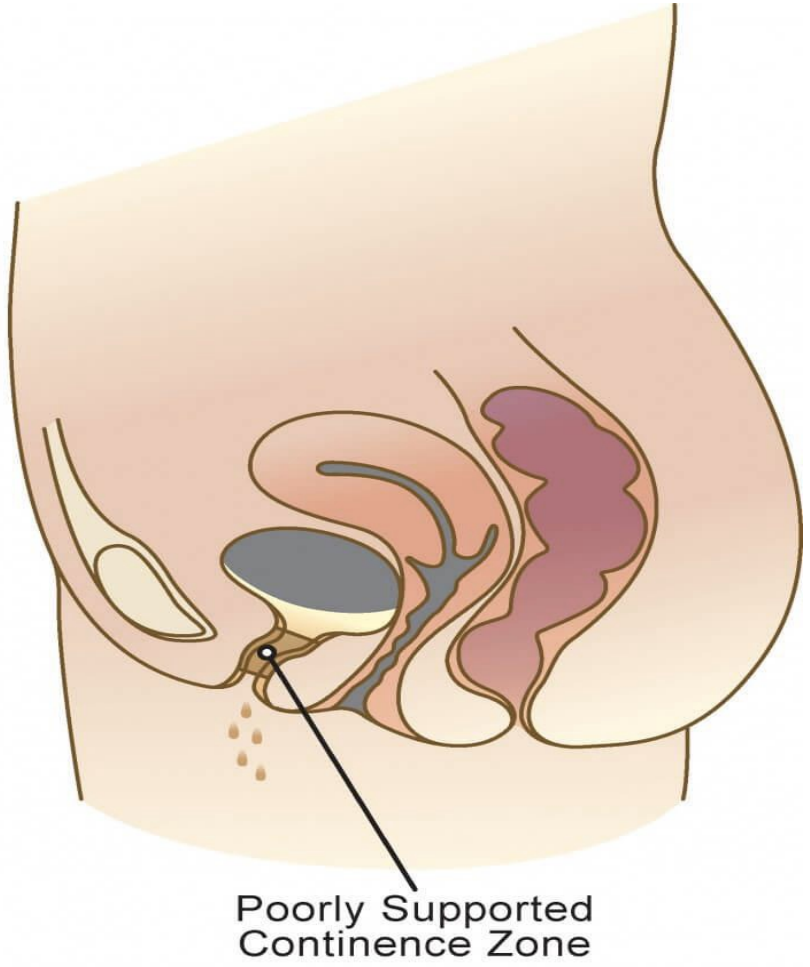




Diagnosis of SUI

The primary goals of evaluation of women presenting with symptoms of SUI :

1. Provide a clinical diagnosis of SUI versus OAB symptoms
2. .Determine factors that may contribute to symptoms or that may require further evaluation.
3. Assess whether coexisting pelvic floor disorders, such as pelvic organ prolapse or anal incontinence, are present.
4. Establish baseline SUI severity to aid in assessing treatment effects.
5. Determine the impact of the patient's symptoms on her quality of life.
6. Determine which treatment options are acceptable to each patient.
7. Determine what her own therapeutic goals are?
8. Provide her with appropriate education regarding these goals.

Diagnosis of SUI

Basic evaluation

1. Careful history
2. Physical examination
3. Voiding diary
4. Simple tests

Diagnosis of SUI

Basic evaluation : Careful history

1. Frequency and amount of leakage
2. .Precipitating factors
3. Impact of the leakage on daily life and pad use
4. Pelvic floor symptoms, such as a sensation of bulge or pressure in the vagina, urinary urgency or frequency, nocturia, hematuria, recurrent urinary tract infections, voiding problems, anal incontinence, and defecating dysfunction

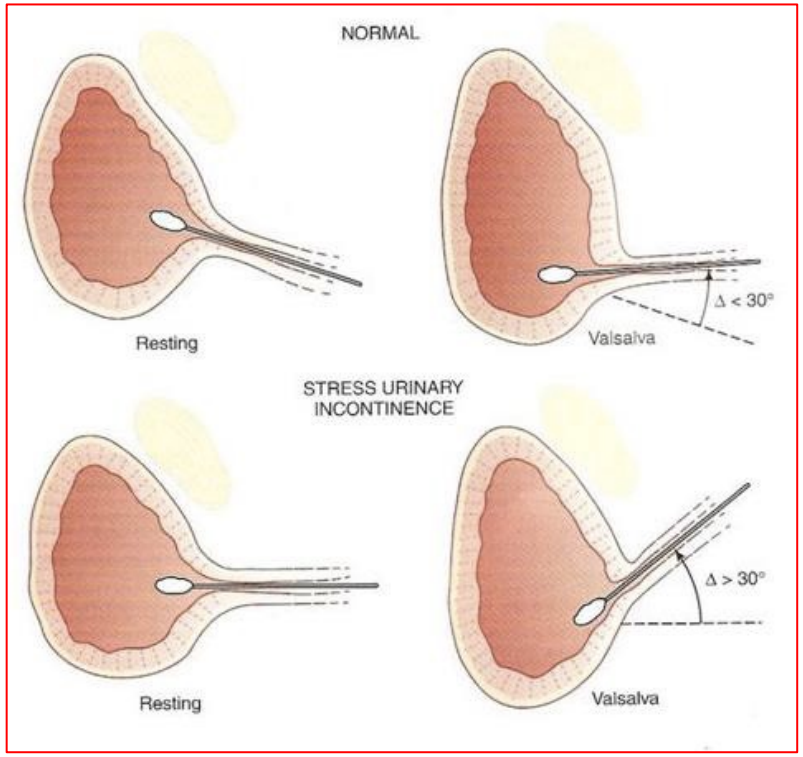
Diagnosis of SUI

Basic evaluation : Physical examination

1. Pelvic examination to rule out pelvic or abdominal masses, pelvic organ prolapse, and vaginal atrophy.
2. A positive cough stress test, in which leakage is visualized at the moment of the cough, is helpful to confirm the diagnosis
3. On vaginal or rectal examination, check the pelvic floor muscles quality (symmetry and bulk) and whether or not, and to what degree, a woman can volitionally contract her muscles.

Diagnosis of SUI
Basic evaluation: Physical exam

4. Cotton swab test (test of urethral mobility); see figure→
5. To rule out urinary retention and overflow incontinence, we assess the postvoid residual volume by either direct catheterization or by ultrasonography (*Most experts agree that a postvoid residual volume less than 50 mL is normal and more than 200 mL is abnormal).*
6. Finally, a urinalysis is done to UTIs as a transient cause of stress urinary incontinence.



Diagnosis of SUI
Advanced evaluation

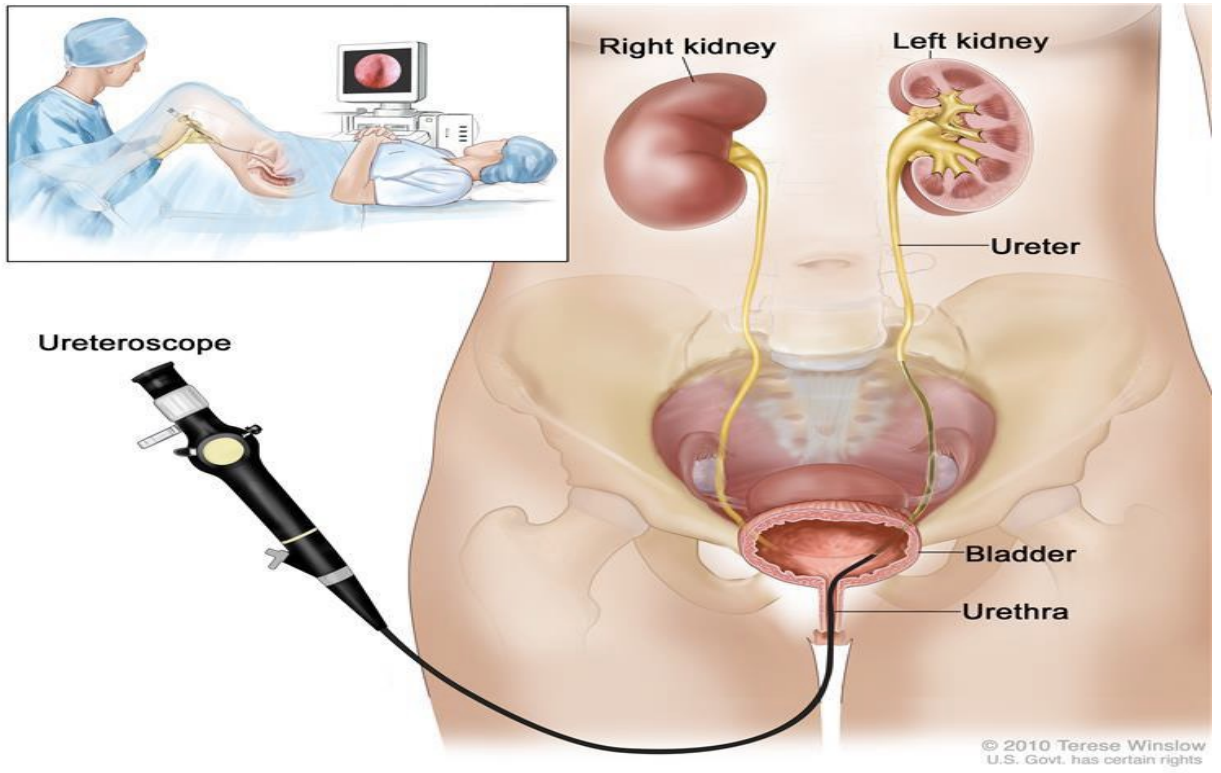
1. Further evaluation is needed after basic testing if we are still left with an uncertain diagnosis:
2. Major discrepancies between the history, the voiding diary and symptom scales
3. When Pt is considered for surgery.
4. If the patient has hematuria in the absence of an infection
5. An elevated postvoid residual volume, a neurologic condition that may complicate treatment (such as multiple sclerosis),
6. marked pelvic organ prolapse, or numerous prior surgical attempts at correction

Diagnosis of SUI

Advanced evaluation: *Urethroscopy*

Provides Information about:

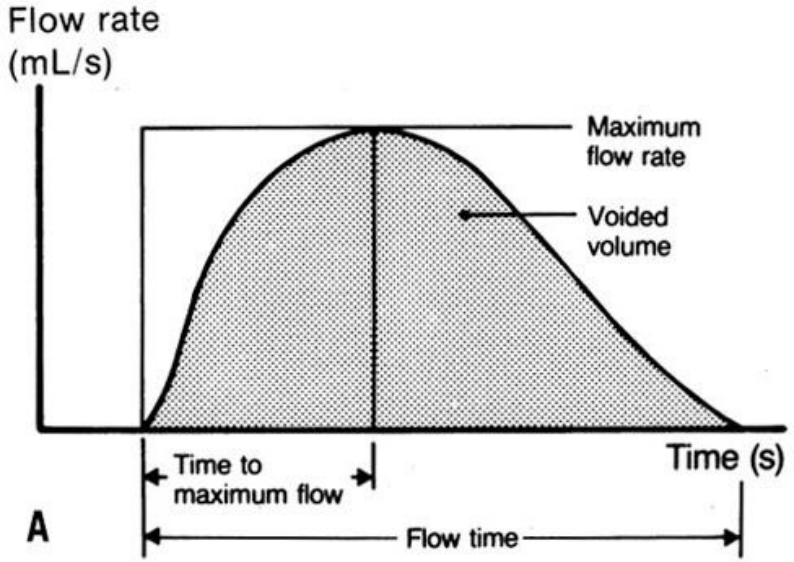
1. Opening pressure
2. Urethritis
3. Diverticula
4. Rigid urethra
5. Urethro-vesical junction



Diagnosis of SUI

Advanced evaluation: *Uroflowmetry*

- Volume of urine passed is plotted over time.
- Flow time, peak flow rate, and time to peak flow increase with the volume voided.



Diagnosis of SUI
Advanced evaluation: *cystometry*

- done to assess bladder and urethral function during bladder filling.
- Cystometry is termed simple when only bladder pressure is recorded and complex (or multichannel) when both bladder and abdominal pressure (measured via a rectal or vaginal catheter) are recorded.

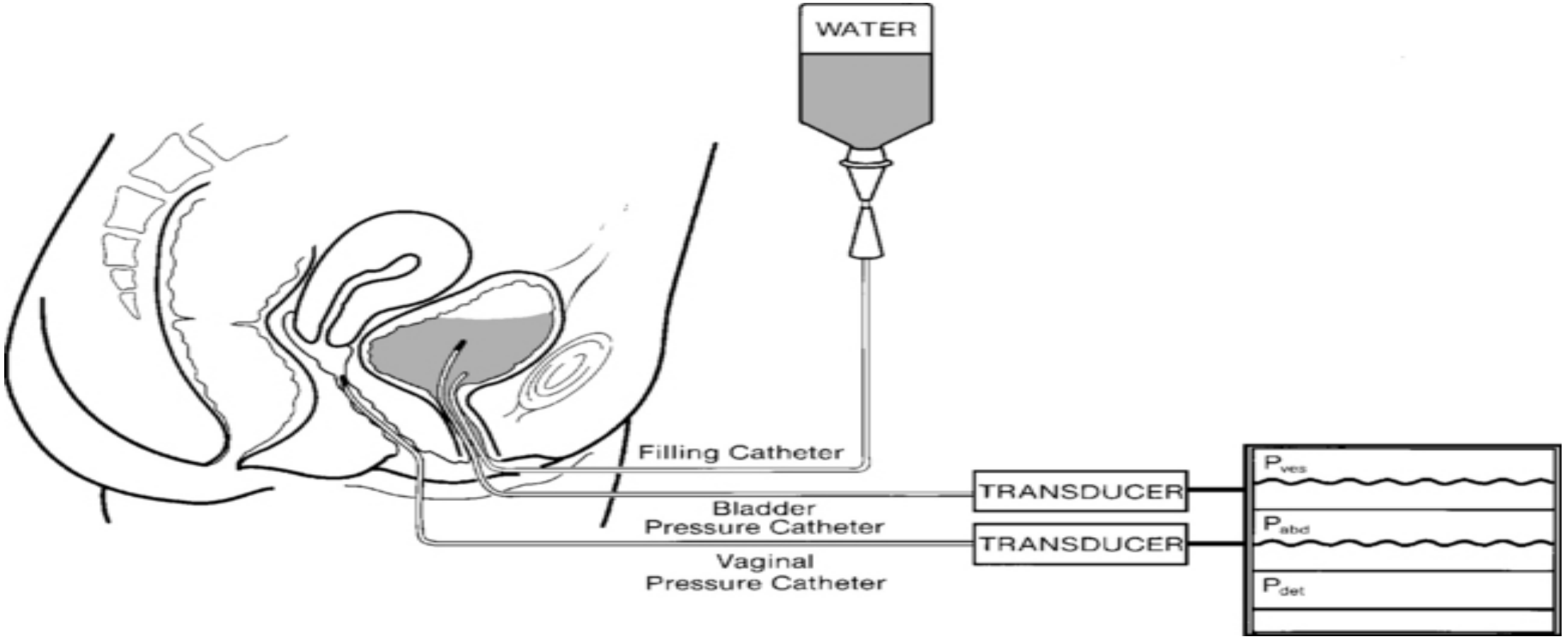
a) *After void, insert foley, measure PVR, [N<50cc]. Attach syringe to foley, instill sterile saline. Normal first desire ~200cc.*

b) *Observe column of saline, unusual waves suggest detrusor dyssynergia.*

c) *Maximum bladder capacity ~500 cc.*

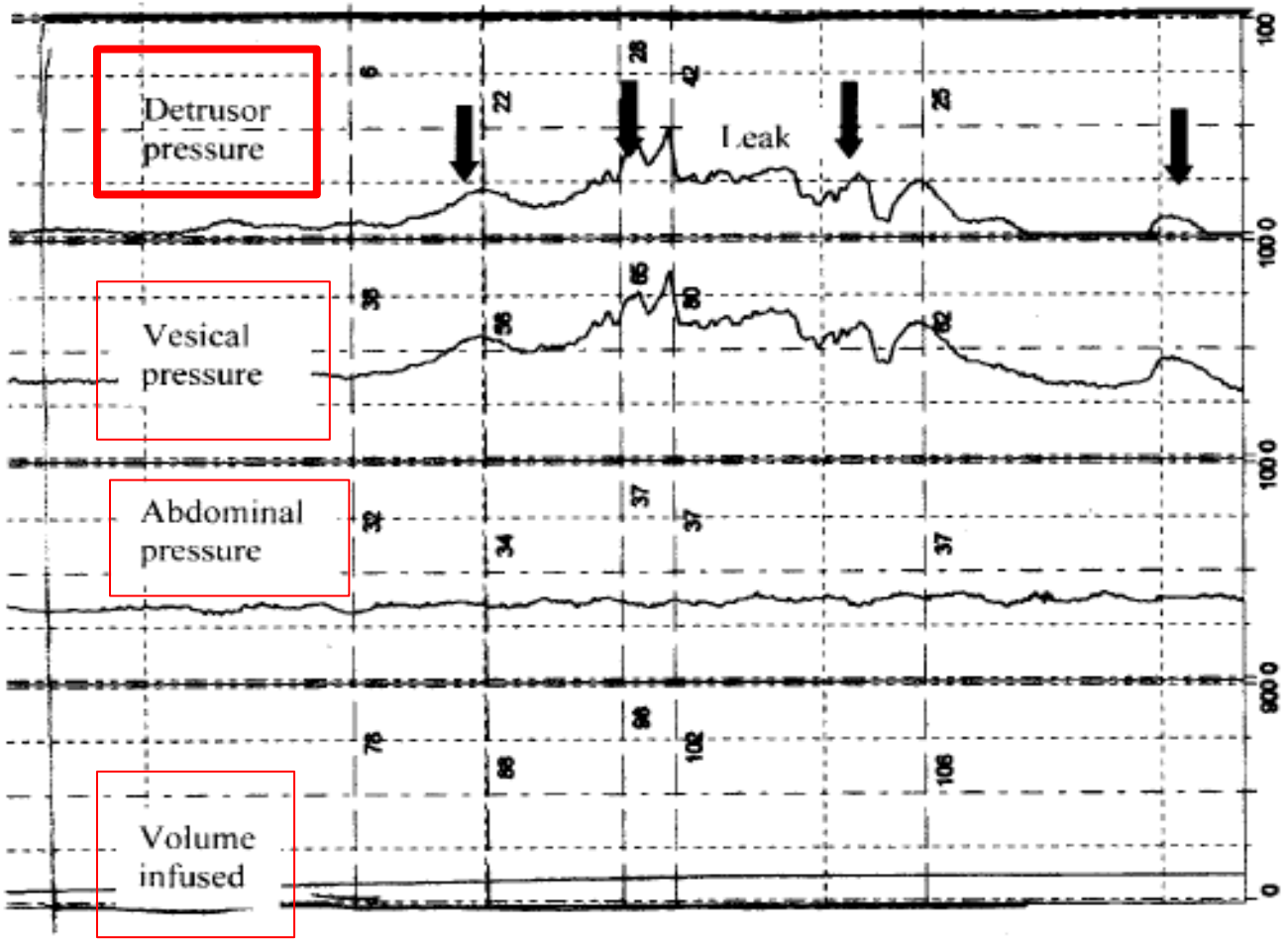
d) *Remove ~250 cc, remove foley, ask to cough, loss of urine suggests GSI.*

Cystometry


WATER
Filling Catheter
Bladder
Pressure Catheter
Vaginal
Pressure Catheter
TRANSDUCER
TRANSDUCER
P_{ves}
P_{abd}
P_{det}

Diagnosis of SUI

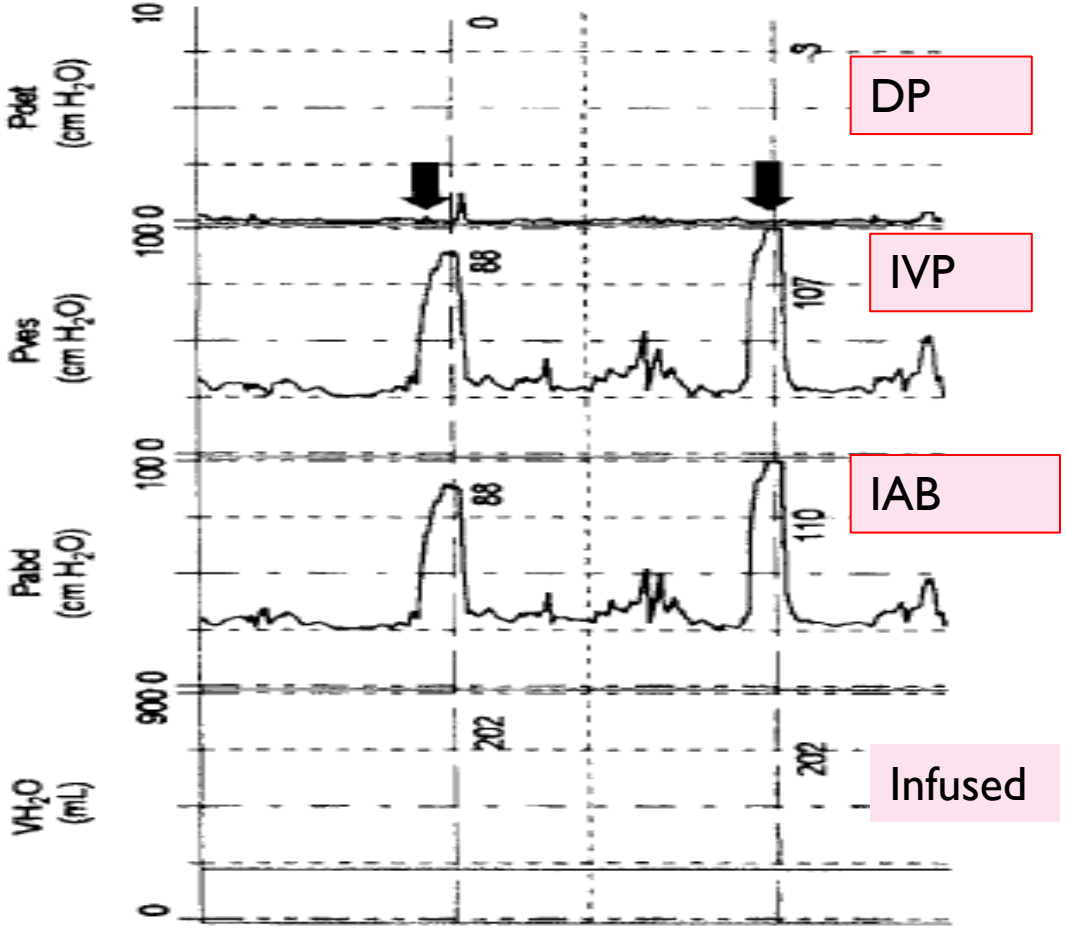
Advanced evaluation: *cystometry*



Multichannel cystometrogram showing detrusor overactivity. Note that at the peak of the detrusor contractions, the patient leaked urine, and the detrusor pressure then gradually decreased. No increase in abdominal pressure over baseline is seen.

Diagnosis of SUI

Advanced evaluation: *cystometry*



Multichannel cystometrogram showing urodynamic stress incontinence. Each spike represents a Valsalva effort. The abdominal pressure generated by the Valsalva is transmitted to the bladder as seen by the increased vesical pressure. However, the detrusor pressure remains low, and leakage *(black arrows)* occurs in the absence of a detrusor contraction.

Diagnosis of SUI

Advanced evaluation: *Urodynamic studies*

1. *Cystometry*: measurement of pressure within the bladder and urethra during artificial filling (see before)
2. *Uroflowmetry*: urine flow rate and volume.
3. *Micturition cystourethrography*: for posterior urethro-vesical angle
4. *Other studies*

a). *Ultrasound*: for bladder volume and residual urine.

b). *Video-cystourethrography:* it combines the pressure studies with video position of bladder neck and urethro-vesical angle.

c) *MRI:* to detect the defect in pelvic floor muscle and supporting fasciae

Urodynamic remarks

1- Cystometry:

Compliance, 1st desire (90-150ml), no. desire(200-300ml), 2nd desire 400-550 ml, true subtracted detrusor pressures

2- Valsalva leak point pressure:

=Amount of intraabdominal pressure needed to leak

- <60 cm H2O is ISD

3- Urethral pressure profile

- Full bladder, catheter pulled along urethra
- Urethral closure pressure >30 cm H20 normal, <20 is ISD

Urodynamic remarks

4- Uroflow
- Rate and pattern of urine flow
- Peak flow 20-30 ml/sec

5- Pressure flow test
- Details voiding mechanism, obstructive dysfunction, poor contractility
- Voiding detrusor pressure 10-30 cm H20 is normal

6- Electromyography
- Electrical activity of pelvic floor musculature
- Timing and degree of muscle relaxation impacts voiding mechanism.

Urodynamic remarks

Urodynamic evaluation answers

1. Does the patient have stress incontinence ?
   -Stress test
   -Valsalva leak point pressure
2. Does she have ISD ?
   -Urethral pressure profile
   -Valsalva leak point pressure
3. Does she have overactive bladder?
   -Multichannel urodynamics
4. What is the voiding mechanism?
   -Uroflow
   -Pressure flow study
   -Electromyography

Management of SUI

- Women have both non-surgical and surgical options to treat SUI.
- Not every woman with SUI will need surgery. Some factors should be considered before deciding whether to undergo surgery include:

(a).the severity of SUI symptoms and their effect on daily activities;

- (b) desire for future pregnancy as vaginal delivery can cause recurrence of SUI symptoms, which could require future surgery.

Management of SUI

A. Non-surgical treatment:

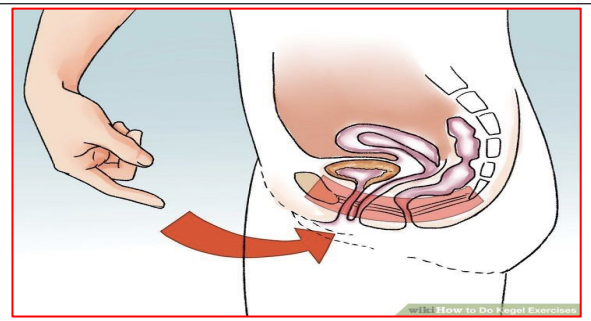
1. Lifestyle interventions
2. Pelvic floor muscle training
3. Medications
4. Devices

B. Surgical treatment of SUI

1. Use of injectable bulking agents,
2. Laparoscopic suspensions
3. Midurethral slings
4. Pubovaginal slings
5. Open retropubic suspensions

Non-surgical treatment of SUI: Life style interventions

1. Weight reduction
2. Postural changes (such as crossing legs) often prevent stress urinary incontinence.
3. Fluid intake and voiding habits (decreasing the fluid intake is helpful in for patient with high fluid consumption & voiding prior to sternous activity beneficial in mild SUI)



Non-surgical treatment of SUI: Pelvic floor muscle training

- Supervised pelvic floor muscle training (Kegel exercises) is an effective treatment for stress urinary incontinence.
- Should be offered as first-line conservative management to women.
- Several factors are important in maximizing the chance that pelvic muscle training will alleviate SUI:

1-The woman must do the exercises correctly, regularly, and for an adequate duration.

2-Many physical therapists recommend training sessions 3–4 times per week, with 3 repetitions of 8–10 sustained contractions each time.

Non-surgical treatment of SUI: Medications

1- Estrogen :

-Estrogen has tropical effects on urethral epithelium subepithelial vascular plexus and connective tissues . Studies showed improvement of symptoms, but not urodynamic measurements.

2-Alpha-adrenoreceptor agonist:

-*Ephedrine*, *Norephedrine* and *Midorine* have shown only modest effect in small trials.

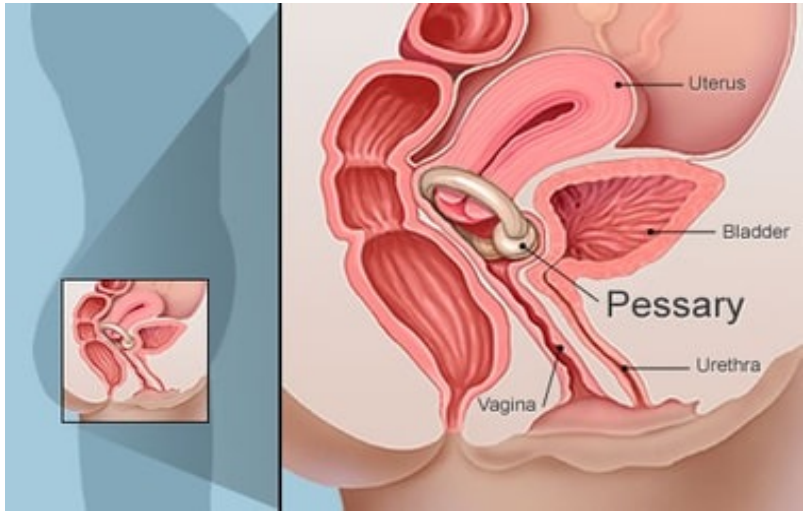
3-Serotonin and norepinephrine reuptake inhibitors :

-*Duloxetine chloride* is effective for the treatment of SUI.

Non-surgical treatment of SUI: Devices

Ring pessary

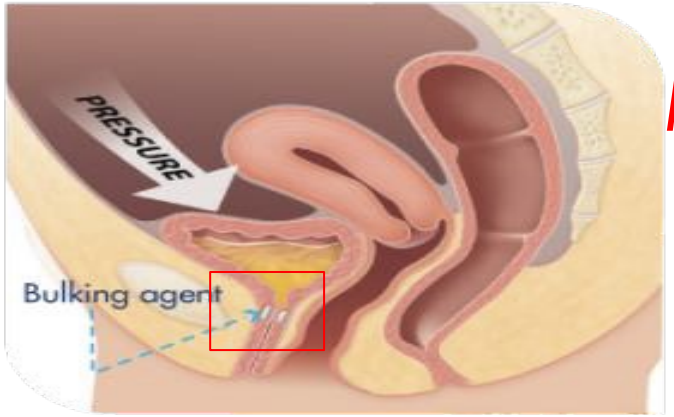
- The pessary compresses the urethra against the symphysis pubis and elevates the bladder neck.
- For some women this may reduce stress leakage



Minimally invasive surgical options

For women in whom Kegel exercises are ineffective and who desire definitive surgery, 5 procedures are endorsed by the American Urological Association:

1. Use of injectable bulking agents,
2. Laparoscopic suspensions (laparoscopic "Burch" colposuspension)
3. Midurethral slings
4. Pubovaginal slings
5. Open retropubic suspensions



Minimally invasive surgical options: *Injectable bulking agents*

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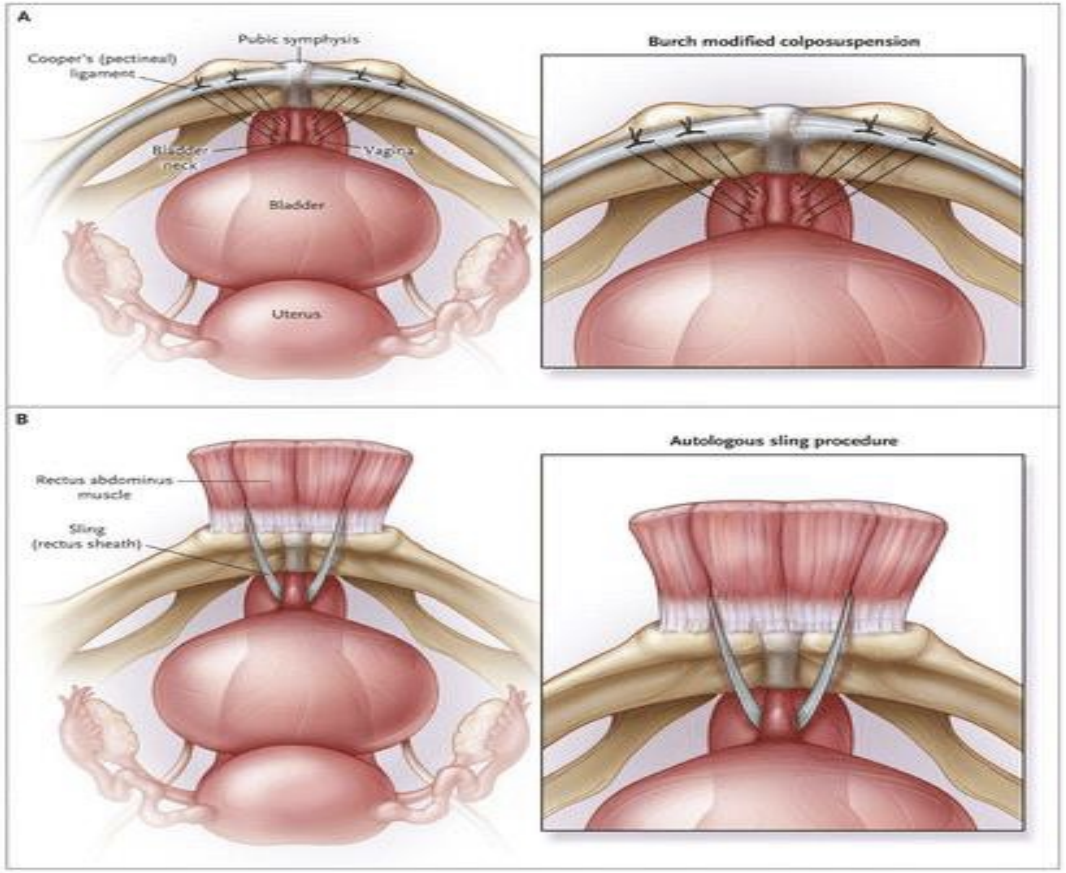
- Bulking agents are injectable materials placed at the bladder neck to improve continence.
- Several different bulking agents are available including silicone particles, carbon beads, calcium hydroxyapatite, ethylene vinyl alcohol copolymer, porcine dermal implants, etc.
- Although less effective than surgery, these agents are a reasonable option for women with multiple comorbidities who are poor surgical candidates and desire short term symptomatic relief.

Minimally invasive surgical options: *Burch colposuspension and fascial slings*

The Burch procedure involves suspending the anterior vaginal wall to the ileo-pectineal (Cooper's) ligament

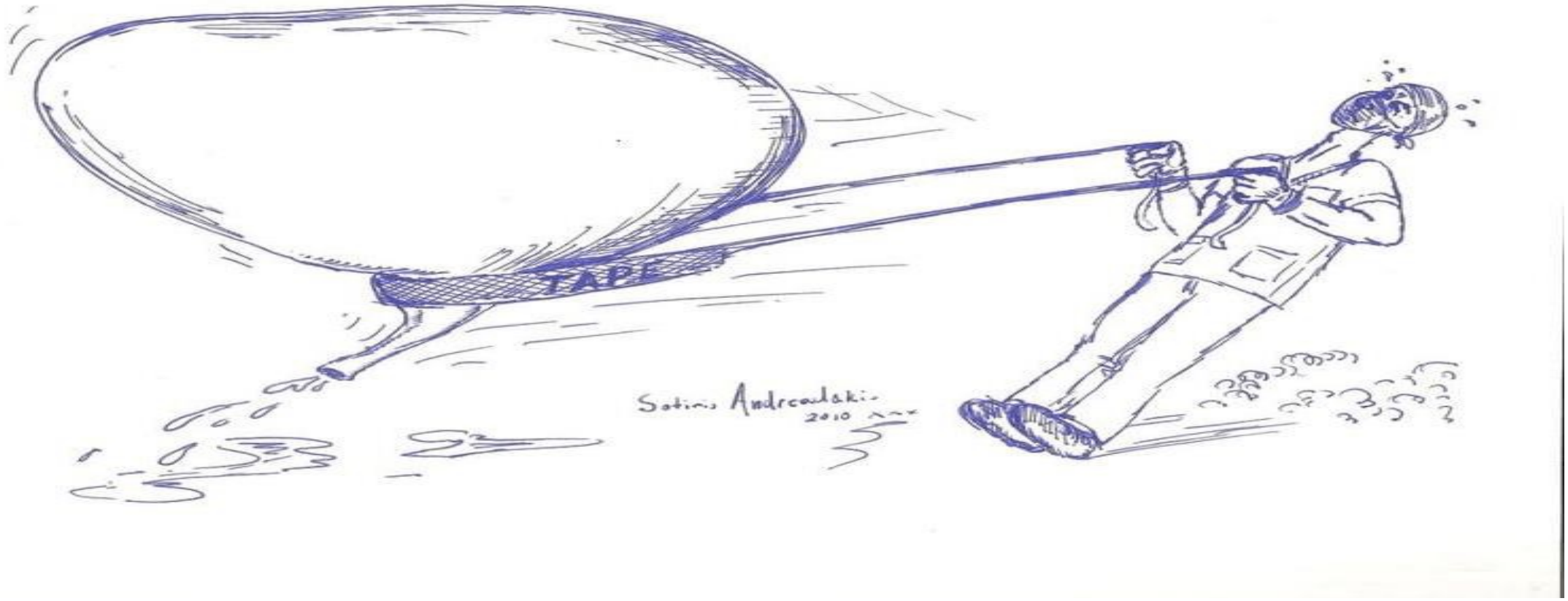
- In women with stress urinary incontinence, success rates were higher for those in the pubovaginal sling group (66%) *versus* (49%) in Burch colpo-suspension.



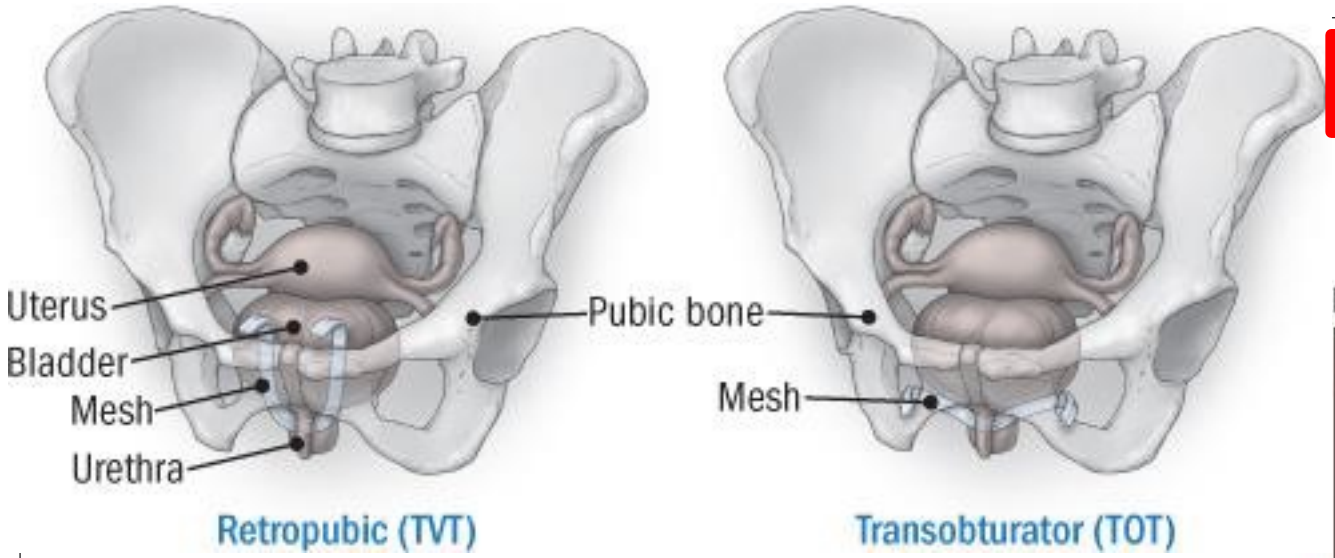
Minimally invasive surgical options: *Midurethral synthetic slings*

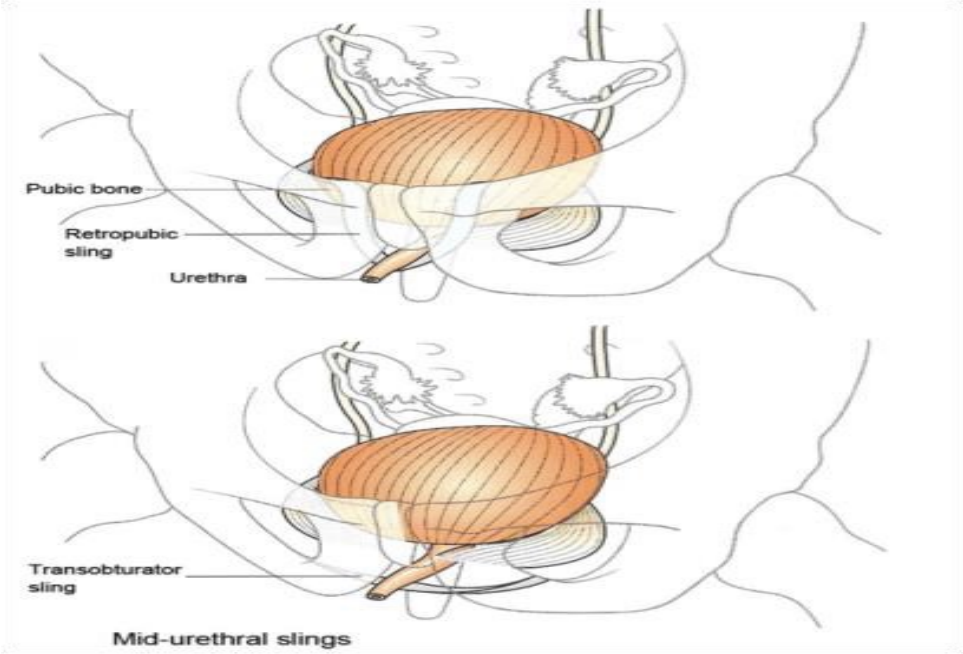
- Mid-urethral synthetic slings have replaced pubovaginal slings as the gold standard for surgical correction of stress urinary incontinence
- The placement of a sling is minimally invasive and is usually performed in an outpatient setting.
- They can be placed either retro-pubically, as in the classic tension-free vaginal tape procedure (TVT), or through the trans-obturator tape(TOT) approach

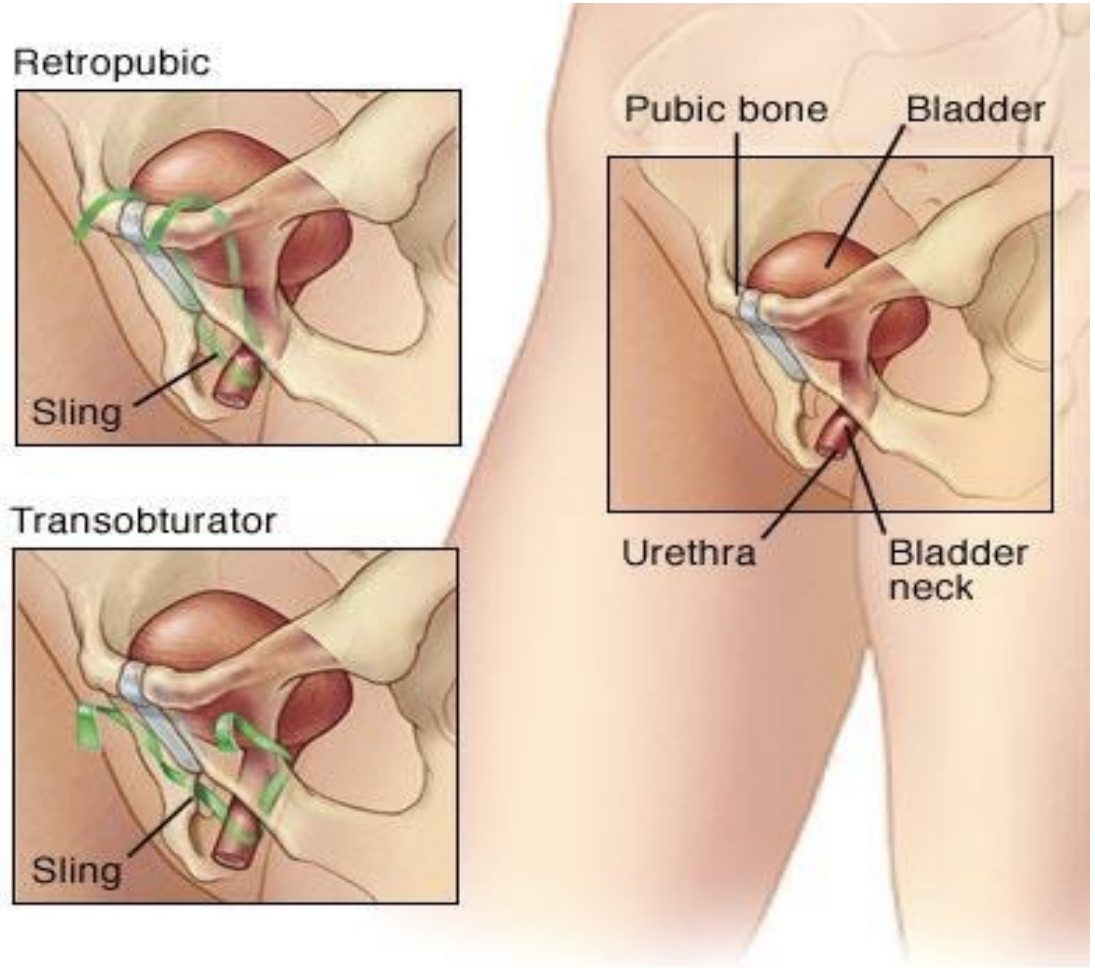
Minimally invasive surgical options:
Midurethral synthetic slings



Midurethral synthetic slings







Minimally invasive surgical options: *Midurethral synthetic slings*

CHOICE OF THE SLING:

- Several reports have revealed a reduction in the use of mid-urethral slings because of negative public perception after an increased number of complications. These complications include; injuries to bladder, urethra, and vascular elements.
- The AUA and SUFU guidelines regarding the treatment of SUI introduced 4 options of surgery which are as follows: bulking agents, autologous fascia pubovaginal sling, Burch colposuspension, and midurethral slings (Koboshi et al 2017).
- Surgeons should know the risks and benefits of the different options for SUI to identify a tailored surgical option for each woman with SUI.

Ann Kim et al 2020

Minimally invasive surgical options: *Midurethral synthetic slings*

CHOICE OF THE SLING:

- The use of either TVT or TOT are recommended for objective and subjective cure.
- Pubovaginal slings are recommended over Burch procedures to maximize cure .
- Midurethral slings are recommended over pubovaginal slings for better subjective cure
- Single incision mini-slings have gained popularity as an option with potentially fewer complications. However, mini-slings have lower subjective and objective cure rates and higher reoperation rates when compared with traditional midurethral slings.

Minimally invasive surgical options:
Midurethral synthetic slings

- COMPLICATIONS:

A- intraoperative:

1. Significant bleeding
2. Bladder & urethral injuries

B.Early postoperative :

1. lower urinary tract symptoms (LUTS)
2. voiding dysfunction,
3. infection,
4. extrusion
5. Pain

C- Late postoperative:

1. Extrusion
2. Erosion
3. Obstruction/voiding dysfunction

CONCLUSION

- Stress urinary incontinence is common in women and may impact their activity levels and quality of life.
- Conservative management should precede surgery.
- Minimally invasive treatment measures can readily be initiated by primary care providers, with referral to a specialist when conservative management is not effective
- Many gaps remain in our knowledge of this disorder. Further research is also needed to study prevention of leakage, factors that impact treatment success, and longevity of various therapies.
- New therapies should be studied in randomized clinical trials before general clinical use.

- THAK YOU FOR ATTENTION

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