

# بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ

\*\*This file contains the following topics:

- 1) Neurogenic bladder
- 2) Urologic trauma
- 3) UTI
- 4) Urolithiasis
- 5) Pediatric urology
- 6) Renal cancer
- 7) Bladder cancer
- 8) BPH
- 9) Prostate cancer
- 10) Benign scrotal swelling
- 11) Erectile dysfunction
- 12) Infertility

\*\*Missed topics:

1- Introduction ( Signs & Symptoms )

2- Urinary Catheter

3- Testicular cancer



A decorative arrangement of fresh blueberries and mint leaves is scattered on the left side of the slide. The blueberries are clustered in several groups, with some individual berries and small sprigs of mint leaves interspersed. The background is a solid, light purple color.

# Neurogenic Bladder (NB)

Presented by : Eslam wasfi AL-Tarawneh

• Neurogenic bladder is a term used to describe lower urinary tract (LUT) dysfunction resulting from a neurologic disease or process. *result voiding dysfunction*

• Up to 80% of neurological diseases develop Lower Urinary Tract Symptoms (LUTS) *→ frequency/urgency/urge incontinence/poor stream*

• Accurate diagnosis and proper management of LUT dysfunction in the neurogenic population consist of two main goals: (1) to preserve the safety of the bladder with low pressure storage and adequate emptying and (2) to maintain a reasonable quality of life in relationship to the bladder. *→ Pt with stroke & frequency*

*" " " " urge incontinence  
female " obese & bedridden + " " (wet genitalia & liable to develop ulcers)*

*≠ inadequate emptying  $\xrightarrow{\text{result}}$  residual urine  $\rightarrow$   $\uparrow$  p. in bladder  $\rightarrow$  back p. on kidney*

*∴ we treat manifestation of neurological d. on lower urinary tract  $\rightarrow$  to preserve low storage p. & adequate emptying to preserve upper tract*



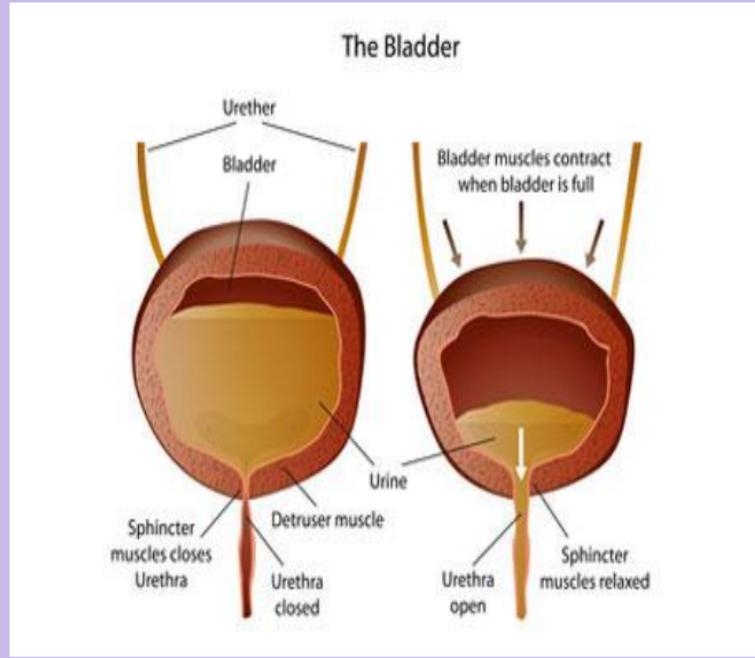
# lower urinary tract function

urine storage and micturition depend on the coordination of the bladder, bladder neck (sphincter), urethra and urethral sphincter

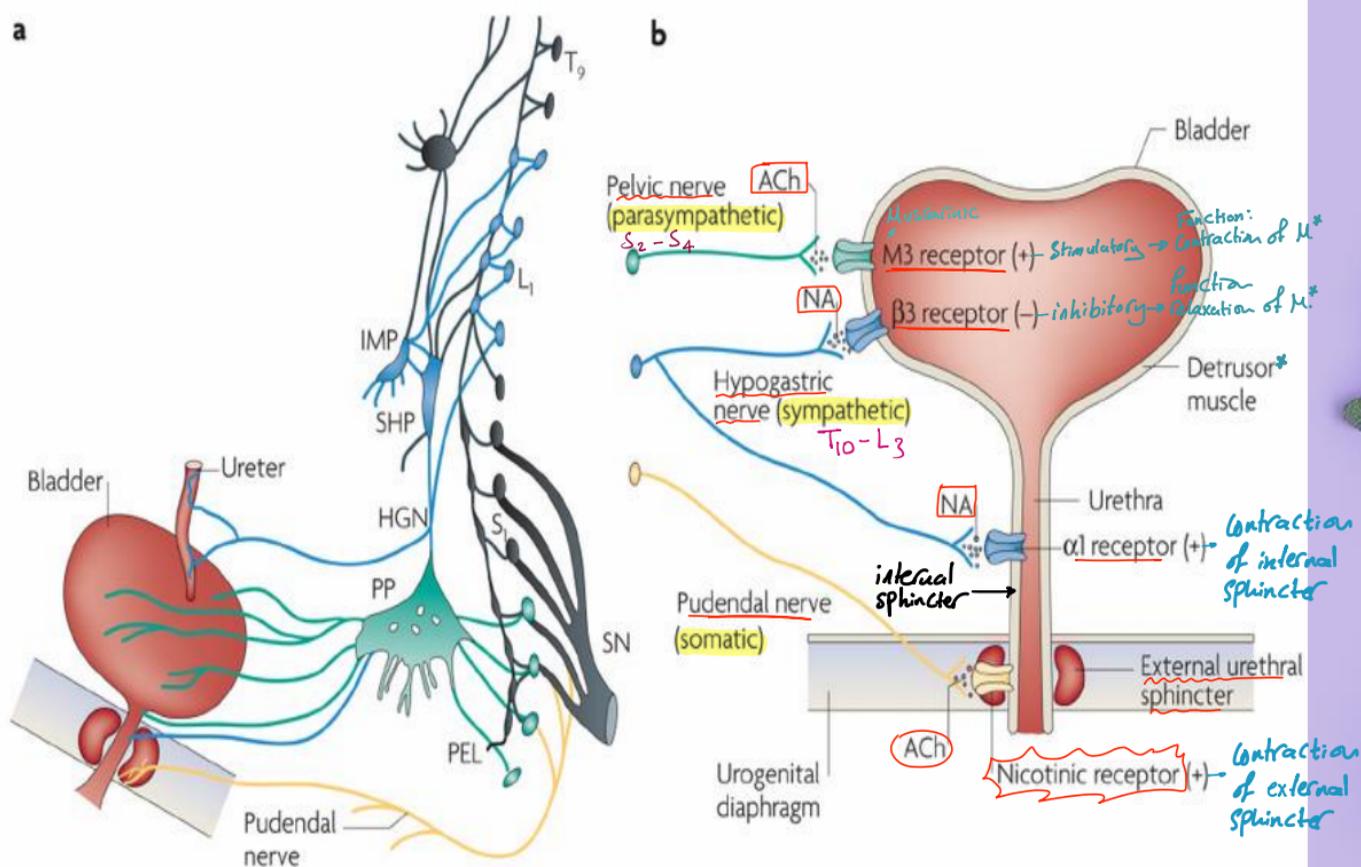
bladder M.  
(detruser M.)

coordination between the muscles of the lower urinary tract is mediated by neural pathway in the ;

- ✓ brain } CNS
- ✓ spinal cord } CNS
- ✓ peripheral nerve - PNS



# NEURAL CONTROL OF THE LOWER URINARY TRACT (LUT)



Phase	Storage phase	Voiding phase
Parasympathetic	Off	On
Sympathetic	On	Off
Somatic	On	Off

- Pelvic splanchnic nerve (Parasympathetic) signals lead to contraction of the Detrusor (M3 receptors = **Stimulatory**).
- Hypogastric nerve (Sympathetic) signals lead to Relaxation of the Detrusor (B3 receptors = **Inhibitory**) and contraction of Internal Urethral sphincter (A1a receptors = **Stimulatory**).
- Pudendal nerve (Somatic) signals lead to Contraction of the external urethral sphincter (Nicotinic receptors = **Stimulatory**)



\* once bladder start to be filled → stretch →

there is receptors in bladder wall in detrusor M. (stretch receptors) Since the increase in volume & increase in P. → start signalling (afferent)



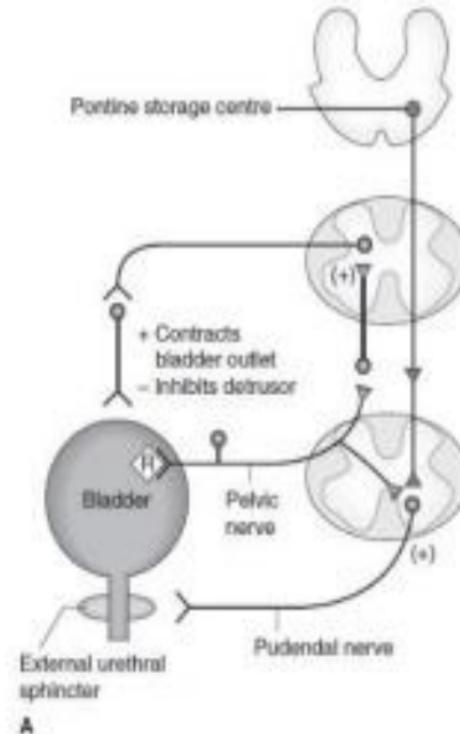
\* But



low-level afferent signal are organized in the spinal cord and promote urine storage via if it on signal from the CNS

# urine storage reflux

- During normal bladder filling, sympathetic (hypogastric nerve) and somatic (pudendal nerve) neural mechanisms mediate the contraction of the internal smooth and external striated urethral sphincters, respectively. As the bladder fills, sympathetic-mediated inhibition of the detrusor allows for the bladder to accommodate increasing volumes at low intravesical pressures



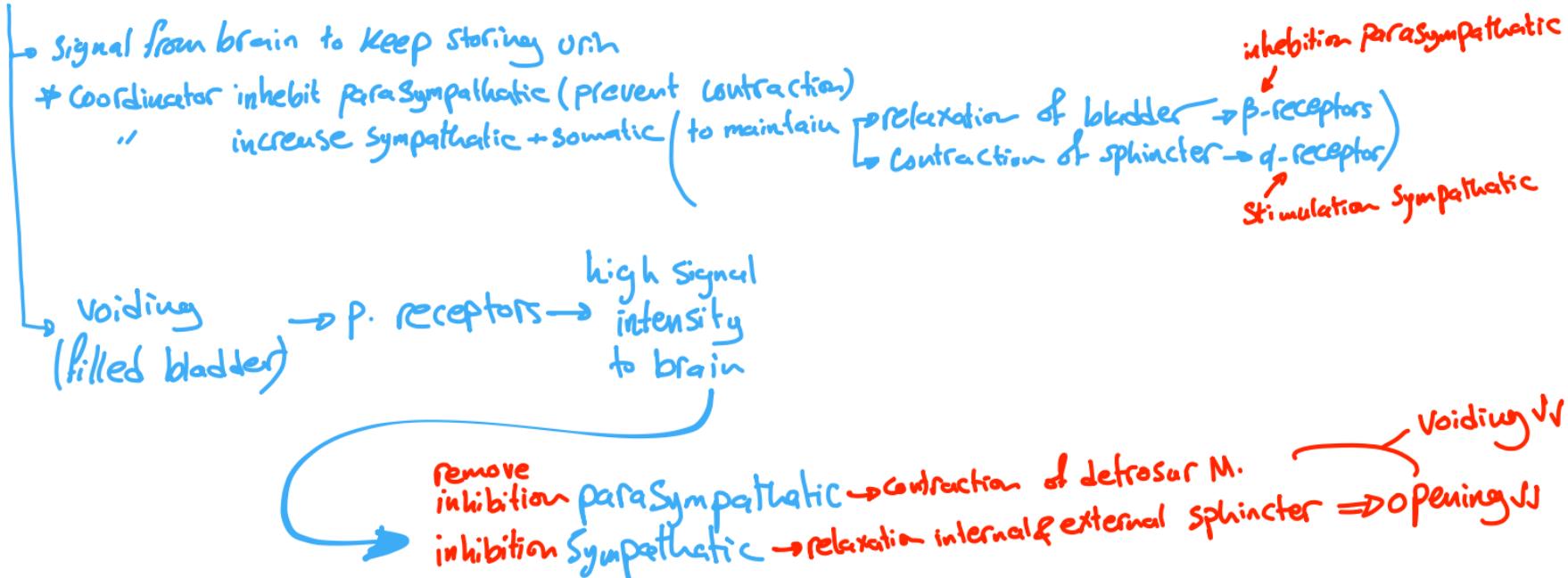
so this reflects is \*on\*  
when we have  
“ low intensity signal and socially  
causes”



# Brain micturation center in frontal loop

# low signal OR situation not suitable for urination (socially unsuitable) ---> brain send signals for pontine (the coordinator)

\* **pontine** (micturation center inside it)



# Any problem in peripheral N. or Spinal Cord or center (brain)

or  
lesion

Sacral or infrasacral lesion

- flaccid bladder (without sensation or contraction → hypcontractility)
- increase residual urine
- Symp. → can't emptying bladder
- mainly → voiding Symp.

intrapontine  
Suprasacral  
lesion

- loss of storage function
- storage Symp. → frequency, urgency, urge incontinence, nocturia
- coordination affected; so present with both storage & voiding Symp. → poor stream, intermitency, inability complete emptying, increased residual volume, disorganization, dyssynergia btw 2 sphincters in addition to detrusor overactivity

center (brain)

subpontine lesion

- loss of storage function
- storage Symp. → frequency, urgency, urge incontinence, nocturia
- Sphincter Spare (synergia preserved) so the emptying will be completely so no residual urine
- function: sphincter normal detrusor overactivity

M. & sphincter  
one of them contracted  
the other relaxed



high level afferent signals are stimulated by intravesical pressure resulting in increased activity to the brain

descending efferent pathways then cause voluntary bladder contraction and the flow of urine

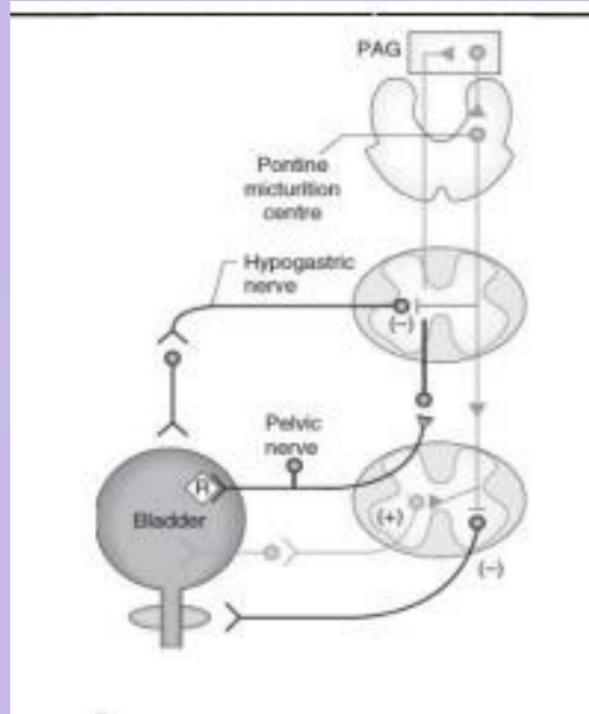
normal voiding is, therefore, a function of a positive feedback mechanism



# Urine voiding reflex

## A positive feedback loop

- When an individual decides that it is time to urinate, the pontine micturition center (PMC) is released from tonic inhibitory control of the higher cortical and subcortical centers of the brain, initiating the voiding process. The parasympathetic system then switches “on,” stimulating a detrusor contraction and relaxation of the pelvic floor and external and internal urethral sphincters



# Nervous system damage and LUT dysfunction



## Suprapontine lesion

- **History:** predominantly storage symptoms
- **Ultrasound:** insignificant PVR urine volume
- **Urodynamics:** detrusor overactivity

### Upper motor neuron

Each filling episode of bladder will leave to activation of the pontine center.



**Storage symptoms : Frequency , Urgency & Nocturia.**

## Spinal (infrapontine-suprasacral) lesion

- **History:** both storage and voiding symptoms
- **Ultrasound:** PVR urine volume usually raised
- **Urodynamics:** detrusor overactivity, detrusor-sphincter dyssynergia

### Upper motor neuron

Pontine center isn't receiving signals from below.



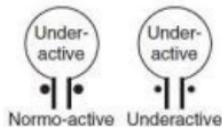
**Voiding symptoms : Weak stream , Retention , Hesitancy & Dribbling.**

## Sacral/intrasacral lesion

- **History:** predominantly voiding symptoms
- **Ultrasound:** PVR urine volume raised
- **Urodynamics:** hypocontractile or acontractile detrusor

### Lower motor neuron

Weak bladder.



# History and Physical Examination

\* Spinal Shock → 1<sup>st</sup> 3 months → manifestation of LMNL (infrasacral manifestation)  
→ after 3m → " " " UMNL → over activity & dysynergia

• A detailed history should factor in urinary tract symptoms, neurologic symptoms and diagnosis (if known), the clinical course of the neurologic disease, bowel symptoms, sexual function, comorbidities, and use of prescription and other medication and therapies.

↳ have Sympathetic or parasympathetic SE

• assessment of patient mobility, hand function, cognitive function and social support are also important.

↳ spine cord injury & paraplasia in addition to dysynergia & he can't empty his bladder & overactivity (back P. la kidney)

• Other factors to consider are risk and history of urinary tract infections, decubitus ulcers, and other urologic factors that may contribute to LUT dysfunction such as prostate enlargement in men and urethral hypermobility in women.

↳ Superimposed urologic symp. ⇒ complications...

Clean intermittent catheterization  
أداء قسطرة نظيفة

لأن

⇒ if the patient is incapacitated → indwelling catheter inserted



# History and Physical Examination

A general physical examination should include blood pressure measurement, an abdominal examination, an external genitalia examination in males and a vaginal examination if clinically indicated to look for pelvic floor prolapse in women along with a rectal exam to look for fecal loading or alteration in anal tone

. A focused neurological examination is also recommended. This may include assessment of cognitive function, ambulation and mobility, hand function, and lumbar and spinal segment function, including testing sensation and reflexes in the urogenital area.



# Investigations

A. Urine Testing → residual urin stasis, infection

B. Measurement of Renal Function → high p. system in bladder → back p. to kidney

C. Upper Tract Evaluation → stasis (stone formation)

D. Urodynamic Investigations

\* hydronephrosis ⇒ U/S

→ insertion of catheter & measuring P. of detrusor M.  
+ check coordination btw detrusor M. & sphincter

RF & hydronephrosis





# MANAGEMENT OF NEUROGENIC BLADDER

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Presented by : مروة الخرشة



# Goals of Accurate diagnosis and proper management of LUT dysfunction



(1) to preserve the safety of the bladder with low pressure storage and adequate emptying .



(2) to maintain a reasonable quality of life in relationship to the bladder.

Management of  
neurogenic  
bladder

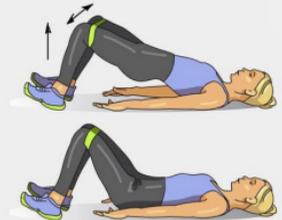
- 1. Management of Storage Dysfunction:
  - <sup>أولاً</sup> **A- Behavioral and conservative Treatments.**
  - **B- Pharmacotherapy.**
  - **C- Neuromodulation.**
  - **D- Onabotulinumtoxin A**
  - **E- Surgical.**
- 2- Management of voiding dysfunction:
  - **A- Medications.**
  - **B- Catheterization.**

# A- Behavioral and conservative Treatments.

- Lifestyle interventions
  1. Moderation of fluid intake to 1-1.5 litres per day
  2. Avoid alcohol , caffeine
  3. Drug regimens avoiding diuretics ,  
*Prevent stress incontinence*
  4. control of chronic cough and constipation ,
  5. cessation of smoking .
  6. exclusion or treatment of urinary tract infection ,
  7. weight reduction is desirable .

## Behavioral therapy

1. Timed voiding
2. Pelvic floor muscle training and exercise ( including pelvic floor relaxation ) .
3. Delayed voiding .
4. Double voiding .
5. Biofeedback



## B. Pharmacotherapy TWO LINE OF MEDICATIONS

### 1) Anticholinergic drugs (Antimuscarinic)

\*To inhibit detrusor contraction (inhibit parasympathetic)

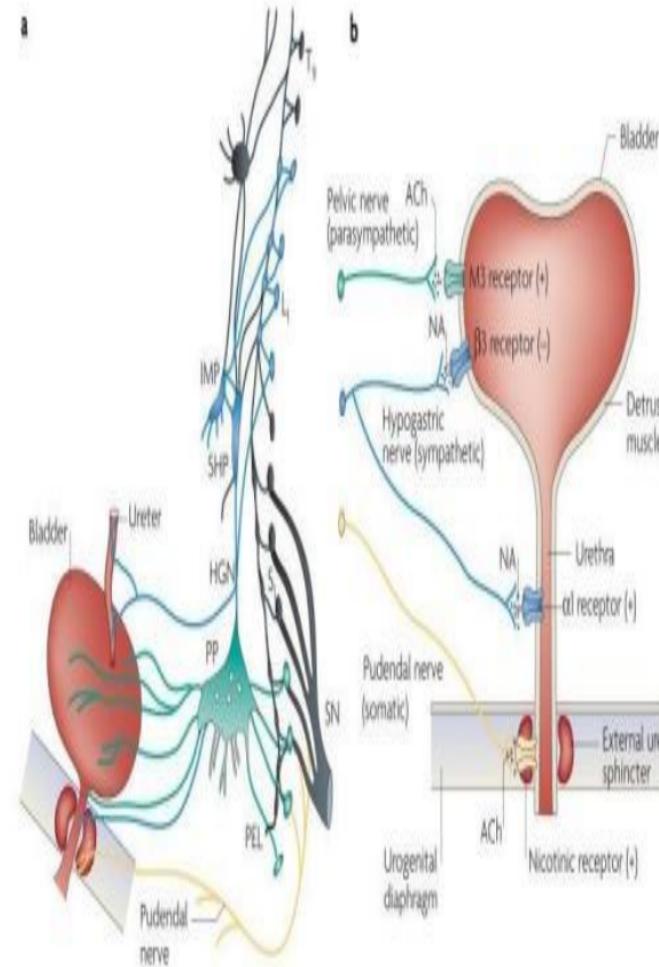
Anticholinergic medications are the mainstay of pharmacotherapy for individuals with neurogenic detrusor

Overactivity (level of evidence Ia) and are considered to be first-line therapy, at times in combination with clean intermittent catheterization (CIC).

Anticholinergic medications aim to increase bladder capacity and reduce episodes of urinary incontinence secondary to neurogenic detrusor Overactivity.

These medications works on the: M2 and M3 ↖ Most common ↗ Most active/function

There are two types of muscarinic receptors in the bladder: M2 and M3. M2 receptors are most abundant, but M3 receptors are functionally more relevant to bladder relaxation.



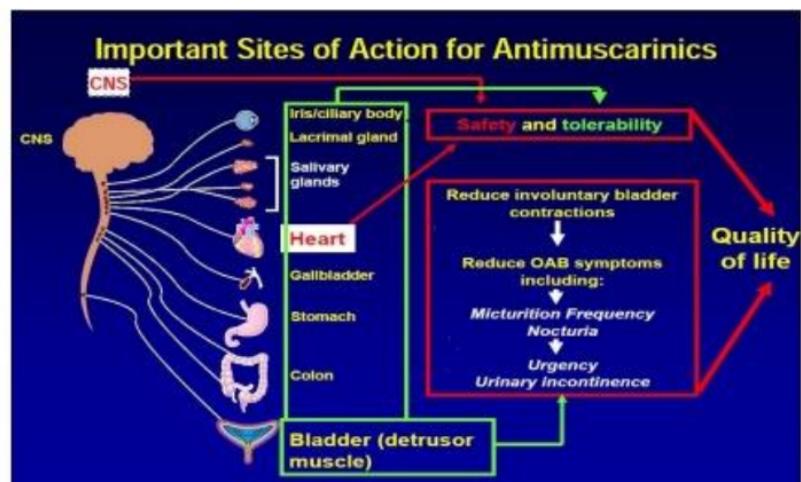
**Adverse effects** of anticholinergic medications most commonly include dry mouth, blurred vision, constipation, tachycardia, and confusion, some or all of which may already be present in the neurogenic patient.

#Affect contractility of bladder SE

Difficulty emptying the bladder is another potential adverse event of these medications, which should be considered in any individual who has an elevated PVR and in individuals with multiple sclerosis, stroke, or Parkinson's disease.

It is also recommended to monitor PVRs after starting treatment with an anticholinergic medication and to take into account that these medications can cross the blood-brain barrier, can reduce bladder emptying increasing the risk for urinary tract infection, and can precipitate or exacerbate constipation.

- **Oxybutynin** (immediate release [IR], extended release [ER]. patch, topical gel), **Tolterodine**, **Solifenacin**, **Fesoterodine** (3ry)
- Darifenacin** (M3 Selective)
- Tropium chloride** (4ry) . Amine-->high molecular weight-->not cross BBB-->no CNS SE ✓



## Mnemonic

### Anticholinergic Side Effects

Can't **SEE** 👁️

Can't **PEE** 🚽

Can't **SPIT** 🗑️

Can't **SH•T** 🚽

MEMORY PHARM

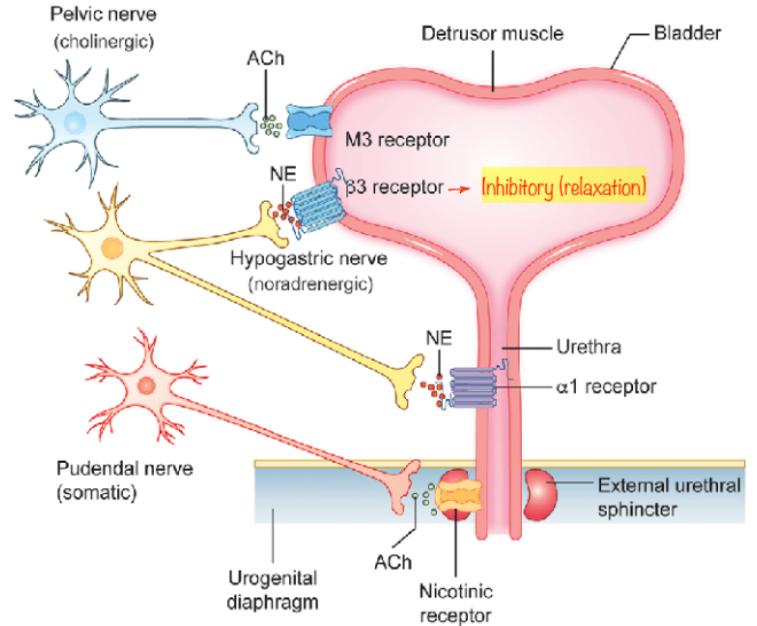
## Beta-AR agonists

Over 97% of B-adrenergic receptors in the bladder are of the  $\beta_3$  type, representing the main method of bladder relaxation in humans.

These receptors serve to relax the detrusor muscle, making them an ideal therapeutic target.

The selective  $\beta_3$ -adrenoceptor agonist mirabegron was approved in by the Food and Drug Association (FDA) in 2012 for clinical use as an additional medication used to treat overactive bladder symptoms.

The main side effects of this medication are cardiovascular with a mean rise in blood pressure of up to 2.4 mm Hg and small increases in heart rate. → Recommendation to monitor HR & BP



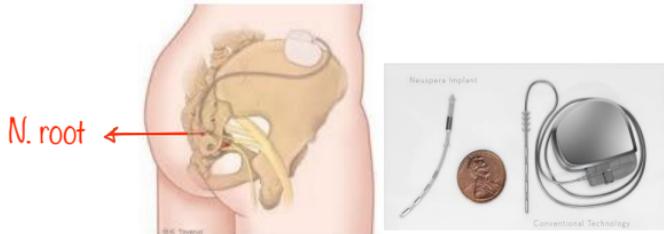
\* Abnormal afferent signals--> الحبل stimulation of N. root--> inhibit excitatory stimuli to bladder (then maintain storage -relaxation of detrusor M.-

## C- Neuromodulation

- Neuromodulation is a well-established third-line treatment for nonneurogenic overactive bladder, but its use in neurogenic bladder is relatively less established.

Neuromodulation is currently performed in **two varieties**:

### A- sacral neuromodulation (SNM)-Directly



### B -percutaneous tibial nerve stimulation, (PTNS).



Peripherally



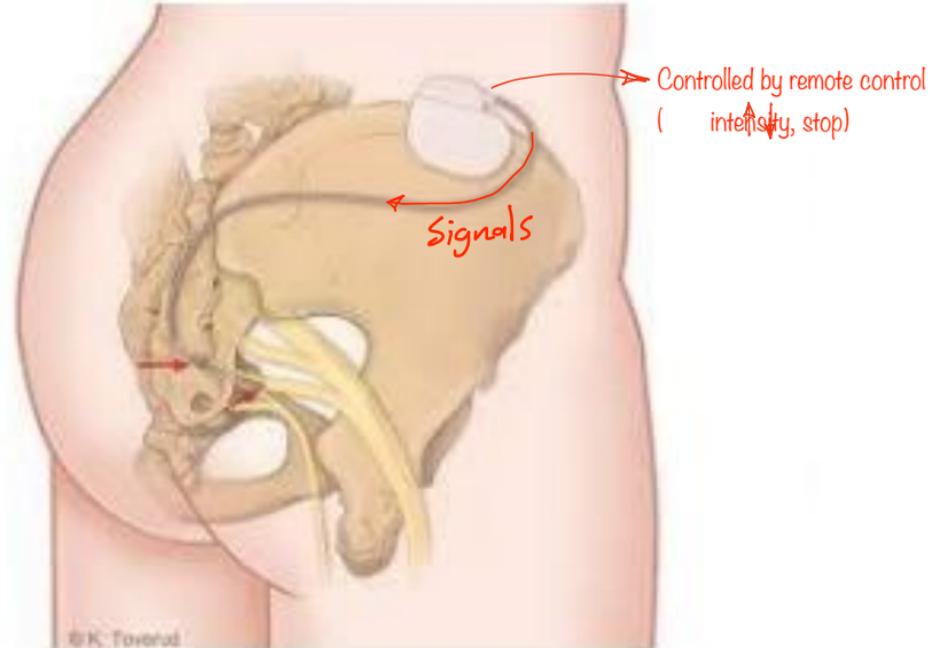
## hyperactivity

Sacral neuromodulation → Battery & lead at normal root position

Stimulation of the S3 / S4 nerve root by an implanted electrical pulse generator

The stimulator is a small electrical pulse generator, approximately the same size as a cardiac pacemaker, and is commonly implanted in the upper outer quadrant of the buttock.

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# D. Onabotulinumtoxin A

\*inhibition of NMJ  $\Rightarrow$  relaxation of detrusor M.

- Onabotulinumtoxin A works by blocking the release of acetylcholine from nerve endings (exocytosis), resulting in the blockage of neural transmission and alteration of afferent sensory input. It is important to consider that these injections may increase the PVR among individuals who void, introducing the need for CIC or other more invasive bladder management strategies.

Cytotoxin  $\leftarrow$

مضاد حيوي  
Clean intermittent catheterization

\* through cystoscope & intradetrusor injections

\* these toxins later on  $\rightarrow$  degradation (efficacy = 6-8 months)

so they have to repeat this management



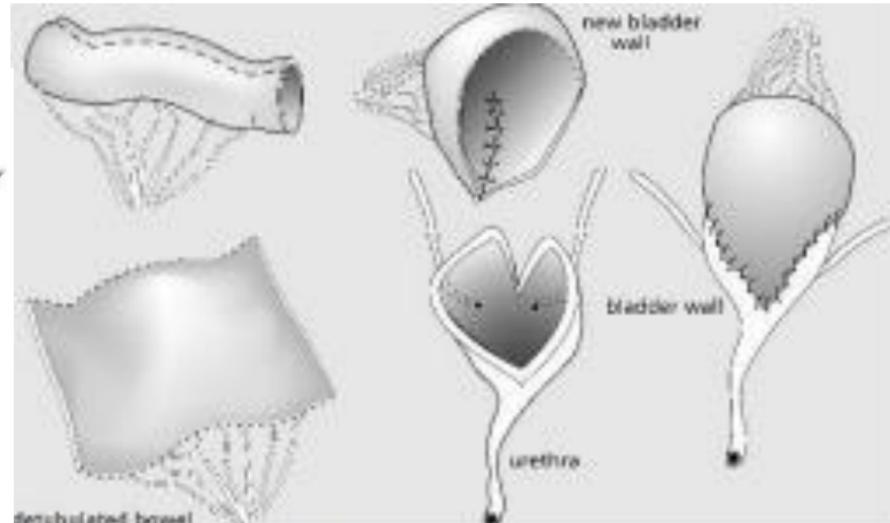
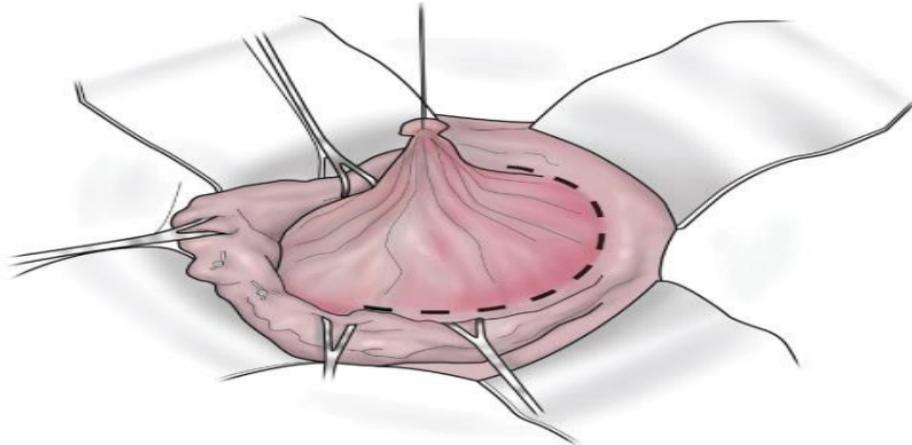
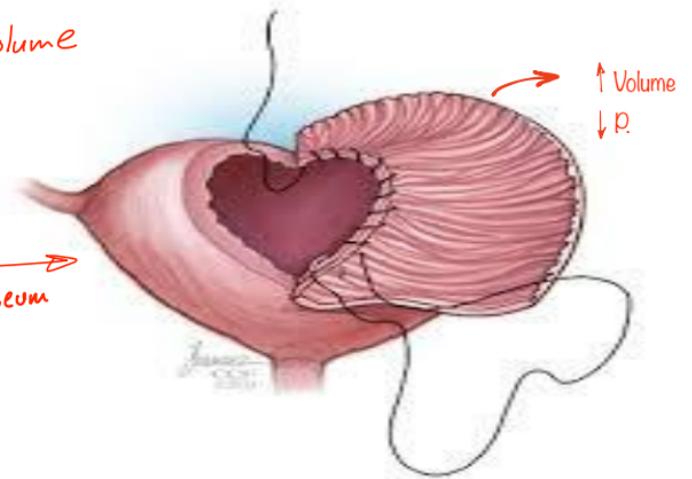
• **E. Surgical** : *→ spastic bladder & has low volume*

A- Clam augmentation cystoplasty . *from ileum*

B- Detrusor myectomy .

C- Denervation procedures .

D- Urinary diversion

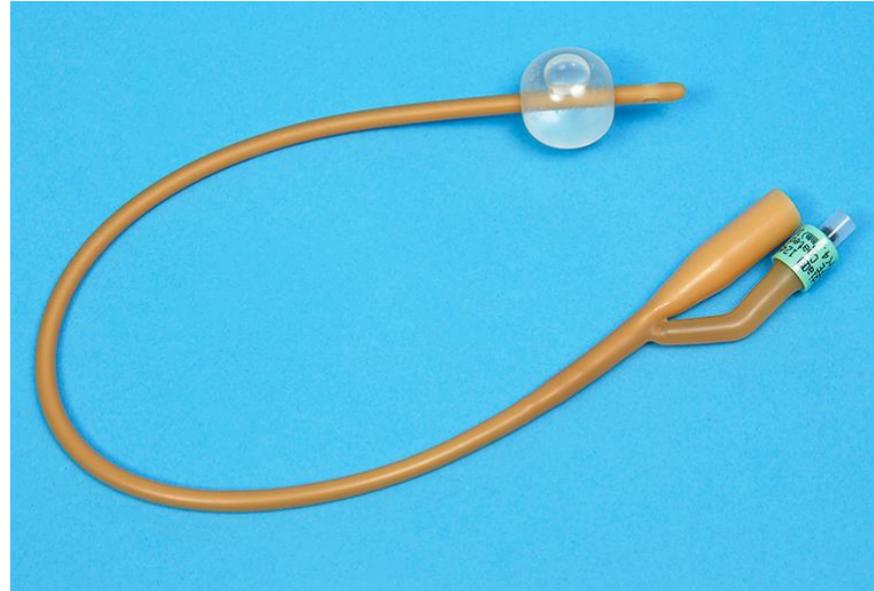
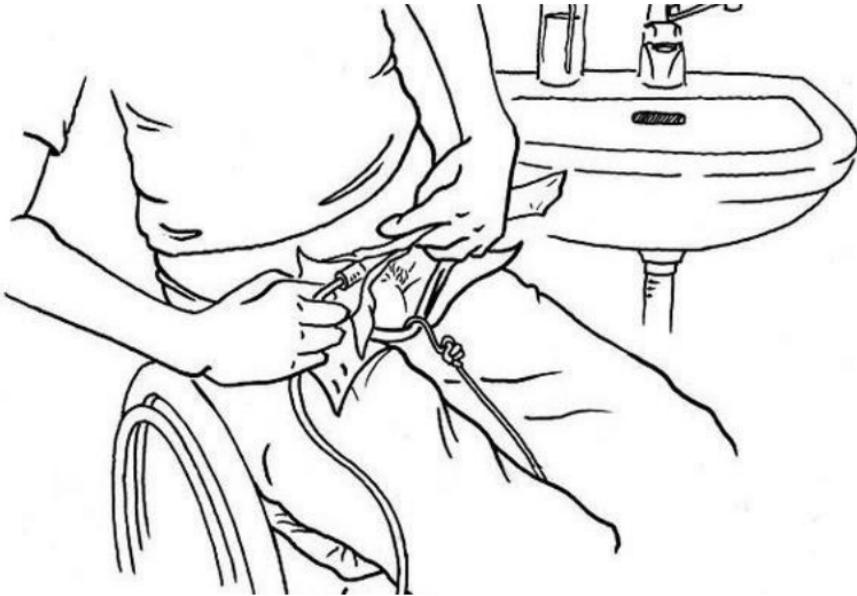


## 2-management of voiding dysfunction → High RV

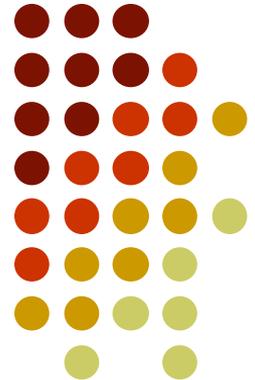
Cholinergomemics ← Medications → Withdrawn from markets bez their high SE

### -Catheterization

- Indwelling (change every 3 months)--> pt continuously draining his bladder
- Clean intermittent catheterization (CIC)--> pt can catheterize him/herself at time feeling for voiding



# Urological Trauma





# introduction

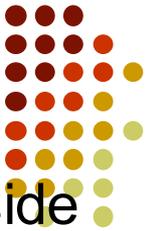
- Urologic trauma is classified according to the location of injury:
  - 1- **upper urinary tract** (kidneys and ureters)
  - 2- **lower urinary tract** (bladder and urethra), and **external genitalia** (penis, scrotum, and testes).



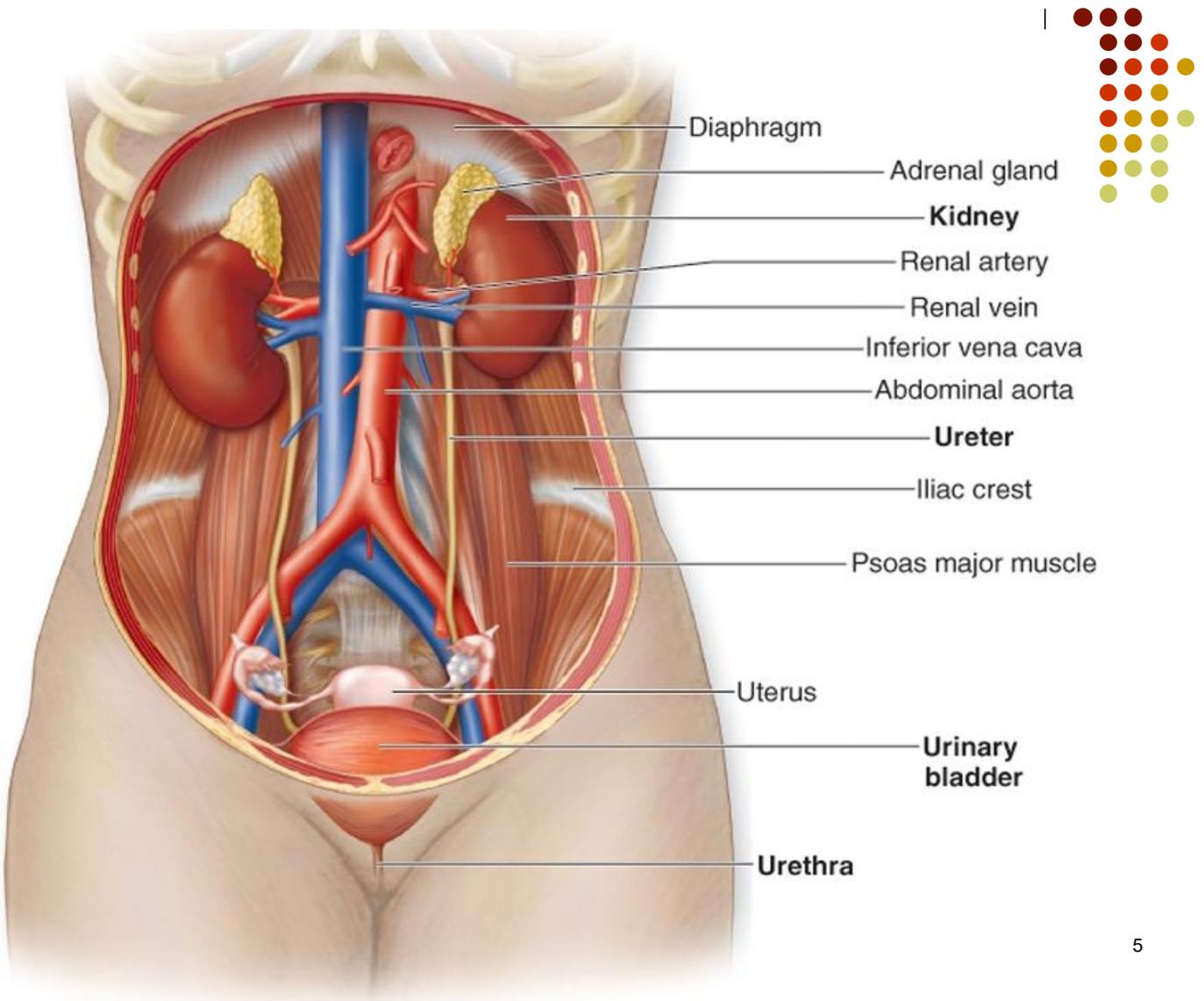
# Renal trauma

Very rare → 1-10% maximum of abdominal trauma → with renal injury (rare)

# Renal Anatomy



- The kidneys are retroperitoneal organs on each side of the vertebral column (T12-L3), at about the level of the twelfth rib.
- The **left kidney** is **lightly higher in the abdomen** than the right.
- On an **average**, each kidney **weighs 150 g.**
- The kidneys have the following **coverings:**
  1. **Fibrous capsule**
  2. **Perirenal fat**
  3. **Renal fascia**
  4. **Pararenal fat**





# Relevant anatomy

- The superior aspect of the kidneys is somewhat protected by the lower ribs.
- the lower poles are inferior to the 12th ribs.
- The **parenchyma of the kidney** has **a segmental arterial supply.** *(end arteries, no anastomosis)*  
*\* venouse drainage → venouse drain communicating btw all parts of renal parenchyma*
- there is numerous anatomical variations, including pelvic kidneys; horseshoe kidneys; and multiple renal arterial, venous, and ureteral duplications.



# Renal trauma

- The kidney is the **most commonly injured structure in the urinary tract**, accounting for **1%** of all traumatic injuries. Nevertheless, operative intervention is pursued in only approximately 10% of renal injuries.

*30% renal injury manage conservative.*

- The majority of renal injuries are **mild** and can be managed conservatively.



# Mode of Injury

- The mechanisms of renal injuries are classified as **blunt (closed)** or **penetrating (open)**. <sup>90%</sup>
- **Blunt injuries** → tend to fracture along the planes between the segmental vessels, **but** penetrating injuries → cross the segmental vessels.
- **Blunt trauma (90%)** can be the result of **direct compression or deceleration.**
  - Motor vehicle accidents
  - falls
  - direct blows to the flank
  - **Deceleration injuries** are particularly dangerous **because they may lead to renal vascular injuries.**



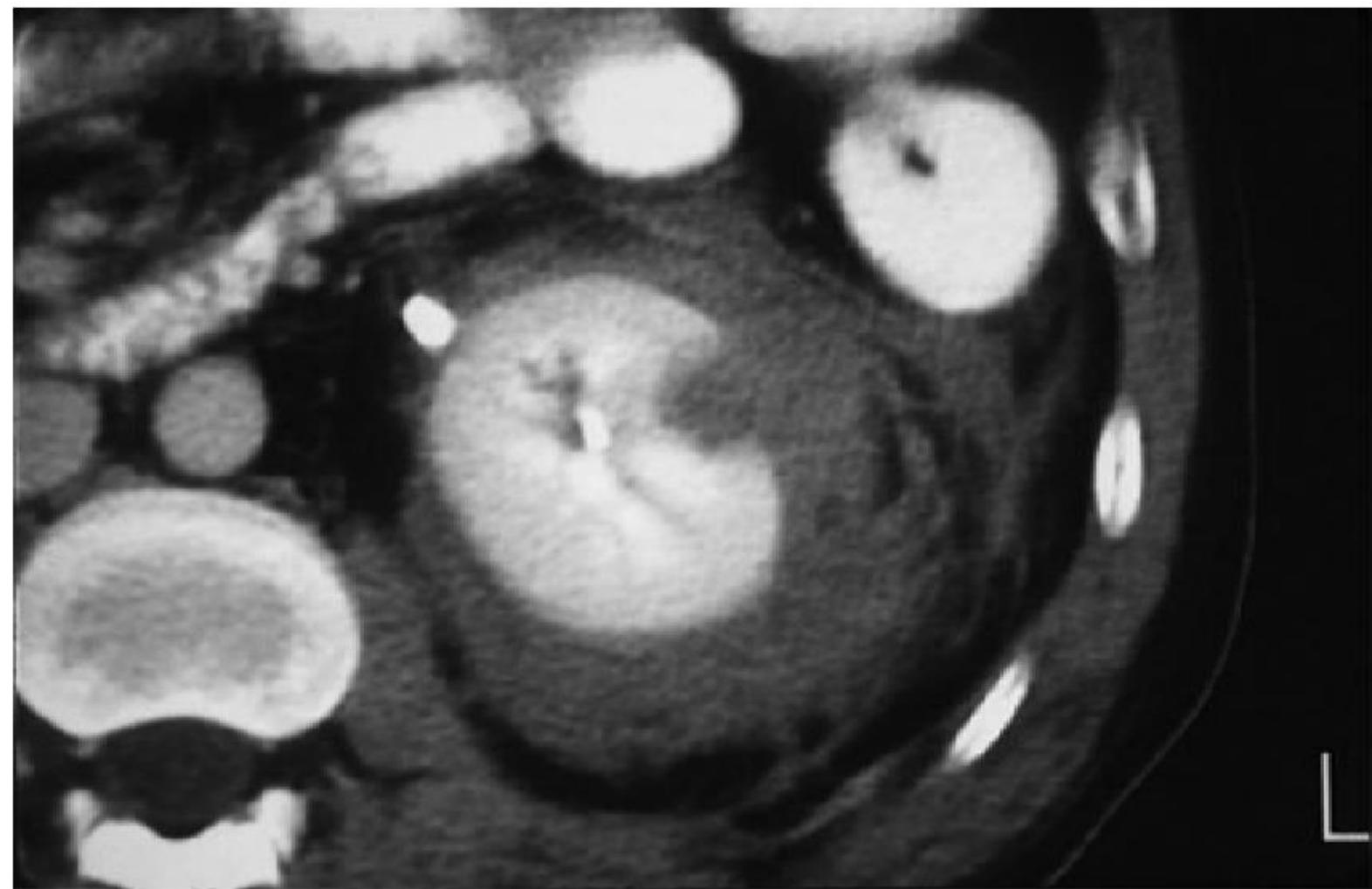
- **Penetrating wounds(10%)** are ones open to the external environment.
  - **Gunshots**
  - **Stab wounds**
- Renal injuries from penetrating trauma tend to be **more severe** and less predictable than those from blunt trauma. *exploration*

## Box 10.1 Staging of the renal injury <sup>hs</sup>

*with contrast*

Using CT, renal injuries are staged according to the American Association for the Surgery of Trauma (AAST) Organ Injury Severity Scale. Higher injury severity scales are associated with poorer outcomes.

- Grade I** Contusion or subcapsular hematoma with no parenchymal laceration
- Grade II** Parenchymal laceration of cortex <1 cm deep, no extravasation of urine (i.e., collecting system intact) (Fig. 10.1)
- Grade III** Parenchymal laceration of cortex >1 cm deep, no extravasation of urine (i.e., collecting system intact)
- Grade IV** Parenchymal laceration involving cortex, medulla, and collecting system OR segmental renal artery or renal vein injury with contained hemorrhage
- Grade V** Completely shattered kidney OR avulsion of renal hilum



**Figure 10.1** Renal CT with IV contrast in blunt trauma patient shows a superficial (grade 2) laceration amenable to nonoperative management.



# Initial emergency assessment <sup>(ABC)</sup>

1. Initial assessment of the trauma patient should include **(ABC)** controlling any external bleeding and resuscitation of shock as required, and securing of the **airway**.
2. Take careful history
3. Physical examination is usually carried out during stabilization of the patient.
4. When renal injury is suspected, further evaluation is required for a prompt diagnosis.

\* Urin analysis; hematuria (most imp indicator of urinary injury)

full rib fracture, bruising, ecchymosis, pulsating hematoma on flank

# History and physical examination



- **Haemodynamic stability** should be decided upon admission
- **History** should be taken from conscious patients, witnesses, and rescue team personnel regarding the **time and setting of the incident.**
- **Abnormal kidneys are more liable to injury** thus, a history of **past renal surgery**, and known **pre-existing renal abnormalities** (large cysts, stones) should be recorded.  
*Pelvic kidney, horseshoe kidney, malformations.*
- In penetrating wounds Do **examination** of thorax, abdomen, flanks and back for should be obtained (**eg. Bruises, rib fractures...etc**)



- The following findings on physical examination may indicate possible renal involvement:

1. **Haematuria**
2. Flank pain
3. Flank ecchymosis
4. Flank abrasions
5. Fractured ribs *11<sup>th</sup> / 12<sup>th</sup>*
6. Abdominal distension
7. Abdominal mass
8. Abdominal tenderness.

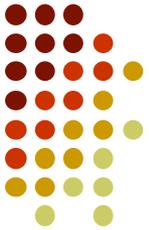


# Laboratory studies

## -Urinalysis:

- It is the **single most important laboratory test** in the evaluation of renal injuries.
- **Hematuria is an important indicator** of injury to the kidney, yet the presence or absence of hematuria should be viewed in the clinical context and not used as the sole decision point in the assessment of a patient with a possible renal laceration.  
*x but not indicator for severity of renal injury (degree of injury)*
- **The degree** of hematuria, **does not** precisely correlate with the severity of injury.

# Imaging studies



- **The goal** of radiographic assessment is to provide complete and **accurate staging** of renal injuries in order **to determine the need for and to plan operative management.**
- **Indications:**
  1. **Gross hematuria**
  2. **Microscopic** (<sup>→ with hemodynamic instability</sup> >5 RBCs per high-powered field [hpf]) or dipstick hematuria in a hypotensive patient (systolic blood pressure of <90 mmHg recorded at any time since the injury) <sub>3- Pediatric with microscopic hematuria → even with stable vitals</sub>
  4. **History of rapid deceleration** with evidence of multisystem trauma (e..g., fall from a height, high-speed motor vehicle accident).
  5. **Penetrating** chest and abdominal wounds (knives, bullets) with any degree of hematuria or suspicion of renal injury based on wound location



- **These criteria do not apply to pediatric trauma patients; in this population, **significant renal injury can occur** even in the setting of microscopic hematuria without hypotension.**



# Ultrasonography

- **Advantages**

1. It is noninvasive
2. It may be performed in real time in concert with resuscitation
3. It may help define the anatomy of the injury.

- **Disadvantages**

1. Optimal study results related to anatomy require an experienced sonographer
2. **Bladder injuries may be missed.**



# Computed Tomography

- **Advantages:**

1. It allows unsurpassed functional and anatomic assessment of the kidneys and urinary tract
2. It allows for the diagnosis of concurrent injuries.

- **Disadvantages:**

1. It requires intravenous contrast in order to maximize information about functionality, hematoma, and, possibly, bleeding.
2. The patient must be stable enough to go to the scanner
3. Full urinary assessment is dependent on the timing of contrast and scanning in order to view the bladder and ureters.



# Intravenous Pyelogram *IVU*

- **Advantages**

1. It allows functional and anatomic assessment of both kidneys and ureters,
2. It may be performed in the emergency department or **operating room**. (*Unstable pt → on table*)

*CT ← ہوکھ نکون بہیل*

- **Disadvantages**

1. It requires multiple images for maximal information.
2. The radiation dose is relatively high.
3. Findings do not reveal the full extent of injury.



# Angiography

*↳  
yoga,  
die* Curative aim (emphasis of a.),  
not for diagnosis or evaluation only!

## ● Advantages:

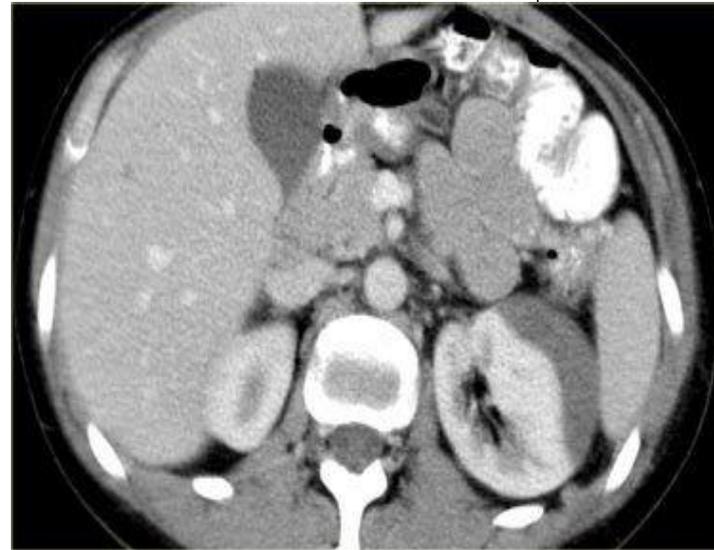
1. It has the capacity to aid in both the diagnosis and treatment of renal injuries
2. It may further define injury in patients with moderate IVP abnormalities or with vascular injuries.

## ● Disadvantages:

1. It is **invasive** *renal or injection of*
2. It **requires contrast** *high dose*
3. It requires mobilization of resources to perform the study, which may be time-consuming
4. The patient must travel to the radiology department.



**Abdominal CT scan demonstrating multiple kidney lesions of varying radiographic densities**



**On the left a typical subcapsular hematoma, which is also a grade I renal injury.**



# Management of renal trauma

- Stable patients, following grade 1-4 blunt renal trauma, should be managed <sup>30%</sup> conservatively with bed-rest, prophylactic antibiotics, and continuous **monitoring** of vital signs **until haematuria resolves**
- **Indications for surgical** <sup>(exploration)</sup> management include:
  1. **Haemodynamic instability**
  2. **Exploration for associated injuries**
  3. **Expanding pulsatile retroperitoneal haematoma during laparotomy**
  4. **grade IV** ( in haemodynamically unstable patient ) and, especially, **grade V** injuries often require nephrectomy to control bleeding (grade V injuries function poorly if repaired).

Patients with <sup>5-</sup> **penetrating trauma** to the kidney require renal exploration **unless** radiographic imaging clearly delineates injury that can be managed safely nonoperatively in a hemodynamically stable patient.

# Post-operative management and follow up



- Repeated imaging is recommended for all hospitalized patients within 2 to 4 days following renal trauma
- Within 3 months of major renal injury, patients' follow-up should involve:
  1. Physical examination
  2. Urinalysis
  3. Individualized radiological investigation
  4. Serial blood pressure measurement
  5. Serum determination of renal function
- Long-term follow-up should be decided on a case-by-case basis



# Complications

- **Early complications:**

-occur within the first month after injury

-include:

- 1-bleeding
- 2- infection
- 3-perinephric abscess
- 4-sepsis
- 5-urinary fistula
- 6-hypertension
- 7-urinary extravasation
- 8-urinoma.

- **Delayed complications:**



-include:

- 1- bleeding
- 2- hydronephrosis
- 3-calculus formation
- 4-chronic pyelonephritis
- 5-hypertension
- 6-arteriovenous fistula
- 7- pseudoaneurysms.



# Ureteral Anatomy

- The ureters are retroperitoneal tubes measuring each about 25 cm long and about 3 mm in diameter.

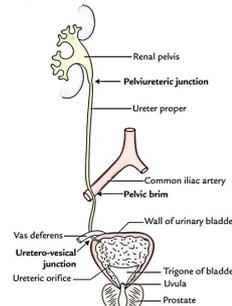
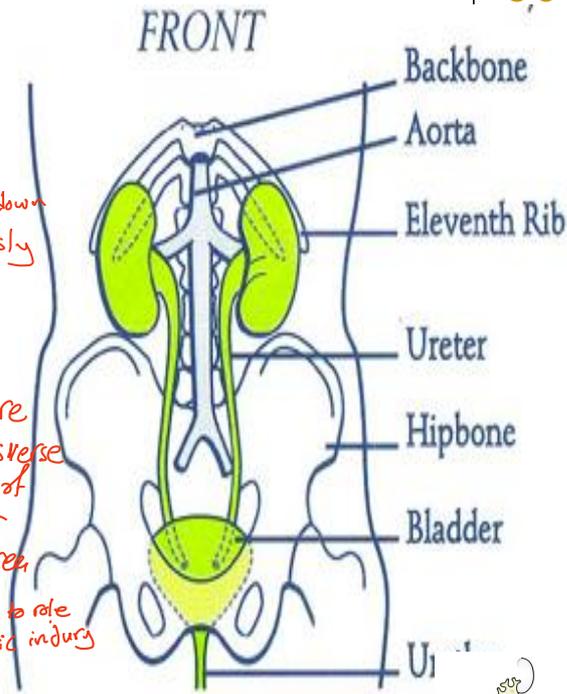
*3-5mm stones can go down spontaneously*

- They descend with an inclination medially on the posterior abdominal wall opposite the tips of the lumbar transverse processes. They continue following the contour of the pelvis.

*Stone in KUB  
along tip of transverse process of lumbar vertebrae*

- They pass obliquely in the wall of the bladder of 1 inch before they open at the sides of the trigone.

*fracture of transverse process of lumbar vertebrae  
\* you have to rule out uretric injury*



## # 3 narrow areas of ureter:

the ureteropelvic junction (UPJ), the ureterovesical junction (UVJ), and the crossover of the common iliac arteries.



# Ureteral Trauma

- Trauma to the ureter is relatively rare and accounts for only 1% of all urinary tract trauma.
- The ureters may be injured as a result of external violence (penetrating or blunt trauma) or by iatrogenic injury during an operation.

*MCC - iatrogenic (ureteroscope, abdominal surgery/gyne surgery)*

## Mode of Injury:

- **Simple:** Perforation (iatrogenic)
- **Complex:** Transection (extensive surgeries, RTA)

# Diagnosis *→ easy to miss*



- No classic clinical symptoms and signs associated with acute ureteral trauma caused by external injury. **(EASY TO MISS)**
- Ureteral trauma should be **suspected in:**
  1. **Penetrating abdominal injury** and blunt deceleration trauma, in which the kidney and renal pelvis can be torn away from the ureter.
  2. Isolated ureteral injuries if missed: subsequent evidence of upper tract obstruction, urinary fistula formation and sepsis.
  3. **Gynecological pelvic surgery:** complaints of flank pain, vaginal leakage of urine or become septic.

# Laboratory Studies



- Laboratory evaluation should include **urinalysis**,<sup>↑ hematuria determin</sup> urine culture, **complete blood count**, and creatinine,<sup>↓ KFT</sup> determination from the serum and drainage .
- Interestingly, hematuria is not a reliable finding in ureteral injuries, as only 74% of cases involve gross or microscopic hematuria. A failure to observe hematuria may be seen with a completely transected ureter or partial transection of an adynamic segment.



# Imaging Studies

- **CT:** <sup>with contrast</sup> It is the **critierion standard for evaluating abdominal injuries** due to blunt trauma in stable patients. Contrast-enhanced CT scanning is highly sensitive in detecting urine extravasation and thus can be considered the primary imaging modality to evaluate for ureteral integrity in the stable patient.
- **IVP:** used in patients who must undergo immediate exploratory laparotomy for a penetrating injury to the abdomen



# Classification of ureteral lesions



Grade	Description of Injury
I	Contusion or hematoma
II	<i>tear</i> < 50% transection
III	> 50% transection
IV	Complete transection with < 2 cm devascularization
V	Avulsion with > 2 cm devascularization

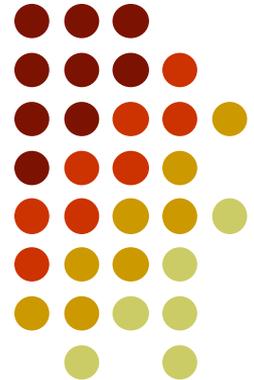
# management

## Contusion

Although a contusion may be considered a minor injury, it can result in a stricture if left untreated. Extensive areas of contusion may even result in ureteral necrosis secondary to microvascular damage. Minor injuries can be treated with internal ureteral stenting, while severe or large areas of contusion should be excised and ureteroureterostomy performed.

## Partial transection

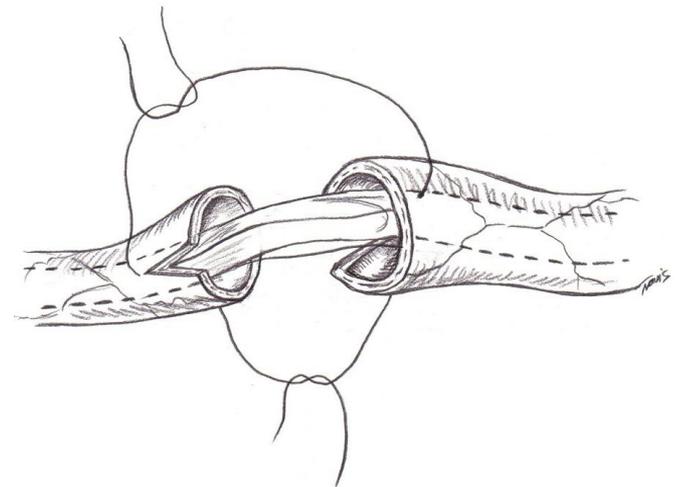
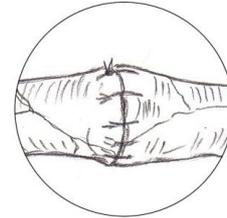
Partial ureteral transections can be repaired with primary closure. Instead, the injured segment should be resected, with 2-cm margins, and the edges reapproximated. For non-ballistic injuries, the defect may be closed primarily by closing the longitudinal laceration transversely in order to avoid narrowing of the lumen).



- **Complete transections**; upper, middle and distal ureteral injuries



1. **Ureteroureterostomy:** involves an end-to-end repair of ureteral defects smaller than 3 cm. This is mostly performed in the upper and mid ureter.





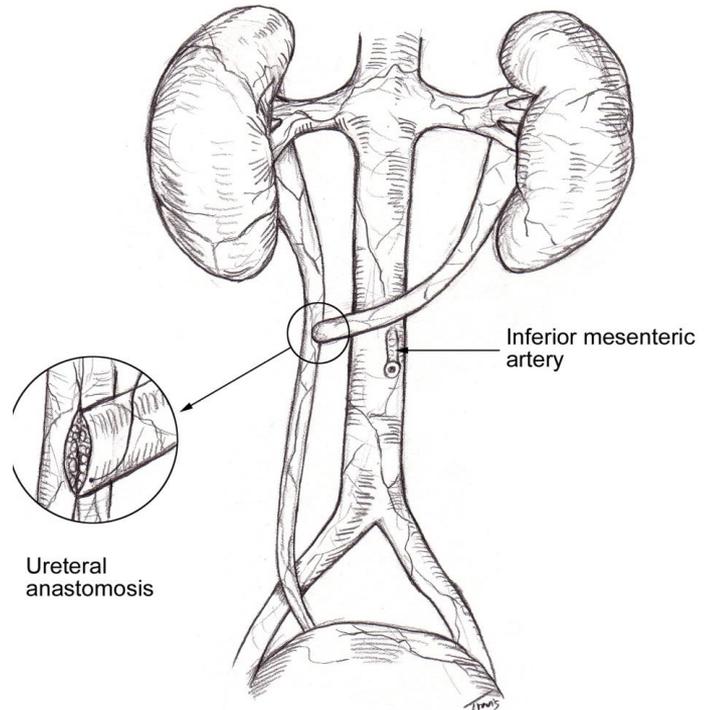
2. **Ureteropyelostomy:** the ureter may be anastomosed directly into the renal pelvis, this is done in case of proximal ureteral injury. (upper)
3. **Ureterocalicostomy:** If the renal pelvis or ureteropelvic junction is damaged beyond repair the ureteral stump may be sewn end-to-side into an exposed renal calyx. (upper)

4.

## Transureteroureterostomy

*(significant segmental loss)*

y: this can be performed to manage an extensive defect that involves the mid or upper ureter if the length for anastomosis to the bladder is insufficient. This involves bringing the injured ureter across the midline to the recipient ureter in an end-to-side anastomosis

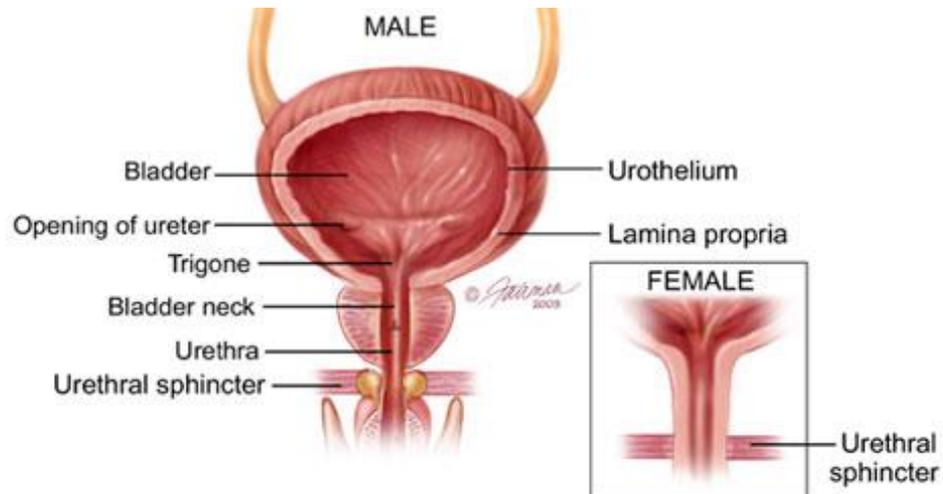




5. **Ureteroneocystostomy**: Injuries to the lower ureter are usually associated with disruption of its blood supply from the iliac vessels. Therefore, these injuries are best repaired with ureteroneocystostomy. The principles of repair include debridement and spatulation of the ureter, tunneling in the bladder wall toward the bladder neck in a 3:1 ratio of tunnel length to diameter of ureter. *(lower)* <sup>uretric reimplantation</sup>
6. **Vesicopsoas hitch**: This procedure involves mobilizing the bladder and pulling it superiorly and laterally by fixing it to the psoas tendon. *(lower)*
7. **Boari bladder flap**: For injuries too long to be bridged with the psoas hitch procedure alone, a Boari flap can be created to provide an additional 12-15 cm of length *(lower)*

# Bladder Anatomy

- The adult bladder is located in the anterior pelvis and is enveloped by extraperitoneal fat and connective tissue. It is separated from the pubic symphysis by an anterior prevesical space known as the space of Retzius. The dome of the bladder is covered by peritoneum, and the bladder neck is fixed to neighboring structures by reflections of the pelvic fascia and by true ligaments of the pelvis.



# Relevant Anatomy



The type of extravasation depends upon the location of the laceration and its relationship with the peritoneal reflection.

- If the perforation is above the peritoneal reflection, the extravasation is intraperitoneal.
- If the injury is below the peritoneal reflection, the extravasation is extraperitoneal.

With an anterosuperior perforation, urinary extravasation may be intraperitoneal, extraperitoneal or both. If the tear is posterosuperior, fluid can spread intraperitoneally and/or retroperitoneally.



# Bladder Trauma *(rare)*

- Lower urinary tract injury may be caused by either blunt, penetrating, or iatrogenic trauma.
- 70-97% of patients with bladder injuries from blunt trauma have associated pelvic fractures.
- An exceedingly light blow may rupture the fully distended bladder, but the empty bladder is seldom injured except by crushing or penetrating wounds. *rarely injured*



# Classification

Type	Description
1	<u>Bladder contusion</u>
2 <i>exmp</i>	<u>Intraperitoneal rupture</u> (dome is most weak part of the bladder) <i>low grade fever, irritation of diaphragm</i>
3	Interstitial bladder injury
4	<u>Extraperitoneal rupture</u> <i>→ oru in pelvis</i>
a.	Simple
b.	Complex
5	Combined injury

# Diagnosis



- The two most common sign and symptoms are **gross haematuria** and **abdominal tenderness** in patients with major bladder injuries.
- Other findings may include the **inability to void**, bruises over the suprapubic region and **abdominal distension**.
- Extravasation of urine may result in **swelling in** the perineum, **scrotum and thighs**, as well as along the anterior abdominal wall within the potential space between the transversalis fascia and the parietal peritoneum. (if left undiagnosed → abscess may occur)
- Intraperitoneal extravasation may lead to **referred shoulder pain** and respiratory distress.

# Laboratory studies and Imaging studies



- Macro / Microscopic haematuria (95%)
- Cystography: standard diagnostic procedure; most accurate. (contrast)
- CT: method of choice for evaluation of blunt or penetrating abdominal / pelvic injury. *with contrast*
- IVP: high false negative results
- U/S: not routinely used for evaluation of bladder injury

پیشنہ شدہ  
تجزیہ



# Management

- The first priority in the treatment of bladder injuries is **stabilization of the patient and treatment of associated life-threatening injuries.**
- Blunt trauma:
  - → **Extraperitoneal rupture:** catheter drainage. *foly's → 2-3w*
  - → **Intraperitoneal rupture:** surgical exploration.
- Penetrating injuries: All bladder perforations due to a penetrating trauma should undergo **emergency exploration and repair**
- The **perivesical hematoma** should be **left undisturbed** to avoid introducing bacteria.



# Urethral Anatomy

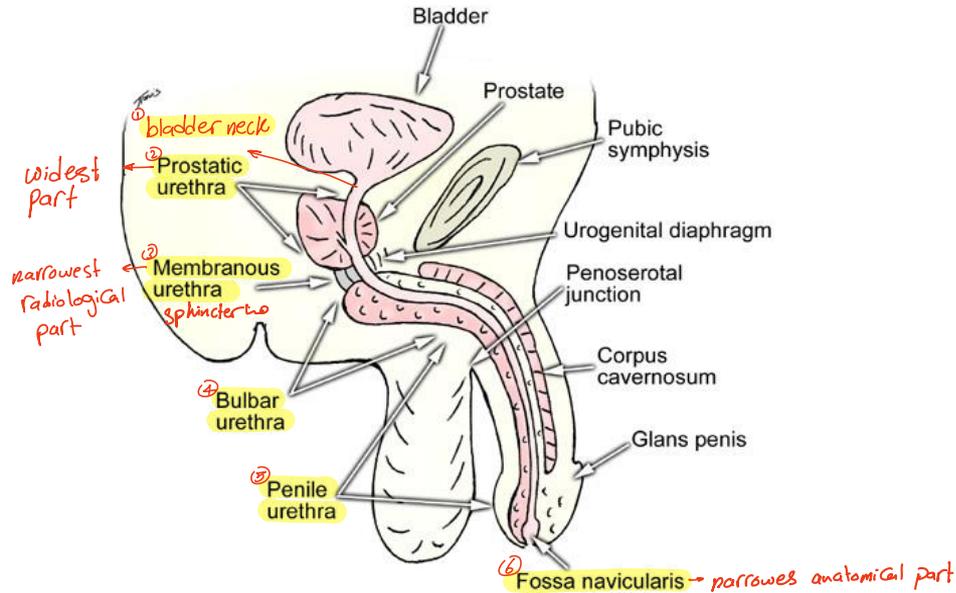
- **Male urethra:**

Canal for the discharge of urine and seminal fluid. It is 18-20 cm in length.

The male urethra may be divided into 2 portions. The **posterior urethra** includes the prostatic urethra and the membranous urethra, **The anterior urethra** includes 3 segments. The bulbar urethra courses through the proximal corpus spongiosum and ischial cavernosus-bulbospongiosus muscles to reach the penile urethra. The penile urethra then extends through the pendulous portion of the penis to the final segment, the fossa navicularis. The fossa navicularis is invested by the spongy tissue of the glans penis.

*injured in pelvic fracture*

*straddle type injury; fall or kicks*



## • Female urethra:



Canal for discharge of urine that is 4 cm in length. It corresponds to the prostatic and membranous urethra in the male ( posterior urethra). The anterior urethra corresponds to the labia minora



# Relevant Anatomy

- *Usually* The membranous urethra is <sup>posterior "</sup> prone to injury from pelvic fracture
- The bulbar urethra is susceptible to blunt force injuries because of its path along the perineum
- Straddle-type injuries from falls or kicks to the perineal area can result in bulbar trauma. Conversely, the penile urethra <sup>rare</sup> is less likely to be injured from external violence because of its mobility, but iatrogenic injury from catheterization or manipulation can occur, which is also possible in the fossa navicularis .

✦ MCC of injury of urethra → iatrogenic (traumatic foly's cath., Cystoscopy...)

# Diagnosis

→ any pelvic fracture Pt, penile or perineal trauma  
Evaluate urethra



- A diagnosis of acute urethral trauma **should be suspected from the history**. A **pelvic fracture**, or any **external penile** or **perineal trauma**, can be suggestive of urethral trauma.
- In conscious patient, a thorough voiding history should be obtained to **establish the time of last urination, force of urinary stream, painful urination** and **presence of haematuria**.
- On **digital rectal examination**, the so-called **high-riding prostate** may be identified, or the **prostate may appear to be absent** (*a large pelvic hematoma causes superior displacement of the prostate when the urethra is disrupted*)



- The following **clinical indicators** of acute urethral trauma warrant a complete urethral evaluation:

1. **Blood at the meatus** / Blood at the vaginal introitus
2. **Haematuria**: although non-specific, haematuria on a first voided specimen may indicate urethral injury.
3. **Pain on urination** or **inability to void** (<sup>complete</sup> disruption)
4. **Haematoma or swelling**

**Retrograde urethrography** is the radiographic imaging study of choice for evaluation the patient with suspected urethral injury.

- **This study should precede any attempts to pass a urethral catheter.**

≠ any suspected urethral injury → don't try to enter Foley's cath (partial injury <sup>convert</sup> to traumatic injury)

# Management

→ with or without urine retention, management is  
Urin diversion (suprapubic cath.)



## ● Anterior urethral injury

- Blunt trauma
  - Partial tears: suprapubic cystostomy to divert urine away from site of injury, and this is maintained for 4 weeks to allow healing.
  - Complete tear: end to end anastomosis
- Open injury: surgical exploration and repair

## ● Posterior urethral injury

- Partial tear : cystostomy
- Complete tear: urethroplasty later on

# Urinary Tract Infection

Dr. Fadi Sawaqed

Presented by:  
Monther Al-Qatawneh  
Amin Al-Qatawneh

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# Introduction

- **Urinary tract infection (UTI)** is a term that is applied to a variety of clinical conditions ranging from localized infection of the bladder with lower urinary tract symptoms to pyelonephritis with severe infection of the kidney and the potential for resultant urosepsis.
- **Accurate diagnosis and treatment of a UTI is essential** to limit its associated morbidity and mortality and avoid prolonged or unnecessary use of antibiotics.
- Unfortunately, because of the **increasing rates of bacterial resistance** to various antibiotics, **medical therapies are becoming less efficacious**

# Epidemiology

- In the neonatal period males are twice as likely as females to experience a UTI.
- From ages 1 to 6 months the rate of UTI is equal between genders, but from 6 to 12 months of age <sup>child to elderly</sup> the rate of UTI in male and female children is 1 to 4.   
*Short urethra + contamination of perineum*
- Overall, UTIs are more common in females
- The incidence of UTI in uncircumcised males is 85% higher than circumcised males

● *over all UTI more common in females*

Epidemiology of UTI by age, group, and sex

Incidence (%)			
Age (y)	Female	Male	Main risk factors
<1	0.7	2.7	Foreskin, anatomic GU abnormalities
1–5	4.5	0.5	Anatomic GU abnormalities, functional GU abnormalities
6–15	4.5	0.5	Functional GU abnormalities
16–35	20	0.5	Sexual intercourse, diaphragm use
36–65	35	20	Surgery, prostate obstruction, catheterization
>65	40	35	Incontinence, catheterization, prostate obstruction

GU = genitourinary; UTI = urinary tract infection.

# Epidemiology

## Risk factors for UTI include:

- Circumcision status.
- History of prior UTI.
- Sexual activity among older populations.
- Anatomical abnormalities like vesicoureteral reflux, ureterocele, ureteropelvic junction obstruction & posterior urethral valves.
- Functional abnormalities : neurogenic bladder, and bladder and bowel dysfunction
- Certain medical conditions like diabetes. obesity. sickle cell trait.

# Pathogenesis

## Understanding of:

- The mode of bacterial entry,
- Host susceptibility factors,
- Bacterial pathogenic factors

Are essential to tailoring appropriate treatment for the diverse clinical manifestations of UTI.

01

# Bacterial Entry

the site through which micro-organisms  
enter the susceptible host

# Bacterial Entry

*MC made of enteri  
& MC seen in females* → It is generally accepted that periurethral bacteria with a uropathogen from the gut **ascending** into the urinary tract causes most UTI.

- The **colonization of the urethra** and **migration to the bladder** leads to invasion of the bladder mediated by pili and adhesions factors.
- Most cases of pyelonephritis are caused by the ascent of bacteria from the bladder, through the ureter, and into the renal parenchyma.
- Consequently, the short nature of the female urethra combined with its close proximity to the vaginal vestibule and rectum likely predisposes women to more frequent UTIs than men

# Bacterial Entry

- Other modes of bacterial entry are uncommon causes of UTI.
  - I- Hematogenous** spread can occur in immunocompromised patients and in neonates. Staphylococcus aureus, Candida species, and Mycobacterium tuberculosis are common pathogens that travel through the blood to infect the urinary tract.
  - II- Lymphatogenous** spread through the rectal, colonic, and periuterine lymphatics has been postulated as a cause for UTI;
  - III- Direct extension** of bacteria from adjacent organs into the urinary tract can occur in patients with intrapertoneal abscesses or vesicointestinal or vesicovaginal fistulas.

## 02

# Host Defense

The protection an organism is afforded against infections Types.

*\* most imp. & 1<sup>st</sup> defence mechanism ⇒ voiding (wash out)*

# Host Defense

- Unobstructed urinary flow with the subsequent <sup>1<sup>st</sup> defence mechanism</sup> **washout of ascending** bacteria is essential in preventing UTI.
- In females, **normal vaginal and periurethral flora** contain microorganisms like lactobaeillus that help prevent uropathogenic colonization
- **The urine itself has specific characteristics** (its osmolality, urea concentration, organic acid concentration, and pH) that inhibit bacterial growth and colonization.
- It also contains factors that inhibit bacterial adherence, such as **Tamm-Horsfall glycoprotein (THG)**
- **The epithelium lining the urinary tract** not only provides a <sup>mechanical</sup> physical barrier to infection but also <sup>+</sup> has the capacity to recognize bacteria in order to activate innate host defenses.
- **Specific serum and urinary antibodies** are produced by the kidney to enhance bacterial opsonization and phagocytosis and inhibit bacterial adherence

03

# Bacterial Pathogenic Factors

# Bacterial Pathogenic Factors

- The ability of *E. coli* to adhere to epithelial cells is mediated by ligands located on the tips of the bacterial fimbriae (pili). *important in migration of bacteria & imp for adhesion of bacteria with epithelium*
- Most uropathogenic *E. coli* strains produce hemolysin, which initiates tissue invasion and makes iron available for the infecting pathogens
- The presence of K antigen on the invading bacteria protects them from phagocytosis by neutrophils
- Encapsulation and biofilm formation → *hidden bacteria from host defence mechanism*

# Causative Pathogen

MC micro-organism → gram -ve bacilli → of them

- Most UTIs are caused by a single bacterial species. At least 80% of the uncomplicated cystitis and pyelonephritis in premenopausal women are due to *E. coli*.
- Other less common uropathogens include *Staphylococcus saprophyticus*, *Klebsiella*, *Proteus*, and *Enterobacter* spp. and enterococci.
- In hospital-acquired UTIs, a wider variety of causative organisms is found, including *Pseudomonas* and *Staphylococcus* spp.
- In children, the causative bacterial spectrum is slightly different but there is still a predominance of *E. coli* among inpatient and outpatient populations. *Enterobacter*, *Enterococcus*, and *Klebsiella* species make up the remainder of common culprits of pediatric UTI.
- Anaerobic bacteria, lactobacilli, corynebacteria, streptococci (not including enterococci), and *Staphylococcus epidermidis* are found in normal periurethral flora. They do not commonly cause UTIs in healthy individuals and are considered common urinary contaminants. → Urin Culture & sensitivity

# Diagnosis

→ imp. to determine simple uncomplicated UTI → infection in healthy pt with N. urinary tract anatomy & function  
complicated → any anatomical or functional abnormalities ass with UTI

2 things:

- Standard diagnosis of UTI is completed by <sup>①</sup>urinalysis and <sup>②</sup>urine culture of 100 CFU/mL (Where CFU = colony-forming units) of bacteria.
- Occasionally, localization studies may be required to identify the source of the infection. Most often, the urine is obtained from a voided specimen.
- An uncomplicated UTI consists of an infection in an otherwise healthy patient with normal urinary tract anatomy.
- On the other hand, a complicated UTI can occur when anatomic abnormalities, immunocompromised state, or multi-drug-resistant bacteria allow for increased bacterial colonization or decreased therapeutic efficacy.

# Urine Analysis

→ looks for acidity, color

- The urine can be immediately evaluated for **leukocyte esterase**<sup>Ⓣ</sup>, a compound produced by the breakdown of white blood cells (WBCs) in the urine and is 95% sensitive for UTI in children with symptoms. *neutrophils*
- Positive leukocyte esterase indicates the presence of 5—15 WBC per high-power field (hpf).
- **Urinary nitrite** is produced by reduction of dietary nitrates by many Gram-negative bacteria.
- Esterase and nitrite can be detected by a urine dipstick and are more reliable when the bacterial count is >100,000 colony-forming units (CF Us) per milliliter.
- **Combined positive nitrite and leukocyte esterase on urine dipstick analysis is 80—90% sensitive and 60—98% specific for UTI**

# Urine Analysis

- Microscopic examination of the urine for WBCs and bacteria is performed after centrifugation.
- For children, urine concentration should be taken into consideration when diagnosing infants with UTI.
- A pyuria threshold of 3 WBC/hpf in dilute urine and 6 WBC/hpf in concentrated urine is noted for a diagnosis of UTI

Presence of WBC's in Urin

Pyuria is one of main findings in Urin analysis → DDX: bacterial infection  
 mycobacterium (TB infection)  
 inflammation (interstitial cystitis, chronic prostatitis)  
 without bacterial infection  
 asr. with malignancy  
 with carcinoma in situ

# Urine Culture

- The gold standard for <sup>diagnosis</sup> identification of UTI is the quantitative culture of urine for specific bacteria.
- Defining the CPU/ml. that represents clinically significant infection can be difficult. It is dependent on the method of collection, the sex of the patient, and the type of bacteria isolated.
- Traditionally, cultures demonstrating 100,000 CPU/ml. are considered diagnostic of a UTI, but now AAP guidelines suggest pyuria and 50,000 CPU/ml. of a single organism are diagnostic of UTI

# Localization Studies

- Occasionally, it is necessary to localize the site of infection.

*Urin sample directly from one kidney or from one ureter → through cystoscopy*

- For upper urinary tract localization, the bladder is irrigated with sterile water and a ureteral catheter is placed into each ureter. → *reach renal pelvis*

- A specimen is collected from the renal pelvis. Culture of this specimen will indicate whether infection in the upper urinary tract is present.

- In men, infection in the lower urinary tract can be differentiated (Figure).

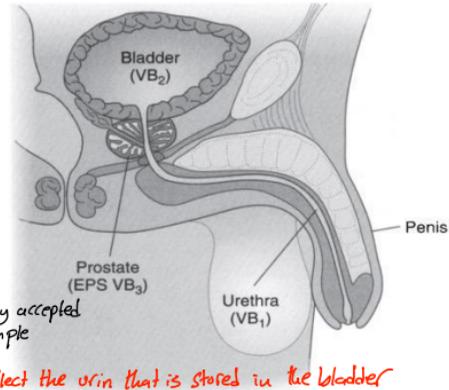
- A specimen is collected at the beginning of the void and represents possible infection in the urethra (VB1). Next, a midstream specimen (VB2) is collected and represents possible infection in the bladder. The prostate is then massaged and the patient is asked to void again (VB3), this specimen represents possible infection of the prostate.

*the 1<sup>st</sup> voiding part (1<sup>st</sup> voided sample)*

*reflect urethral colonization*

*widely accepted sample*

*reflect the urin that is stored in the bladder*



# Antibiotics

- The goal in treatment is to eradicate the infection by selecting the appropriate antibiotics that would target specific bacterial susceptibility.
- The general principles for selecting the appropriate antibiotics include:
  - Consideration of the infecting pathogen (antibiotic susceptibility, single-organism vs polyorganism infection, pathogen vs normal flora, community vs hospital-acquired infection);
  - The patient (allergies, underlying diseases, <sup>RF</sup>age, previous antibiotic therapy, other medications currently taken, outpatient vs inpatient status, pregnancy);
  - The site of infection (kidney vs bladder vs prostate)
    - Pyelonephritis
    - Prostatitis

pharmacokinetic characteristics  
 mechanism of action  
 side effects

# Antibiotics

- Recommended antimicrobial agents and duration of therapy based upon the type of UTI for adults.

CI for:  
 G6PD Pf  
 sulfa allergy

1) **Trimethoprim—Sulfamethoxazole**

young < 16y (still growing cartilages)

2) **Fluoroquinolones** → ciprofloxacin, levofloxacin

tissue infection:  
 Prostatitis, pyelonephritis  
 (becz completely excreted in urine)

3) **Nitrofurantoin** → has peripheral neuropathy SE

renal impairment

4) **Aminoglycosides** → nephrotoxicity & ototoxicity → if you give it for long time you have to follow hearing function (audiometry)

penicillin allergy  
 (has cross allergic reaction with penicillin)

5) **Cephalosporins** → 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> generations ; bec 1<sup>st</sup> generation mainly covering gram +ve cocci

Diagnosis	Choice of antibiotics	Duration of therapy
Cystitis	1st: TMP-SMX 2nd: Fluoroquinolone	1–3 days
Pyelonephritis	1st: Fluoroquinolone 2nd: 2nd-generation cephalosporin 3rd: Aminopenicillin/BLI	7–10 days
Complicated UTI <sup>a</sup>	1st: Fluoroquinolone 2nd: Aminopenicillin/BLI 3rd: 3rd-generation cephalosporin Aminoglycosides	Afebrile: 2 weeks Febrile: continue for additional 3–5 days after last fever (minimum 2 weeks)
Prostatitis	1st: Fluoroquinolone 2nd: 2nd-generation cephalosporin 3rd: 3rd-generation cephalosporin	Acute: 2 weeks Chronic: 4–6 weeks
Epididymitis	1st: Fluoroquinolone 2nd: 2nd-generation cephalosporin or 1st: Doxycycline 2nd: Macrolide	14 days
Urethritis <sup>b</sup>	1st: IM ceftriaxone + azithromycin 2nd: Doxycycline	Single dose 7 days

<sup>a</sup>Complicated UTI: infection in the setting of metabolic, immunocompromised, functional, or anatomic abnormality

<sup>b</sup>If suspicion of sexual transmitted disease as source.

\* See notes below !!

# Specific Infections

- Acute Pyelonephritis
- Emphysematous Pyelonephritis
- Renal Abscesses
- Xanthogranulomatous Pyelonephritis
- Acute Cystitis
- Acute Bacterial Prostatitis

# Acute Pyelonephritis

- Inflammation of the kidney and renal pelvis, and its diagnosis is usually made clinically.
- Present with chills, fever, and costovertebral angle tenderness.
- Accompanying lower tract symptoms such as dysuria, frequency, and urgency.
- Sepsis may occur, with 20—30% of all systemic sepsis resulting from a urine infection.
- Urinalysis commonly demonstrates the presence of WBCs and red blood cells in the urine.
- Leukocytosis, increased erythrocyte sedimentation, and elevated levels of C-reactive protein are commonly seen on blood analysis.
- Bacteria are cultured from the urine, when the culture is obtained before antibiotic treatment is instituted. E.coli is the most common causative organism, accounting for 70-80% of the cases.

one of main complication of acute pyelonephritis ←

Pyelonephritis carries high risk for septicemia & septic shock →

# Acute Pyelonephritis

## Management:

- The management of acute pyelonephritis depends on the severity of the infection. In patients who have toxicity due to associated septicemia, hospitalization is warranted. Approximately 10-30% of all adult patients with acute pyelonephritis require hospitalization.
- Empiric therapy with intravenous ampicillin and aminoglycosides. Alternatively, amoxicillin with clavulanic acid or a third-generation cephalosporin can be used.
   
→ tell getting initial result of culture (sensitivity)
- For adults, fluoroquinolones or TMP-SMX is well tolerated and effective.
- Outpatient treatment with an initial parental antibiotic (ceftriaxone or gentamicin) followed by oral therapy for 7-14 days → most of acute pyelonephritis
   
last 10 days of PT not empirically selected
- If bacteremia is present, parenteral therapy should be administered for 7—10 days and then the patient should be switched to oral treatment for an additional 10-14 days.
- Pregnant patient with concerns for pyelonephritis requires admission with parental antibiotics secondary to the risk of preterm labor.
   
+ parenteral tx

+  
 immunocompromised  
 +  
 borderline kidney function

# Emphysematous Pyelonephritis

- Emphysematous pyelonephritis is a necrotizing infection characterized by the presence of gas within the renal parenchyma or perinephric tissue.
- About 95% of patients with emphysematous pyelonephritis have diabetes;
- women experience this condition 6 times more commonly than men.
- Other contributing factors include renal failure, immunosuppression, obstructed upper tracts, and polycystic kidneys.
- Fever, flank pain, and vomiting that fails initial management with parenteral antibiotics
- Pneumaturia may be present.
- Bacteria most frequently cultured from the urine include E. coli (66%); Klebsiella pneumonia (26%); and Proteus, Pseudomonas, and Streptococcus spp.

# Emphysematous Pyelonephritis

- The diagnosis of emphysematous pyelonephritis is made after radiographic examination.
- Gas overlying the affected kidney may be seen on a plain abdominal radiograph (kidneys, ureters, bladder [KUB]).
- CT scan is much more sensitive in detecting the presence of gas in the renal parenchyma than renal ultrasonography.
- In the management of emphysematous pyelonephritis, prompt control of blood glucose and relief of urinary obstruction are essential, in addition to fluid resuscitation and parenteral antibiotics

# Renal Abscesses

- Renal abscesses result from a severe infection that leads to liquefaction of renal tissue; this area is subsequently sequestered, forming an abscess. They can rupture out into the perinephric space, forming perinephric abscesses. When the abscesses extend beyond the Gerota's fascia, paranephric abscesses develop.

*Sever not treated infection*

- + Hematogenous spread of staphylococci, particularly from infected skin lesions. Patients with diabetes, those undergoing hemodialysis, or intravenous drug abusers have been at high risk for developing renal abscesses.

- Fever, flank or abdominal pain, chills, and dysuria. Many of the symptoms have lasted for more than 2 weeks

*\* U/S → anechoic mass within or displacing the kidney. posterior acoustic enhancement, or lack of vascularity on doppler imaging*

*\* CT → Can demonstrate an enlarged kidney with focal areas of hypodensity early during the infection*

*\* if pt doesn't respond within 48h of treatment, percutaneous drainage under CT scan or U/S guidance is indicated, particularly for abscesses >3cm*

# Xanthogranulomatous Pyelonephritis

- Chronic bacterial infection of the kidney, unilaterally. The affected kidney is almost always hydronephrotic and obstructed
- Severe inflammation and necrosis obliterate the kidney parenchyma - Characteristically foamy lipid-laden histiocytes
- (xanthoma cells) are present and may be mistaken for renal clear cell carcinoma
- Flank pain, fever, chills, and persistent bacteriuria. A history of urolithiasis is present in about 35% of patients
- Flank mass can often be palpated. Urinalysis commonly demonstrates leukocytes, bacteria, and proteinuria. Serum blood reveals anemia and may show hepatic dysfunction in approximately 50% of the patients

# Xanthogranulomatous Pyelonephritis

- E. coli or Proteus species are commonly cultured from the urine.
- Computed tomography scan is the most reliable method in imaging patients suspected of having XGP. It usually demonstrates a large, heterogeneous, nonenhancing reniform mass.
- On contrast-enhanced images, these lesions will have a prominent blush peripherally, while the central areas, which are filled with pus and debris, do not enhance.
- In some cases, XGP is misdiagnosed as a renal tumor and a nephrectomy is performed and a diagnosis is made pathologically.
- In those in whom a diagnosis of XGP is suspected, kidney-sparing surgery such as a partial nephrectomy is indicated in focal disease. However, when the infection is diffuse, a nephrectomy with excision of all involved tissue is warranted.

total

# Acute Cystitis

Complicated  
Uncomplicated

- Urinary infection of the lower urinary tract, principally the bladder.
- Acute cystitis more commonly affects women than men.
- The primary mode of infection is <sup>merely</sup> ascending from the periurethral/vaginal and fecal flora.
- The diagnosis is made clinical.
- Present with irritative voiding symptoms such as dysuria, frequency, and urgency. (lower urinary tract symp.)
- Low back and suprapubic pain, hematuria, and cloudy/foul-smelling urine are also common symptoms. Fever and systemic symptoms are rare.

\* Urin analysis → presence of WBCs diagnostic. Urin culture is required

\* E coli → MC

\* ttt for short time: TMP, nitrofurantoin, fluoroquinolones have excellent activity

\* Recurrent cystitis/UTI caused by either persistence or reinfection with another organism

# Acute Bacterial Prostatitis

- Inflammation of the prostate associated with a UTI- It is believed that infection results from ascending urethral infection or reflux of infected urine from the bladder into the prostatic ducts.
- Uncommon in prepubertal boys but frequently affects adult men/
- It is the most common urologic diagnosis in men younger than 50 years and third most common in men older than 50 years
- Present with an abrupt onset of constitutional (fever, chills, malaise, arthralgia, myalgia, lower back/rectal/perineal pain) and urinary symptoms (frequency, urgency, dysuria). They may also present with urinary retention due to swelling of the prostate.
- Digital rectal examination reveals a tender, enlarged gland that is irregular and warm.

# Acute Bacterial Prostatitis

- Urinalysis usually demonstrates WBCs and occasionally hematuria.
- Serum blood analysis typically demonstrates leukocytosis.
- Prostate-specific antigen levels are often elevated. *sometimes initiate ttt IV empirically & continue with TMP*
- Empiric therapy directed against Gram-negative bacteria and enterococci should be instituted immediately while awaiting the culture results- Trimethoprim and fluoroquinolones have high drug penetration into prostatic tissue and are recommended for 4-6 weeks. *→ oral ttt*
- Patients who have sepsis, are immunocompromised or in acute urinary retention, or have significant medical comorbidities would benefit from hospitalization and treatment with parenteral antibiotics. *→ admission*
- Patients with urinary retention secondary to acute prostatitis should be managed with a suprapubic catheter because transurethral catheterization or instrumentation is contraindicated.

Urolithiasis

# Epidemiology

The lifetime prevalence of Urolithiasis is approximately 12% for men and 7% for women in the United States, and it is rising.

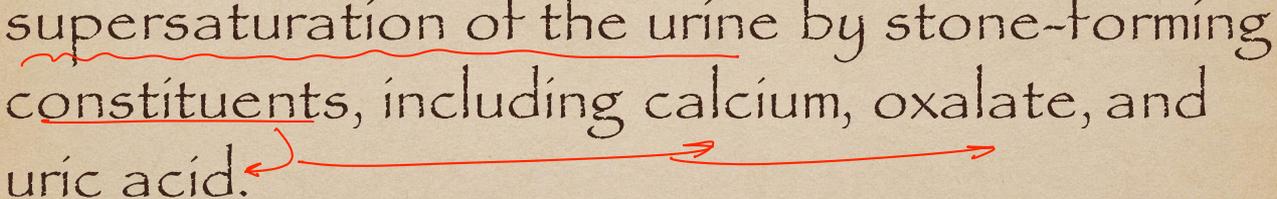
Peak incidence occurs in people aged 35-45 years.

male-to-female ratio of 3:1.

Calcium stones represent about 80%.

# Pathophysiology

supersaturation of the urine by stone-forming constituents, including calcium, oxalate, and uric acid.



# Etiology

- Environmental: A low fluid intake, with a subsequent low volume of urine production, produces high concentrations of stone-forming solutes in the urine.
- Metabolic: Hypercalciuria is the most common metabolic abnormality.

• The four main chemical types of kidney stones are:

- Calcium stones
- Uric acid stones
- Struvite stones
- Cystine stones

# Calcium stones

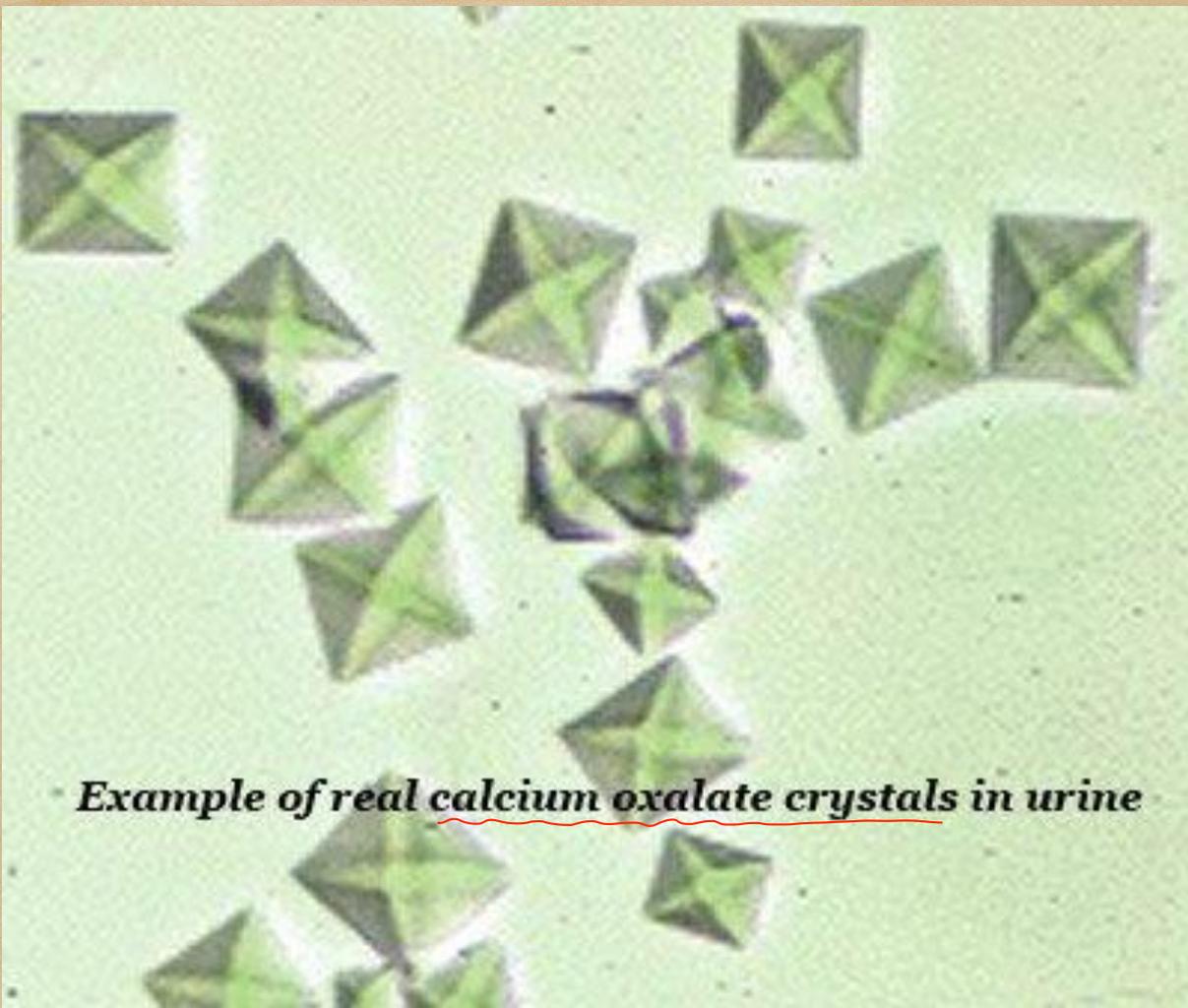
Calcium oxalate, calcium phosphate, and calcium urate are associated with the following disorders:

Hyperparathyroidism

Increased gut absorption of calcium

Renal calcium leak

Hyperoxaluria (fat malabsorption)



*Example of real calcium oxalate crystals in urine*

# Struvite stones

Struvite stones account for 15% of renal calculi. They are associated with chronic urinary tract infection (UTI) with gram-negative, urease-positive organisms that split urea into ammonia, which then combines with phosphate and magnesium to crystallize into a calculus. Usual organisms include Proteus, Pseudomonas, and Klebsiella species.

Escherichia coli is not capable of splitting urea and, therefore, is not associated with struvite stones.



**50 microns**

# Uric acid stones

Uric acid stones account for 6% of renal calculi. These are associated with urine pH less than 5.5, high purine intake (eg, organ meats, legumes, fish, meat extracts, gravies), or malignancy (ie, rapid cell turnover).

Approximately 25% of patients with uric acid stone have gout. النقرس



# Cystine stones

Cystine stones account for 2% of renal calculi. They arise because of an intrinsic metabolic defect resulting in failure of renal tubular reabsorption of cystine, ornithine, lysine, and arginine. Urine becomes supersaturated with cystine, with resultant crystal deposition.



*Handwritten signature or text, possibly "L. W. H. S."*

100

# Risk factors

- Patient habits: lower calcium intake, higher oxalate intake, higher animal protein intake, lower potassium intake, higher sodium intake, or lower fluid intake.
- History of prior urolithiasis
- Family history

# Clinical manifestations

Asymptomatic

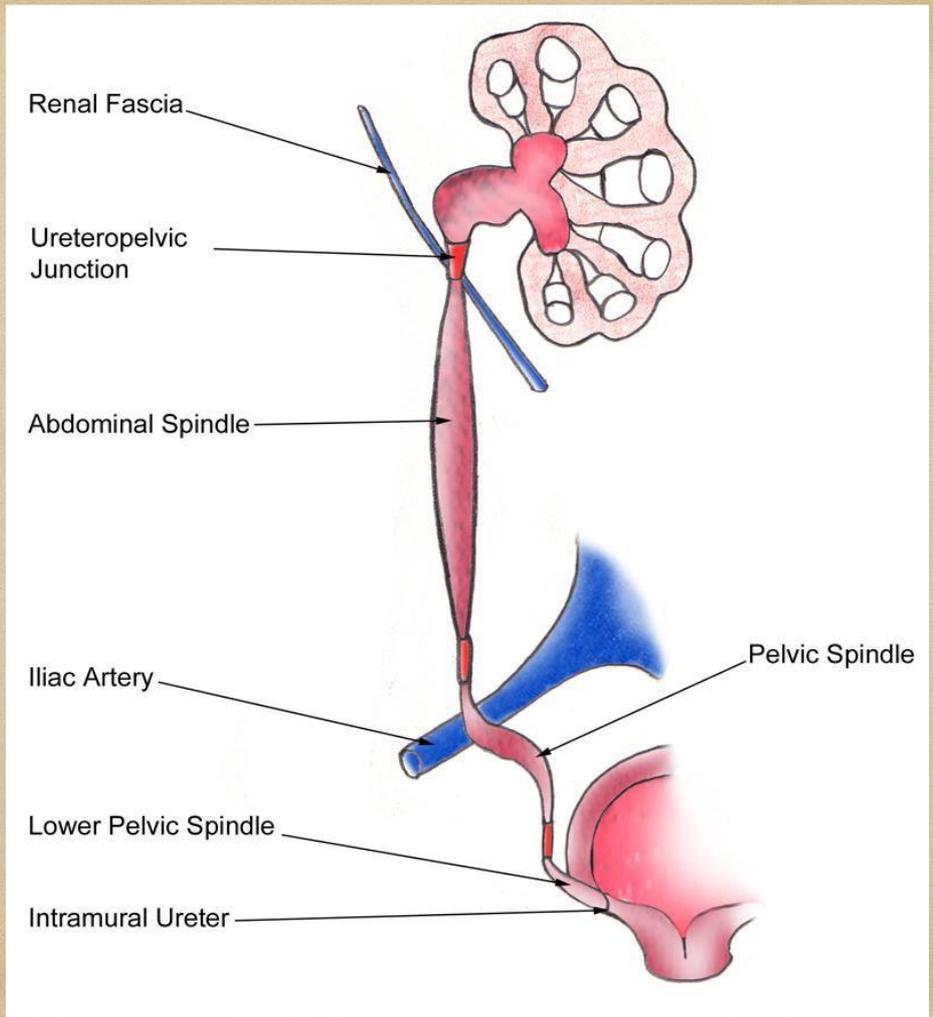
Acute onset of severe colicky flank pain  
radiating to the groin

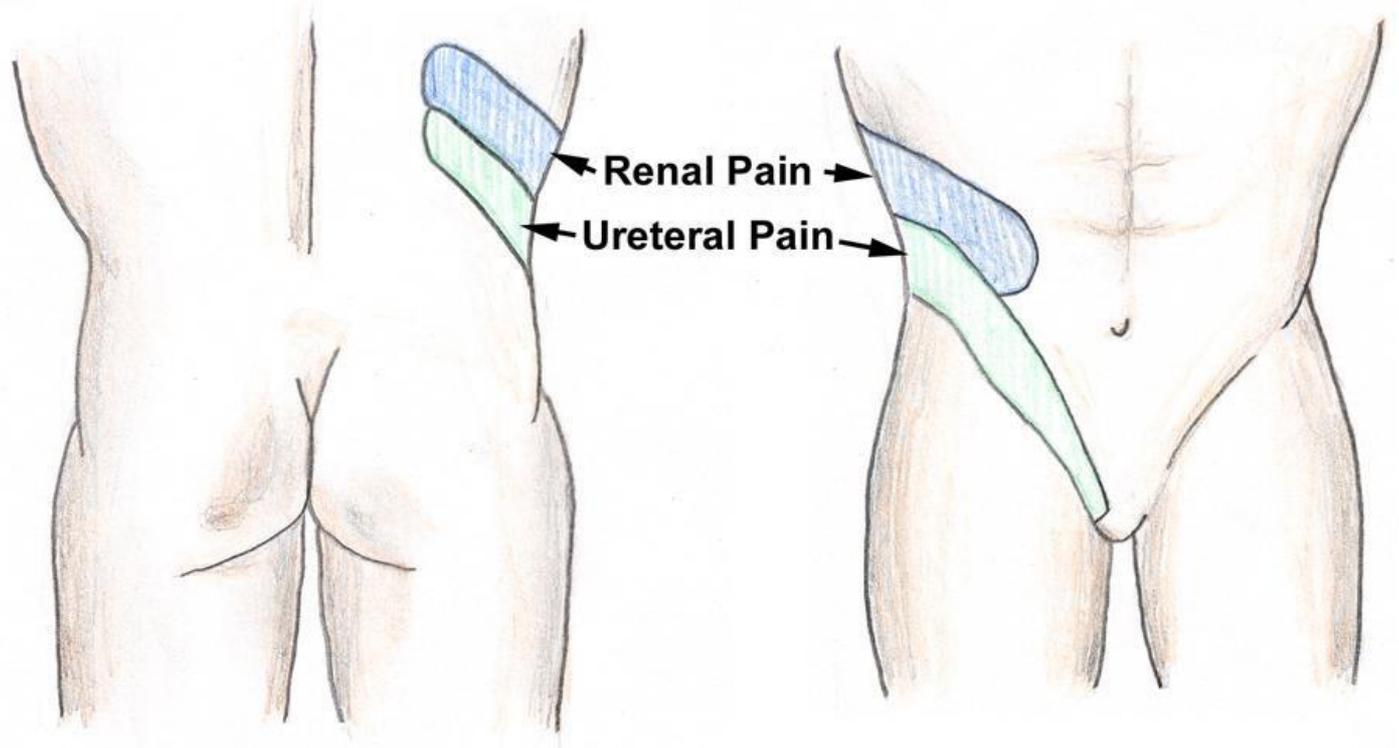
gross or microscopic hematuria

nausea, and vomiting

Physical examination is often unremarkable

\* 3 points of N. stricture.





# Diagnosis

- STONE score
- Low probability (0-5)
- Moderate probability (6-9)
- High probability (10-13)

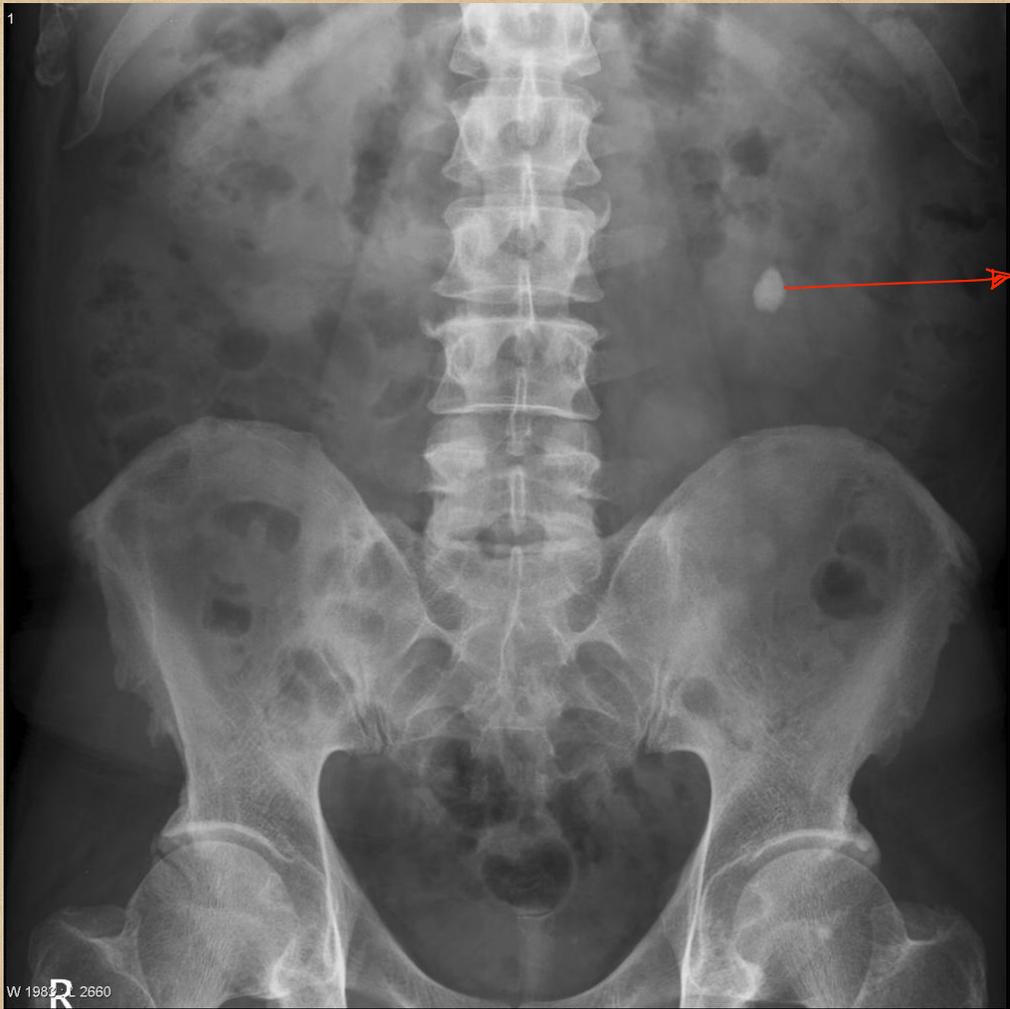
Factor	Points
<b>Sex:</b>	
Female	0
<u>Male</u>	<u>2</u>
<b>Duration of pain:</b>	
>24 hours	0
<u>6-24 hours</u>	<u>1</u>
<u>&lt;6 hours</u>	<u>3</u>
<b>Race:</b>	
Black	0
<u>Non-black</u>	<u>3</u>
<b>Nausea and vomiting:</b>	
None	0
<u>Nausea alone</u>	<u>1</u>
<u>Vomiting alone</u>	<u>2</u>
<b>Hematuria:</b>	
Absent	0
<u>Present</u>	<u>3</u>

- Imaging:

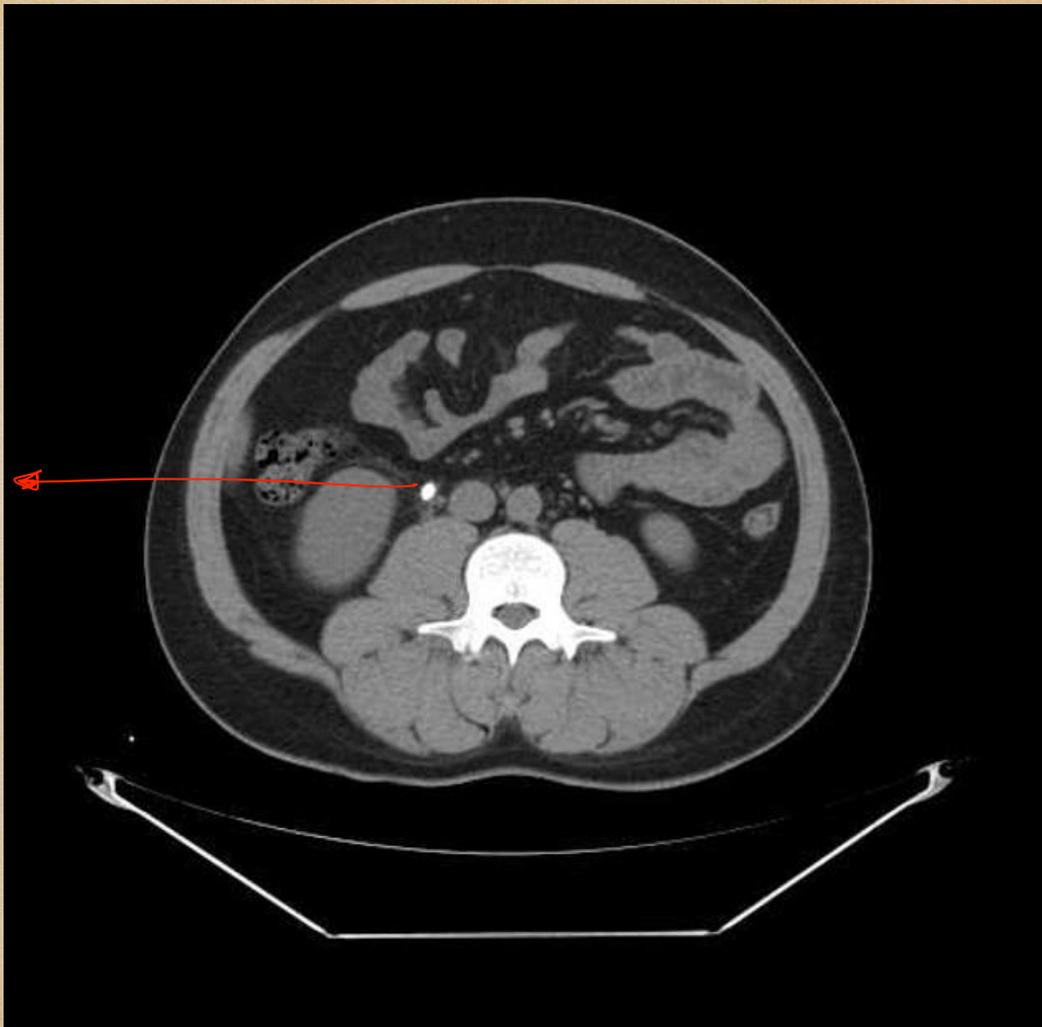
- Gold standard: non-contrast spiral CT.

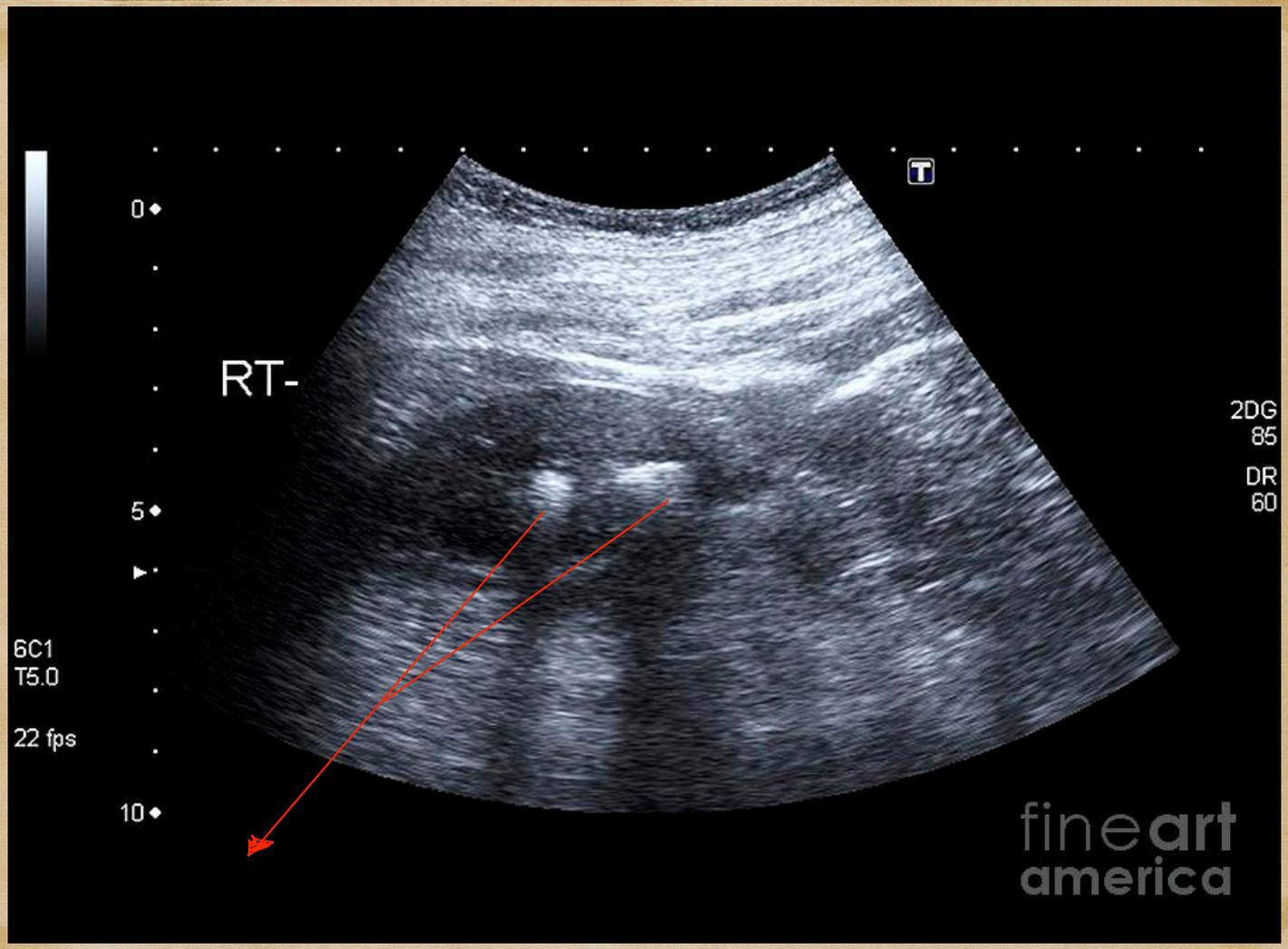
- Ultrasound, especially in pregnant cases.

- KUB



W 1982 L 2660





RT-

0

5

10

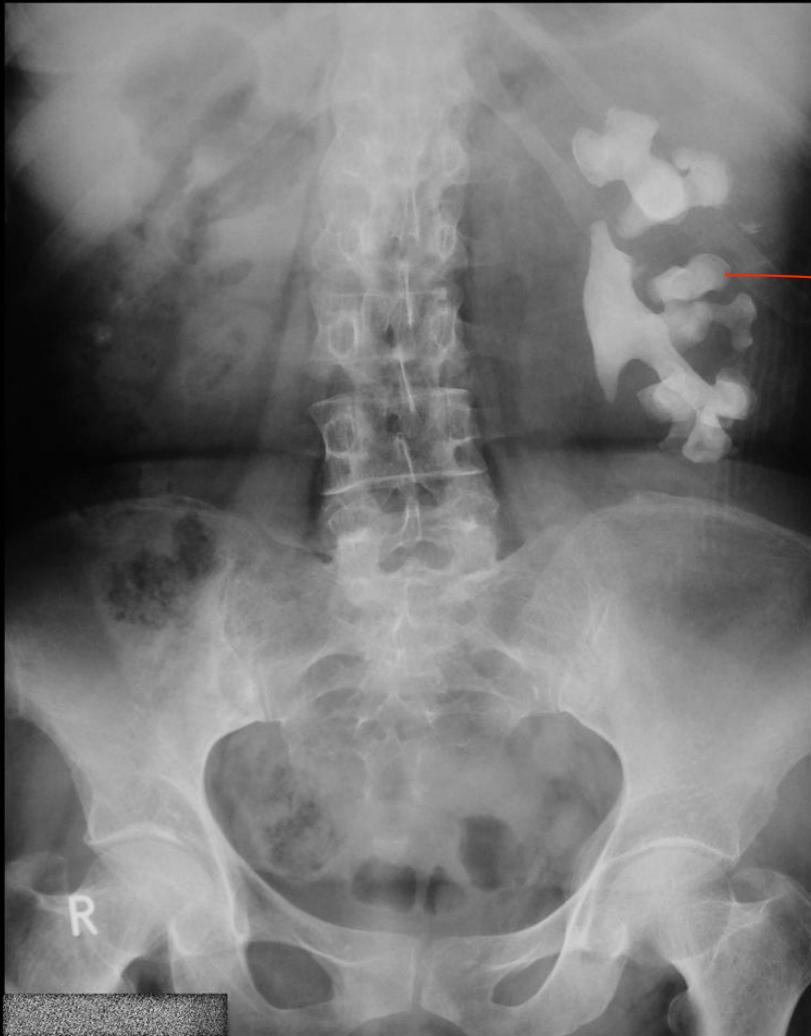
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# Presentation

- **Incidentally**

- **Symptoms:**

- **Pain**

sudden severe flank pain that is colicky (waves of increasing severity are followed by a reduction in severity, but it seldom goes away completely). It may radiate to the groin as the stone passes into the lower ureter.

- **Hematuria** (microscopic or occasionally macroscopic)

- **Malaise, weakness, and loss of appetite** can also occur.

acute management

# 1- Pain relief

- ❖ **NSAID** (diclofenac or ketorolac tromethamine)  
IM or IV, Orally or per rectum, provides rapid and effective pain control. Its analgesic effect is partly anti-inflammatory, partly by reducing ureteric peristalsis.
- ❖ **Opiate analgesics** When NSAIDs are inadequate, such as morphine are added.

- ❖ **Calcium channel antagonists** (nifedipine) may reduce the pain of ureteric colic by reducing the frequency of ureteric contractions upper ureteral stones, whereas **Alpha-blockers** (Tamsulosin) may be used for distal ureteral stones.
- ❖ **Antiemetic drug** (metoclopramide)
- ❖ **Antibiotic therapy**  
Only if the patient has clinical evidence of a UTI

- **No need** to encourage the patient to drink copious amounts of fluids or to give them large volumes of fluids intravenously in the hope that this will flush out the stone.

Excess urine output will tend to cause a greater degree of hydronephrosis in the affected kidney, which will make ureteric peristalsis even less efficient than it already is.

Peristalsis, can only occur if the walls of the ureter above the bolus of urine can coapt, i.e., close firmly together. If they cannot, as occurs in a ureter distended with urine, the bolus of urine cannot move distally.

## 2-watchful waiting

- Chances of spontaneous stone passage depend principally on stone size.
- Many ureteric stones are 4 mm in diameter or smaller and most such stones (90%+) will pass spontaneously, given a few weeks (3weeks) with analgesics for exacerbations of pain.
- Stones that have not passed in 2 months <sup>خلص يجب تفنؤن</sup> are much less likely to do so, though large stones do sometimes drop out of the ureter at the last moment.

- Therefore, accurate determination of stone size (on plain abdominal X-ray or by CTU) helps predict chances of spontaneous stone passage.
- Calcium channel blocker (nifedipine) and Alpha-blockers may assist spontaneous stone passage and reduce frequency of ureteric colic.

- Asymptomatic stones followed over a 3-year period are more likely to require intervention or to increase in size or cause pain if they are >4 mm in diameter and if they are located in a middle or lower pole calyx. The approximate risks, over 3 years of follow-up, relative to stone size.

**Table 8.3** Approximate 3-year risk of intervention, pain, or increase in stone size

	Stone size			
	<5 mm	5–10 mm	11–15 mm	>15 mm
% Requiring intervention	20%	25%	40%	<u>30%</u>
% Causing pain	40%	40%	40%	<u>60%</u>
% Increasing in size	50%	55%	60%	<u>70%</u>

- Some stones are definitely not suitable for watchful waiting. **Untreated struvite** (i.e., infection related) **staghorn calculi** will eventually destroy the kidney if untreated and are a significant risk to the patient's life unless patient comorbidity is such that surgery would be a higher risk than watchful waiting.

# Indications for stone removal

- Pain that fails to respond to analgesics or recurs and cannot be controlled with additional pain relief
- Impaired renal function (solitary kidney obstructed by a stone, bilateral ureteric stones, or pre-existing renal impairment that gets worse as a consequence of a ureteric stone)
- Prolonged unrelieved obstruction (generally speaking, ~4–6 weeks)
- Social reasons.

- These indications need to **be related to the individual patient**—their stone size, their renal function, presence of a normal contralateral kidney, their tolerance of exacerbations of pain, their job and social situation, and local facilities (the availability of surgeons with appropriate skill and equipment to perform endoscopic stone treatment).

## Emergency temporizing and definitive treatment of the stone

- When the pain of a ureteric stone fails to respond to analgesics or renal function is impaired because of the stone, then temporary relief of the obstruction can be obtained by insertion of a JJ stent or percutaneous nephrostomy tube (Percutaneous nephrostomy tube can restore efficient peristalsis by restoring the ability of the ureteric wall to coapt)
- but the stone is still present
- subsequent definitive treatment is still required

## **Kidney stone treatment options:**

- \*Stone fragmentation techniques**
- \*Flexible ureteroscopy and laser treatment**
- \*Percutaneous nephrolithotomy (PCNL)**
- \*open stone surgery**
- \*medical therapy (dissolution therapy)**

# **Stone fragmentation techniques;**

**extracorporeal lithotripsy**

**Intracorporeal techniques of stone fragmentation**

# extracorporeal lithotripsy

The technique of focusing externally generated shock waves at a target (the stone )

Three methods of shock wave generation are commercially available:—

electrohydraulic, electromagnetic, and piezoelectric

# Efficacy of extracorporeal lithotripsy

fragmentation with ESWL depends on

stone size and location,

anatomy of renal collecting system,

degree of obesity

stone composition.

It is less effective for

- \*stones >2 cm diameter

- \*lower-pole stones in a calyceal diverticulum (poor drainage)

- \*composed of cystine or calcium oxalate monohydrate (very hard).

## **complications after ESWL :**

### **Common**

- **Bleeding** on passing urine for short period after procedure
- **Pain in the kidney** as small fragments of stone pass after fragmentation
- **UTI** from bacteria released from the stone, needing antibiotic treatment.

### **Occasional**

- Stone will **not break** as too hard, requiring an alternative treatment
- **Repeated ESWL** treatments may be required
- **Recurrence of stones**

# Intracorporeal techniques of stone fragmentation

## **Electrohydraulic lithotripsy (EHL)**

A high voltage applied across a concentric electrode under water generates as a spark. This vaporizes water, and the subsequent expansion and collapse of the gas bubble generates a shock wave.

# Intracorporeal techniques of stone fragmentation

## Electrohydraulic lithotripsy (EHL)

EHL is an effective form of stone fragmentation.

The shock wave is not focused, so the EHL probe must be applied within 1 mm of the stone to optimize stone fragmentation.

Principal uses are for bladder stones (wider safety margin than in the narrower ureter)

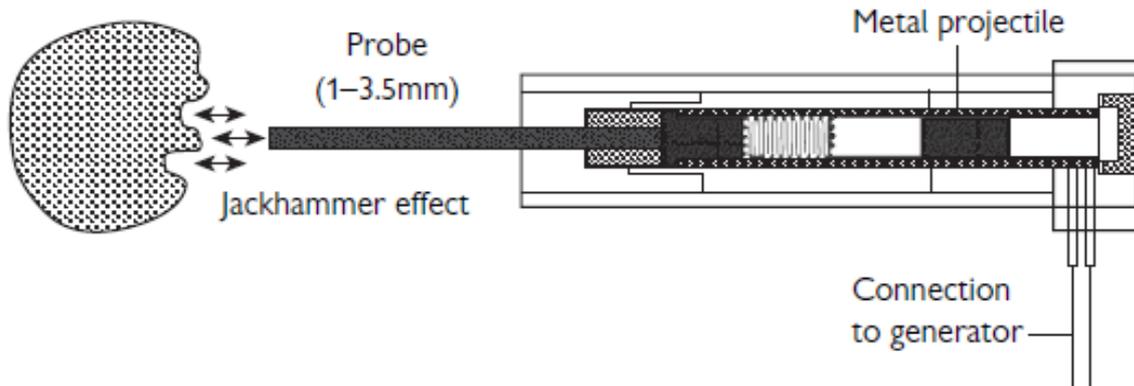
# Pneumatic (ballistic) lithotripsy

A metal projectile contained within the handpiece is propelled backward and forward at great speed by bursts of compressed air.

It strikes a long, thin, metal probe at one end of the handpiece at 12Hz

(12 strikes/second) transmitting shock waves to the probe, which, when in contact with a rigid structure such as a stone, fragments the stone.

This technique is used for stone fragmentation  
in the ureter or kidney



**Figure 8.3** The Lithoclast: a pneumatic lithotripsy device. This figure was published in Walsh PC, et al. *Campbell's Urology*, 8th edition, pp. 3395–979. Copyright Elsevier 2002.

## **advantage**

- \*Pneumatic lithotripsy is very safe
- \*The device is low cost and requires low maintenance

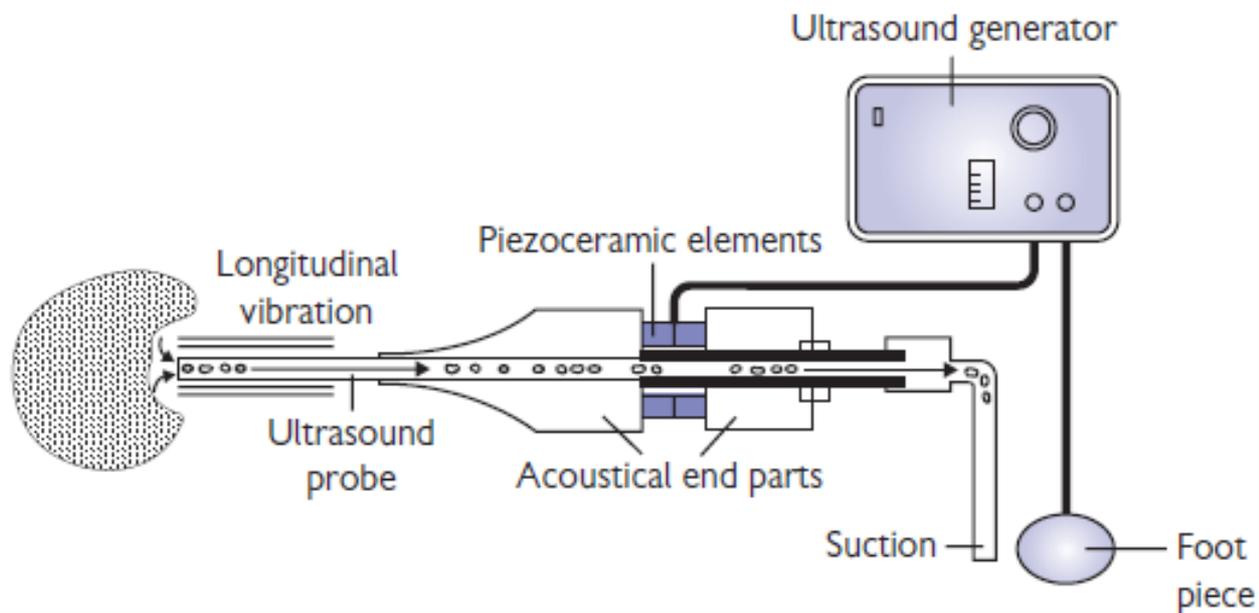
## **disadvantage**

- \*Its ballistic effect has a tendency to cause stone migration into the proximal ureter or renal pelvis, where the stone may be inaccessible to further treatment
- \*The metal probe cannot bend around corners, so it cannot be used for ureteroscopic treatment of stones within the kidney or with a flexible ureteroscope

## **Ultrasonic lithotripsy**

An electrical current applied across a piezoceramic plate located in the ultrasound transducer generates ultrasound waves of a specific frequency (23,000–25,000 Hz).

The ultrasound energy is transmitted to a hollow metal probe, which in turn is applied to the stone



**Figure 8.4** The Calcuson: an ultrasonic lithotripsy device. This figure was published in Walsh PC, et al. *Campbell's Urology*, 8th edition, pp. 3395–979. Copyright Elsevier 2002.

The stone resonates at high frequency and this causes it to break into small fragments that are then sucked out through the center of the hollow probe.

Soft tissues do not resonate when the probe is applied to them and thus are not damaged.

This technique can only be used down straight, rigid instruments.

**Principal uses include fragmentation of renal calculi during PCNL.** - *percutaneous nephrolithotomy*

# Laser lithotripsy

The holmium:YAG laser is principally a photothermal mechanism of action, causing stone vaporization.

It has **minimal shock-wave generation** and therefore **less risk of causing stone migration** .

The 200-micron fiber is very flexible and can be used to gain access to stones even within the lower pole of the kidney

# Principal uses are for ureteric stones and small intrarenal stones

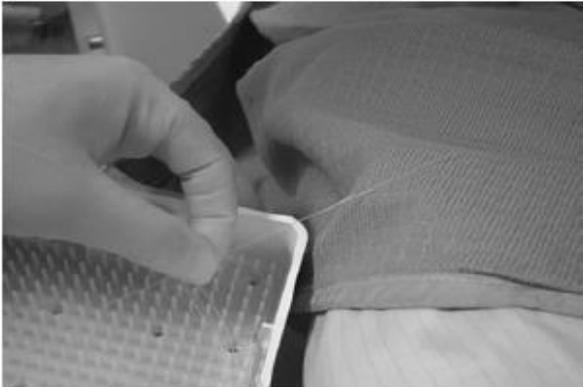


Figure 8.5 A laser fiber.



Figure 8.6 Access to the lower pole of the kidney with a flexible ureteroscope.

# Flexible ureteroscopy and laser treatment

## Indications

\*ESWL failure.

*Extracorporeal shock wave lithotripsy*

\*Lower pole stone

\*Cystine stones.

\*Obesity such that PCNL and ESWL is difficult

\*Musculoskeletal deformities such that stone access by PCNL or ESWL is difficult or impossible (e.g. kyphoscoliosis).

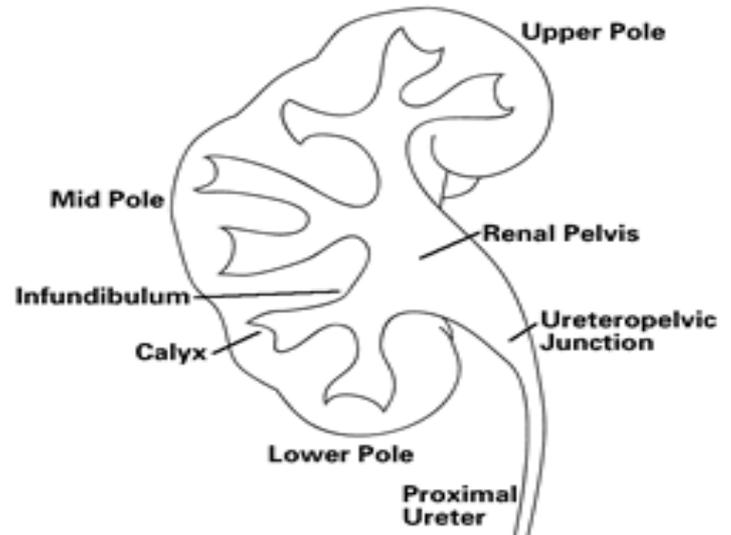
\*Stone in a calyceal diverticulum

\*Stenosis of a calyceal infundibulum or at angle between renal pelvis and infundibulum.

\*Bleeding diathesis

\*Horseshoe or pelvic kidney

\*Patient preference



# percutaneous nephrolithotomy

**PCNL** is the removal of a kidney stone via a track developed between the surface of the skin and the collecting system of the kidney.

## Steps of PCNL

- 1) inflation of the renal collecting system (pelvis and calyces) with fluid or air by ureteric catheter .
- 2) percutaneous puncture of a renal calyx with a nephrostomy needle



**Figure 8.7** A ureteric catheter is inserted into the renal pelvis to dilate it with air or fluid.



**Figure 8.8** A nephrostomy needle has been inserted into a calyx.

**3. guidewire is inserted into the renal pelvis to act as a guide over which the track is dilated**

**4. access sheath is passed down the track and into the calyx, and through this a nephroscope can be advanced into the kidney**

**5. ultrasonic lithotripsy probe is used to fragment the stone and remove the debris.**



**Figure 8.9** A guide wire is inserted into the renal pelvis and down the ureter; over this guide wire the track is dilated.



**Figure 8.10** An access sheath is passed down the track and into the calyx, and through this a nephroscope can be advanced into the kidney.

# Indications for PCNL

- stones >3cm in diameter, those that have failed ESWL and/or an attempt at flexible ureteroscopy and laser treatment.
- **It is the first-line option for staghorn calculi**
- For stones 2-3cm in diameter, options include ESWL, flexible ureteroscopy and laser treatment, and PCNL. PCNL gives the best chance of complete stone clearance with a single procedure, but this is achieved at a higher risk of morbidity.

# open stone surgery

- Complex stone burden (projection of stone into multiple calyces, such that multiple PCNL tracks would be required to gain access to all the stone)
- Failure of endoscopic treatment
- Anatomic abnormality that precludes endoscopic surgery (e.g. retrorenal colon)
- Body habitus that precludes endoscopic surgery (e.g. gross obesity, kyphoscoliosis)
- Patient request
- Non-functioning kidney

# Specific complications of open stone surgery

\*wound infection (the stones operated on are often infection stones)

\*flank hernia

\*wound pain

\*stone recurrence

# medical therapy (dissolution therapy)

- Uric acid stones

Dissolution therapy is based on

- ✓ hydration,
- ✓ urine alkalization → sodium bicarbonate  
or potassium citrate
- ✓ Allopurinol,
- ✓ dietary manipulation

# Cystine stones

The **aim** is to do the following:

- **Reduce cystine excretion** (dietary restriction of the cystine precursor amino acid methionine and also of sodium intake to <100 mg/day)
- **Increase solubility of cystine** by alkalinization of the urine to >pH 7.5, maintenance of a high fluid intake, and use of drugs that convert cystine to more soluble compounds.

**D-penicillamine , N-acetyl-D-penicillamine, and mercaptopyrionylglycine**

bind to cystine—the compounds so formed are more soluble in urine ✓

# Pediatric urology



done by :  
Manar Omoush  
Eliza Dumour  
Samar Jaradat

# Undescended testes



- The testes descend into the scrotum in the third trimester (passing through the inguinal canal at 24–28 weeks), **Failure of testicular descent** results in cryptorchidism (or undescended testes).

- **Incidence:**

Incidence is 3% at birth (unilateral > bilateral).

Approximately 80% will spontaneously descend by 3 months. The incidence at 1 year is 1%.

*\* we wait until age of 6 months & more before doing surgery*



## • **Classification**

\* **Retractile**: an intermittent active cremasteric reflex causes the testis to retract up and out of the scrotum.

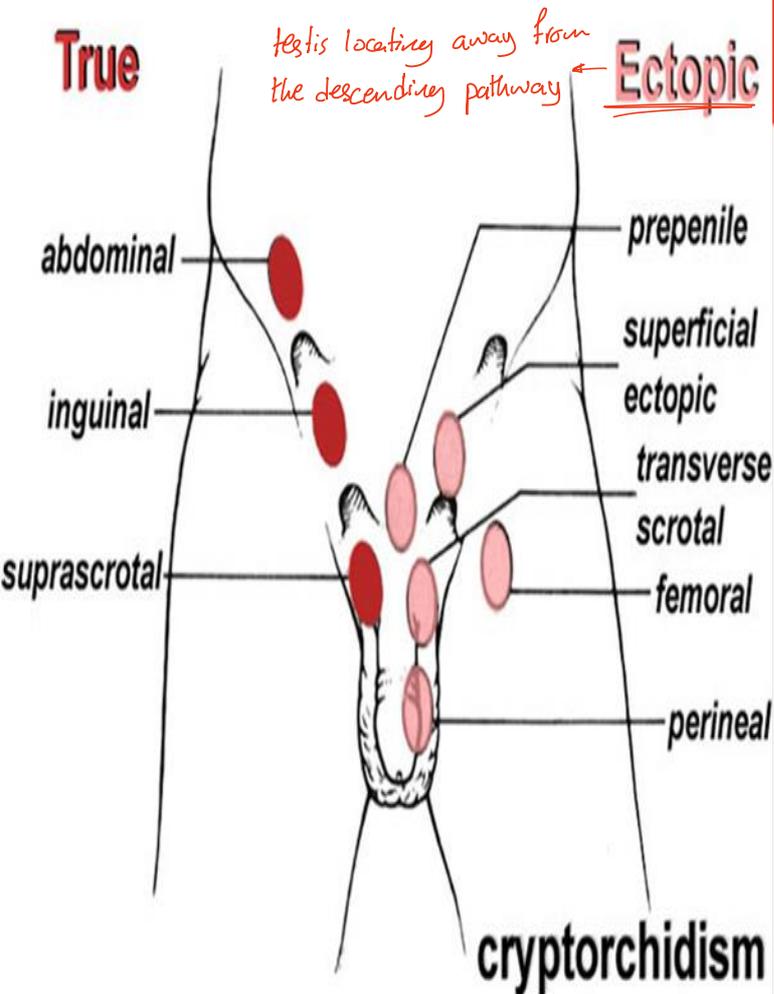
\* **Ectopic** (<5%): abnormal testis migration below the external ring of the inguinal canal (to perineum, base of penis, or femoral areas)

\* **Incomplete descent** (~95%): testis may be intra-abdominal, inguinal, or prescrotal

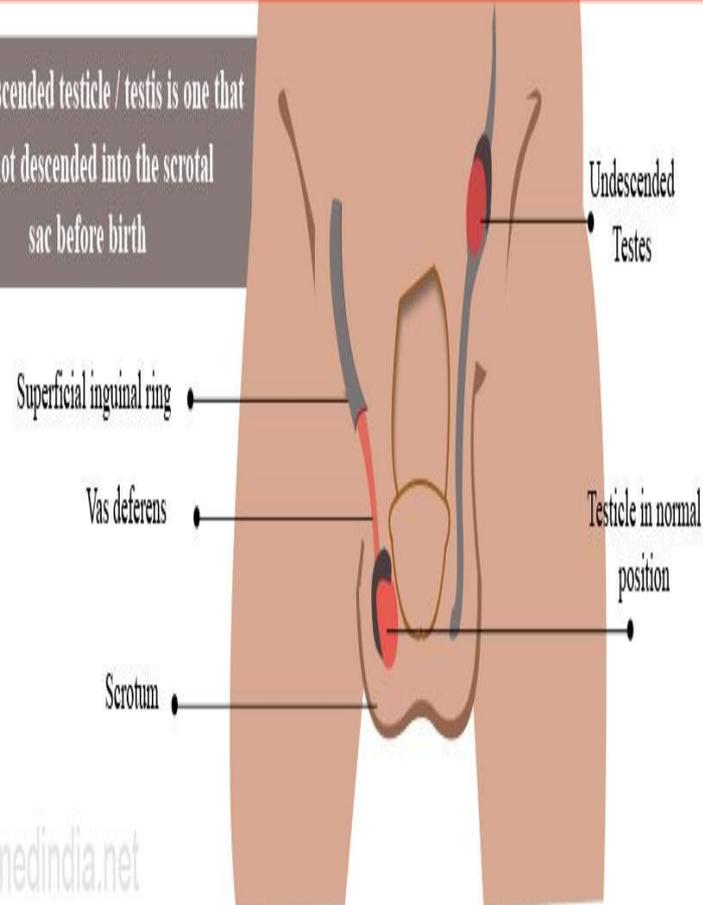
## **Atrophic/absent**

\* *Treat these pt's similarly*

# UNDESCENDED TESTICLES



An undescended testicle / testis is one that has not descended into the scrotal sac before birth





- **Risk factors**

These include preterm infants, low birth weight, small for gestational age, and twins.

- **Etiology**

This includes :

- 1) abnormal testis
- 2) gubernaculum
- 3) endocrine abnormalities (low level of **androgens [hCG], (LH), calcitonin gene-related peptide**)
- 4) decreased intra abdominal pressure (prune-belly syndrome, gastroschisis).



- **Pathology**

There is degeneration of **Sertoli cells**, loss of **Leydig cells**, and atrophy and abnormal **spermatogenesis**.

- **Long-term complications**

- Relative risk of cancer is 40-fold higher in the undescended testis. Most are **seminomas**; carcinoma in situ represents a small percentage (~2%).
- Reduced fertility
- Increased risk of testicular torsion
- Increased risk of direct inguinal hernias

# Diagnosis



- Full examination is required to elucidate if the testis is palpable and to identify location.
- Assess for associated congenital defects.
- If neither testis is palpable, consider chromosome analysis (to exclude an androgenized female) and hormone testing (high LH and FSH with a low testosterone indicates anorchia).
- before discharging any newborn male pt we have to examine the genitalia, and part of examination is scrotal examination to assess if there are testicles or not (so diagnosis of undescending testicle can be immediately after birth)

# Management



- Treatment should be performed within the first year.
- Hormone therapy (hCG, LHRH) stimulates testosterone production. *→ is Coj ~ especially if Pt have bilateral*
- **Surgery** consists of inguinal exploration, mobilization of spermatic cord, ligation of processus vaginalis, and securing the testis into a dartos pouch in the scrotal wall (**orchidopexy**).

*Done btw 1-2 y*



- Intra-abdominal testes may require division of spermatic vessels to provide extra length (Fowler-Stevens procedure, relying on collateral blood flow from vas), two-stage procedures, or microvascular autotransplantation.

Why we should operate pt with undescended testicles: ~~~~~

~> + to preserve fertility & testicular growth + Psychological issues in pt to have single testicle

bcz there is high possibility of atrophy

"	"	"	malignancy	) ← to avoid
"	"	"	trauma	
"	"	"	torsion	

# Vesicoureteric reflux (VUR)

Unilateral

bilateral



- **Definition**

Results from abnormal **retrograde** flow of urine from the bladder into the upper urinary tract. *(up to kidneys)*

- **Epidemiology**

incidence >10%;

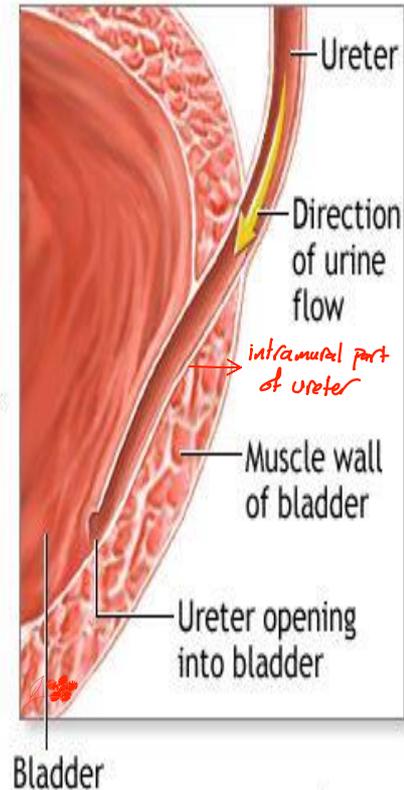
younger > older;

girls > boys (5:1)

Siblings of an affected child have a 40% risk of reflux

# Pathogenesis

- The ureter passes obliquely through the bladder wall (1–2 cm), where it is supported by muscular attachments *(Submucosally)* that prevent urine reflux *(physiological valve)* during bladder filling and voiding. The normal ratio of intramural ureteric length to ureteric diameter is 5:1. *→ that prevent reflux*
- Reflux occurs when the intramural length of ureter is too short (ratio < 5:1). *(Ureter short insertion in bladder)*



# Classification:



- **Primary reflux** (1%) results from a **congenital** abnormality of the ureterovesical junction. *no pathological causes*
- **Secondary reflux** results from urinary tract dysfunction associated with **elevated intravesical pressures**. *: also neurogenic bladder, obstruction of ureters*

Causes include posterior urethral valves (reflux seen in 50%), urethral stenosis, neuropathic bladder, and **detrusor sphincter dyssynergia (DSD)**.

*↓  
Pt voiding against closed sphincter ⇒ produce high P. in bladder induce reflux*

\* reflux induce renal damage in 2 forms :

- ① 2° to reflux of infected urin up to kidney lead to recurrent pyelonephritis <sup>no</sup> producing scars & fibrosis in renal cortex
- ② water hammer effect, urin will go high up to kidney with high flow → this will hit the renal collecting sys. & then lead to injury in cortex of kidney

and up with reflux nephropathy



## • Complications

VUR associated with UTI can result in reflux nephropathy with hypertension and progressive renal failure.

\* if we minimize risk of bladder infection or cystitis → we will reduce risk of renal injury  
\* " " reduce bladder p. we can minimize water hammer injury from reflux into kidney  
] conservative ttt

## • Presentation

Patients have symptoms of UTI, fever, dysuria, suprapubic or abdominal pain, failure to thrive, vomiting, and diarrhea.

(recurrent febrile UTI in pediatric age group → we have to think seriously in reflux)

● Renal imperment, hydronephrosis...

● Diagnosed by MCUG (VCUG)

تصوير



- **Investigation**

- Urinalysis and culture to diagnose UTI

- Urinary tract **ultrasound** scan and **VCUG** to ass. cortex of kidney ① voiding ② diagnose presence or absence of reflux (unilateral/bilateral) & grade of reflux Contrast injected into bladder MCUG \* Contrast go up to kidney in case of reflux

- **Urodynamic** assessment

- **DMSA scan** ③ Nuclear study used to diagnose if there is renal scars or not? to detect and monitor associated renal cortical scarring

- According to voiding cystourethrogram-->we diagnose the grade of reflux & presence or absence of reflux

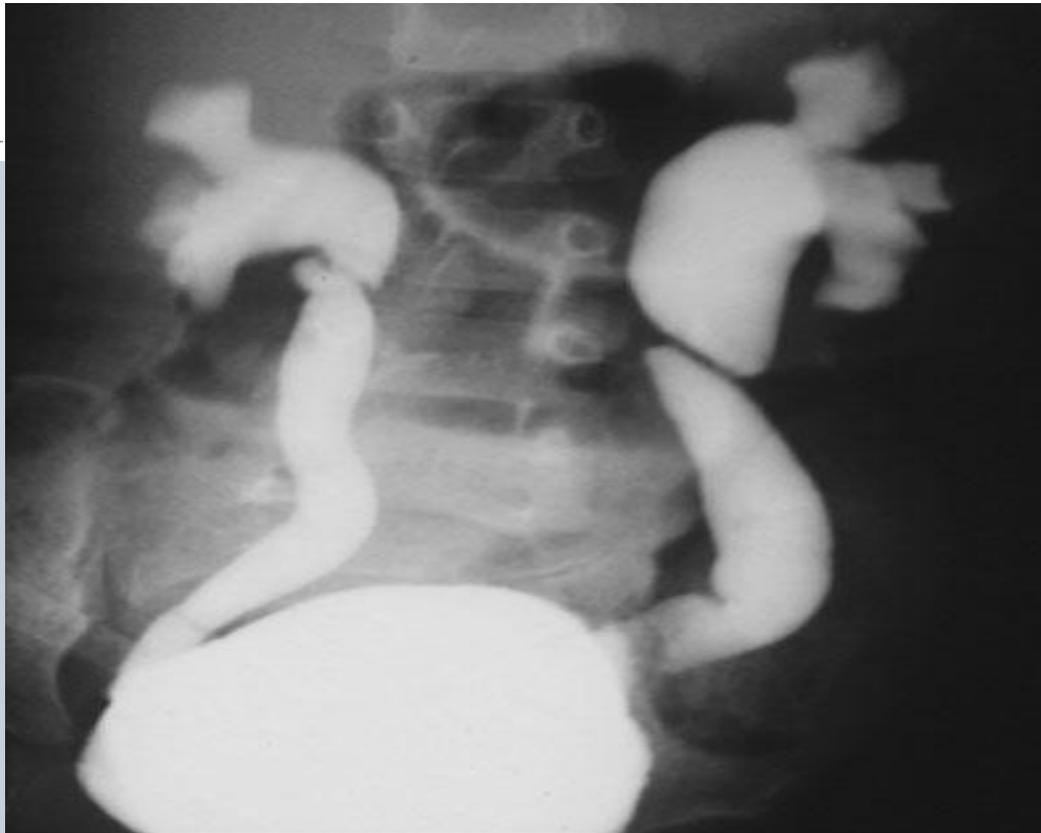
# Kidney and bladder ultrasound grading



- **Grade I** – reflux into non-dilated ureter
- **Grade II** – reflux into the renal pelvis and calyces without dilatation
- **Grade III** – mild/moderate dilatation of the ureter, renal pelvis and calyces with minimal blunting of the fornices
- **Grade IV** – dilation of the renal pelvis and calyces with moderate ureteral tortuosity
- **Grade V** – gross dilatation of the ureter, pelvis and calyces; ureteral tortuosity; loss of papillary impressions

Low grade

High grade



Bilateral high grade  
reflux  
Grade 5

Massive bilateral reflux is seen on  
cystogram in young child.

# Management

#Keep pt on conservative ttt



Correct problems contributing to secondary reflux.  
Most primary VUR grade I–II cases will resolve spontaneously (~85%), with 50% resolution in grade III. Observation and medical treatment are initially recommended.

# Medical treatment



**Low-dose antibiotic** prophylaxis should be given to keep the urine sterile and lower the risk of renal damage until reflux resolves. **Anticholinergic** drugs are given to treat bladder overactivity

- If we fail to keep urin sterile go for

# Surgical Management

two



②  
re-implantation of ureter

minimally invasive

- (ureteronecystostomy ± ureteroplasty) or subureteral injection

## Indication for surgery:

- If it is not possible to keep the urine sterile and reflux persists
- If acute pyelonephritis recurs despite a strict medical regimen and chronic suppressive antimicrobial therapy.
- If increased renal damage is demonstrated by serial excretory urograms or nuclear scan.
- High grade reflux (grade IV or V - not an absolute indication)

# Hypospadias: ventrally located meatus

with 5 associations: ① ventrally located meatus

② absent of ventral foreskin

③ penile chordee

④ absent of penile ventral skin

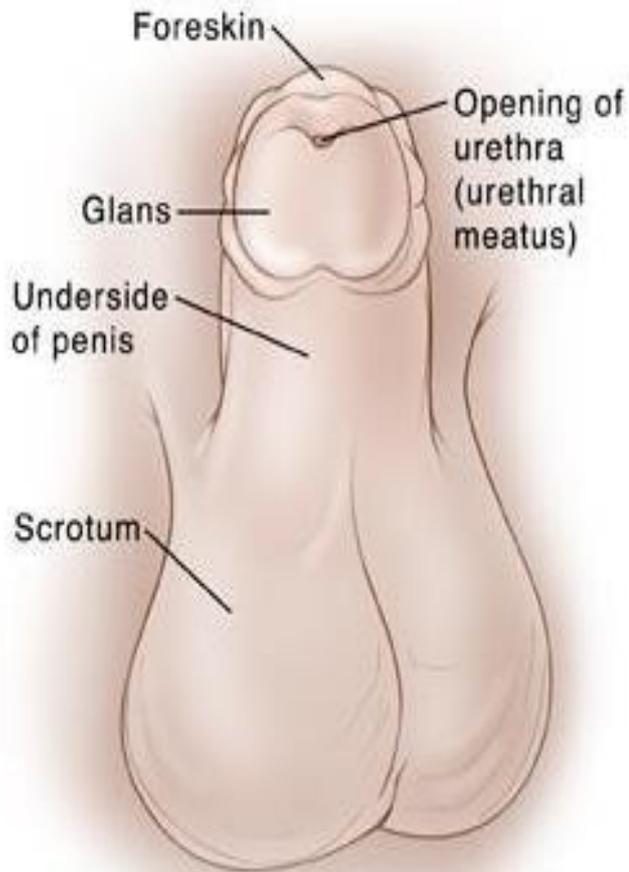
⑤ deviation of median raphe to one side of penis

## • Definition

Hypospadias is a **congenital deformity** in which the opening of the urethra (the meatus) occurs on the underside (**ventral**) part of the penis, anywhere from the glans to the perineum. It is often associated with a **hooded foreskin** and **chordee** (ventral curvature of the penile shaft).

- It is the **most common congenital malformation of the urethra**. It occurs in 1 in 250 live male births

↳ the more the proximal the meatus the more the severity of hypospadias



**Normally, the opening of the urethral meatus is located at the tip of the penis.**



**With hypospadias, the opening of the urethra is located on the underside of the penis or near the scrotum.**

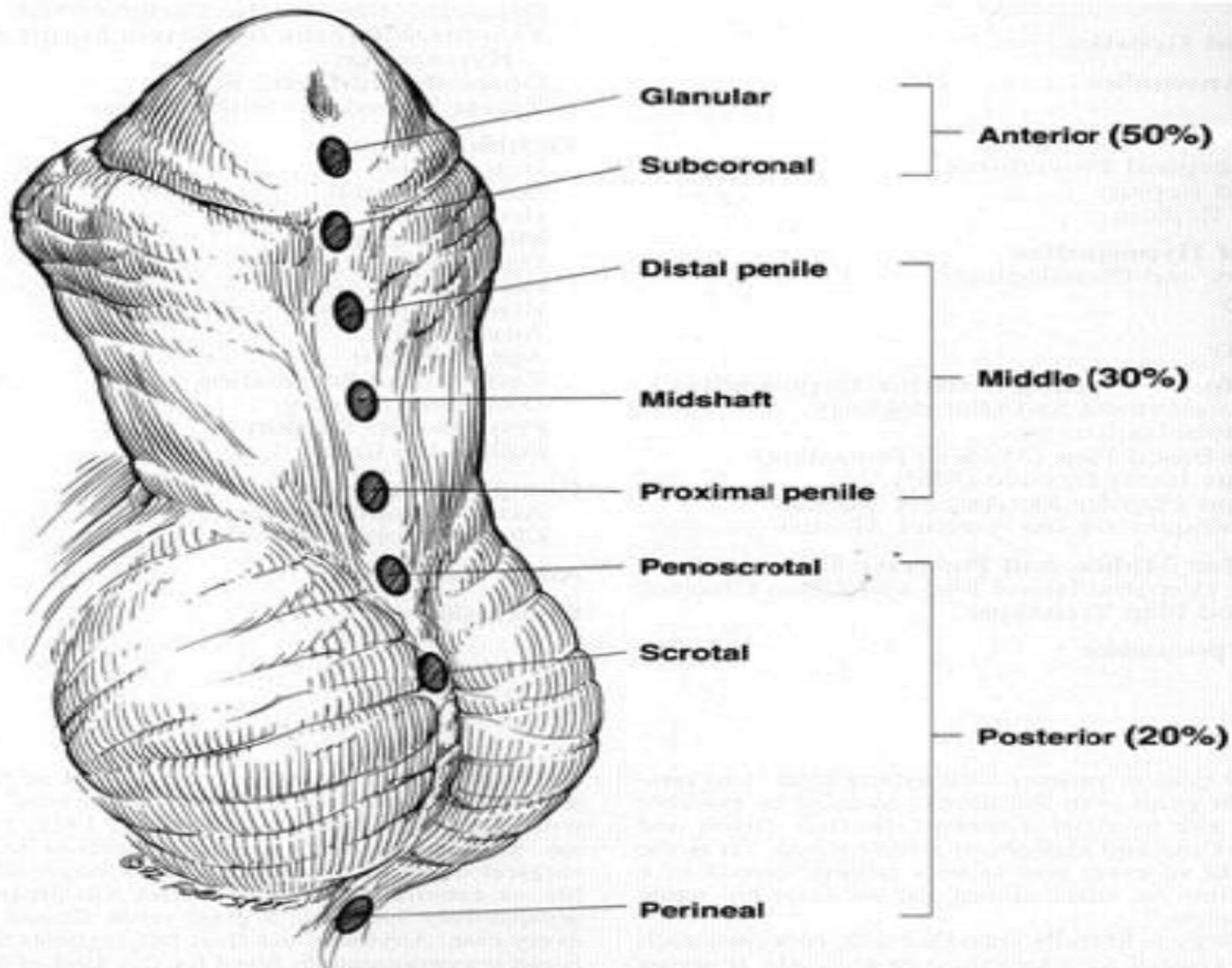


... (trapezoid medially with arrow) with dorsal border

# Classification



- Hypospadias can be classified according to the anatomical location of the urethral meatus
- **Anterior** (or distal)—glanular, coronal, and subcoronal (~50%)  
*usually doesn't affect fertility*  
*wild*
- **Middle**—distal penile, midshaft, and proximal penile (~30%)  
*affect fertility*  
*rare + refer pt to pediatric urologist to reassure parents*
- **Posterior** (or proximal)—penoscrotal, scrotal, and perineal (~20%)



Urethra opening



Subcoronal

Urethra opening



Midshaft

Urethra opening



Penoscrotal

# Etiology



- Hypospadias results from incomplete closure of urethral folds on the underside of the penis during embryological development.
- This is related to a defect in production or metabolism of **fetal androgens**, or the number and **sensitivity of androgen receptors** in the tissues.

# Diagnosis



- A full clinical examination will make the diagnosis. However, it is also important to seek out **associated abnormalities** that will need treatment (undescended testes, inguinal hernias, and hydroceles).
- Patients with absent testes and severe hypospadias should undergo **chromosomal and endocrine** investigation to exclude intersex conditions

#reassure family:

1) shouldn't do circumcision before age of 1y (that done at tjme of deffinitive hypospadias repair)

2) this congenital pathology will not increase incidence of UTI or not affect fertility or erection in the future

# Treatment

Whatever the site of hypospadias!



ttt of choice ( doing cosmetic & functional surgery)

- **Surgery** is indicated where deformity is **severe**, interferes with **voiding**, OR is predicted to interfere with **sexual function**. Surgery is now performed between 6 and 12 months of age.
- Local application of **testosterone** for 1 month preoperatively can **help increase tissue size**.
- The aim of surgery is to correct penile curvature (orthoplasty), reconstruct a new urethra, and bring the new meatus to the tip of the glans using urethroplasty, glanuloplasty, and meatoplasty techniques.

# Complications



- These include bleeding, infection, urethral strictures, meatal stenosis, urethrocutaneous fistula, urethral diverticulum, and failed procedures requiring reoperation

# Nocturnal enuresis: *passage of urine during sleep involuntary*



- **Enuresis** is normal but involuntary voiding that occurs at an inappropriate time or social setting, during the day, night, or both.
- **Nocturnal enuresis** : describes any involuntary loss of urine during sleep.





## Prevalence

Age (years)	Females	Males
5	10–15%	15–20%
7	7–15%	15–20%
9	5–10%	10–15%
16	1–2%	1–2%



## • Classification

- **Primary**: never been dry for more than a 6-month period
- **Secondary**: re-emergence of bed wetting after a period of being dry for at least 6 months

## • Etiology

- Familial
- Delay in functional bladder maturation
- Altered antidiuretic hormone (**ADH**) secretion; abnormal decrease in ADH levels at night causes increased urine production (nocturnal polyuria)
- Altered sleep/arousal mechanism
- Psychological factors
- UTI (1% of cases)

# Evaluation



- **History**: frequency of episodes; daytime symptoms; new or recurrent; family history; UTIs; bowel problems; psychosocial history
- **Examination**: Usually every thing is normal exclude organic causes (neurological disease)
- **Investigation**: urinalysis (infection, specific gravity is reduced in nocturnal polyuria, glucose, protein); voiding diary

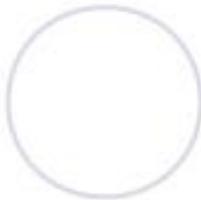
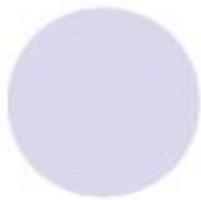
# Management



- **Behavioral**

Provide reassurance; bladder training; motivational techniques to **improve the child's self-esteem**; conditioning therapy (an alarm is connected to the child's underwear, which is triggered with the first few drops of urine).

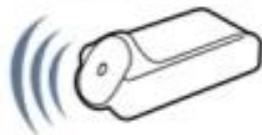




# Wet Alarm Therapy



DRI-Sleeper Eclipse  
Wireless Alarm Unit



Sensor



Type v



## • Pharmacological

• Imipramine—a tricyclic antidepressant with anticholinergic, antispasmodic properties.

• • DDAVP or <sup>Only one used:</sup> **desmopressin** (synthetic analogue of ADH) given intranasally or orally Or (suplingual tablet)  
1h before bedtime

## • Prognosis

◉ 15% of patients have spontaneous resolution of symptoms per year.

# Posterior urethral valves

(PUV)

Congenital valve in  
prostatic urethra only in  
male pt



## Definition

Posterior urethral valves (PUV) are abnormal congenital mucosal fold in the prostatic (posterior) urethra causing lower urinary tract obstruction. Incidence 1 in 5000 male.

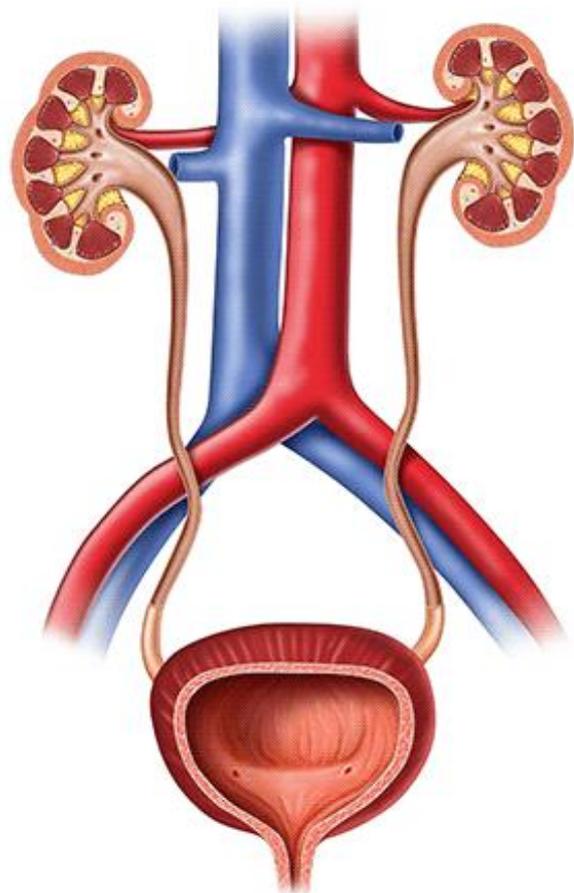
*lead high p. in bladder → back up to kidney ; inducing renal failure*

## Cause:

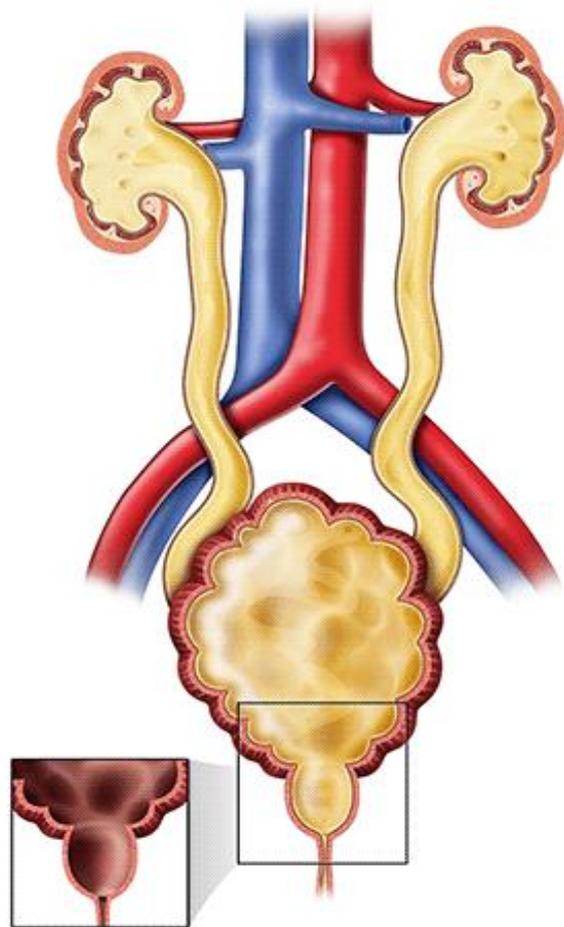
Normal male urethra has small, paired lateral folds (**plicae colliculi**) found between the lateral, distal edge of verumontanum and lateral urethral wall.

PUVs probably represent a congenital overgrowth of these folds from abnormal insertion of Wolffian ducts into the posterior urethra during fetal development.

Normal System



Posterior Urethral Valves (PUV)





- The verumontanum, or mountain ridge, is a distinctive landmark in the prostatic urethra, important in the systemic division of posterior valve disorders:
  1. Type I - Most common type; due to anterior fusing of the *plicae colliculi*, mucosal fins extending from the bottom of the verumontanum distally along the prostatic and membranous urethra
  2. Type II - Least common variant; vertical or longitudinal folds between the verumontanum and proximal prostatic urethra and bladder neck
  3. Type III - Less common variant; a disc of tissue distal to verumontanum, also theorized to be a developmental anomaly of congenital urogenital remnants in the bulbar urethra

Usually we detect moderate  
Valve, usually identified  
during antenatal US

← **Presentation** → depend on severity of obstruction

## **Prenatal US features**

These include **bilateral hydroureteronephrosis**, dilated bladder with elongated ectatic posterior urethra, thick-walled bladder, **oligohydramnios** (reduced amniotic fluid), and renal dysplasia.

Early features are associated with poor prognosis.

## **Newborn and infants**

These children have respiratory distress (secondary to pulmonary hypoplasia), palpable abdominal mass (hydronephrotic kidney or distended bladder), ascites, UTI, electrolyte abnormalities, and failure to thrive.

## **Older children**

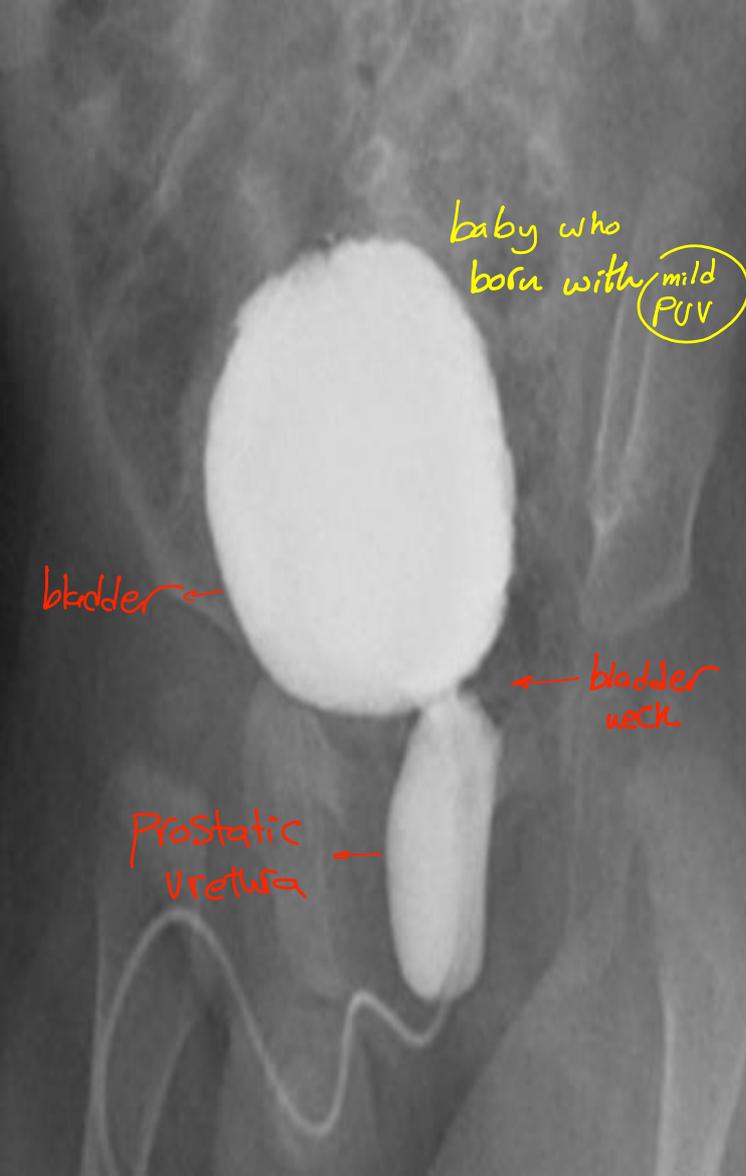
Milder cases may present later with recurrent UTI, poor urinary stream, incomplete bladder emptying, poor growth, and incontinence. There is a risk of **renal failure**, **vesicoureteric reflux**, and **voiding dysfunction** (overactive or underactive bladder), also described as **valve bladder syndrome**.

# Investigation



## Investigation

- Ultrasound scan of kidneys and bladder.
- **VCUG** <sup>*MCUG → should be diagnosed during voiding phase*</sup> shows distended and elongated posterior urethra, partially filled anterior urethra, bladder neck hypertrophy; **GOLD STANDARD FOR DIAGNOSING PUV.**
- Isotope renal scan (MAG-3, DMSA) assesses renal function.
- Video urodynamics allows diagnosis of associated voiding dysfunction, urethra, bladder neck



**Figure 15.9** VCUG in infant with posterior urethral valves shows dilated elongated prostatic urethra and thickened bladder neck.

**Treatment:** → MCUG → *there is valve!* → *Catheter insertion in bladder to drain bladder + minimize P. in bladder* → *then valve vulgarization by resectoscope*



**COMMENCE PROPHYLACTIC ANTIBIOTICS IMMEDIATELY, CHECK SERUM .ELECTROLYTES DRAIN THE BLADDER WITH A PEDIATRIC FEEDING TUBE. IF THERE IS IMPROVEMENT, CYSTOSCOPY AND TRANSURETHRAL ABLATION OF VALVE (CUTS AT 5 AND 7 O’CLOCK WITH ELECTROCAUTERY) IS RECOMMENDED (COMPLICATIONS INCLUDE URETHRAL STRICTURES).**

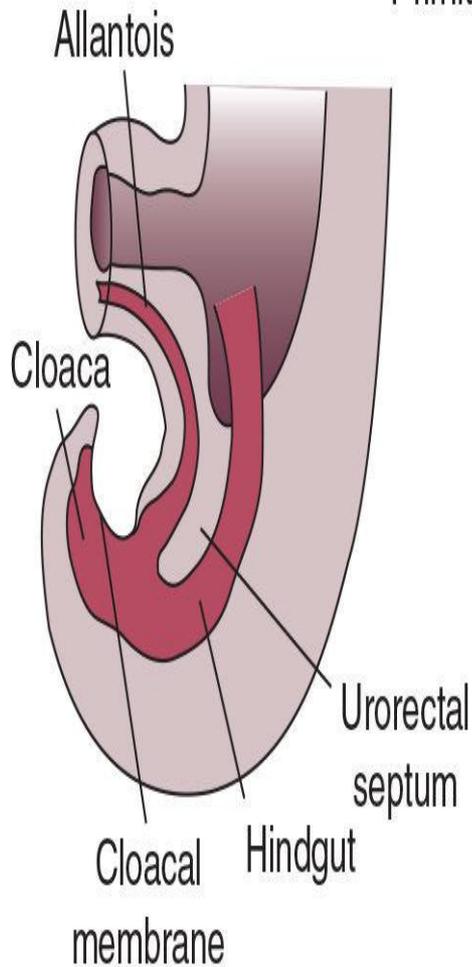
**IF UPPER TRACTS REMAIN DILATED WITH RAISED CREATININE AFTER BLADDER DRAINAGE, A TEMPORARY CUTANEOUS VESICOSTOMY IS INDICATED (COMMUNICATING STOMA BETWEEN THE BLADDER DOME AND SUPRAPUBIC ABDOMINAL WALL, ALLOWING FREE DRAINAGE OF URINE). AN ALTERNATIVE IS URETEROSTOMY DRAINAGE. VALVE ABLATION IS PERFORMED AT A LATER STAGE.**

# Extrophy of the Bladder

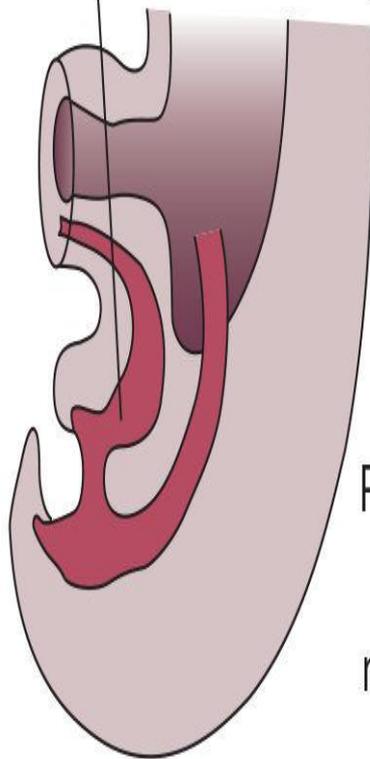
*extremely rare.*

Absence of bladder coverage (by abnormal wall)

- ❖ Bladder extrophy results from defective development of the anterior bladder and lower abdominal walls, leaving the posterior bladder wall lying exposed on the abdomen.
- ❖ M:F >2:1
- ❖ Risk increased in family , younger maternal age and increased parity.



Primitive urogenital sinus



Urogenital membrane

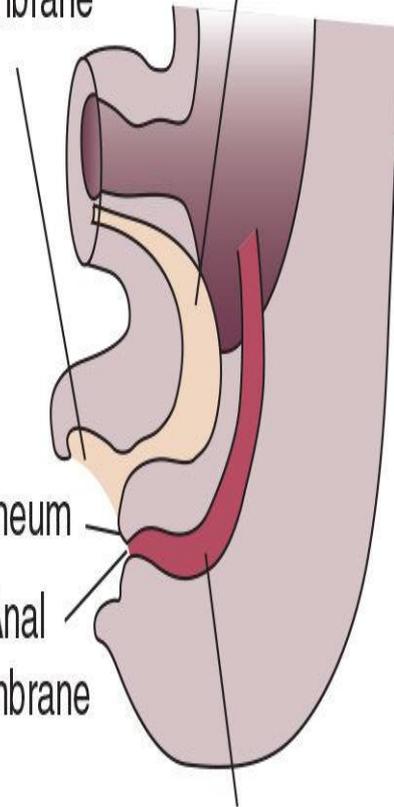
Urinary bladder

Perineum

Anal membrane

Anal membrane

Anorectal canal



# Embryology



- An embryological malformation results in the abnormal overdevelopment of the cloacal membrane, which prevents in-growth of lower abdominal tissues. The cloacal membrane normally perforates to form the urogenital and anal openings, but in extrophy there is premature rupture, resulting in a triangular defect below the umbilicus. The timing of this rupture determines the type of defect (**bladder extrophy, cloacal extrophy, OR epispadias**).

## Associated anomaly:

- ❖ Urinary tract defect: VUR.
- ❖ Bone defect: Widening of the pubic symphysis
- ❖ Genital defect: Epispadias.
- \* Musculofascial defect: Inguinal , femoral hernia.



# Investigation



- Typical features seen on **prenatal ultrasound** scan include :
  - lower abdominal wall mass
  - absent bladder filling
  - low-set umbilicus
  - small genitalia
  - abnormal iliac crest widening.

# Management



- ❖ At birth, cover the bladder with plastic film and irrigate regularly with sterile saline.
- ❖ Trauma to the bladder mucosa can eventually result in squamous metaplasia, cystitis cystica, or adenocarcinoma and squamous cell carcinoma after chronic exposure.

Dr said:

1) cover bladder mucosa with guze or wet sponge to avoid dryness of bladder mucosa

2) reffered pt to tertiary center to deal with pt (immediatly)



- Selected cases are suitable for one-stage repair, but most require a three-stage procedure:
- **Newborn:** **pelvic osteotomy** (cutting bone to correct deformity) with external fixation with closure of bladder, abdominal wall, and posterior urethra
- **6–12 months:** **epispadias repair**
- **4–5 years:** **Bladder neck reconstruction** (Young–Dees–Leadbetter procedure) and **anti-reflux surgery** (ureteric reimplantation) are performed when there is **adequate bladder capacity** and **children can participate in voiding protocols**.
- Where bladder capacity is too small, bladder augmentation or urinary diversion is required.

# Prognosis



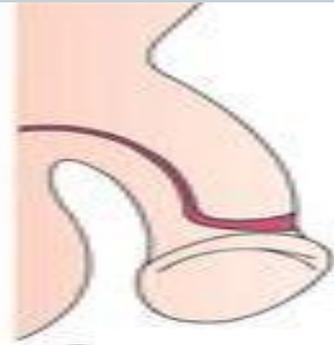
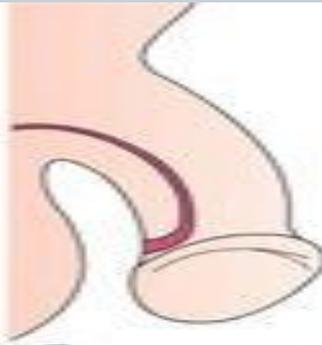
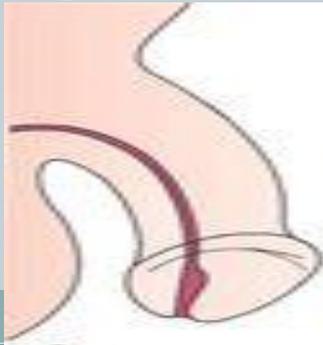
- Even with successful surgery, patients may have long-term problems with
  - > Incontinence
  - > Urinary reflux
  - > Repeated UTI
  - > Bladder adenocarcinoma
  - > Colonic adenocarcinoma
  - > Uterine prolapse
- Sexual function and libido are normal in extrophy patients.

# Epispadias

*Very rare*

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- The urethra open in the dorsal surface of the penis anywhere from the glans, penile shaft or most commonly the **penopubic region**.
- Etiology represents **failure of closure of the cloacal membrane**, resulting in the bladder and urethra opening directly through the abdominal wall
- M:F ... 5:1
- **High morbidity** + **incontinence, infertility, reflux.**



# Management

- **at 6–12 months** >> This involves **urethroplasty** with functional and cosmetic reconstruction of the external genitalia (penile lengthening and correction of chordee).  
*Keeping urethra in normal orthotopic position*
- **The modified Cantwell–Ransley technique** is commonly used in **males**. It describes mobilizing the urethra to the ventral aspect of the penis, with advancement of the urethral meatus onto the glans with a reverse MAGPI (meatal advancement-glanuloplasty) .
- **From age 4–5 years** >> when children can be toilet trained, **bladder neck reconstruction** can be performed (**Young–Dees–Leadbetter procedure**). This achieves continence, and any bladder residuals may then be emptied by urethral catheterization.

# Phimosis



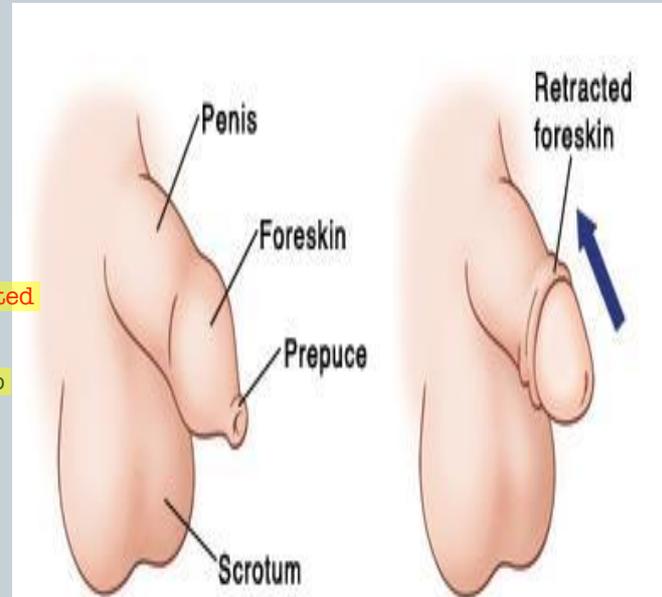
Tight foreskin, causing recurrent infection -UTI- (collection of bacteria under foreskin)+ ballooning of foreskin during

54

Is when the foreskin cannot be retracted behind the glans.

- A **physiological phimosis** is present at birth due to adhesions between the foreskin and glans.
- As the penis develops, epithelial debris (smegma) accumulates under the foreskin, causing gradual separation.
- 90% of foreskins are retractile at age **3 years** , (<1% of phimosis at **age 17**)

With time improve spontaneously or treated cortison or corticosteroid cream  
\*if not improved we do circumcision



The unretreated foreskin and prepuce cover the penis. Retraction of the foreskin uncovers the head of the penis.

#Pathological phimosis--> secondary to scars in foreskin

\*Treatment\*

- **Recurrent balanitis in uncircumcised males can cause new phimosis**

## Circumcision

For Information,  
Visit: [www.epainassist.com](http://www.epainassist.com)

ePainAssist.com

**Uncircumcised  
Penis**

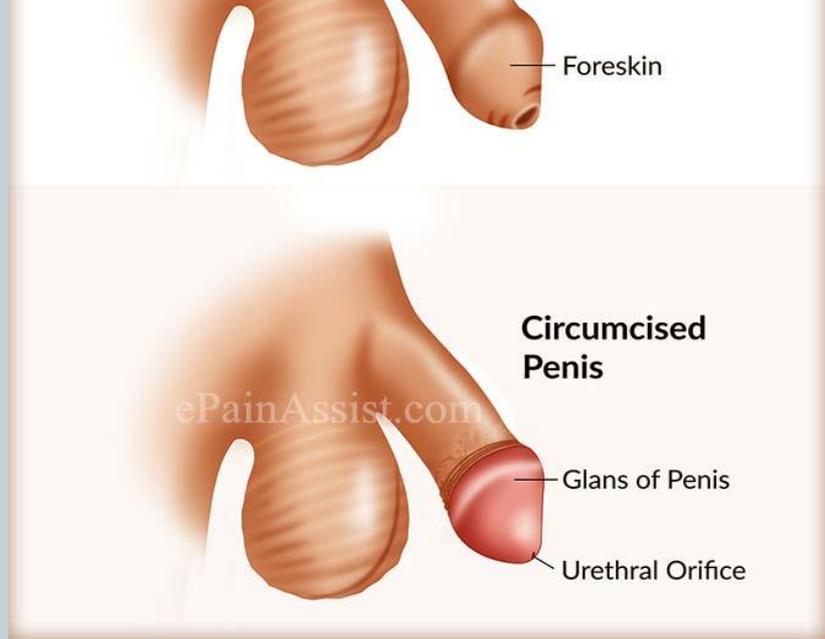
Foreskin

**Circumcised  
Penis**

ePainAssist.com

Glans of Penis

Urethral Orifice



# Treatment



- **Older children** with phimosis, suffering recurrent infection (balanitis), can be treated with a **6-week course of topical 0.1% dexamethasone cream**, which acts to soften the phimosis and allow foreskin retraction (**avoid circumcision where possible**).
- **Adults** may require a **dorsal slit or circumcision** for recurrent balanitis, voiding obstruction, or difficulties with sexual intercourse.

# Paraphimosis

Serious pathology !

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- Paraphimosis is when the **uncircumcised foreskin** is retracted under the glans penis and the foreskin becomes edematous, and cannot be pulled back over the glans into its normal anatomical position.



phimosis



paraphimosis

Retract foreskin+ left it backward retracted

Ring around glans

Increase with time  
bez of edema

Pt may develop gangrene or necrosis of glans !



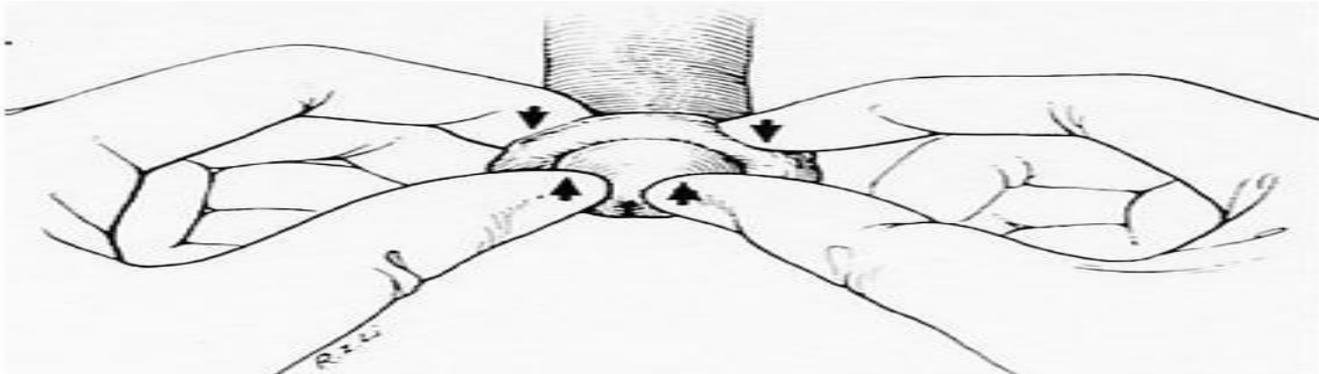
- It occurs most commonly in **teenagers or young men** and also in elderly men (who have had the foreskin retracted during catheterization, but where it has not been returned to its normal position).
- Paraphimosis is usually **painful**. The foreskin is edematous and a small area of ulceration of the foreskin may have developed.

# Treatment:

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- **Manual reduction** is preferred using **ice packs**, **elastic compression**, and **topical anesthetic** such as **2% lidocaine gel**.
- Operative **dorsal slit** may be required in refractory cases.
- **Elective circumcision** for definitive treatment (paraphimosis tends to recur).

Figure 5. Paraphimosis Reduction



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سید مہر

# Disorder of sexual differentiations:



**ARE DEFINED AS CONGENITAL CONDITIONS  
IN WHICH THE DEVELOPMENT OF CHROMOSOMAL,  
GONADAL, OR ANATOMICAL SEX IS ATYPICAL.  
THEY ARE ESTIMATED TO AFFECT 1 IN 4500 BIRTHS.**

# DSD are subdivided into:



- \* SEMINIFEROUS TUBULE DYSGENESIS (KLINEFELTER SYNDROME XXY, 46XX MALE).**
- \* TURNER SYNDROME 45XO.**
- \* TRUE HERMAPHRODITES 46XX, XY WITH BOTH OVARIAN AND TESTICULAR TISSUE.**
- \* MIXED GONADAL DYSGENESIS (STREAK GONADS AND AMBIGUOUS GENITALIA).**
- \* PURE GONADS DYSGENESIS (FEMALE WITH STREAK GONADS).**

# Diagnosis:



- \*DETAILED HISTORY AND MATERNAL HISTORY ESPECIALLY DRUGS USED DURING THE PREGNANCY AS STEROID AND CONTRACEPTIVE PILLS**
- \*GENERAL EX MAY SHOW ASSOCIATED SYNDROME ,EVIDENCE OF DEHYDRATION, POSITION OF URETHRAL MEATUS ,CAREFUL PALPATION MAY SHOW THE PRESENCE OF TESTES AND THE PRESENCE OF FEMALE PSUDOHERMAPHRODITES.  
CHROMOSOMAL ANALYSIS CONFIRM KARYOTYPE.**
- \*SERUM ELECTROLYTE ,TESTOSTERONE ,DHT FOR SALT WASTING IN CAH.**
- \* $17$  HYDROXY PROGESTERONE DONE AFTER 3 DAYS CAN DIAGNOSE  $21$  HYDROXYLASE DEFICIENCY.**
- \*HCG STIMULATION TEST CAN DIAGNOSE ANDROGEN RESISTANCE AND  $5\alpha$  REDUCTASE DEFICIENCY.**

# Treatment



**A MULTIDISCIPLINARY APPROACH IS REQUIRED WITH FULL PARENTAL INPUT. GENDER ASSIGNMENT OF AMBIGUOUS GENITALIA IS GUIDED BY THE FUNCTIONAL POTENTIAL OF GONADAL TISSUE, REPRODUCTIVE TRACTS, AND GENITALIA, WITH THE AIM OF OPTIMIZING PSYCHOSOCIAL WELL-BEING AND PRODUCING A STABLE GENDER IDENTITY.**

**PATIENTS HAVE A HIGHER RISK OF GONADAL MALIGNANCY, WHICH REQUIRES SURVEILLANCE AND/OR REMOVAL OF GONADAL TISSUES AND HORMONE REPLACEMENT.**

# \*Renal cysts and Benign renal tumors

## \*Renal cyst :

\*The **most common** (70%) are simple cysts, present in >50% of those aged >50y.

\*Rarely symptomatic, usually **incidental finding on abdominal imaging**

# Etiology :

❑ **Developmental** - Multicystic dysplastic kidney (MCDK)

❑ **Genetic** Autosomal recessive polycystic kidney disease (ARPKD),

massive kidneys with early renal failure in children associated with hepatic disease and blood vessels of brain and heart

❑ autosomal dominant polycystic kidney disease (ADPKD),

progressive bilateral disease leading to hypertension and renal failure associated with hepatic cysts and cerebral aneurysms

❑ Cysts associated with systemic disease

❑ - Von Hippel-Lindau syndrome (VHLS), renal cysts, cerebellar and retinal hemangioblastomas, pancreatic and epididymal cysts  
30-40% incidence of renal cell carcinoma

❑ tuberous sclerosis (TS)

Autosomal dominant syndrom characterized by mental retardation , epliepsy , adenoma sebacaum , and other hamartomas

❑ Acquired Simple cysts, acquired cystic renal disease, medullary sponge kidney (MSK): dilatations of the collecting ducts usually benign course, but predispose to calcium phosphate stones

❑ Malignancy Cystic renal cell carcinoma (RCC)

# \*Solitary (simple) cyst of the kidney

## The cyst:

- Contains **Clear Fluid** & may contain altered blood .
- Lined by **Flat** epithelium.
- Surrounded by **Fibrous** tissue

C/P

Usually **ASYMPTOMATIC**.

- Dull aching **PAIN** in the loin due to stretch of renal capsule.
- A **SWELLING** may be felt in the loin.
- Clinical picture of complications (e.g. Hematuria , pyuria...etc.)

Complications: ✓✓

**Hemorrhage**

- Rupture , pressure on ureter ( → Hydronephrosis)
- Infection & Calcification.

# Investigations:

## A. FOR DX:

1. **U/S** is very helpful

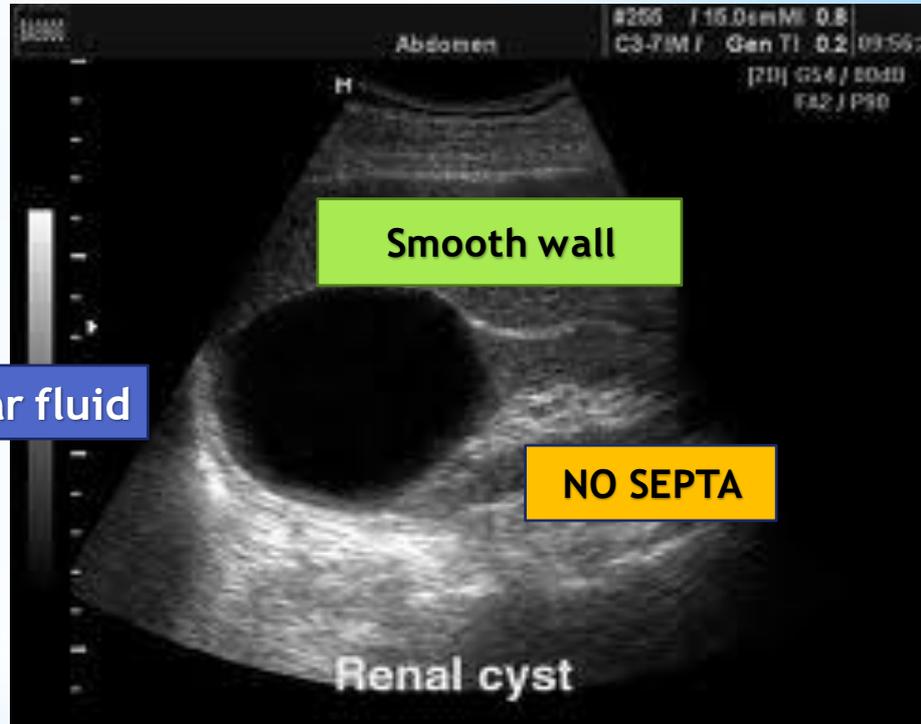
○ Differentiates between **SOLID** and **CYSTIC** lesions.

○ Features of **cyst** are:

(a) **Anechoic** ( echolucent  
...absent of echoes )

(b) **Posterior acoustic  
enhancement**

(c) **Sharply margined smooth  
walls**

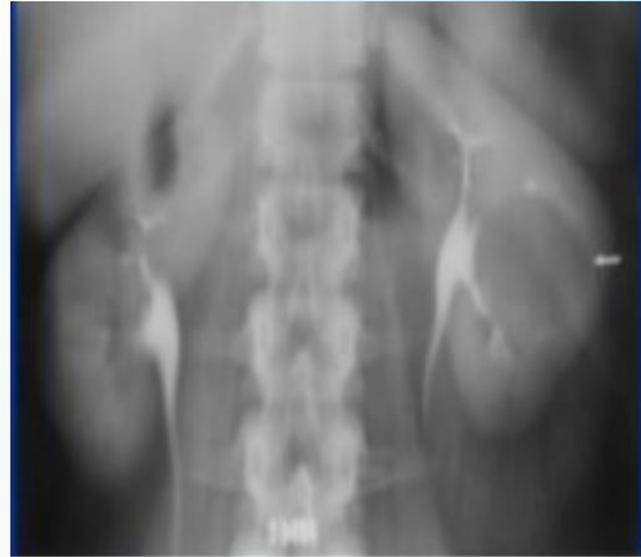


\* **2. IVU** *→ for renal tumor if suspected*

\* ○ smooth amputated calyx.

beak , claw sign ; resulted from stretching

of calyces by cyst



**3. Renal angiography:** *(not done now)* → differentiate between **CYST** and **TUMOR** .

- **Cyst** → avascular
- **Tumor** → Hypervascular



\*Cystic dysplastic kidneys. **Micturating cystourethrogram** on an infant with dysplastic kidneys on ultrasound showing vesicoureteric reflux into tortuous ureters and abnormal calyces with parenchymal filling and blush.

# Bosniak Renal Cyst Classification System

12/10

according CT scan w/o contrast

- I** - **Simple cyst** with a hairline-thin wall.
- No septa, calcifications, or solid components.
- Water attenuation, no enhancement.
  
- II** - **Septa:** few hairline-thin in which not measurable enhancement may be appreciated.
- **Calcification:** fine or a short segment of slightly thickened may be present in the wall or septa.
- **High-attenuation:** uniform in lesions (< 3cm) that are sharply margined and do not enhance.

- IIF** - **Septa:** multiple hairline-thin in which not measurable enhancement of septum or wall is appreciated.
- **Minimal thickening of wall or septa**, which may contain calcification, that may be thick and nodular, but no measurable contrast enhancement.
- No enhancing soft-tissue components.
- **Intrarenal:** totally intrarenal nonenhancing high-attenuating renal lesions > 3 cm

we should follow up

usually

- **Measurable enhancement**
- III** Cystic mass with thickened irregular or smooth walls or septa in which measurable enhancement is present

we should treat them (surgery, partial or radical nephrectomy)

- **Enhancing soft-tissue components**
- IV** Clearly malignant cystic masses that can have all of the criteria of category III but also contain distinct enhancing soft-tissue components independent of the wall or septa

has high % of being RCC

# \*Treatment :

\* 1-no ttt but follow up is required !

\* treat them only if they start to produce symptoms, such as pain, bulge or swelling or complications such as hematuria or pyuria   
 *communication btw renal cyst & pelvicalyceal system.*

\* 2-if the cyst cause hydronephrosis, ttt → **Aspiration of fluid in cyst**   
 *↳ usually recure; unless you inject sclerosing agent [95% alcohol]*

→ **Excision** maybe required.   
 *↳ the best, in laparoscopic technique. easy, 30min, very low recurrence*

3-Atypical cyst (hemorrhagic, thick wall or cloudy fluid) :

→ PNA of content for analysis. Blood, high fat content or +ve cytology gives high suspicion of malignancy.

→ Excise the extrarenal portion of cyst.

→ Partial nephrectomy maybe considered.

# \*RENAL TUMORS

→ Malignant → RCC

**BENIGN**

Angiomyolipoma

Renal adenoma

Oncocytoma

Table 1. WHO Classification of Benign Renal Masses

Classification	Types
Epithelial Tumors	Oncocytoma Papillary adenoma
Mesenchymal Tumors	Angiomyolipoma Leiomyoma Hemangioma Reninoma Schwannoma Lymphangioma
Mixed Epithelial and Mesenchymal Tumors	Mixed epithelial and stromal tumor Cystic nephroma
Metanephric Tumors	Metanephric adenoma Metanephric adenofibroma Metanephric stromal tumor

# \* Oncocytoma

- a **BENIGN RENAL EPITHELIAL NEOPLASM that arise from the intercalated cells of collecting ducts** that comprises approximately 5-9% of renal tubular epithelial tumors
- accounting for 3-7% of renal tumors , more common in **males** .
- They occur with RCC in 7-32% of the cases.
- **Presentation** :83% present as an incidental finding or with flank pain or hematuria

\* **gross appearance:**

- **mainly unilateral**
- **can be multiple and bilateral**
- **Mean size 4-6cm**

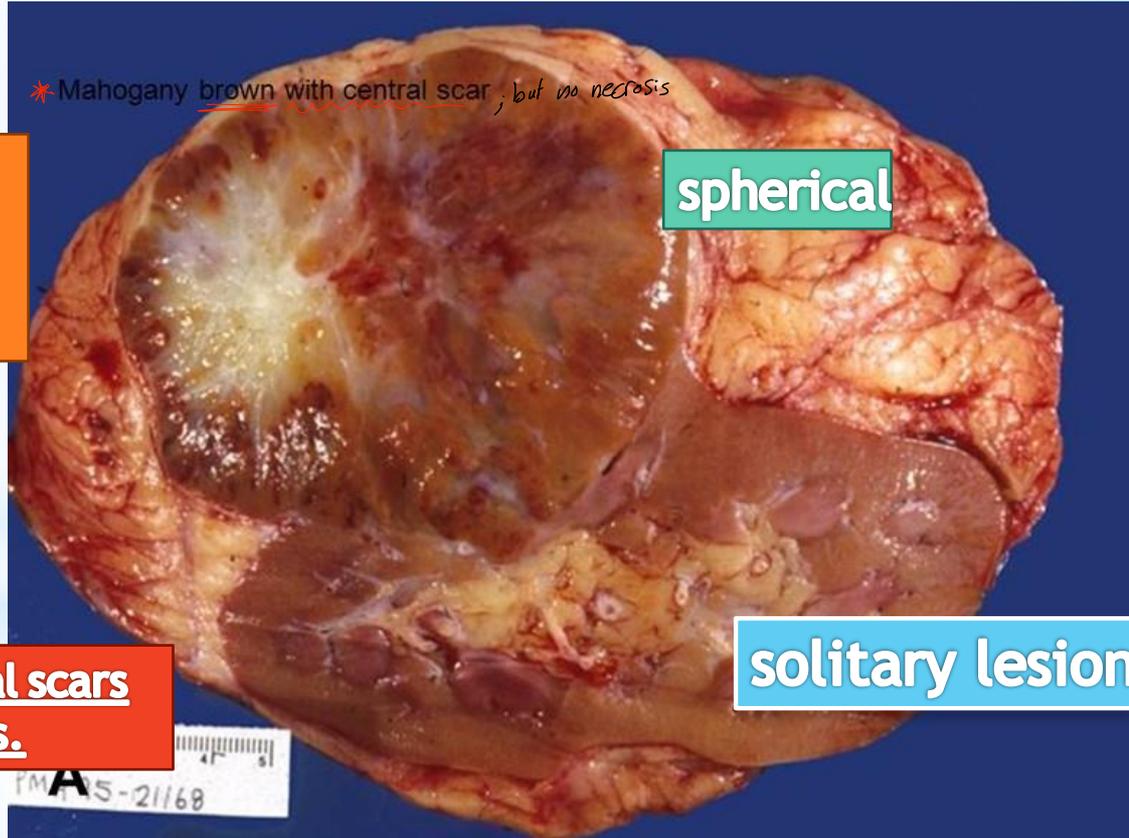
Well defined fibrous capsule with 10-20% extending into the perinephric fat

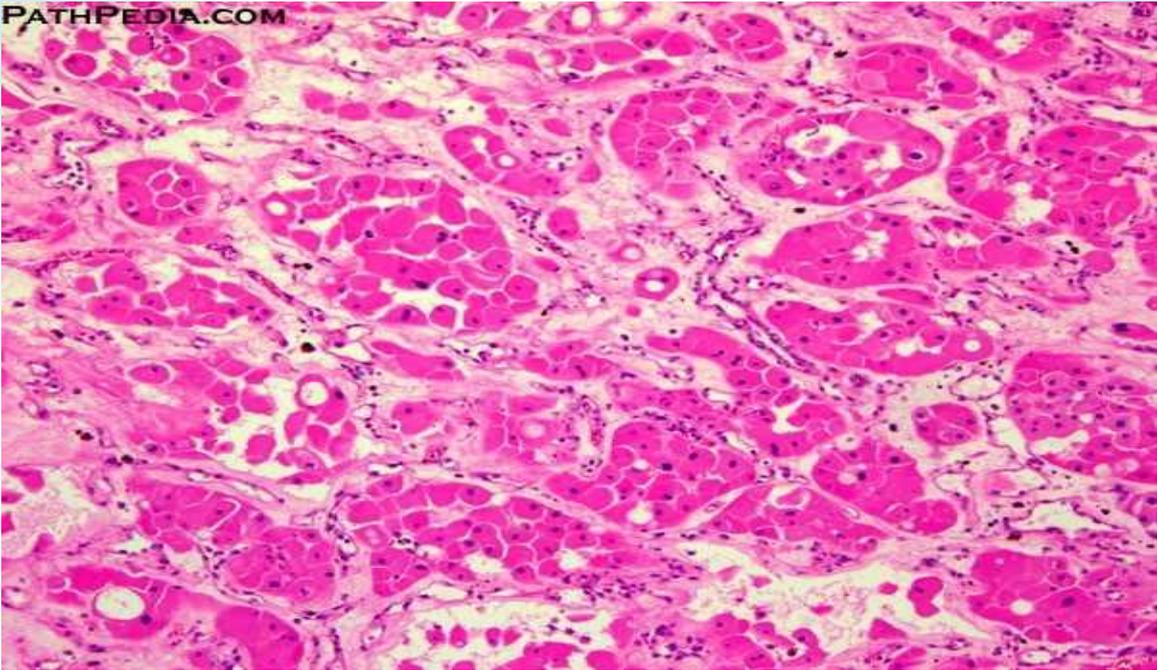
\* Mahogany brown with central scar ; *but no necrosis*

**spherical**

**brown with a central scars but no necrosis.**

**solitary lesion**





- **Histological:** organized **eosinophilic cells** originating from intercalated cells of collecting duct, mitoses are rare and they are considered benign, **not** known to metastasize.

\* **Diagnosis :**

\* oncocytoma **cannot** often be distinguished radiologically from RCC , it may coexist with RCC.

\* rarely they exhibit a **SPOKE WHEEL PATTERN** on **CT scanning** , *→ characteristic of oncocytoma*



*central scar of oncocytoma*



# MANAGEMENTS

*\*depend on the size\**

**HUGE** > 4 cm

**PARTIAL/RADICAL  
NEPHRECTOMY**

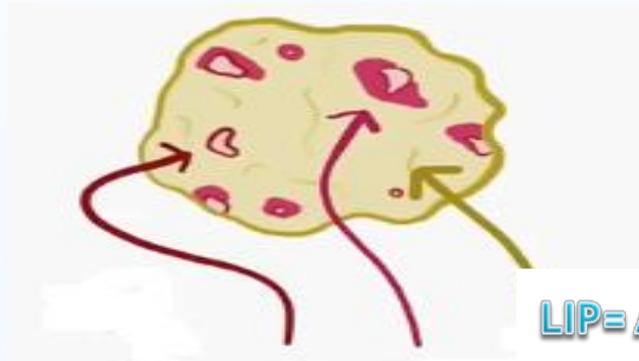
**SMALL**

*< 4cm → left untreated*  
*> 4cm, asymptomatic 100% sure this is oncocytoma with spoke wheel appearance*

- Minimally invasive techniques :
  - 1- Radiofrequency ablation (RFA). (less than 3-4cm )
  - 2- High intensity focused ultrasound (HIFU). Non invasive therapeutic techniques that uses non ionizing ultrasonic waves

# \* Angiomyolipoma

→ easily differentiated from malignant RCC by the presence of adipose or fat within tumor



ANGIO=  
Blood vessels

MYO= smooth  
muscle

LIP= Adipose tissue

- Rare **benign** clonal neoplasms, less than 1%, **F**>**M**, *≠ most of them found incidental >50% on U/S & CT<sub>scan</sub>*, *≠ might present with flank pain mass or painless hematuria*
- 20% associated with **tuberous sclerosis**.
- TS syndrome (autosomal dominant) characterized by mental retardation, epilepsy, adenoma sebaceum, and other hamartomas (mean age 30).
- frequently, AMLs are **multifocal and bilateral**.
- Solitary AMLs are more frequently found in the right kidney.

## ➤ Presentation:

➤ incidental finding >50% on US and CT, they may present with

➤ flank pain,

➤ palpable mass, or painless haematuria.

➤ Massive and life-threatening retroperitoneal bleeding occurs in up to 10% of cases

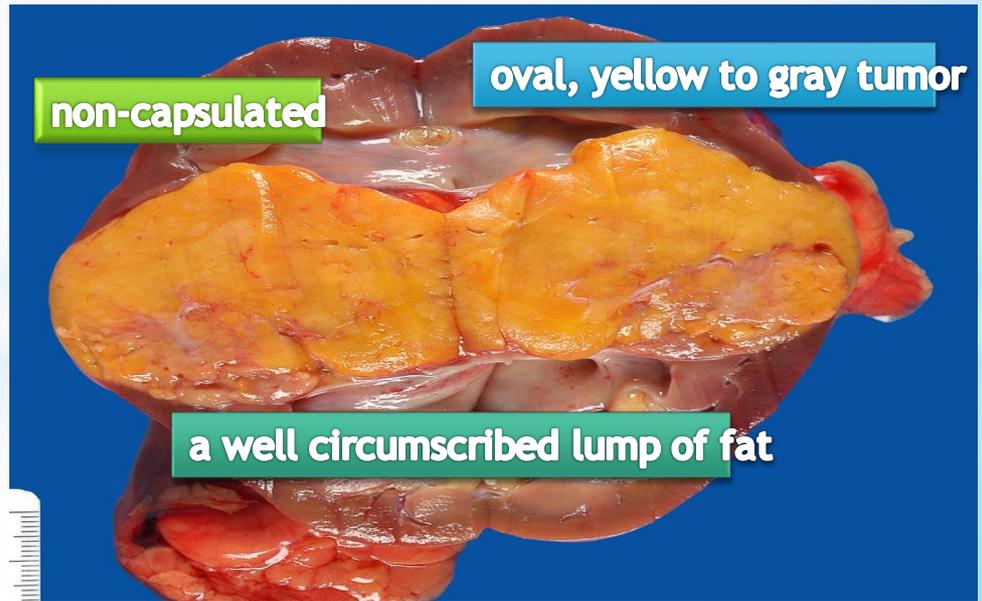
(Wunderlich's syndrome). is spontaneous, nontraumatic renal hemorrhage confined to the subcapsular and perirenal space. It may be the first manifestation of a renal angiomyolipoma (AML), or rupture of renal artery or intraparenchymal aneurysm

*Usually seen in*

Pregnant women appear to be at an increased risk for hemorrhage .

AML is composed of PERIVASCULAR epithelioid cells (PEC)

Gross appearance:



## \*Management :

1- asymptomatic AMLs can be followed with serial US if  $<4$  cm .

2- symptomatic AMLs (bleeding) or  $>4$  cm should be treated surgically or by embolization.

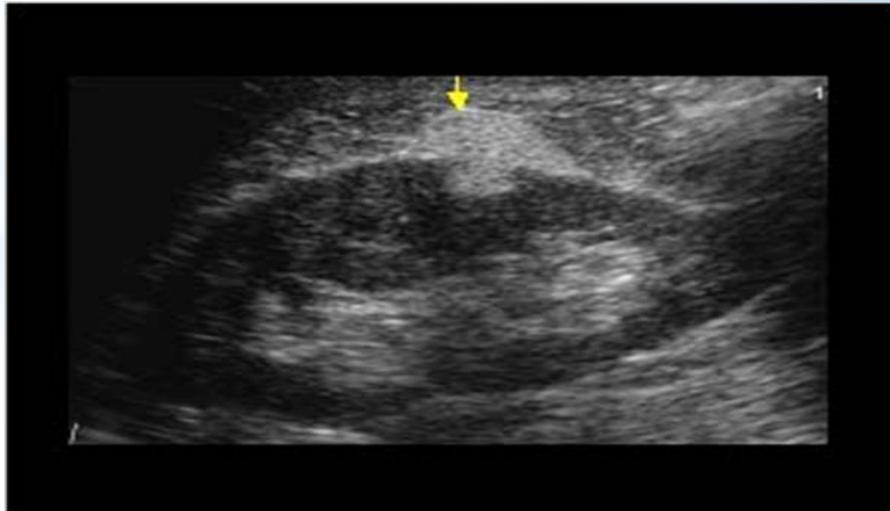
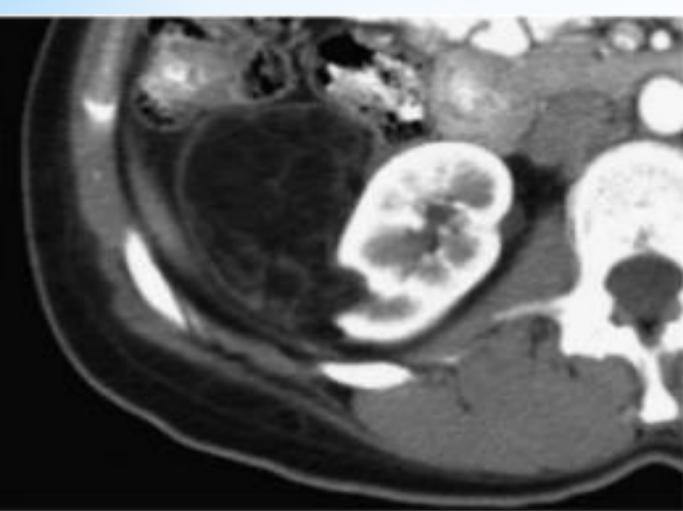
*if symptomatic with bleeding or  $>4$  cm*  
\*emergency nephrectomy or selective renal artery embolization  
may be life saving . *very rare (for wauerlich's syndrome)*

\*in patient with TS , in whom multiple bilateral lesions are present , conservation treatment should be attempted .

# Investigation: *→ easy to differentiate from RCC*

\* **Ultrasound** reflects from fat, hence a characteristic bright echo pattern. This does not cast an 'acoustic shadow' beyond, helping to distinguish an AML from a calculus.

➤ **CT** shows fatty tumour as low density in 86% of AMLs



**Figure 1: Kidney ultrasound. Ultrasound reveals a homogeneous, well-defined, hyperechoic lesion in the left lower kidney, which demonstrates the presence of macroscopic fat. Renal angiomyolipoma is the most likely diagnosis**



# ANGIOMYOLIPOMA

IF LARGE

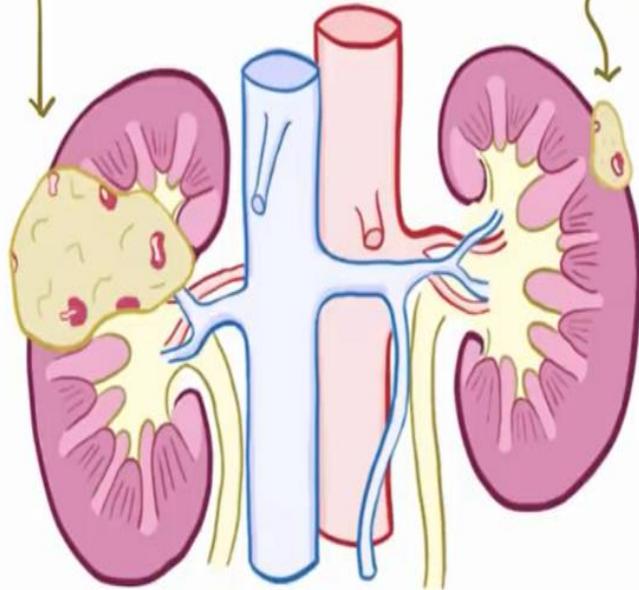
MASS EFFECTS may  
IMPAIR FUNCTION



CHRONIC KIDNEY  
DISEASE



END-STAGE RENAL  
DISEASE



IF SMALL

\* usually HARMLESS

\* do not require

TREATMENT

# ANGIOMYOLIPOMA

ANGIOMYOLIPOMAS have a  
high density of **BLOOD VESSELS**



difficult to **RESECT**

alternatively **DESTROY** the  
**BLOOD SUPPLY**  
with **EMBOLIZATION**

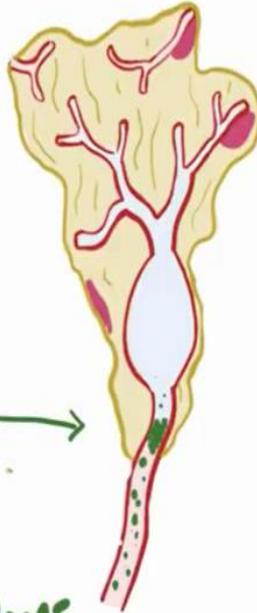


TUMOR can become  
**NECROTIC & SHRINK**



**POSTEMBOLIZATION SYNDROME**

↳ fever, flank pain & malaise



**LARGE TUMORS** can develop  
**IRREGULAR BLOOD VESSELS**



that can **DILATE**



forming an **ANEURYSM**



that can **RUPTURE**



can cause **FLANK PAIN**



**HYPOVOLEMIC SHOCK**  
(esp. if near major **BLOOD VESSEL**)

# \*Renal adenoma

- Renal adenomas are the **most common** form of benign renal tumor . Their cause is unknown. incidence **increase with age** .
- It is traditionally classified into **three distinct types** :
  - 1-renal **papillary** adenoma (the most common renal epithelial neoplasm )
  - 2-renal **tubular** adenoma
  - 3-**alveolar** renal adenoma

- 7 - 23 % at autopsy
- M:F = 3:1
- Cytogenetics : which may exhibit *trisomy of chromosome 7 & 17*
- small cortical lesion < 1 cm
- **Rarely** symptomatic

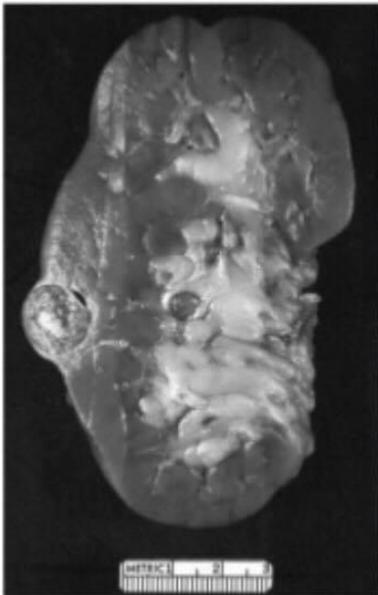


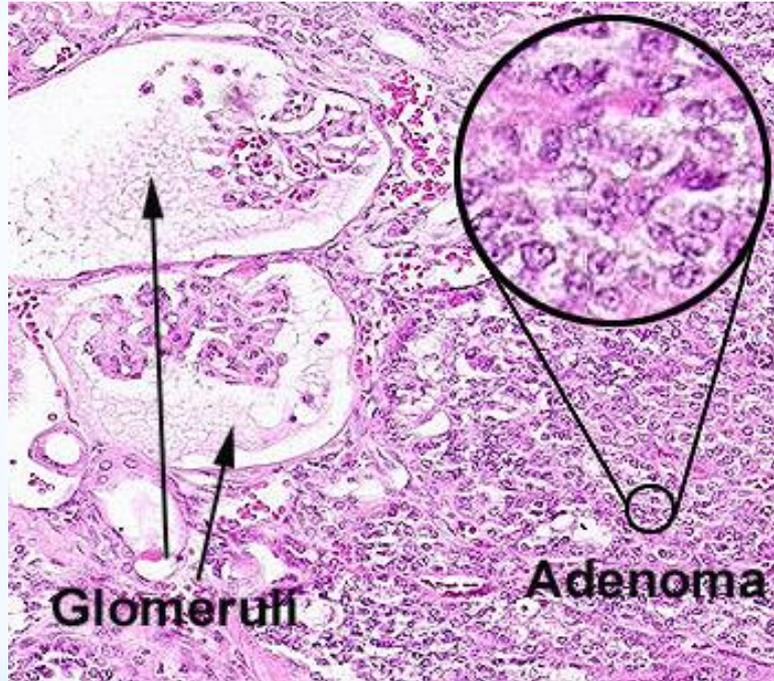
Fig. 1-199 AFP 3rd Series, Vol. 11  
RENAL CORTICAL ADENOMA



**gross appearance :**

**solid ,non-capsulated** kidney tumor, and are typically small.

Majority are solitary but may be multifocal



➤ Histological : organized cells with **no atypia** or little atypia

- Adenoma cells **look much like low-grade RCC cells** under a microscope. In fact, while they are considered benign, there is presently no known cellular classification to differentiate them from RCCs. Many researchers and physicians regard them as early stage precancers, to be treated accordingly.
- Controversy as to whether this represent benign or pre-malignant neoplasm
- **Incidental finding on CT**

Management : **Partial / radical nephrectomy** if mass  $> 3\text{cm}$  due to increase risk of metastasis

→ bcz of any renal mass appearing on CT scan or US other than angiomyolipoma, usually not differentiated whether it is benign or malignant, therefore almost always after doing partial or radical nephrectomy.

## Other rare tumors:

- \* Leiomyoma
- \* Hemangioma
- \* Lipoma
- \* Juxtaglomerular cell tumors
- \* Fibroma
- \* Rhabdomyoma

# Malignant renal tumors

*we will talk about one of them.*

---

Done by: Batool Al Hbaishan



# Renal tumors

## Benign

1. Adenoma.
2. Angioma.
3. Angiomyolipoma.

## Malignant

### Primary

#### Parenchyma (90%)

1. Wilms' tumor.
2. Renal cell carcinoma.

### Secondary

#### Pelvis (10%)

1. Transitional cell carcinoma.
2. Squamous cell carcinoma.

# Renal cell neoplasms

---

- Malignant renal tumors
  - Renal cell carcinoma
  - Nephroblastoma (wilm's tumor)
  - Neuroblastoma

# Renal cell carcinoma (hypernephroma/ Grawitz's tumor) Clear cell, renal cell CA

misnomer, because we  
thought it originated from

---

- The **commonest** of renal tumours
- **85%** of renal malignancies
- constituting **2–3%** of all cancer deaths
- The **most lethal** of all urological tumours, approximately **40%** of patients dying of the condition.
- more in **males** (M:F = **2:1**)
- peak incidence of sporadic RCC is between 50–70y of age.

# Renal cell carcinoma

## Risk factor

---

- ✓ **Smoking cigarettes** doubles the risk of developing kidney cancer.
- ✓ **Gender. Men** are 2 to 3 times more likely to develop kidney cancer than women.
- ✓ **Race.** Black people have higher rates of kidney cancer.
- ✓ **Age.** Kidney cancer is typically found in adults and is usually diagnosed **between** the ages **of 50 and 70.**

- 
- ✓ **Nutrition and weight** Research has often shown a link between kidney cancer and **obesity, vitamins A, C, E, and fruit and vegetable consumption are protective.**
  - ✓ **High blood pressure** *HTN*
  - ✓ **Overuse of certain medications** esp. Painkillers containing **phenacetin** Diuretics and analgesic pain pills, such as aspirin, acetaminophen, and ibuprofen, have also been linked to kidney cancer.
  - ✓ **Occupational with asbestos and cadmium exposure**
  - ✓ **Chronic kidney disease**

- 
- ✓ **Long-term dialysis** → are at very high risk of developing RCC  
the highest risk of developing this CA
  - ✓ **Family history of kidney cancer** People who have first-degree relatives with kidney cancer have an increased risk of developing
  - ✓ **Anatomical risk factors include polycystic and horseshoe kidneys.**

# Renal cell carcinoma etiology

---

## Genetic :

### **\*\*Clear cell renal cell carcinoma:**

This is associated with deletion of chromosome 3p and/or mutations of the VHL gene.

### Von Hippel–Lindau (VHL) syndrome

Half of individuals with this autosomal dominant syndrome, characterized by pheochromocytoma, renal and pancreatic cysts, and cerebellar hemangioblastoma,

develop RCC, often bilateral and multifocal.

Patients typically present in third, fourth, or fifth decades.

- 
- **Chromophobe RCC** is a result of **loss of chromosome 17**
  - **A papillary variant of RCC** also has an autosomal dominant familial component, **characterized by trisomy 7 and 17**
  - **Tuberous sclerosis complex (TSC)** is a genetic condition associated with changes in the skin, brain, kidney, and heart. People with TSC also have an increased risk of developing angiomyolipomas of the kidney and kidney cancer

---

## ➤ Origin :

RCC is adenocarcinoma of the renal cortex, arise from Epithelium of proximal convoluted tubules

## ➤ Site :

Usually unilateral mainly from upper pole.

\*\* Bilateral tumor (1-2%) :

- ① • Von-Hippel Lindau disease
- ② • hereditary papillary renal carcinoma (*genetic*)

## ➤ Macroscopic picture :

---

- **Mass** (mainly from upper pole of kidney) infiltrating edge
- area of **hemorrhage ,necrosis and scarring**
- **golden yellow color** due to **high lipid content**
- They are usually circumscribed by a **pseudocapsule of compressed tissue**
- 7-20% are **multifocal**, 10–20% contain **calcification**, and 10–25% contain **cysts or are predominantly cystic**.
- usually invades the **pelvis early, capsule late**

# ➤ Microscopic picture :

---

## Adenocarcinoma:

### a. Cells:

- **clear cell type** (due to lipid, cholesterol and glycogen content)
- **or granular cell type** (due to increased mitochondria in the cytoplasm of the cell ).

### b. Vascular CT. ○

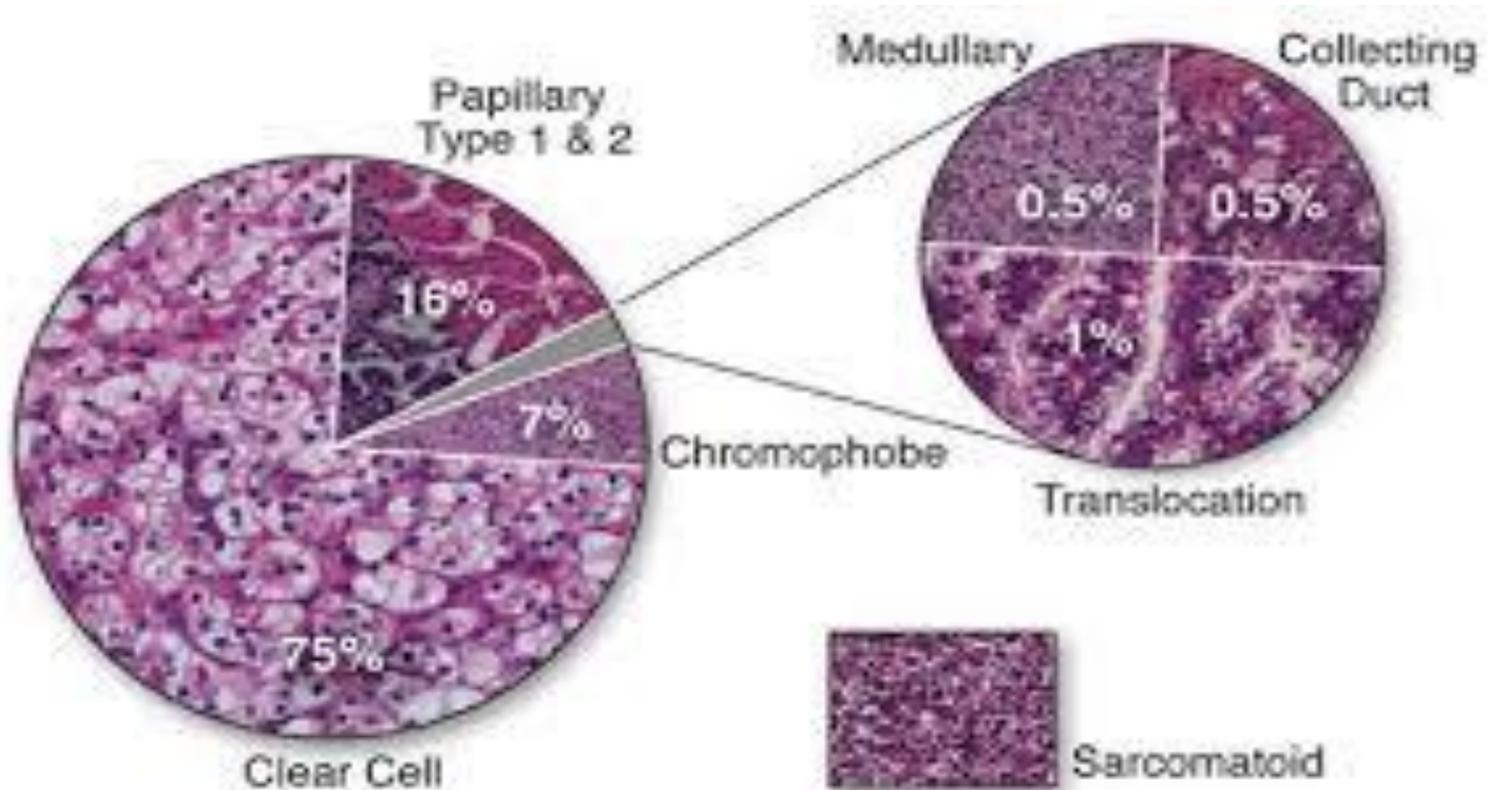
# Spread:

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- By **Direct** extension to adrenal gland (7.5% in tumors >5 cm), through the renal capsule, into the renal vein, inferior vena cava (IVC), right atrium
- By **Lymphatics** to hilar and para-aortic lymph nodes
- **Hematogenous** to lung (75%), <sup>MC</sup> bone (20%), liver (18%), and brain (8%).

*✍️ most common organ metastasis to the kidney is the lung  
from kidney to lung (MC) & W*

# Histological classification of RCC



# Histological classification of RCC :

- 
- **Conventional (70–80%)**: <sup>mc</sup> arise from the proximal tubule; highly vascular; cells clear (glycogen, cholesterol) or granular (eosinophilic cytoplasm, mitochondria) <sup>Clear cell</sup>
  - **Papillary (10–15%)**: papillary, tubular, and solid variants; 40% multifocal
  - **Chromophobe (5%)**: arises from the cortical portion of the collecting duct
  - **Collecting duct (Bellini)**: <sup>rp</sup> rare; young patients; poor prognosis
  - **Medullary cell**: rare; arises from calyceal epithelium; young, Black, sickle-cell sufferers; poor prognosis

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## **Grading is by the Fuhrman system**

\*\* based on nuclear size , outline, and nucleoli

Grade 1 = well-differentiated

Grade 2 = moderately differentiated

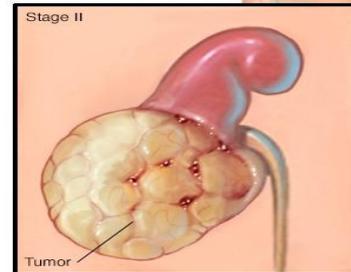
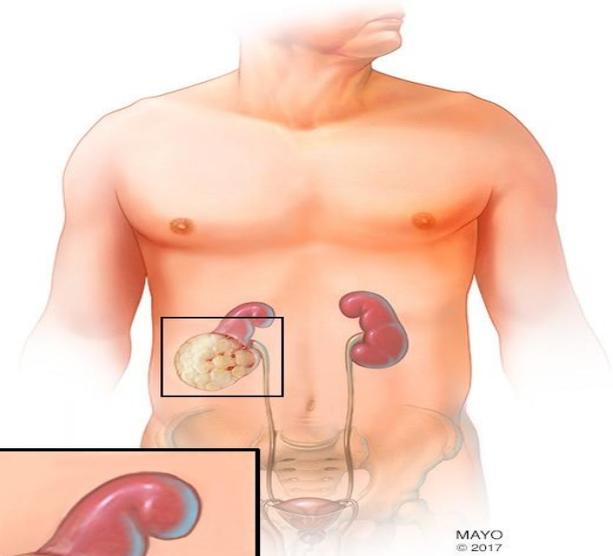
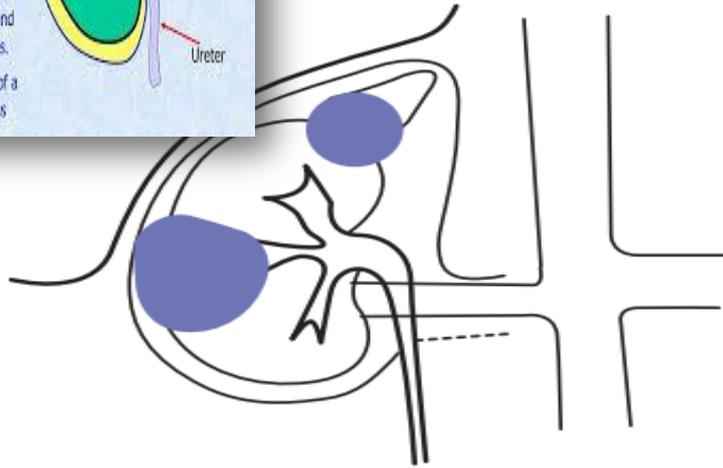
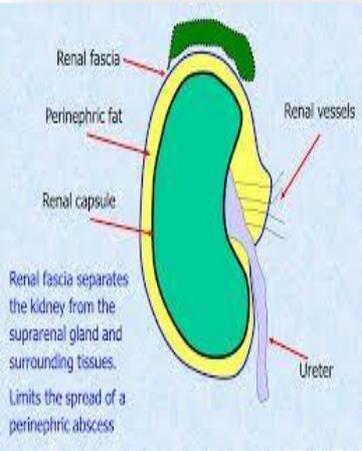
Grade 3 and 4 = poorly differentiated

**Staging is by the <sup>most imp.</sup> TNM** 

is the most important prognostic indicator for RCC

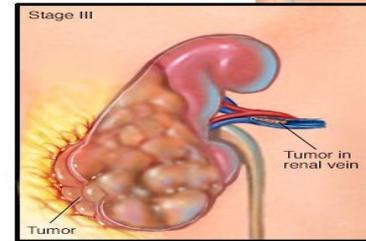
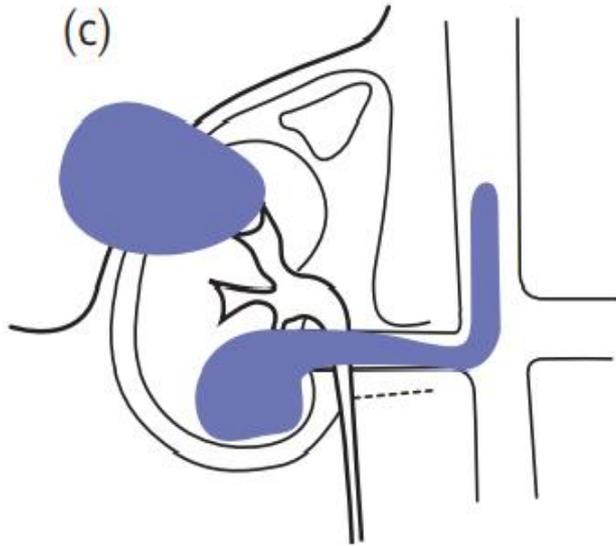


**Primary tumor is limited to kidney (T1/T2).**  
**T1a is < 4 cm And T1b >4 cm But not >7 cm**  
**T2 is >7 cm**



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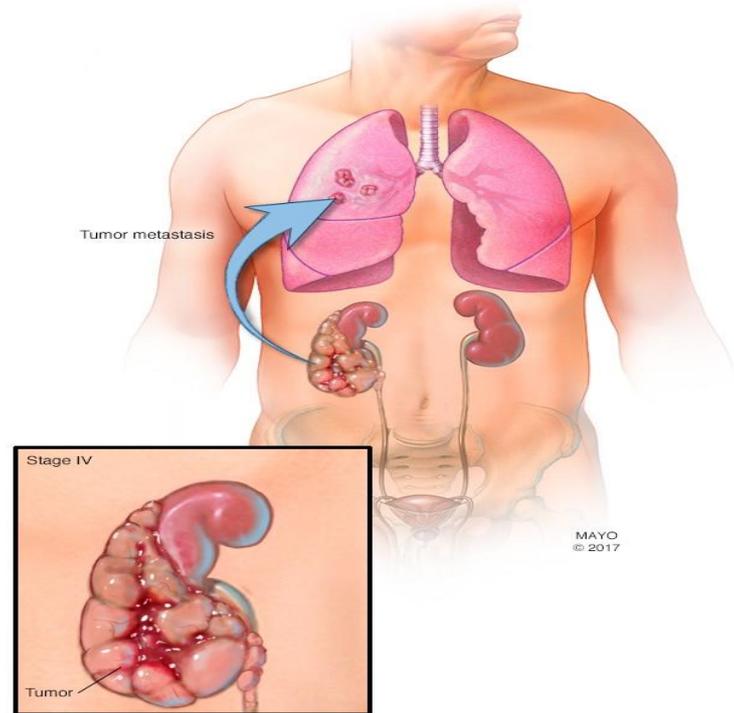
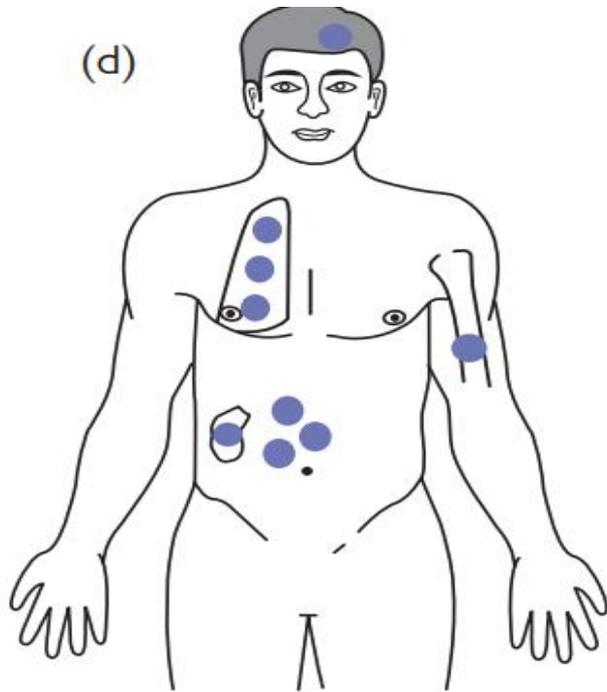
**(b) Primary tumor invades perinephric tissue but not beyond perinephric fascia or invades adrenal gland (T3a)**



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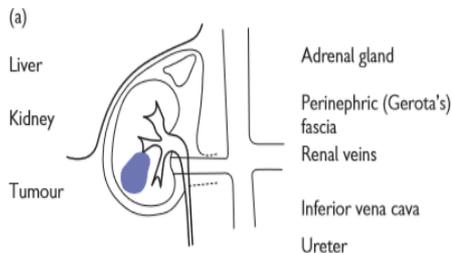
(c) Primary tumor extends into **renal veins** or **IVC** below the **diaphragm (T3b)**; **above** the **diaphragm** into right atrium or invades wall of vena cava (**T3c**); or outside perinephric fascia (e.g., into liver, bowel, or posterior abdominal wall) (**T4**)



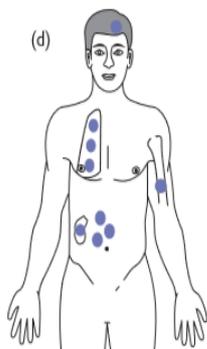
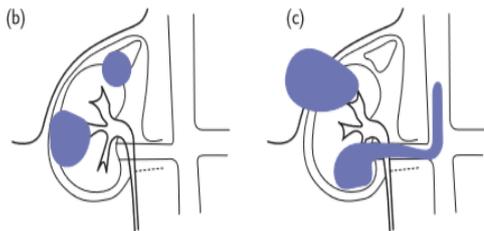
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**(d) N and M staging:** involves multiple para-aortic or paracaval nodes; pulmonary, bone, or brain metastases **(T1-4N2M1)**



T1 & T2 are limited to kidney.



Adrenal gland involvement

**Table 6.13** TNM staging of RCC

Tx	Primary tumor <b>cannot be assessed</b>
T0	<b>No evidence of primary tumor</b>
T1	Tumor <b>&lt;7 cm</b> , limited to the kidney
T1a	Tumor is <b>4 cm or less</b> , limited to kidney
T1b	Tumor <b>&gt;4 cm but &lt;7 cm</b> , limited to kidney
T2	Tumor <b>&gt;7 cm</b> , limited to the kidney
T3	Tumor <b>extends outside the kidney, but not beyond Gerota's (perinephric) fascia</b>
T3a	Tumor <b>invades adrenal gland or perinephric fat</b>
T3b	Tumor <b>grossly extends into renal vein or subdiaphragmatic IVC</b>
T3c	Tumor <b>grossly extends into supradiaphragmatic IVC or heart; invades wall of vena cava</b>
T4	Tumor <b>invades beyond Gerota's fascia</b>
Nx	Regional (para-aortic) lymph nodes cannot be assessed
N0	No regional lymph node metastasis
N1	Metastasis in a single regional node
N2	Metastasis in 2 or more regional nodes
Mx	Distant metastasis cannot be assessed
M0	No distant metastasis
M1	Distant metastasis present

# prognosis -->Depends on T classification & staging

## Box 6.5 Prognosis—5-year survival

● Organ-confined	T1a	90–100%	Best survival rate
	T1b	80–90%	
	T2	70–80%	
● Capsular transgression/adrenal	T3a	60–70%	
● Renal vein or IVC thrombus	T3b/c	50–80% (25% with IVC wall invasion)	
● Visceral/lymph node involvement	T4 or N+	5–30%	
● Distant metastasis	M+	5–100%	

Nomograms have been developed to predict risk of recurrence

Reprinted with permission from Kattan MW, Reuter V, Motzer RJ, Katz J, Russo P. (2001).  
*J Urol* 166(1): 63–67.

# Clinical presentation

➤ 50% detected incidentally <sup>(mc)</sup> → U/S or CT

## ➤ symptomatic presentation

❖ 50% of patients present with hematuria

❖ 40% with flank pain

❖ 30% of patients notice a mass

❖ 10% patients exhibit the classic triad of hematuria, flank pain, and mass

# Clinical presentation

---

## ➤ symptomatic presentation

- ❖ 25% have symptoms or signs of metastatic disease ( bone pain, night sweats, fever, fatigue, weight loss, hemoptysis)
- ❖ pyrexia of unknown origin (9%),
- ❖ acute varicocele 5%
- ❖ lower limb edema
- ❖ 10–40% paraneoplastic syndromes<sup>\*</sup>, with any disease stage

# paraneoplastic syndromes

**Table 6.14** Paraneoplastic syndromes

**Syndrome associated with RCC**

*due to release of certain hormones*

**Cause**

Anemia

Hematuria, chronic disease

Polycythemia

Ectopic secretion of erythropoietin

Hypertension (25%)

Ectopic secretion of renin, renal artery compression, or AV fistula

Hypoglycemia

Ectopic secretion of insulin

Cushing

Ectopic secretion of ACTH

Hypercalcemia (10–20%)

Ectopic secretion of parathyroid hormone-like substance

Gynecomastia, amenorrhea, reduced libido, baldness

Ectopic secretion of gonadotrophins

Stauffer syndrome: hepatic dysfunction (increased liver function testing), fever, anorexia

Unknown; resolves in 60–70% of patients post-nephrectomy

Treated by excising tumor by partial or radical nephrectomy

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## ➤ Clinical examination

may reveal abdominal mass, cervical lymphadenopathy, non-reducing varicocele, or lower limb oedema (both suggestive of venous involvement).

# Investigation :

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- CBC ❖ Full blood count may reveal polycythemia or anemia.
- KFT ❖ kidney function test Serum creatinine and electrolytes, calcium,
- LFT ❖ liver function tests
- ❖ Urine cytology and culture: should be normal.
- ❖ Urine analysis → hematuria

# Investigation :

## ❖ Radiological evaluation :

○ Abdominal – pelvis US: cyst or solid , biopsy for diagnosis and staging.

○ CT scan : before and after contrast , **most important investigation**  
*→ best modality to diagnosis pt with RCC*  
*Urinary tract with IV contrast*

**any solid-enhancing renal mass is considered a renal carcinoma until proven otherwise!!** FNA, or CT guided FNA (biopsy) ⇒ CI in pt suspected renal mass, **except:**

\*Lymphadenopathy >2 cm is highly indicative of metastases

○ MRI : with gadolinium contrast for imaging the :

inferior vena cava or renal vein (MRV)

locally advanced disease

renal insufficiency

- ① Suspecting renal abscess → bone pain  
Clinically ill; fever chills & rigors
- ② Pt with known lymphoma & presented with 2° metastatic renal lymphoma  
only 2 indications for FNA in renal masses

- 
- Plain urinary tract (PUT) ) obliterated psoas shadow.
  - IVU pelvi-calyceal system is → Dilated, Enlarged Amputated Distorted (DEAD) )
  - Renal angiography differentiates benign from malignant (now replaced by CT) , also , Angiography may be helpful in planning partial nephrectomy or surgery for horseshoe kidneys

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○ **CT-guided fine needle aspiration (FNA)**: limited value !

□ false-negative biopsy results

□ risks of hemorrhage (5%)

□ tumor spillage (*Seeding*)

○ If doubt persists, **isotope renography** is used.

\*\*\*When RCC is diagnosed radiologically, **staging chest CT** will follow and **bone scan**, if clinically indicated. Any suggestion of renal vein or IVC involvement on CT may be further investigated with **Doppler USS or MRI**.

# Treatments modalities :

According to size & depend if localized or metastasis

❖ Localized disease :  $\leq 4\text{cm} \rightarrow$  Partial nephrectomy  
 $> 4\text{cm} \rightarrow$  Radical nephrectomy

✓ radical nephrectomy : if  $> 4\text{cm}$

• remove the kidney with renal capsule & perinephric fat & with Gerota's fascia, with excise upper half of ureter,  $\pm$  LN  $\pm$  Adrenal gland if involved  
• simple nephrectomy  $\rightarrow$  only we remove kidney with out any thing

○ Open approach :

**\*\*gold-standard curative treatment of localized RCC !**

1. Transperitoneal , thoracoabdominal , flank incision
2. excise the kidney with the perinephris (Gerota fascia)
3. ipsilateral adrenal gland : tumors  $> 5\text{ cm}$  , upper pole tumors , evidence of adrenal invasion
4. With regional nodes : hilar , para-aortic , paracaval

○ Laparoscopic approach <sup>MC</sup> : transperitoneal , retroperitoneal : masses of up to 10–12 cm

---

## partial nephrectomy :

- **multifocal, bilateral tumors**, particularly if the patient has **VHL** syndrome or **single functioning kidney**
- **small** (<4 cm) tumors, **even with a normal contralateral kidney**
- **local recurrence!**

∴ **Tumor ablation therapy** : thermal ablation by heating (radiofrequency ablation, or RFA) and cryotherapy

# Treat. Count.

Not radiosensitive

## Metastatic RCC :

lung, liver, bone subcutaneous sites, and central nervous system

- <sup>palliative</sup> **Nephrectomy** for **palliation** of symptoms (pain, hematuria)
- if inoperable, **arterial embolization** can be helpful
- **Hormone therapy and cytotoxic chemotherapy** : have little role
- **Radiotherapy** : is useful for **palliation** of metastatic lesions in **bone and brain**, and in combination with surgery for **spinal cord compression**

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➤ Immunotherapy : *علاج*

- IL-2 (Aldesleukin)
- Interferon A-2b

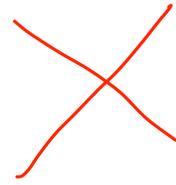
*Now* ➤ Molecular targeted therapies : *bcz RCC very vascular & produce lots of vessels* Sunitinib, Sorafenib, Temozolimod, Everolimus, Bevacizumab

➤ Palliative care : megestrol acetate , steroids

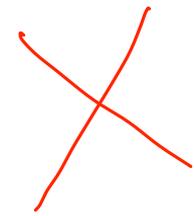
*if pt presented with →* **\*\*Resection of a solitary metastasis is an appropriate option for a small number of patients, usually a few months after nephrectomy, to ensure the lesion has remained solitary** *you can do metastasectomy after nephrectomy →, even it is brain (this type of palliative care)*

# Nephroblastoma ( wilm's tumour )

---



- ❖ Originated from the primitive embryonic cells
- ❖ Pathologically contains renal tissue with various degree of differentiation
  - Produces a mixed histological picture of epithelial structures
  - Resembling tubules and variety of mesenchymal tissues
- ❖ Affect 1:10000 live birth , it is the 4<sup>th</sup> malignancy in children, represent 10% of childhood malignant tumour
- ❖ Almost equal in both sex
- ❖ It is may be familial in 1-2% of cases



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**60%** presented **before the age of three years**

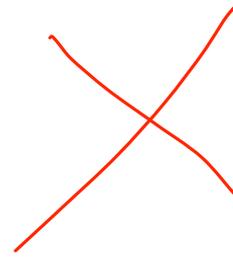
**90%** presented as **abdominal mass**

**10%** of tumours are **bilateral**

**40%** have **metastatic spread** at presentation , **but don't prevent cure**

**Diagnosis** : can be confirmed by **US** and **CT** scan

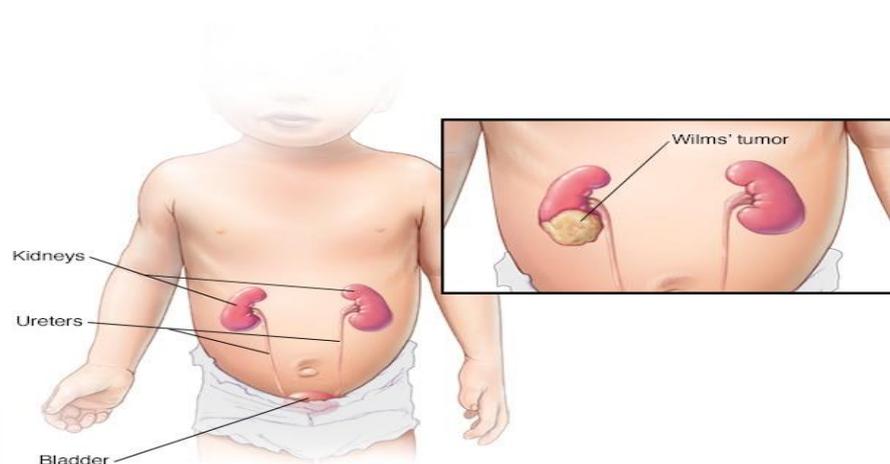
**Treatment** : with **nephrectomy** and **postoperative chemotherapy and radiotherapy**



## □ Prognosis :

**Stage 1** ( localized to kidney) has 3years survival of >90% and cure rate 90%

**Stage 4** (Hematogenous spread) has 3years survival less than 30%



	WILM'S	RCC
Incidence	<ul style="list-style-type: none"> <li>- 10% of childhood malign.</li> <li>- 3 – 4 yrs old</li> <li>- ♂ = ♀</li> </ul>	<ul style="list-style-type: none"> <li>- 75% of renal tumors</li> <li>- 50 – 70 yrs old</li> <li>- More in ♂</li> </ul>
Pathology	<ul style="list-style-type: none"> <li>- Bilat 5 – 10 %</li> <li>- Embryonic tissues</li> <li>- Early capsule &amp; Late pelvis</li> <li>- Mixed tumor</li> </ul>	<ul style="list-style-type: none"> <li>- Mainly unilateral</li> <li>- PCT</li> <li>- Early pelvis &amp; Late capsule</li> <li>- Adenocarcinoma</li> </ul>
C/P	<ul style="list-style-type: none"> <li>- <b>Main present:</b> abd. Mass</li> <li>- <b>Associated \$:</b> familial types</li> <li>- pain, hematuria, HTN.</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Main present:</b> hematuria</li> <li>- <b>Associated \$:</b> paramalignant</li> <li>- pain, mass, 2ry varicocele</li> </ul>
Investigations	<ul style="list-style-type: none"> <li>- IVP: displaced pelvi-calyceal system (rarely invaded)</li> </ul> <p style="text-align: center;">U/S + CT + Ascending pyelogram + PUT + Staging + Preoperative.....→</p>	<ul style="list-style-type: none"> <li>- IVP: DEAD</li> </ul>
Treatment	<ul style="list-style-type: none"> <li>- <b><u>Operable:</u></b> Radical resection</li> <li>- <b><u>Inoperable:</u></b> chemotherapy then resection + radiotherapy for malignant LN</li> <li>→ Post-op.: chemotherapy or radiotherapy</li> </ul>	<ul style="list-style-type: none"> <li>- Radical nephrectomy.</li> <li>- In advanced tumors: symptomatic TTT</li> </ul>
Prognosis	80 % 5 year survival	<ul style="list-style-type: none"> <li>- 60 % 5 year survival</li> <li>- 70% 3 year survival</li> </ul>

# Secondary renal tumors

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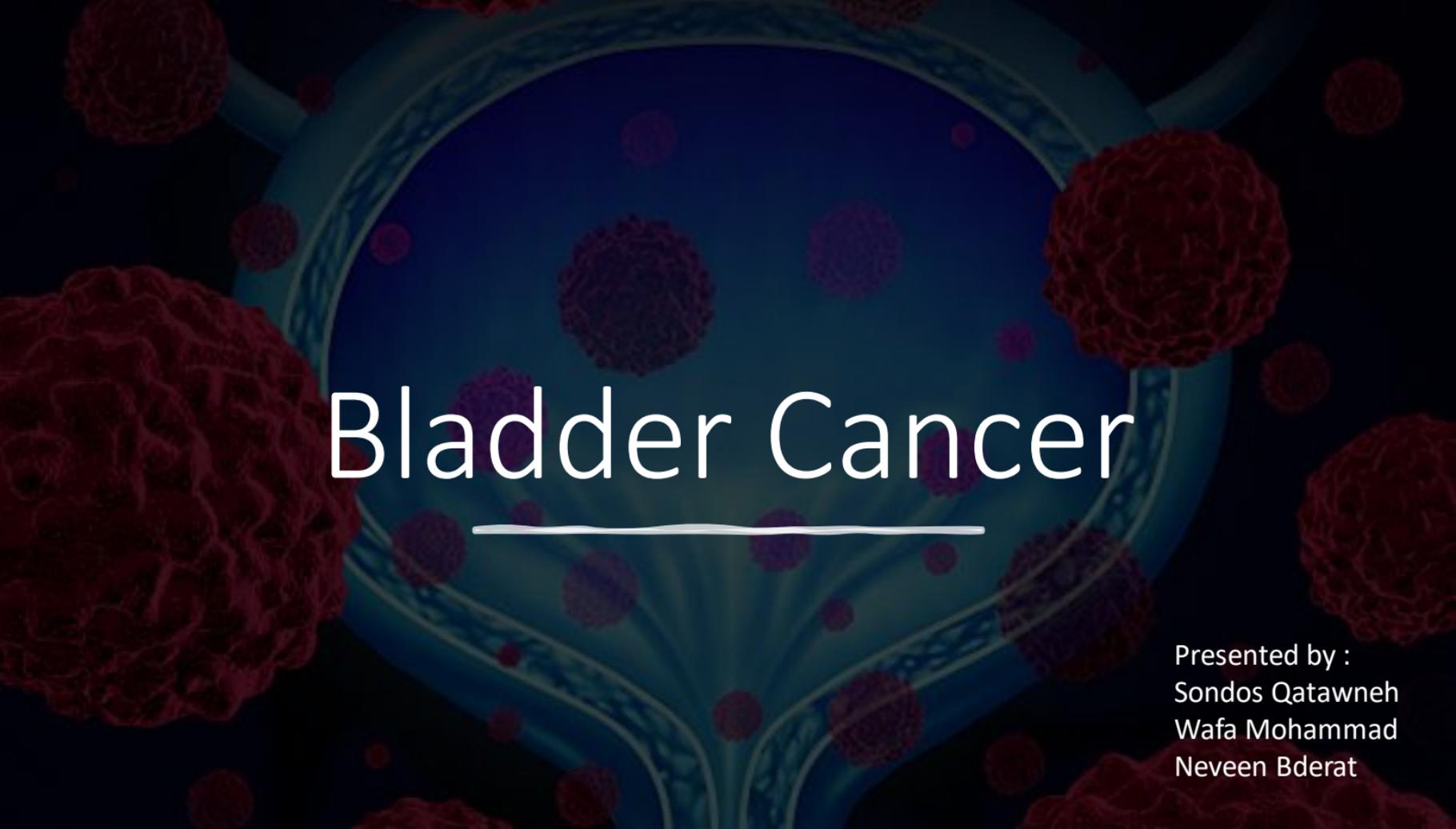
lung (20%)

breast (12%)

stomach (11%)

Albuminuria and hematuria are common

pain and renal insufficiency are rare

A medical illustration of a bladder cross-section. The bladder is shown in a light blue color, with its internal folds (rugae) and the ureters entering at the bottom. The interior of the bladder is filled with numerous dark red, spherical, textured masses of varying sizes, representing bladder cancer tumors. The background is dark, making the bladder and tumors stand out.

# Bladder Cancer

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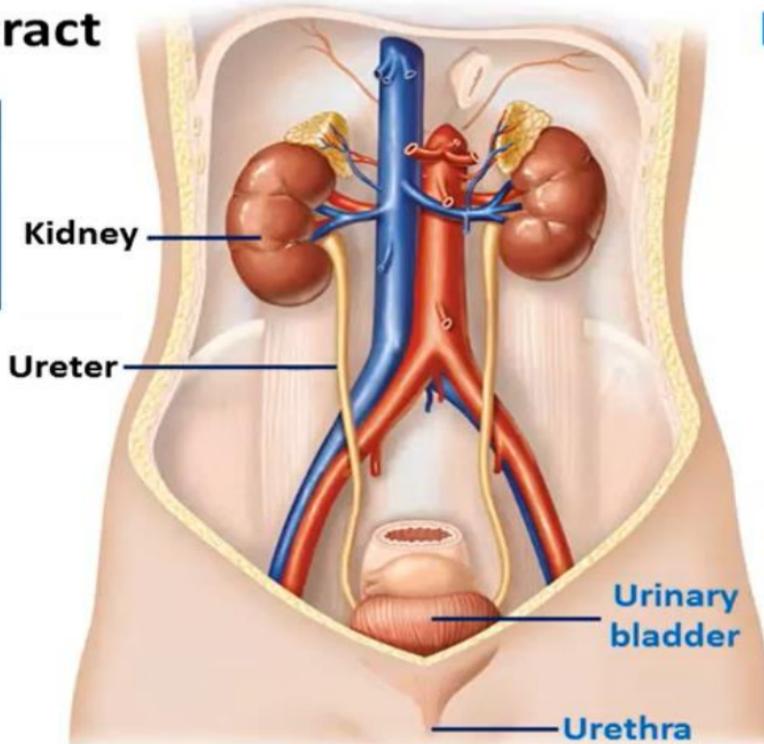
Presented by :  
Sondos Qatawneh  
Wafa Mohammad  
Neveen Bderat

# The urinary system

## Upper urinary tract

-It includes:

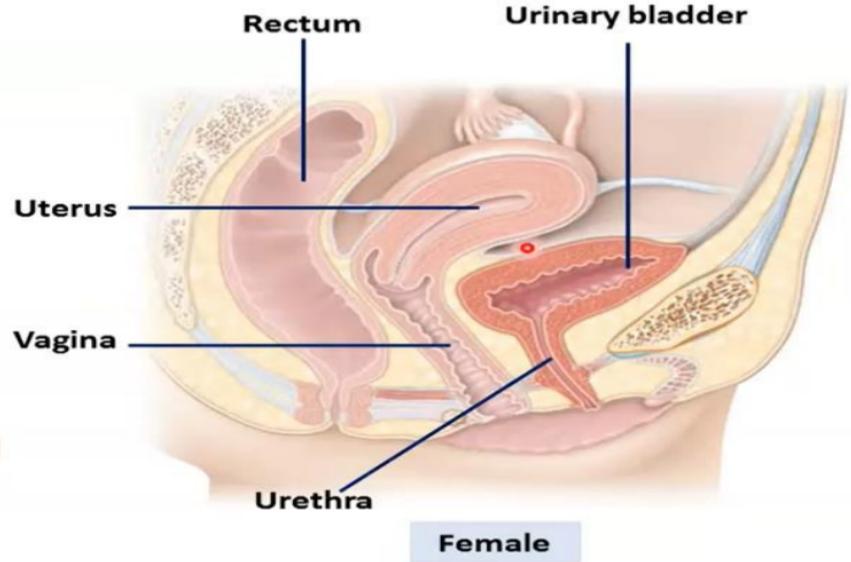
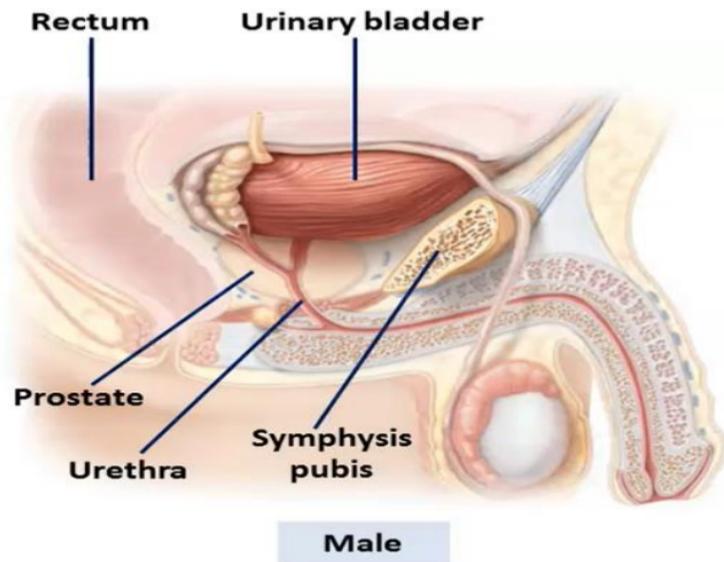
- ✓ 2 kidneys,
- ✓ 2 ureters.



## Lower urinary tract

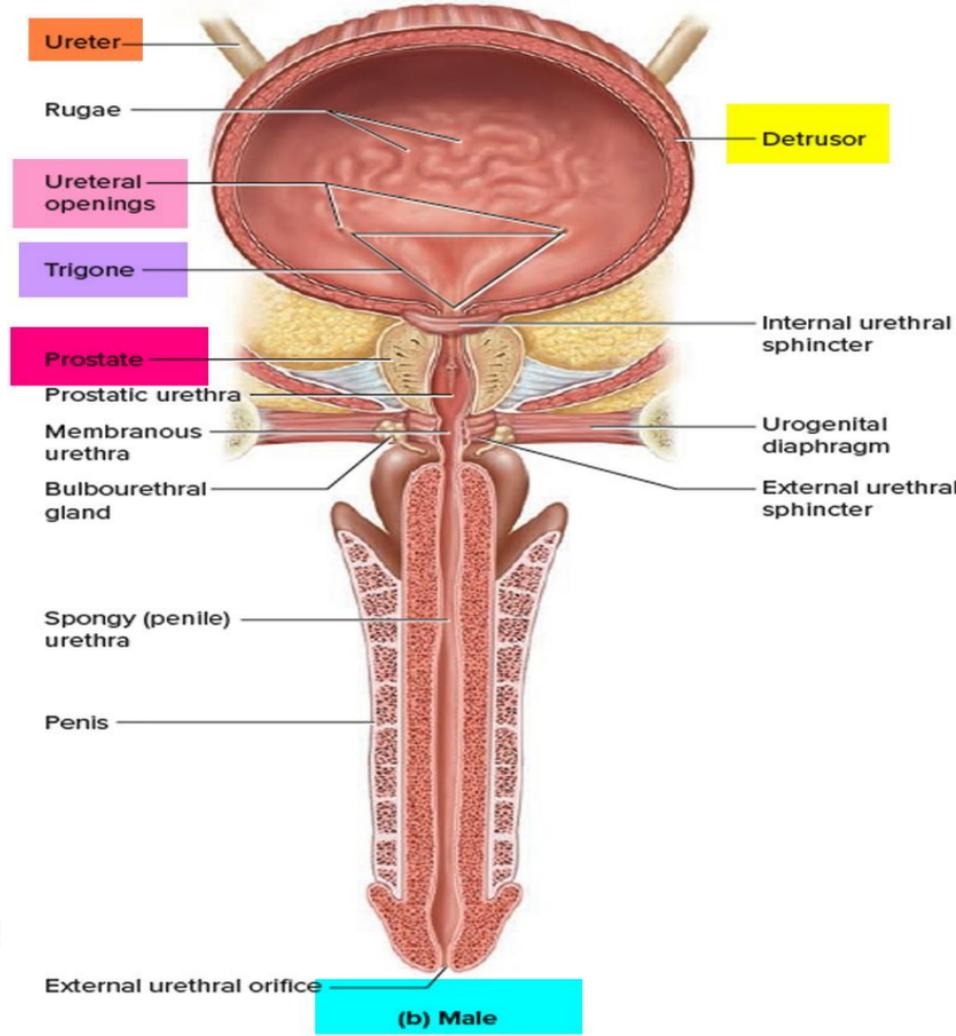
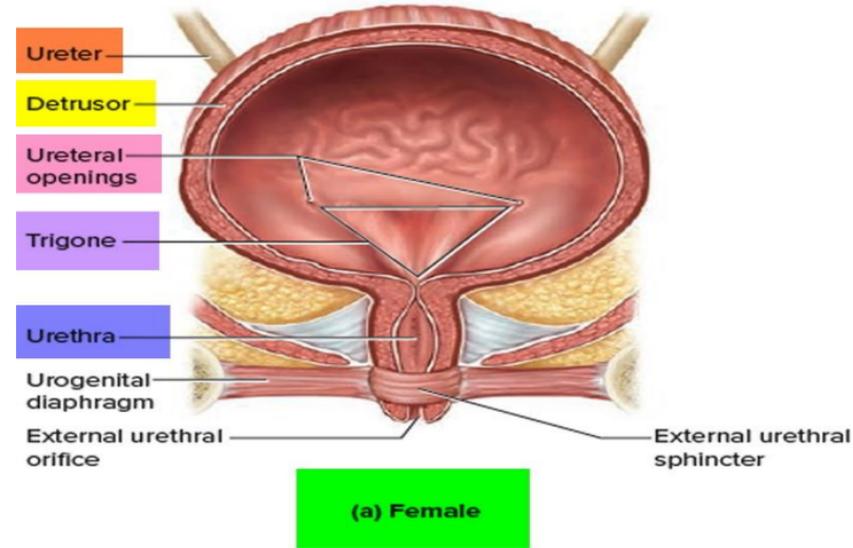
-They include:

- ✓ The urinary bladder,
- ✓ The urethra.



## Urinary Bladder

- The urinary bladder is a hollow, collapsible **muscular sac** that stores and expels urine
- Collect urine (**500-700 ml**)
- situated in the pelvic cavity posterior to the pubic symphysis.
- In **males**, it is directly anterior to the rectum
- in **females**, it is anterior to the vagina and inferior to the uterus



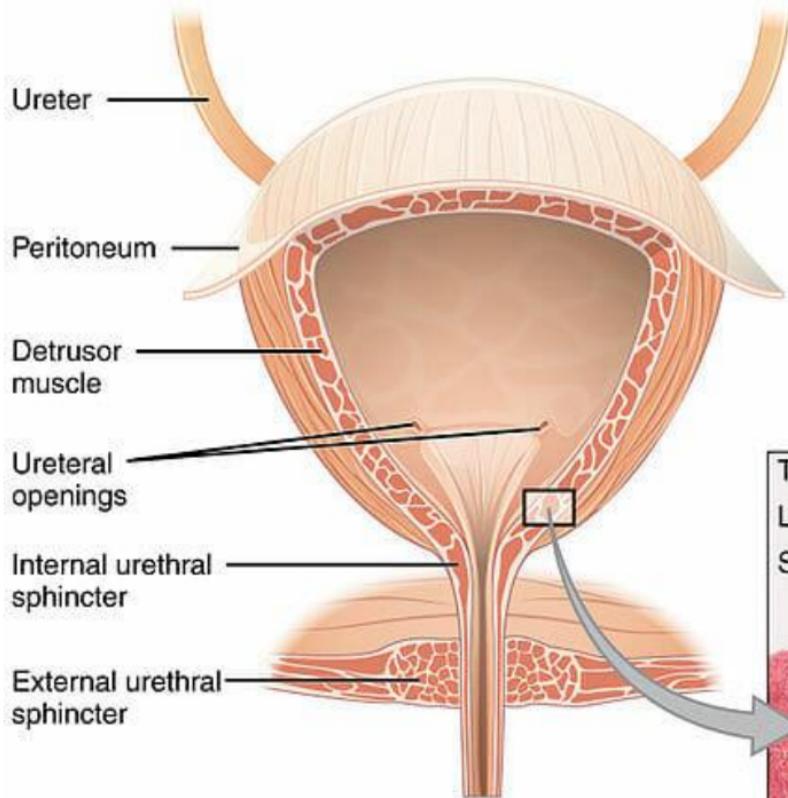
## *difference*

### Male urethra

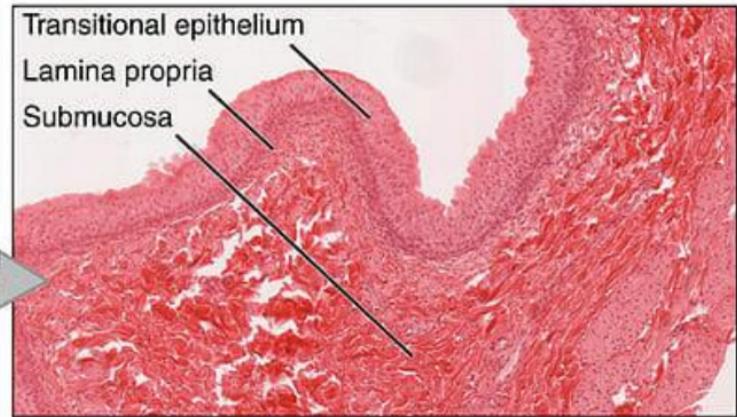
- 1 Long
- 2 Length= 18- 20 cm
- 3 Function—
  - i) urination
  - ii) ejaculation of semen
- 4 Course– curved (double)

### Female urethra

- 1 Short,,
- 2 Length= 4 cm
- 3 Function—only urination
- 4 Course– nearly straight
- 5 Foley catheterisation is easy



(a)

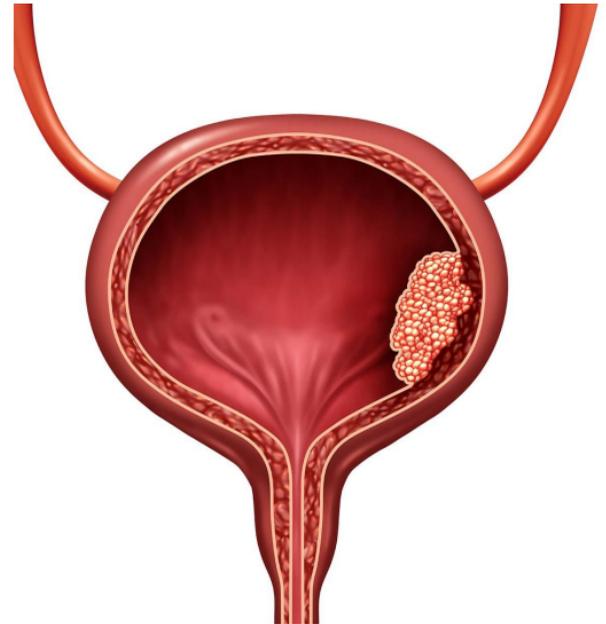


(b)

# What is Bladder Cancer?

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- Bladder cancer is **the second most common urological malignancy**, accounting for 5000 deaths in the UK in 2001. This represents 3% of all cancer deaths.
- Incidence is ~13,000 per year, indicating that the majority of patients have curable or controllable disease.



# Risk factors

*>Smoking & they have greater urin residual in bladder post urination*

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- **Men** are 2.5 times more likely to develop the disease than women, may be associated with greater urine residuals in the bladder.
- **Age** increases risk , most commonly diagnosed in the **8th decade** and rare <50 years.
- **Racially**, **Black people** have a lower incidence than White people, but inexplicably they appear to carry a poorer prognosis.
- **Environmental carcinogens** found in urine, are the major cause of bladder cancer.

- **Chronic inflammation of bladder mucosa:** bladder stones, long-term catheters → paraplegic, immobilized or comatose ⇒ all at risk of developing squamous cell type of bladder CA
- **Smoking** is the major cause of bladder cancer in the developed world → leading to upgrading of bladder CA (instead of superficial → muscle invasive) & increases recurrence of bladder CA  
↓  
>10y to back N after quit smoking
- **Occupational exposure to carcinogens,** in particular aromatic hydrocarbons like aniline
- **Drugs:** phenacetin and cyclophosphamide.
- **Pelvic radiotherapy.** Especially for females with cervical cancer

# Bladder cancer: pathology and staging

- Benign tumors of the bladder, including inverted papilloma and nephrogenic adenoma, are uncommon.
  - The vast majority of primary bladder cancers are malignant and transitional epithelial in origin.
-

# Types of Bladder Cancer

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- >90% are transitional cell carcinoma (TCC)
- 7% are squamous cell carcinoma (SCC)
- 75% are SCC in <sup>more common in</sup> areas where schistosomiasis is endemic (iraq & egypt)
- 2% are adenocarcinoma
- Rarities include pheochromocytoma, melanoma, lymphoma, and sarcoma arising within the bladder muscle
- Secondary bladder cancers are mostly metastatic adenocarcinoma from gut, prostate, kidney, or ovary

▶ **Tumour spread :**

this cause shift from T<sub>1</sub> to T<sub>2</sub>

▶ **Direct** <sup>majority</sup> tumour growth to involve the detrusor, the ureteric orifices, prostate, urethra, uterus, vagina, perivesical fat, bowel, or pelvic side walls.

obstructing lesion  
Cause bilateral  
hydronephrosis

muscle

▶ **Implantation into** wounds/percutaneous catheter tracts.

▶ **Lymphatic infiltration** of the iliac and para-aortic nodes.

▶ **Haematogenous**, most commonly to liver (38%), lung (36%), adrenal gland (21%), and bone (27%). Any other organ may be involved.

MC

2nd MC

that is why if a patient arrived to ER with urine retention and you will not be able to insert Foley's catheter due to stricture or BPH and he's known to have bladder CA it is CI to insert Subrapubic catheter (Cystostomy); bcz of risk of percutaneous catheter tract seeding, therefore you should admit the patient and do Cystoscopy and insert a Foley's catheter under vision

## ▶ Histological grading

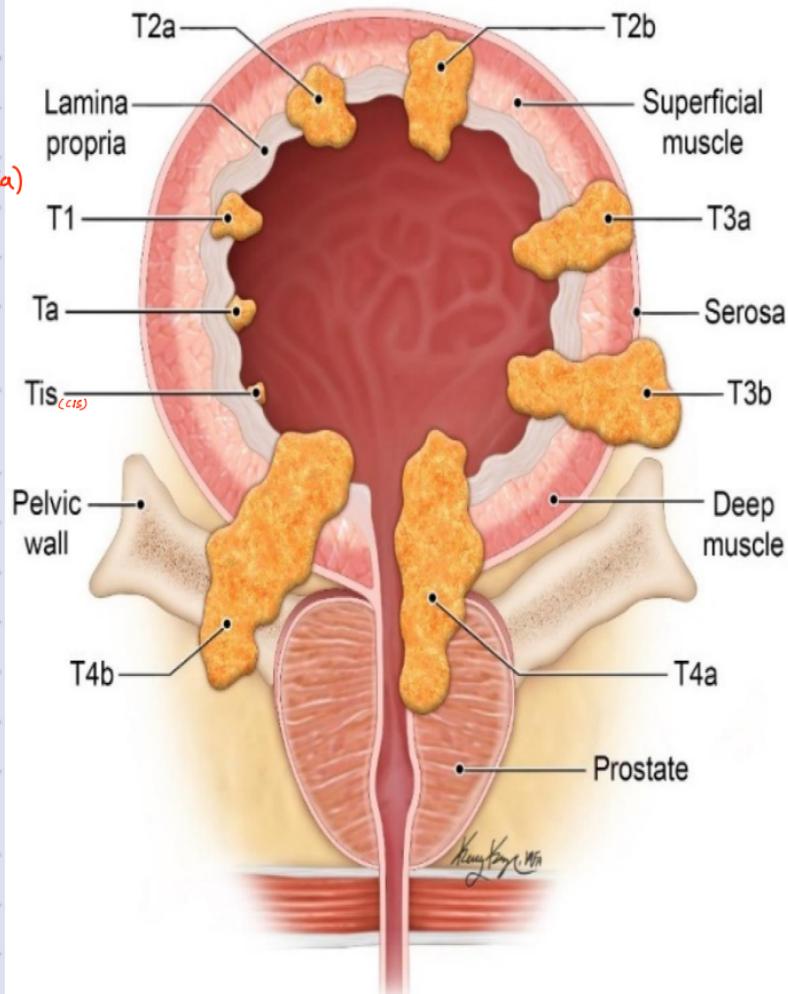
is divided into: well, moderately, and poorly differentiated (abbreviated to G1, G2, and G3 respectively).

## ▶ Staging

is by the TNM (1997) classification. All rely upon *physical examination and imaging.*

**Table 6.8** 2002 TNM staging of bladder carcinoma

Tx	Primary tumor <b>cannot be assessed</b>
T0	<b>No evidence of primary tumor</b>
Ta	<b>Noninvasive papillary carcinoma</b> → <i>superficial bladder CA (only on mucosa)</i>
Tis	<b>Carcinoma in situ</b>
T1	Tumor <b>invades subepithelial connective tissue</b>
T2	Tumor <b>invades muscularis propria (detrusor)</b> : <u>T2a inner half</u> ; <u>T2b outer half</u> <i>M. invading</i>
T3	Tumor <b>invades beyond muscularis propria into perivesical fat</b> : T3a = <u>microscopic</u> ; T3b = <u>macroscopic</u> (extravesical mass)
T4a	Tumor <b>invades any of prostate, uterus, vagina, bowel</b>
T4b	Tumor <b>invades pelvic or abdominal wall</b>
Nx	<b>Regional</b> (iliac and para-aortic) <b>lymph nodes cannot be assessed</b>
N0	<b>No regional lymph node metastasis</b>
N1	Metastasis in a <b>single lymph node &lt;2 cm</b> in greatest dimension
N2	Metastasis in a <b>single lymph node 2–5 cm</b> or <b>multiple nodes &lt;5 cm</b>
N3	Metastasis in a <b>single lymph node or multiple nodes &gt;5 cm in greatest dimension</b>
Mx	<b>Distant metastasis cannot be assessed</b>
M0	<b>No distant metastasis</b>
M1	<b>Distant metastasis present</b>



# Urothelial carcinoma (transitional cell carcinoma)

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- ▶ Urothelial carcinoma (transitional cell carcinoma) UC may be **single or multifocal**.
- ▶ Because 5% of patients will have a **synchronous** upper tract UC and **metachronous** recurrences may develop after several years, the urothelial field-change theory of polyclonality is favored over the theory of tumor monoclonality with implantation (seeding).
- ▶ **Upper urinary tract cancer** can present with bladder cancer in 20-30% because of urine flow which leads to malignant cells implantation, while **bladder cancer** can present with upper urinary tract cancer in 2-3%.

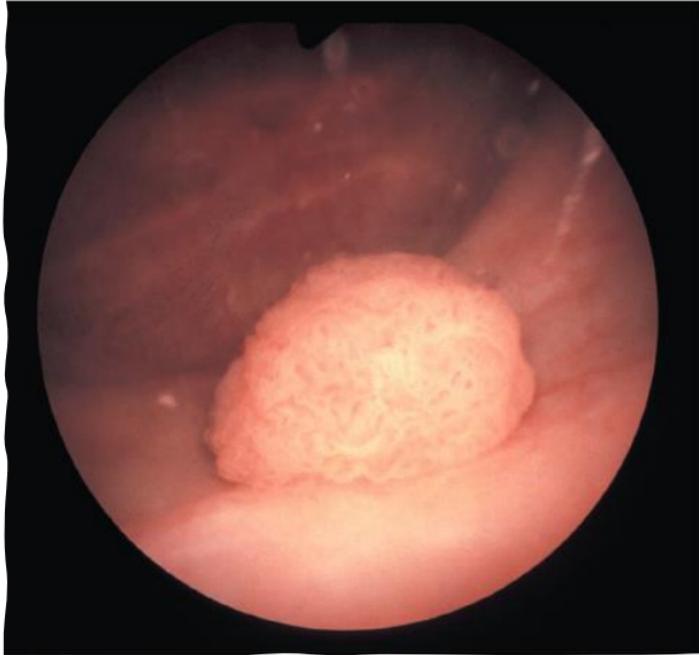
- ▶ Primary TCC is considered clinically as <sup>less than T<sub>2</sub></sup> superficial or <sup>T<sub>2</sub>/T<sub>3</sub>/T<sub>4</sub></sup> muscle-invasive:
- ▶ 70% of tumours are papillary, usually G1 or G2, exhibiting at least 7 transitional cell layers covering a fibro-vascular core (normal transitional epithelium has ~5 cell layers).
- ▶ Papillary TCC is usually superficial, confined to the bladder mucosa (Ta) or submucosa (T1). 10% of patients subsequently develop muscle-invasive or metastatic disease.
- ▶ However, a subset of superficial TCC, G3T1 tumours, are more aggressive, with 40% subsequently upstaging.
- ▶ 10% of TCC have mixed papillary and solid morphology and 10% are solid. These are usually G3, half of which are muscle-invasive at presentation.

## CIS superficial bladder CA

- ▶ 10% of TCC is flat carcinoma in situ (CIS). This is poorly differentiated carcinoma, but confined to the epithelium and associated with an intact basement membrane. 50% of CIS lesions occur in isolation; the remainder occur in association with muscle-invasive TCC.
- ▶ CIS usually appears as a flat, red, velvety patch on the bladder mucosa; 40% of such lesions are CIS, the remainder being focal cystitis of varying aetiology.

\* Cystoscopy: Check for bladder CA if pt presented with painless hematuria

Cystoscopy show a superficial papillary tumor



## CIS..cont..

→ very dangerous type of bladder CA

→ when we suspect CIS, before we do cystoscopy we usually do urine cytology

- ▶ The cells are poorly cohesive, up to 100% of patients with CIS exhibiting positive urine cytology, in contrast to much lower yields (17-72%) with G1/2 papillary UC.
- ▶ From 40% to 83% of untreated CIS lesions will progress to muscleinvasive UC, making CIS the most aggressive form of superficial UC.

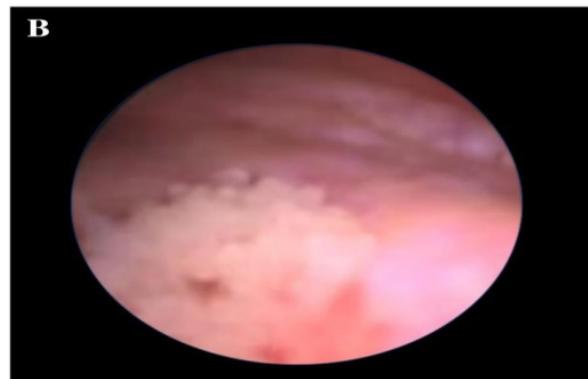
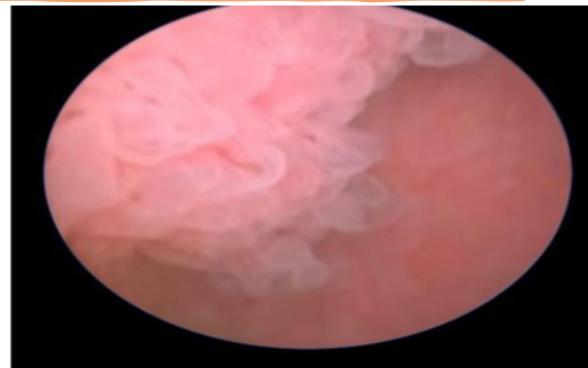
of bladder CA

\* Most dangerous type of superficial bladder CA is CIS

\* least " " " " " " is PUNLMP

## PUNLMP

- Papillary urothelial neoplasm of low malignant potential (PUNLMP) The World Health Organization (WHO) defines PUNLMP as a papillary urothelial tumor that resembles an exophytic urothelial papilloma but shows increased cellular proliferation exceeding the thickness of normal urothelium.
- They are typically small (1–2 cm) and have little, if any, cytological atypia.
- Treatment and follow-up are the same as for low-grade noninvasive urothelial carcinoma.



# Squamous cell carcinoma

*Poorer prognosis than transitional cell CA*

- ▶ Squamous cell carcinoma
- ▶ SCC is usually **solid or ulcerative and muscle-invasive** at presentation. SCC accounts for only 1% of UK bladder cancers. SCC in the bladder is associated with chronic inflammation and urothelial squamous metaplasia, rather than CIS. **In Egypt, 80% of SCC is induced by the ova of Schistosoma haematobium.** 5% of paraplegics with long-term catheters develop SCC. **Smoking** is also a risk factor for SCC.  
*long term catheter + bladder stones*
- ▶ The **prognosis is better for bilharzial SCC than for non-bilharzial disease**, probably because it tends to be lower grade and metastases are less common in these patients.

# Adenocarcinoma

▶ Adenocarcinoma is rare, usually solid/ulcerative and carries a poor prognosis. One third originate in the urachus, the remnant of the allantois, located deep to the bladder mucosa in the dome of the bladder.

*\*present usually with supraumbilical mass, supraumbilical mucus or bloody discharge*

**RF** ▶ Adenocarcinoma is a long-term (10 years) complication of bladder exstrophy<sup>①</sup> and bowel implantation into the urinary tract, particularly bladder substitutions and ileal conduits after cystectomy. <sup>②</sup> *iatrogenic (surgery for neurogenic bladder)*

▶ There is association with cystitis glandularis, rather than CIS.

# Bladder cancer: presentation

\* without burning micturition  
\* " suprapubic pain  
\* " loin pain

sign! in midstream (from bladder)  
intermittent  
> 50y, men, smoker

## Symptoms

- ▶ The most common presenting symptom (85% of cases) is **painless haematuria**. This may be initial or terminal if the lesion is at the bladder neck or in the prostatic urethra. 35% of patients >50 years and 10% <50 years with macroscopic haematuria have bladder cancer. History of smoking or occupational exposure is relevant.
- ▶ Asymptomatic microscopic haematuria, found on routine urine stick-testing. Up to 16% of females and 4% of males have stick-test haematuria: less than 5% of those <50 years, while 7-13% of those >50 years will have a malignancy.
- ▶ **Pain** is unusual, even if the patient has obstructed upper tracts, since the obstruction and renal deterioration arise gradually, Pain may be caused by locally advanced (T4 disease).

*dysuria*

- ▶ **Filling-type lower urinary tract symptoms**, such as urgency or suprapubic pain. There is almost always microscopic or macroscopic haematuria. This so-called malignant cystitis is typical in patients with CIS.
- ▶ **Recurrent urinary tract infections** and **pneumaturia** due to malignant colovesical fistula, though less common than benign causes (diverticular and Crohn's disease).
- ▶ More advanced cases may present with **lower-limb swelling** due to lymphatic/venous obstruction, bone pain, weight loss, anorexia, confusion, and anuria (renal failure due to bilateral ureteric obstruction).
- ▶ Urachal adenocarcinomas may present with a **blood or mucus umbilical discharge** or a **deep subumbilical mass** (rare).

▶ **Signs**

- ▶ General examination may reveal pallor, indicating anaemia due to chronic renal impairment or blood loss.
- ▶ Abdominal examination may reveal a suprapubic mass in the case of locally advanced disease.
- ▶ Digital rectal examination may reveal a mass above or involving the prostate.

# Bladder cancer: diagnosis and staging

---

- ▶ After a urinary tract infection has been excluded or treated, all patients with microscopic or macroscopic haematuria require investigation of their upper tracts, bladder, and urethra. Usually, renal ultrasound and flexible cystoscopy, <sup>CT scan</sup> performed under local anaesthesia, are first-line investigations.
- ▶ If these fail to find a cause, an IVU or CT scan and urine cytology are justified second-line investigations.
- ▶ Patients with predominantly filling-type LUTS, suprapubic pain, or recurrent UTI/pneumaturia should also have urine cytology and cystoscopy.

\* Always the diagnostic modality of choice in bladder CA is rigid or flexible cystoscope.

- ▶ **CT scan before and after IV contrast is becoming the first-line radiological investigation of haematuria.** It is faster and more sensitive than ultrasound or IVU in the detection of renal (parenchymal and urothelial) and ureteric tumours. However, it carries a higher radiation dose and is more expensive.
- ▶ CT scan also detects some bladder tumours, but may overcall bladder wall hypertrophy as tumour and will miss flat CIS and urethral pathology.
- ▶ Thus it cannot replace cystoscopy. If there is hydronephrosis in association with a bladder tumour, it is likely that the tumour is causing the obstruction to the distal ureter. This tends to be caused by muscle-invasive disease rather than superficial TCC.

- ▶ False -ve cytology is frequent (40-70%) in patients with papillary TCC, but more sensitive (90-100%) in patients with high-grade TCC and CIS. False +ve cytology can arise due to infection, inflammation, instrumentation, and chemotherapy.
- ▶ If all investigations are normal, consideration should be given to nephrological disorders that may cause haematuria, such as glomerulonephritis.
- ▶ Fluorescent in situ hybridization (FISH) (sensitivity 77%, specificity 98%) and other tests such as NMP-22 (sensitivity 56%, specificity 85%) may be helpful in the evaluation.
- ▶ Transurethral resection of bladder tumour (TURBT) → diagnostic & therapeutic

## ▶ Staging investigations

- ▶ are usually reserved for patients with biopsy-proven muscle-invasive bladder cancer unless clinically indicated, since superficial TCC and CIS disease are rarely associated with metastases.
- ▶ Pelvic CT or MRI may demonstrate extra-vesical tumour extension or iliac lymphadenopathy, reported if **>8mm** in maximal diameter.
- ▶ Chest X-ray
- ▶ Isotope bone scan <sup>→ if we suspect bone metastasis</sup> is obtained in cases being considered for radical treatment.
- ▶ Staging lymphadenectomy (open or laparoscopic) <sup>→ rare</sup> may be indicated in the presence of CT-detected pelvic lymphadenopathy if radical treatment is under consideration.

# TCC MANAGEMENT

Bladder cancer (**non-muscle invasive TCC**): surgery and recurrence

↳ Ta, Tis, T<sub>1</sub>

**TURBT**

→ transurethral ⇒ resection for bladder tumor → followed by intravesical chemotherapy (mitomycin)

As a primary treatment, a visually complete tumor resection is adequate for 70% of newly presenting patients with Ta/T1 superficial disease. The remaining 30% of patients experience early recurrence, 15% with upstaging.

Because of this, it is **standard care that all new patients receive adjuvant treatment with a single dose of post-operative intravesical chemotherapy (usually mitomycin).**

Complications of TURBT are uncommon, including bleeding, sepsis, bladder perforation, incomplete resection, and urethral stricture.



## Alternatives to TURBT

Transurethral cyst **diathermy or laser** are accepted, quicker and less morbid

*Coagulation*

procedure for ablating small superficial recurrences when obtaining tissue for histology is not considered necessary

*\* Usually not done from first time, bcz you need firstly histology to diagnose bladder CA*

*or Pt who have bleeding diathesis or pt are well known to have bladder CA*

*fillz of diathermy bcz know type of bladder CA*

## Follow-up after TURBT

within < 3min

**Second resection:** an early repeat TUR (within 2–6 weeks) should be undertaken: *\*indications:*

- (a) if the first resection was incomplete (*very large tumor, or complication happen (bleeding)*)
- (b) when the pathologist reports that the resected specimen contains no muscularis propria
- (c) if a high-grade, but apparently non-invasive, T1 tumor has been reported since perhaps 10% (3–25%) of high grade T1 tumors are under staged T2 tumors. This strategy improves recurrence-free survival and prognosis while complications include bladder perforation.

*\* T<sub>1</sub> high grade → G<sub>3</sub> T<sub>1</sub> → 10% of pts are under stage T<sub>2</sub>*

\* if there is no indication for second resection ⇒ Cystoscopy + resection → review cystoscopy (at 3 months)  
if this demonstrates recurrence 70% recur further  
if not " " " 20% recur further

Patients with G3T1 TCC, and CIS are at significantly higher risk of recurrence and 40% subsequently upstage. Some patients experience persistent symptomatic multifocal G1/2, Ta/1 recurrent TCC, demanding frequent follow-up procedures. In these circumstances, adjuvant treatment is indicated.

There is no accepted protocol for upper tract surveillance in patients with a history of bladder TCC, although EAU guidelines<sup>1</sup> recommend yearly imaging (CTU) for patients with high-risk disease.

if Cystoscopy after 3 months  $\Rightarrow$  found no any bladder tumor

follow him with another cystoscopy after 9 months

if there is no any bladder tumor also

you follow him annually by cystoscopy

# ADJUVANT THERAPY



after resection of bladder tumor, you need to give

**Intravesical chemotherapy (e.g. mitomycin C (MMC) [decreases rate of recurrence]**

For many patients at **low risk of recurrence**, the risk reduction seen with **single-dose** postoperative chemotherapy is equivalent to that seen using weekly instillations for **6 weeks**, commencing up to 2 weeks post-TURBT. Such longer courses are still recommended for patients at **higher risk of recurrence** or who have **multifocal recurrences**, excluding those with high-grade Ta/T1 TCC or CIS

**low grade bladder CA**

usually ↓ recurrence  
for this  
any pt with bladder CA, superficial or low grade bladder CA or multifocal bladder CA is candidate for intravesical mitomycin C

# ADJUVANT THERAPY



*like attenuated vaccine*

## **Intravesical BCG [decreases rate of progression]**

BCG produces complete responses in 60–70% of patients. It is as effective as chemotherapy for adjuvant treatment of low- and intermediate risk TCC, therefore, is not often used (except as second-line) **because of the additional toxicity.**

\* Usually used for pts with G<sub>3</sub> T<sub>1</sub> (high grade superficial bladder CA) & for CIS

\* not immediate with in 6w / just in 6w course, every 1w

\* ↓ recurrence, ↓ progression of d. (↓ risk of progression to M. invasive bladder CA)

benefit over mitomycin

if pt failed after intravesical BCG chemotherapy (high grade T<sub>1</sub> or CIS), if recurrence happen → we proceed directly into radical cystectomy; bcz they have 40-83% upgrade risk to develop into M. invasive

## Contraindications to intravesical BCG include:

- Immunosuppressed patients.
- Pregnant or lactating women.
- Patients with haematological malignancy.
- Following traumatic catheterization

# muscle invasive TCC

T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>  
very dangerous (risk of mortality) 3%  


## Radical cystectomy with:

→ in males; excision of bladder + prostate + seminal fluid + vas deference + distal uretrectomy + urethra, pelvic LN [external iliac internal & obturator LN]  
→ in females; in addition to uterus, anterior vagina & bilateral ovaries (pelvic exenteration)

most common • Ileal conduit urinary diversion (Stoma) - incontinent type of diversion

• Ureterosigmoidostomy urinary diversion. cilo;

• Continent urinary diversion → catheterizable stoma or neobladder

of bladder preserving → rare

usually use partial cystectomy in adenocarcinoma

radical cystectomy with ileal incontinent type of urin diversion

2 catheters inserted into ureter

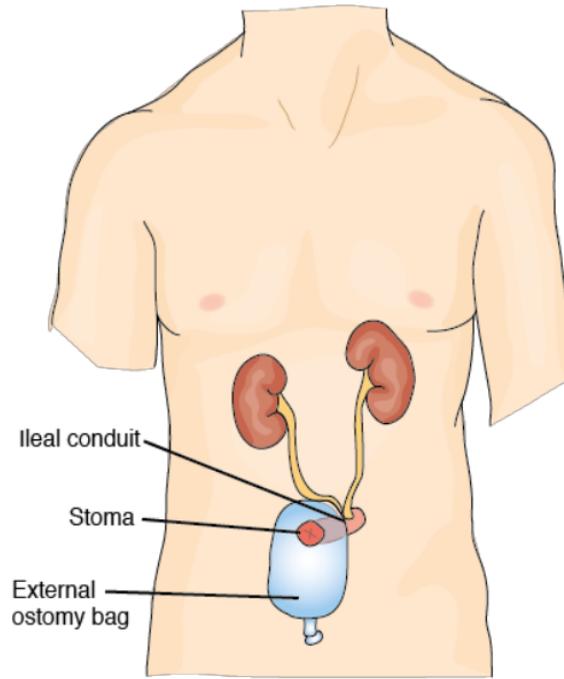
temporary JJ



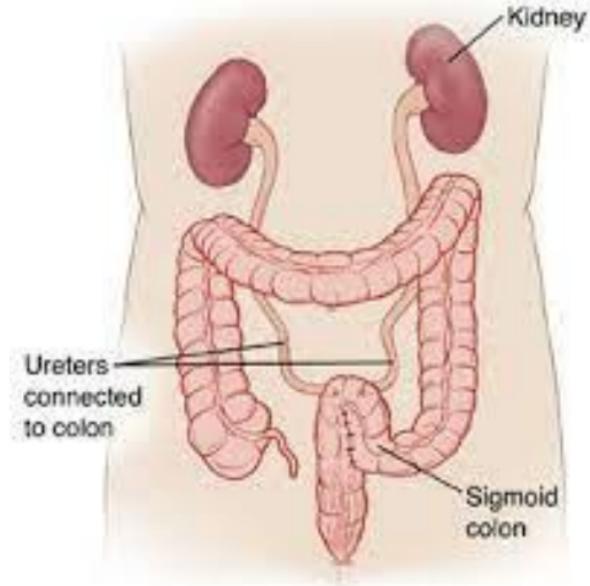


## Radical cystectomy :

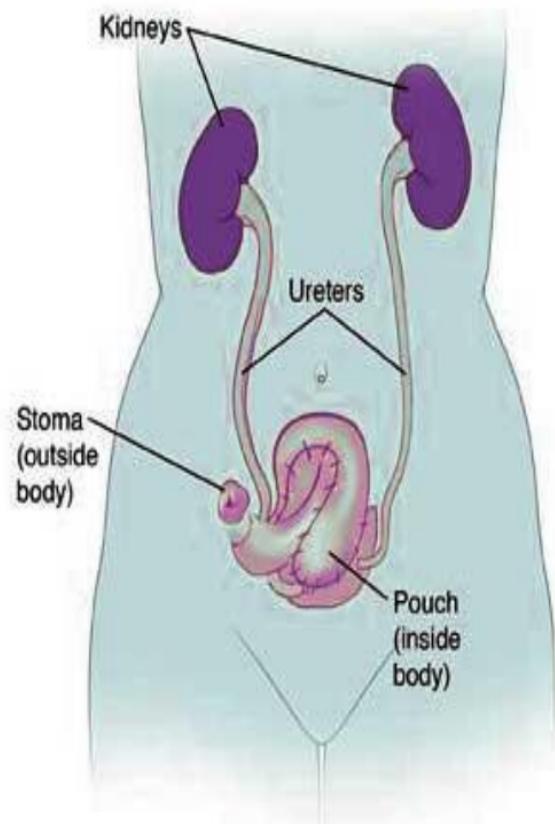
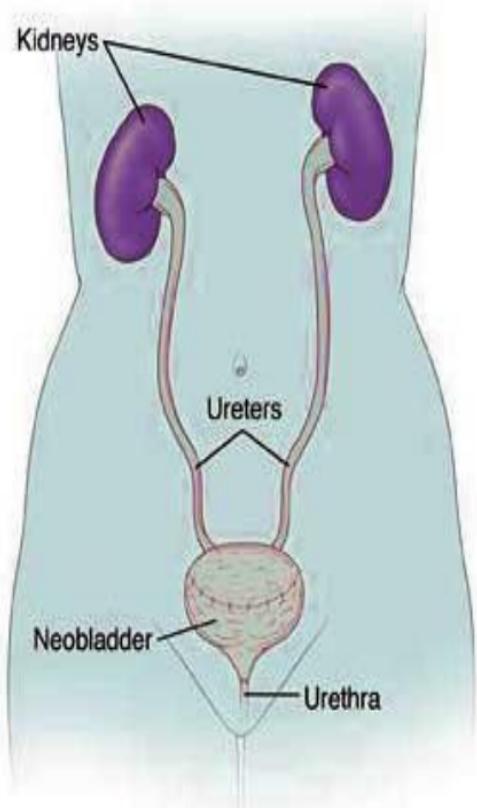
- complete removal of the **urinary bladder**, pelvic **lymph nodes** ; external/ internal iliac LNs and obturator LNs , and **adjacent organs** ; ( prostate, seminal vesicle and proximal part of urethra in **males** / ovaries , fallopian tubes , uterus , cervix and anterior vaginal wall in **females**)



Ileal conduit urinary diversion



Ureterosigmoidostomy urinary diversion



Continent urinary diversion

**Table 7.11** 5y survival rates for cystectomy alone

Stage T1/CIS	90%+
Stages T2,T3a	55–63%
Stage T3b	31–40%
Stage T4a (into prostate)	10–25%
Stage TxN1–2	30%
Salvage T0	70%
Salvage T1	50%
Salvage T2, 3a	25%



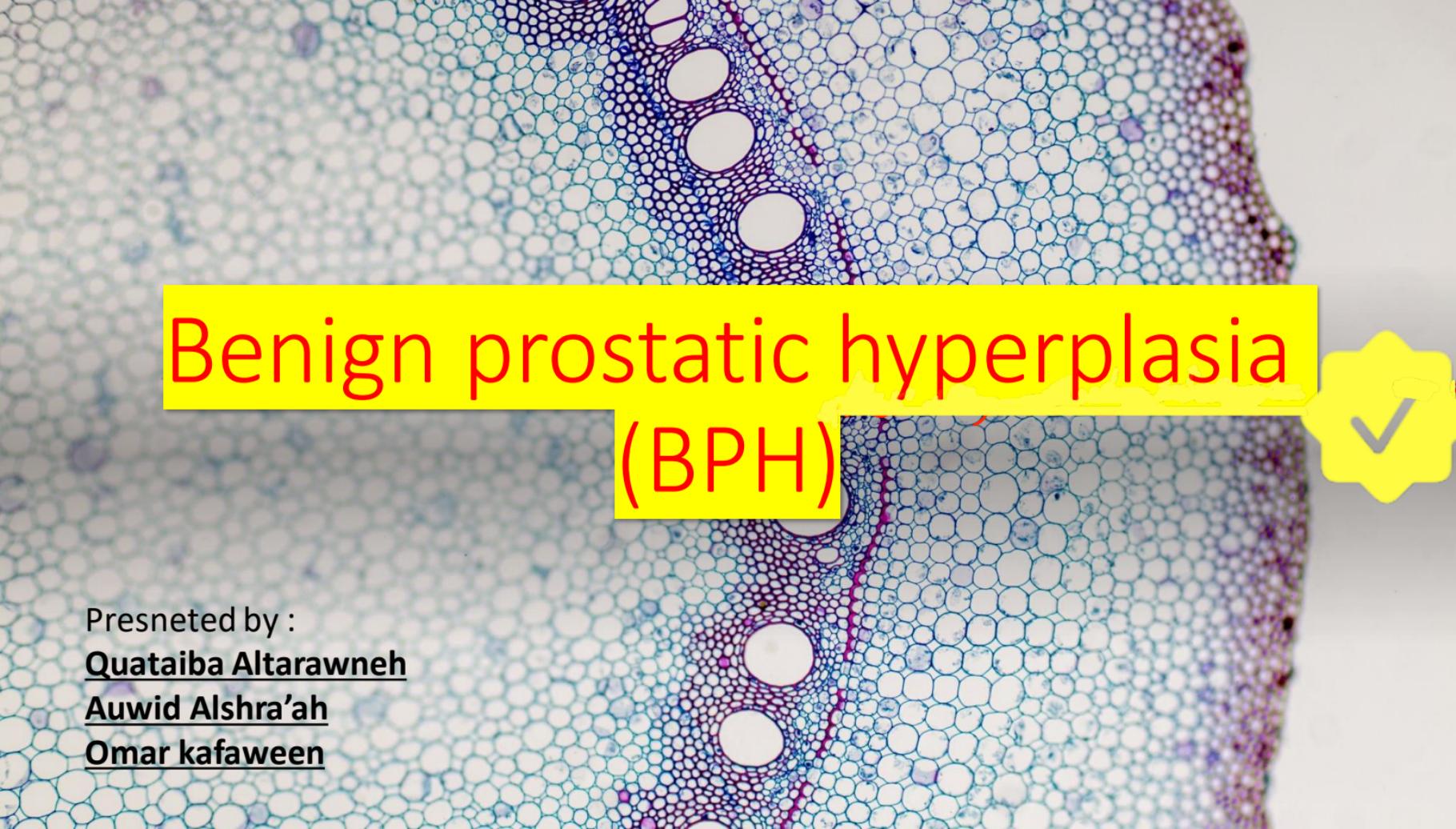
## Palliative treatment

RT is effective for **metastatic bone pain** or to palliate symptomatic (bleeding) local tumor.

**Intractable haematuria** may be controlled by intravesical formalin or a Alum, hyperbaric oxygen, bilateral internal iliac artery embolization or ligation, or palliative cystectomy/diversion.

**Ureteric obstruction** may be relieved by percutaneous nephrostomy & antegrade double J

Involvement of the palliative care team can be very helpful to the patient and family.

A microscopic image of prostate tissue stained with hematoxylin and eosin (H&E). The image shows several glandular units. The glands are lined by a single layer of columnar epithelial cells. The glandular lumens are irregular in shape and size, and some contain secretory material. The surrounding stroma is composed of connective tissue and small blood vessels. The overall appearance is consistent with benign prostatic hyperplasia (BPH).

# Benign prostatic hyperplasia (BPH)

Presented by :

Quataiba Altarawneh

Auwid Alshra'ah

Omar kafaween



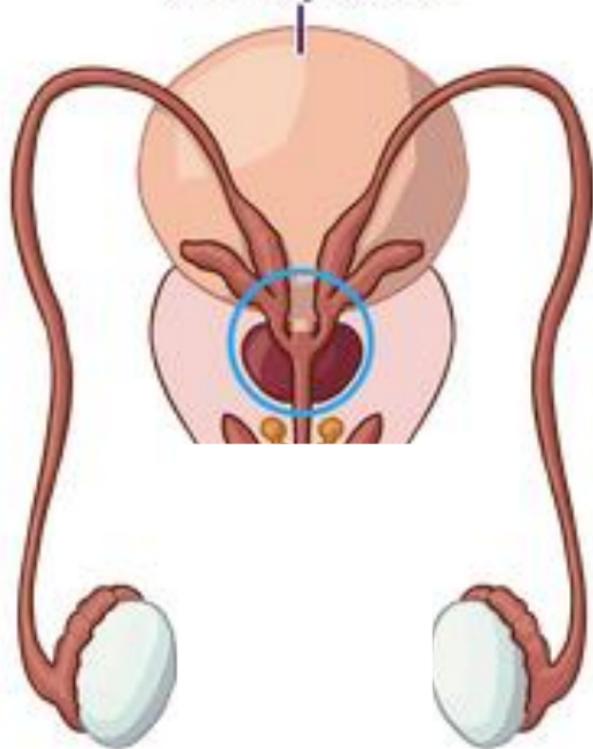
# BPH after 40y → slowly enlargement of prostate

## Surgical anatomy

- The prostate is made up of several zones which fit into each other like an egg in an egg cup
- **Benign enlargement** mainly arises in the transition zone , **cancer** in the peripheral zone .

of prostate 2 component   
 ↳ stromal component   
 ↳ epithelial "   
 ↳ hyperplasia   
 ↳ fibrosis

Posterior surface  
of urinary bladder



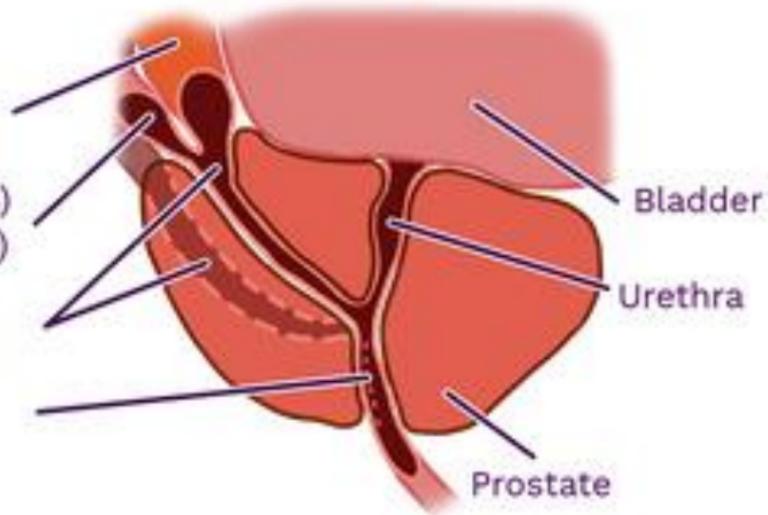
Seminal  
vesicle (R)

Ductus (vas)  
deferens (R)

Ejaculatory  
duct (R+L)

Pores for  
secretion

**Midsagittal section  
of prostate gland**

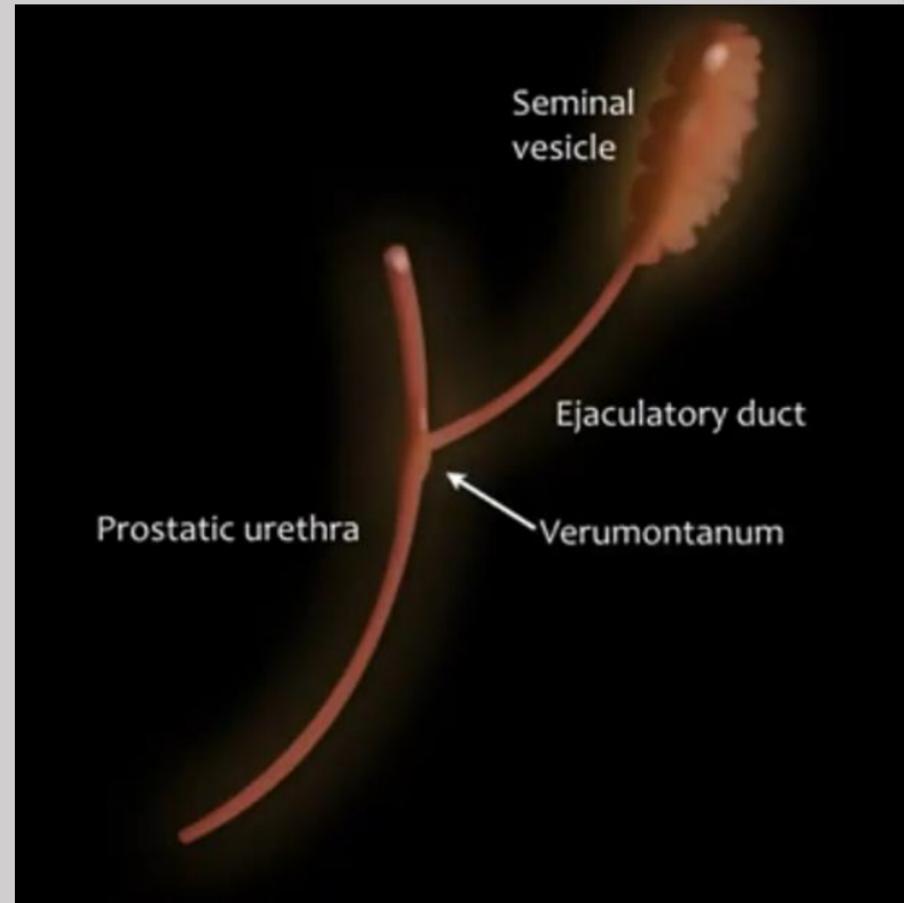


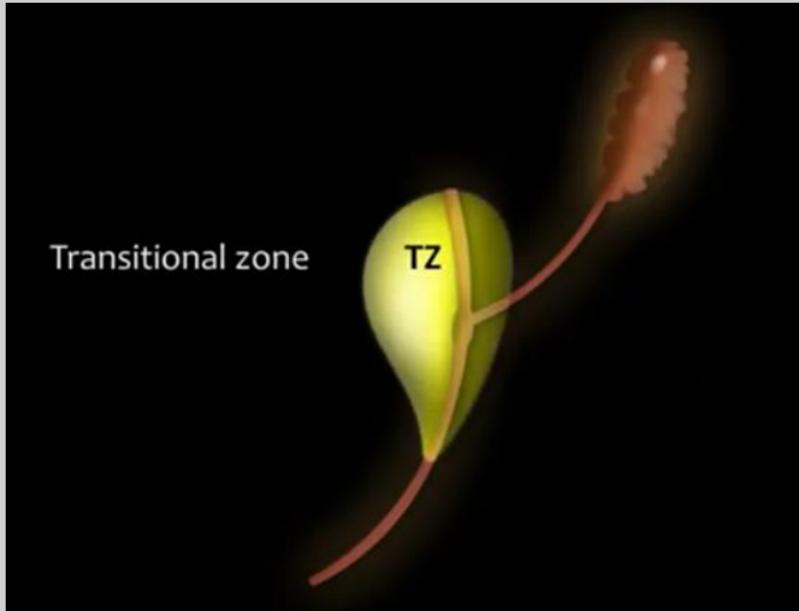
Bladder

Urethra

Prostate

- The ejaculatory duct end in the prostatic urethra at the verumontanum
- Prostatic zones are :
  1. Transitional
  2. Central
  3. Peripheral
  4. Anterior fibromuscular

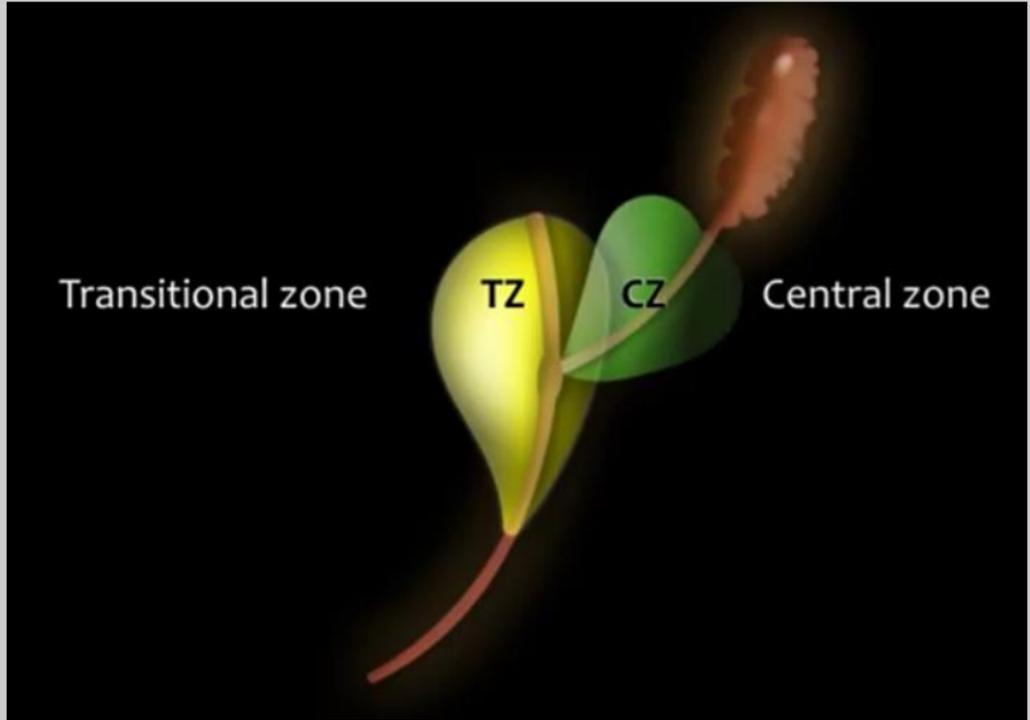


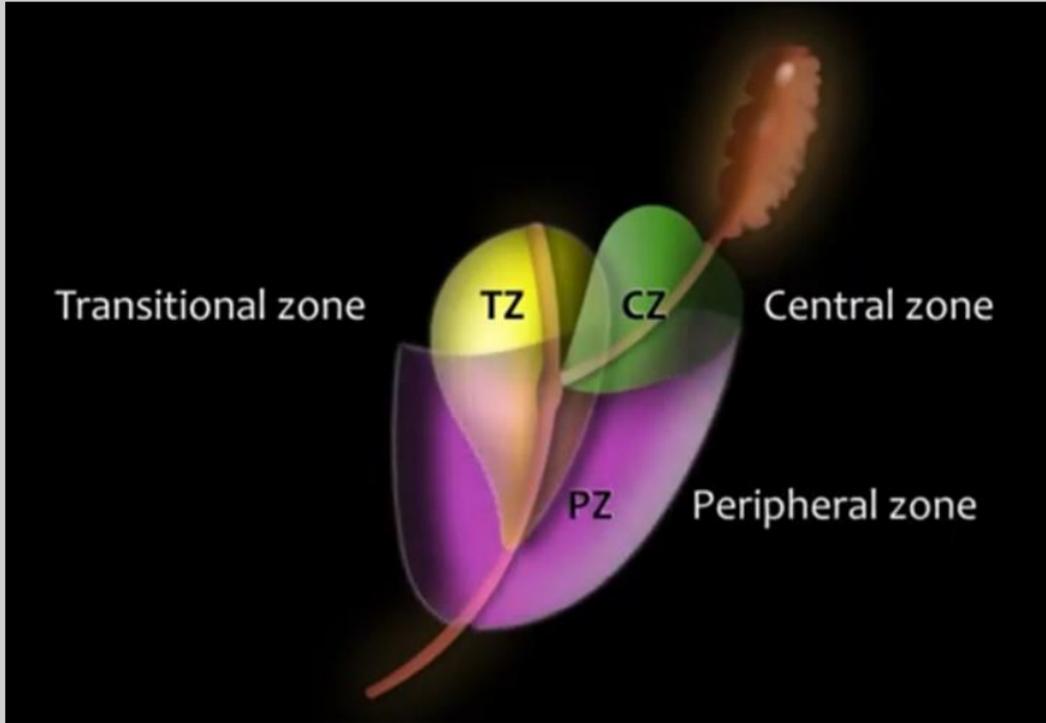


- The **Transitional zone** surrounds the prostatic urethra , 5% of the volume of the young adult prostate

“This zone enlarges in aging men resulting in **Benign Prostatic Hyperplasia**”

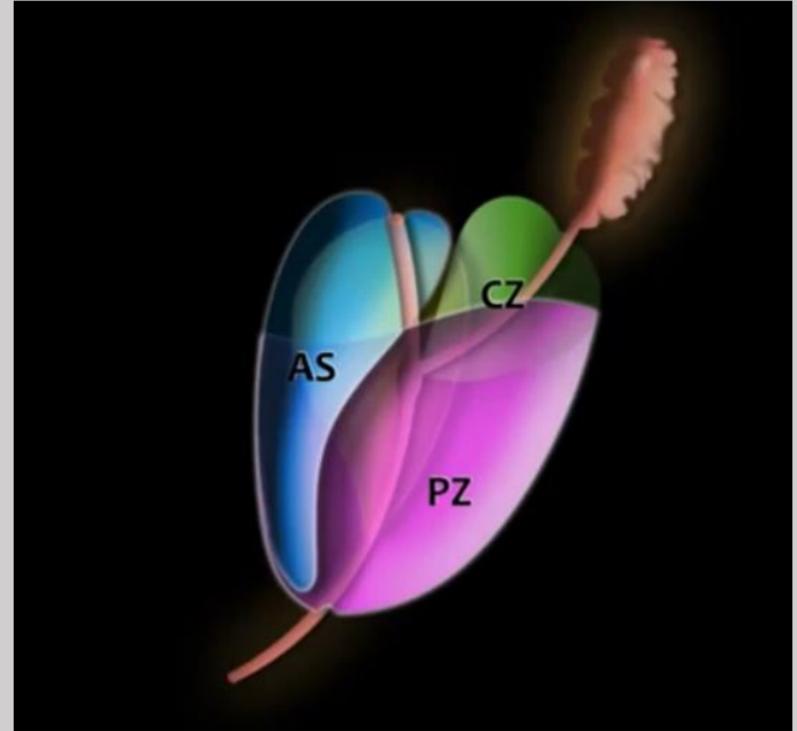
- The **Central zone** lies behind the transition zone and surrounds the ejaculatory duct , 25% of the volume of the young adult prostate





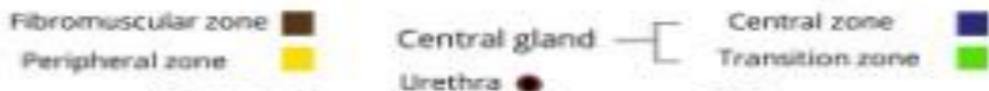
- The **Peripheral zone** is the largest area and situated on the posterior and lateral side, 70% of the volume of the young adult prostate

- The **Anterior fibromuscular stroma** is a thickened area of tissue , it surrounds the base and midportion of the prostate on the anterior side





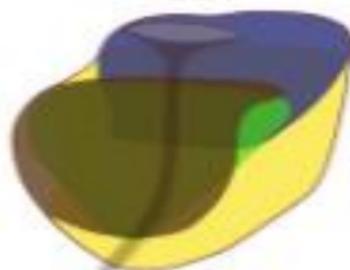
# Prostate anatomy



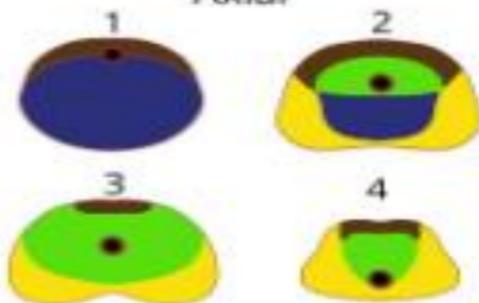
Coronal



3D



Axial



Sagittal



60-70% carcinoma of the prostate (CaP) originate in the peripheral zone , 10-20% in the transition zone and 5-10% in the central zone

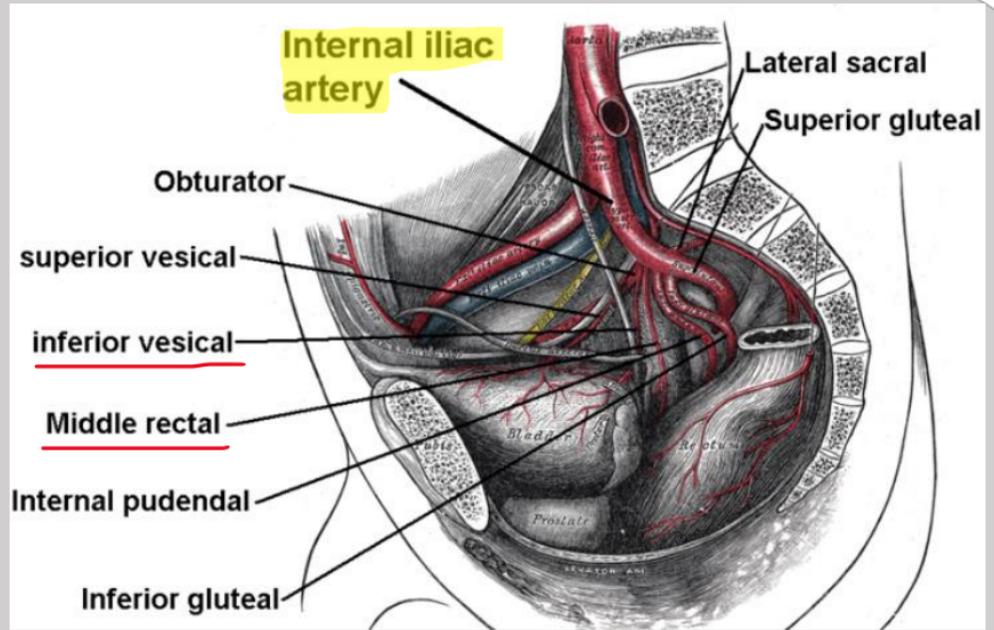


**BPH** uniformly originates in the **Transition** zone

- Blood supply :

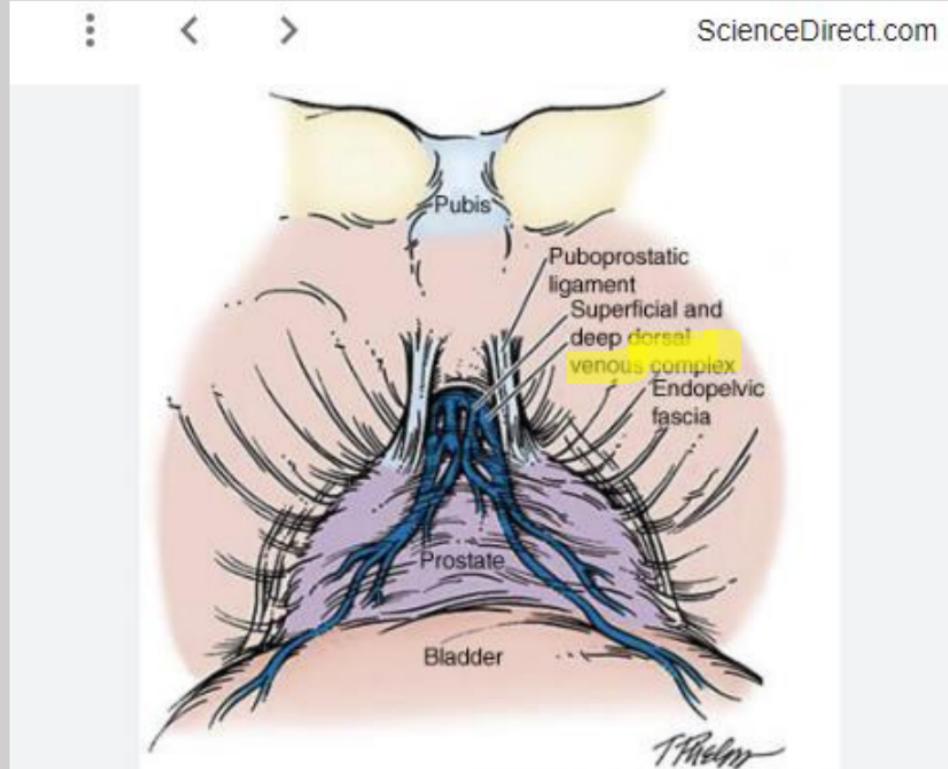
Derived from branches of the internal iliac artery (inferior vesicle & middle rectal arteries)

- Innervation :  
From pelvic plexus



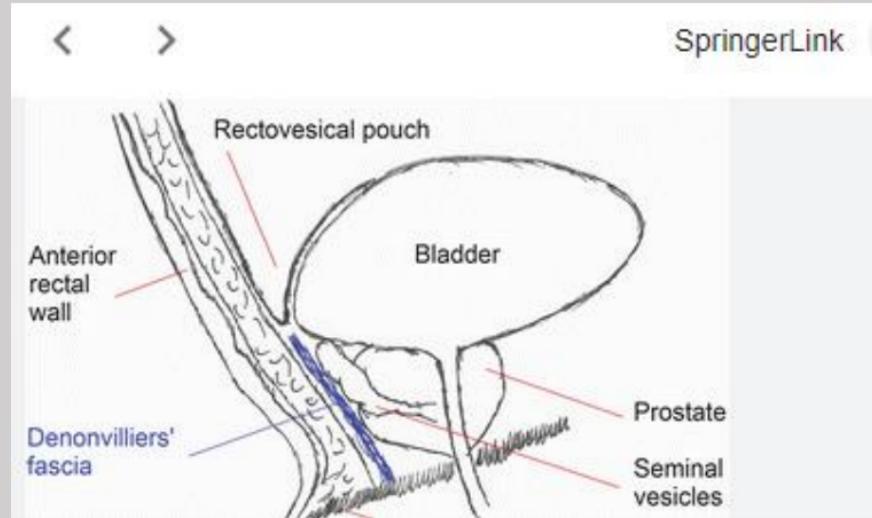
- Venous drainage :

Via the dorsal venous complex, which receive the deep dorsal vein of the penis before draining in the internal iliac vein



# Anatomical relations

- **Anterior** to the prostate is the symphysis pubis
- **Posteriorly**, the prostate is separated from the rectum by the fascia of Denonvilliers.
- **Behind and above** the prostate lies the bladder, seminal vesicle, vasa deferentia and ureters



- It comprises the most proximal aspect of the urethra

# Incidence & Epidemiology



- BPH is the most common benign tumor in the men , and its incidence is age related .
- The prevalence of histologic BPH in autopsy studies rise from approximately 20% in men aged 41-50 to 50% in men aged 51-60 , and over 90% in men older than 80
- Some studies have suggested a genetic predisposition, and some have noted racial differences as risk factor for development of BPH
- Heritable form of BPH is most likely autosomal dominant trait , and first-degree male relatives carry an increased relative risk of approximately 4 folds

# Etiology

The etiology of BPH is not completely understood , but it seems to be multifactorial and endocrine controlled .

The prostate is composed of both stromal and epithelial elements , and each can rise to hyperplastic nodules and symptoms of BPH

A positive correlation between levels of free testosterone and estrogen and the volume of BPH was found

*↑ enlargement → compress urethra → outlet resistant ⇒ obstructive symptoms (Voiding symp.)*

# DIAGNOSIS OF BPH: CLINICAL FEATURES

- Compression of the prostatic urethra and the way in which the bladder responds to obstruction are the main factors involved in symptom generation.

mainly →

*Obstructive*

## Voiding symptoms:

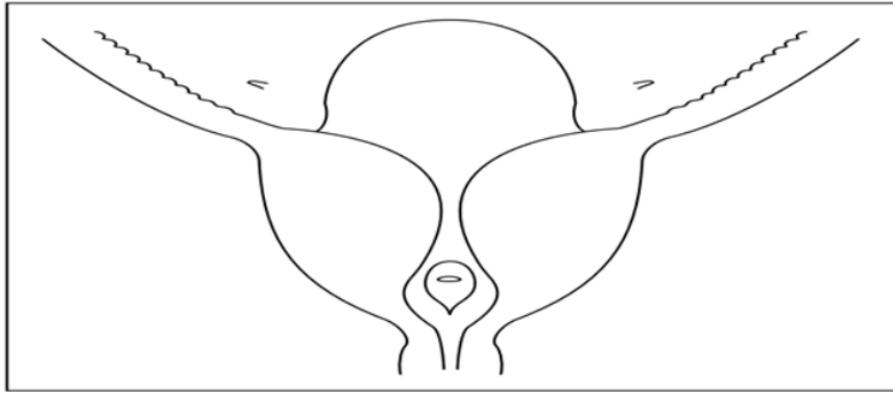
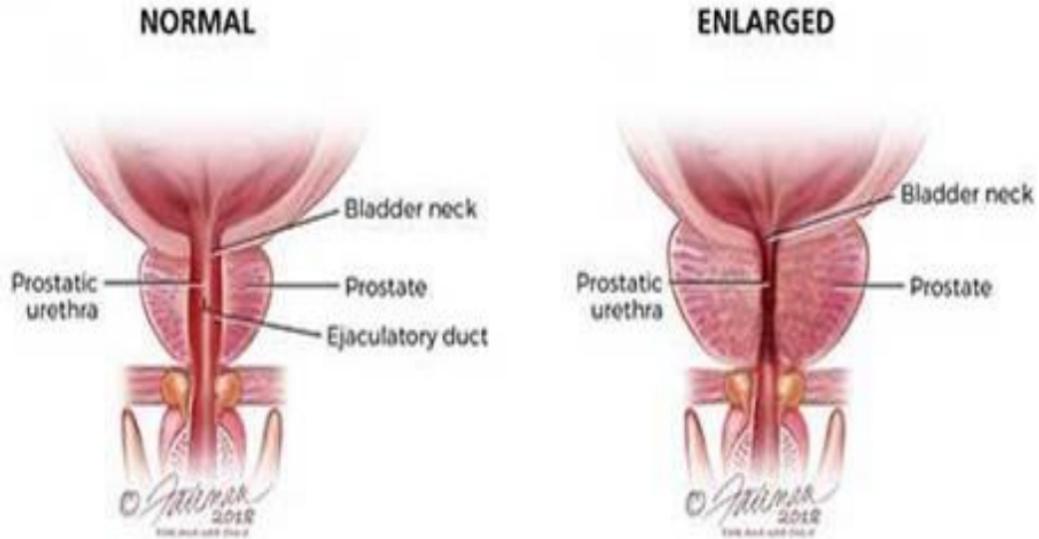
- Hesitancy *• Urinary retention*
- Poor stream
- Straining to urinate *intermittency*
- Incomplete voiding
- Double voiding (urinating a second time within 2 hours of the previous void)
- Terminal dribbling

## Irritative symptoms:

*or Storage Symp.*

- Frequency
- Urgency
- Nocturia

❖ The Irritative voiding complaints of BPH results from the middle lobe protrusion into the bladder causing obstruction to the bladder outlet.



- 
- Lower urinary tract symptoms and their detrimental impact on the patient known as 'bother' are quantified and documented using the International Prostate Symptom Score (IPSS).

It focuses on 7 items that asks patient to quantify the severity of their obstructive or irritative complaints on a scale of 0-5. Thus the score can range from 0-35.

The IPSS valid & reliable in identifying the need to treat patient and in monitoring their response to therapy.

A symptom score of:

- 0-7 is considered mild
- 8-19 is considered moderate
- 20-35 is considered severe

**International Prostate Symptom Score (I-PSS)**

Patient Name: \_\_\_\_\_ Date of birth: \_\_\_\_\_ Date completed \_\_\_\_\_

In the past month:	Not at all	Less than 1 in 5 times	Less than half the time	About half the time	More than half the time	Almost always	Your score
<b>1. Incomplete emptying</b> How often have you had the sensation of not emptying your bladder?	0	1	2	3	4	5	
<b>2. Frequency</b> How often have you had to urinate less than every two hours?	0	1	2	3	4	5	
<b>3. Intermittency</b> How often have you found you stopped and started again several times when you urinated?	0	1	2	3	4	5	
<b>4. Urgency</b> How often have you found it difficult to postpone urination?	0	1	2	3	4	5	
<b>5. Weak stream</b> How often have you had a weak urinary stream?	0	1	2	3	4	5	
<b>6. Straining</b> How often have you had to strain to start urination?	0	1	2	3	4	5	
	<b>None</b>	<b>1 Time</b>	<b>2 Times</b>	<b>3 Times</b>	<b>4 Times</b>	<b>5 Times</b>	
<b>7. Nocturia</b> How many times did you typically get up at night to urinate?	0	1	2	3	4	5	
<b>Total I-PSS score</b>							

**Score** 1–7: *Mild*

 8–19: *Moderate*

 20–35: *Severe*

Quality of life due to urinary symptoms	Delighted	Pleased	Mostly satisfied	Mixed	Mostly dissatisfied	Unhappy	Terrible
If you were to spend the rest of your life with your urinary condition just the way it is now, how would you feel about that?	0	1	2	3	4	5	6

P.E.

- On **DRE** of BPH result in a smooth, firm, non-tender, enlargement of the prostate. *PR: enlarged prostate, nodular, firm*

- Complications of BPH include:

1. **Retention**
2. **Overflow incontinence**
3. **Hydronephrosis**
4. **Renal insufficiency**
5. **Infection**
6. **Gross hematuria**
7. **Bladder stone**

obstructive symp. + large prostate + PSA within normal + PR → no hard nodules → Management of BPH

# DIAGNOSIS OF BPH: INVESTIGATIONS

## LABORATORY investigations:

1. A **urinalysis** to exclude infection or hematuria.
2. **Serum creatinine** measurement to assess renal function are required. Renal insufficiency may be observed in 10% of patients.
3. **Serum PSA** is considered optional but most physicians will include it in the initial evaluation.

KFT

Prostate-Specific Antigen (PSA) Test

4 - CBC

PSA is present in small quantities in the serum of men with healthy prostates, but is often elevated in the presence of prostate cancer or other prostate disorders.

PSA is not a unique indicator of prostate cancer, but may also detect prostatitis or benign prostatic hyperplasia.

## ■ RADIOLOGICAL investigations:

1. Upper tract imaging (intravenous pyelogram or **renal ultrasound**) is recommended only in the presence of concomitant urinary tract disease or complications from BPH ( e.g.: hematuria, UTI, renal insufficiency, hx. of stone ) .

2. **CYSTOSCOPY** :It is not recommended to determine the need for treatment but may assist in (choosing the surgical approach) <sup>-open?</sup> in patients opting for invasive therapy.

*ass. the efficacy of surgery → also ass. of bladder  
severe hypertrophy of M. (bcz prolonged obstruction)  
indicate no benefit from surgery*

3. **ADDITIONAL TESTS : Cystometrogram ( pressure measurement inside the bladder)** & urodynamic profile are reserved for patients with suspected neurologic disease or those who have failed prostatic surgery.

# DIFFERENTIAL DIAGNOSIS

*enlargement of prostate due to BPH, Prostate CA*

- Other **obstructive conditions** of the lower urinary tract must be entertained when evaluating men with presumptive BPH, such as:

*others:*

*or urethral stone*

*or bladder neck stone*

- **Urethral stricture**, **Bladder neck contracture**, (A history of previous urethral instrumentation, urethritis or trauma should be elucidated.) *or fibrosis*
- **Bladder stone**, (commonly associated with hematuria and pain.)
- **CaP**, (may be detected by abnormalities on the DRE ( hard or lumpy) or an elevated PSA.)
- **Neurogenic bladder disorder**, (history of neurologic disease, stroke, diabetes mellitus, or back injury may be present as well. In addition examination may show diminished perineal or lower extremity sensation or alterations in rectal sphincter tone or constipation.)
- *Petrosal sphincter dyssynergia*

# Treatment

1

## Conservative



- Encourage fluid intake
- Program the bladder

2

## Medical



- Smooth muscle relaxation
- Reduce epithelial hyperplasia

3

## Conventional surgical

- TURP / TUIP
- Simple open prostatectomy .

4

## Minimal invasive

- Get a modern PowerPoint Presentation
- Easy to change colors, photos and Text.

*old male 50-60y  
by investigation → no infection  
U/S PR → lury prostate  
PSA → within Normal  
Dx as BPH*

# Conservative (watch and wait)

- If **no complications** (no bladder diverticulum, bladder trabeculae or bladder stone) *or renal impairment*
- mild symptoms  0-7 score



## Your advices:

1. **Adequate fluid intake**
2. **Timed bladder voiding** (program the bladder) *every 3h*
3. **Avoiding of the smoking or excessive caffeine**

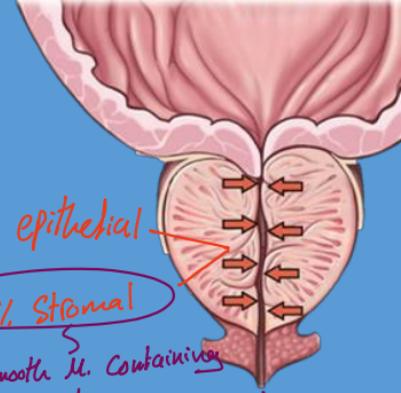
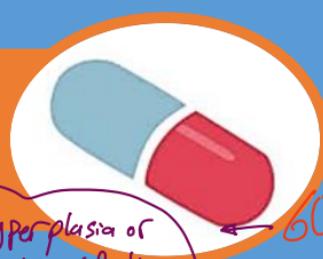


*failed ?!* <sup>go to</sup> medical therapy ✓

# When the treatment is indicated ??

- **Bothersome symptoms** → *affect QOL (quality of life)*
- **Complications**
  - **Acute urinary retention**
  - **Recurrent UTI**
  - **Recurrent hematuria**
- The **size** is **not indication** for treatment

# Medical treatment



from hyperplasia of epithelial proliferation that is depend on dehydro testosterone

60% epithelial

40% stromal

$\alpha$  receptors - Smooth M. Contain more tone (outlet resistant)

## 1 Alpha blocker

Non-selective - Systemic SE

Selective  $\alpha_1$  blocker

Alpha 1a receptor (in smooth muscles)

## 2 5-alpha reductase inhibitor

Epithelial tissue DHT sensitive

## 3 Combination

# 1 Alpha blocker

## Non-selective

- Good response
- **Systematic side effects:**
  - 1) Orthostatic hypotension
  - 2) Dizziness
  - 3) Retrograde ejaculation

**Phenoxybenzamine**

**Prazosin** (short acting)

## Selective

- Block **alpha 1a** (specific)
- **Less Systematic S.E.**

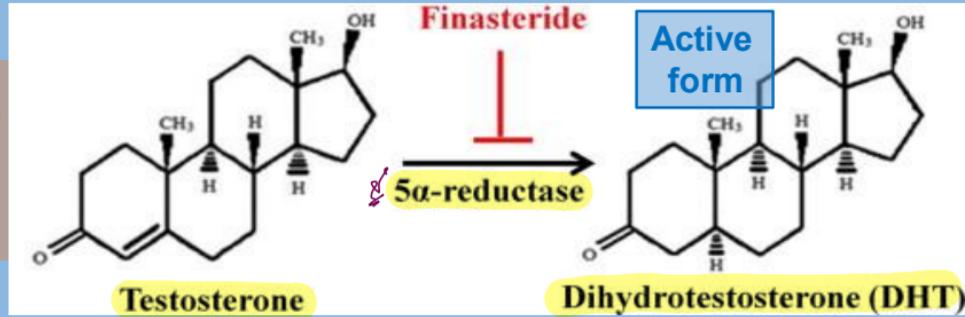
**Tamsulosin** + *afuzosin*



- ✓ Smooth muscle relaxation  decrease the outlet resistance
- ✓ Improvement within 24 h

# 2

## 5-alpha reductase inhibitor



- Epithelial components depend on DHT
- Which will cause hyperplasia of the epithelial tissue
- Finasteride  $\square$  epithelial shrinkage



✓ Shrinkage of the epithelial tissue (block epithelial proliferation)  
✓ Improvement within 2 month and the maximum efficacy within 9 month

6m  $\rightarrow$  reduction in size of prostate 20%

3

## Combination

Alpha blocker + 5-alpha reductase inhibitor

4

## Anticholinergic

- Just if there is irritating symptoms (urgency , frequency and urge incontinence )
- But may precipitate **urinary retention**

# Conventional surgical

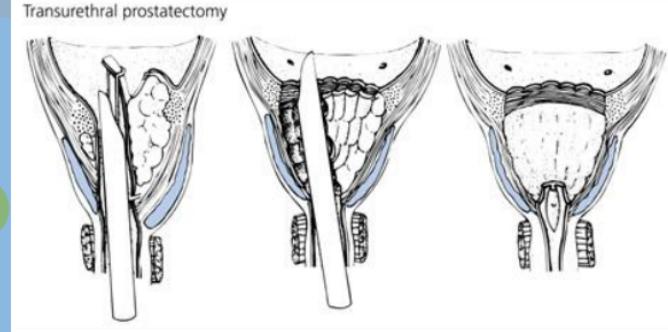
- 1 Trans urethral resection of the prostate (TURP)
- 2 Trans urethral incision of the prostate
- 3 Open simple prostatectomy

# What is the indications for surgery??

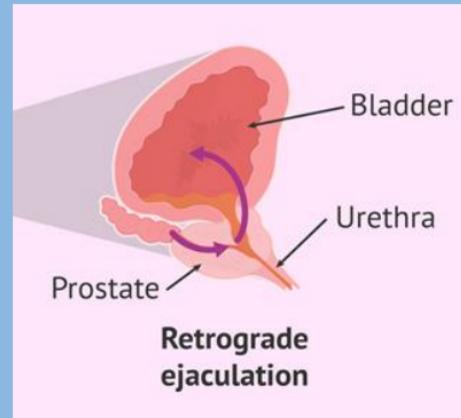
- Failing of the medical treatment *→ persistent of bothering sym. despite medical ttt*
- Recurrent UTI
- Recurrent hematuria
- Recurrent urinary retention
- Bladder complications (diverticulae / stone)
- Kidney complications (elevated Cr / hydronephrosis)

# 1 Trans urethral resection of the prostate (TURP)

- Under GA or spinal anesthesia Insertion of the endoscope contain **resection lobe**
- Resection of the obstructing tissue (remove)
- Irrigating fluid → *hypotonic (glycine & water)*
- ✓ Improvement of the symptoms score and the flow rate (better than minimal invasive procedure)
- ✓ but more complication (relatively higher mortality rate )
- The **gold standard** procedure for bladder outflow obstruction



# Complications of the TURP:



1. Retrograde ejaculation (majority)
2. Impotence
3. Incontinence (especially men with storage symptoms)
4. TUR syndrome - rare
5. Urethral stricture
6. Bleeding

\* Under irrigating p. → irrigated fluid can enter to venous sinuses prostate due to circulation causing \*

## TUR syndrome:

- Hypervolemic hyponatremic state due to absorption of the hypotonic irrigating fluid
- Symptoms are: N+V, confusion, HTN, bradycardia and visual disturbances
- ✓ Treatment  <sup>Usually:</sup> diuresis / <sup>If unresponsive sever symp.</sup> hypertonic saline (in severe cases)
- ✓ The surgery should not exceed 90 minute to avoid this syndrome

# 2

## Trans urethral incision of the prostate

*Un Common*

- endoscope contain needle (not resecting lobe)
- Deep two Incisions at 7 and 5 o'clock
- Lead to relaxation of the prostate

### 3 Open simple prostatectomy

- Open surgery (retropubic / transvesical) *✓ الأكثر استخداماً ✗*
- Simple (not radical) *inoculation*  *↳* remove all the prostate tissue except the capsule (compressed peripheral zone)  enucleation of the prostate
- This procedure does not lower the risk of prostate cancer

#### Indications:

1. Large prostate > 100g *80g or* *↳ bcz, it needs longer time ⇒ more risk of TUR syndrom*
2. Bladder stone / diverticulum / inguinal hernia
3. If lithotomy position is not possible (hip surgery / orthopedic surgery)
4. Long urethra / urethral stricture *⇒ open أفضل*
5. Severe bleeding during the TURP *⇒ open فتحة ذلي inoculation*

! vesion *سكتة ال*

# Minimally invasive procedure

- new 1. **Laser therapy** → blood less operation / very expensive
2. **Transurethral electrovaporization of the prostate**
3. Transurethral needle ablation of the prostate
4. high-intensity focused ultrasound
5. **Intra-urethral stents** (unstable for surgery or unco-operative patient)
6. Transurethral balloon dilation of the prostate
7. hyperthermia

# PROSTATIC CANCER

normal ageing process

↳ indolent CA → not rapidly spreading

# Prostate Adenocarcinoma

Most common form of cancer in men (most prevalent for >65 men)

\* Good prognosis!

b/c of TZ is around urethra

↓  
early presentation

(obstructive  
symp. as BPH)

↓  
by investigation

\* PR → hard loop

\* PSA → elevated

2nd most deadly (lung)

Occur in **peripheral zone PZ (posterior lobe)** of prostate (10-20%) from

70%

TZ, (5-10%) may arise from CZ

↳ b/c of this → TURP (prostatectomy) doesn't protect pt from prostate CA

Classically posterior lobe

Mets to prostate are very rare

Methods of tumor spread:

Local invasion

Lymphatic

Hematogenous

Most common site for metastasis in Prostatic CA is bone (sclerotic lesion; purely osteoblastic)

→ Not osteolytic!!

# Risk factors

Age (>65) *most imp.*

African Americans

Family Hx

1st degree relative = 2X risk

1st and 2nd degree relatives = 9X risk

High dietary fat

Familial prostate CA gene *on chr 1*

*↓*  
*just increasing the risk*

# Clinical features

→ typical presentation to BPH

Early prostate cancer usually asymptomatic

If symptomatic:

Obstructive symptoms: hesitancy, decreased force and caliber of the stream, sensation of incomplete bladder emptying, straining to urinate, postvoid dribbling.

Irritative symptoms: frequency, urgency, nocturia

\* presentation different in case of local invasion (metastasis):

Back pain, incontinence

Bone pain ( metastasis )

Leg pain and edema (nodal metastasis ; lymphatic and venous obstruction)

# Prostate Adenocarcinoma

## Investigations and Diagnosis:

*the best screening for prostate CA:*  
PR + PSA

### Digital rectal exam (DRE) ; findings:

Nodularity with heterogenous texture

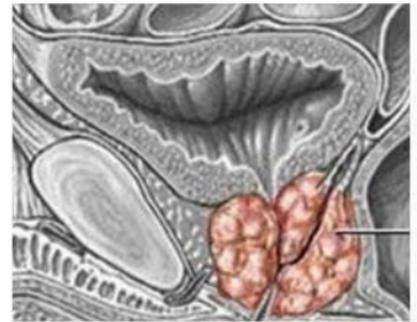
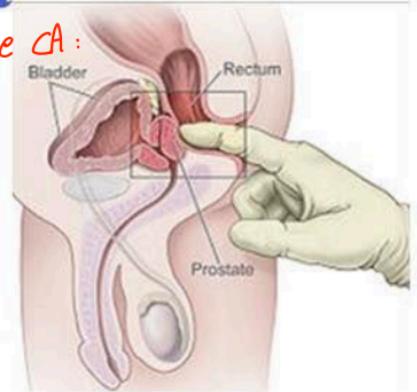
Stony Hard irregular surface

Absence of median sulcus *-if involved both lobes*

Asymmetry

Tethered rectal mucosa

50% of abnormal DREs are associated with prostate cancer, the remainder being benign hyperplasia, prostatic calculi, chronic prostatitis, or post-radiotherapy change



# Prostate Specific Antigen (PSA)

- Enzyme released by prostate during ejaculation
- PSA is prostate-specific, but **not prostate cancer-specific**.
- Leaks into circulation < 4 ng/ml

## Other causes of elevated serum PSA are :

- BPH
- UTI
- Prostatitis
- Prostatic massage
- Acute urinary retention
- Biopsy, TURP, surgery
- Ejaculation
- DRE / *folly's catheterization*

**PSA**  $\rightarrow$  to elevate sensitivity & specificity to test  $\rightarrow$   $\frac{fPSA}{Total PSA}$  ratio  $\rightarrow$   $>17\%$ : unfavorable  
 $<17\%$ : favorable

**Total PSA = free PSA 15% + complexed PSA (85%)**

**Free to total PSA ratio:**  $= \frac{free PSA}{Total PSA}$   $\rightarrow$   $>17\%$ : favorable ratio (the cause of  $\uparrow PSA$  is benign cause)  
 $<17\%$ : Unfavorable ratio (the cause of  $\uparrow PSA$  could be related to prostate CA)

• In prostate cancer the complexed PSA increases and the free decreases

•  **$<10\%$  free PSA (of total)  $\square$  suggestive for cancer**

•  **$>20\%$  free PSA  $\square$  suggests benign cause**

**Causes of unfavorable ratio:**

① prostate CA

② Prostatitis

③ technical error (half life for free PSA 3h)  
Total " 30h

**Pt with unfavorable ratio:**

1<sup>st</sup>: oral antibiotic for 1 month  $\Rightarrow$  to rule out prostatitis

2<sup>nd</sup>: repeat the test

3<sup>rd</sup>: still unfavorable ratio  $\rightarrow$  biopsy: for diagnosis of CA

• **PSA density** =  $\frac{\text{total Serum PSA}}{\text{prostate volume}}$  →  $\frac{\text{سرس}}{\text{حجم}}$  Ratio →  $>17\%$  unfavorable  
 $<17\%$  favorable  
>0.15 ng/ml/g associated with increase risk of cancer

• **PSA velocity** <sup>(معدل الزيادة (total PSA))</sup>: The amount of increase in the PSA level in one year, normally  $< 0.15 \text{ ng/year}$   
Change of  $>0.75 \text{ ng/ml/year}$  associated with increased risk of cancer  
↳ rapid elevation in total PSA → suggestive of CA

• **PSA doubling time**: for already diagnosed prostate CA Pt's; to see if it is aggressive or not? / high or low risk?

**PSA elevations may help in staging, and following up.**

# Age adjusted PSA reference ranges

PSA normal range(ng/ml)	age
0-2.5	40-49
0-3.5	50-59
0-4.5	60-69
0-6.5	70-79

# Transrectal ultrasound (TRUS)

TRUS is useful in:

1. prostatic biopsies under TRUS guidance
2. Staging information (detect extracapsular extension)
3. Measurement of prostate volume.

# TRUS-guided needle biopsy

- The decision to proceed to prostate biopsy should be based primarily on PSA and DRE results , but should take into account multiple factors ( free and total PSA , pnt age, PSA velocity , PSA density, family Hx, ethnicity and comorbidities)

\* before TRUS biopsy we prepare pt by antibiotic (injection gentamicin, levofloxacin beginning from 3days) +  
Clear fluid diet at night & fasting at the day of biopsy

# Complications of prostatic biopsy

- Vaso-vagal, fainting immediately after the procedure.
  - Septicaemia.
  - Rectal bleeding.
  - Mild haemospermia or haematuria, for up to three weeks.
  - Acute prostatitis
- MC



Diffuse osteoblastic bone metastasis

# Methods of tumor spread

- Local invasion<sup>MC</sup> •  
obturator > iliac > presacral/para-aortic)
- Lymphatic ( •
- Hematogenous •

Prostatic CA is the commonest site of origin for skeletal mets → osteoblastic •  
(sclerosis)

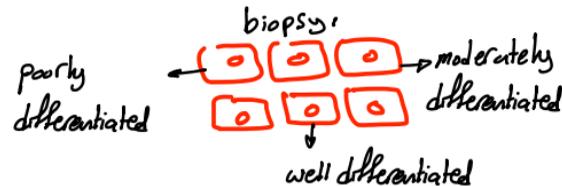
*other CA → osteolytic*

# Staging

through CT scan & IV contrast / MRI  
The **TNM system**, evaluates the size of the tumor, the extent of involved lymph nodes, and any metastasis.

**Gleason's system** ~~\*\*~~ - for grading -

\*\* Used bcz prostate CA is heterogenous ↘



# Gleason's system → 1-5 grades

It is a system that relies upon the low-power appearance of glandular architecture ☉ under the microscope.

**Primary grade** - assigned to the **dominant pattern of the tumor** (has to be greater than 50% of the total pattern seen).

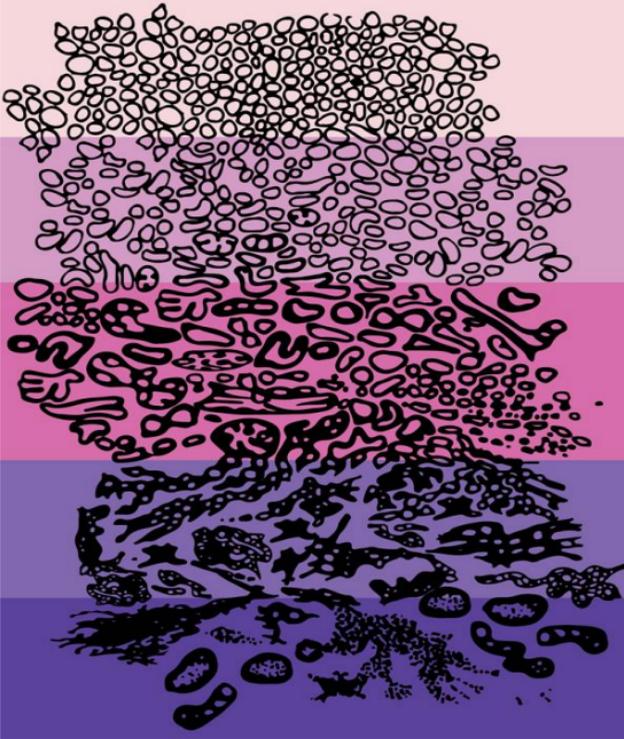
**Secondary grade** - assigned to the **next-most frequent pattern** (has to be less than 50%, but at least 5%, of the pattern of the total cancer observed).

*from 2-10*  
**Gleason sum** → is the addition of the primary and secondary glandular patterns present on microscopic examination

*Higher Gleason score are more aggressive and have a worse prognosis.*

e.g: a Gleason 3+3 = 6 adenocarcinoma carries a worse prognosis than a 3+2 = 5 cancer of equivalent stage.

# Gleason's Pattern



1. Small, uniform glands

2. More stroma between glands

3. Distinctly infiltrative margins

4. Irregular masses of neoplastic glands

5. Only occasional gland formation

Well differentiated

Moderately differentiated

Poorly differentiated/  
Anaplastic

stem

- ◎ tumour grade (Gleason score out of 10)
- 2-4 represent well differentiated
- 5-7 represent moderately differentiated
- 8-10 represent poorly differentiated

# “T” - Primary tumor

**TX:** cannot evaluate the primary tumor

**T0:** no evidence of tumor

**T1:** clinically undetectable tumor, normal DRE and TRUS

T1a: tumor was incidentally found in **less than 5% of prostate tissue resected** (for other reasons) •

T1b: tumor was incidentally found in **greater than 5% of prostate tissue resected** •

T1c: tumor was **found in a needle biopsy** performed due to an elevated serum PSA •

**T2:** palpable, confined to prostate

T2a: the tumor is in **half or less than half of one lobe of the prostate** gland's •

T2b: the tumor is in **more than half of one lobe**, but not both

T2c: the tumor is in **both lobes** •

way through, it is still

**T3:** the tumor extends through the prostatic capsule (if it is only part-

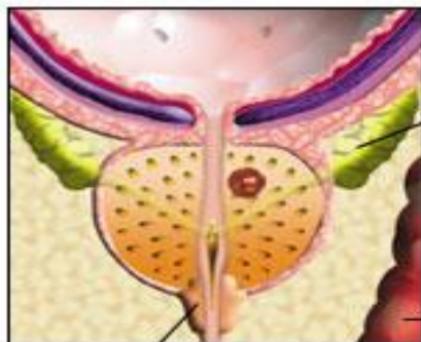
T2)

T3a: the tumor has **spread through the capsule on one or both sides** •

T3b: the tumor has **invaded one or both seminal vesicles** •

**T4:** the tumor has invaded adjacent structures

**T1**



Seminal vesicle

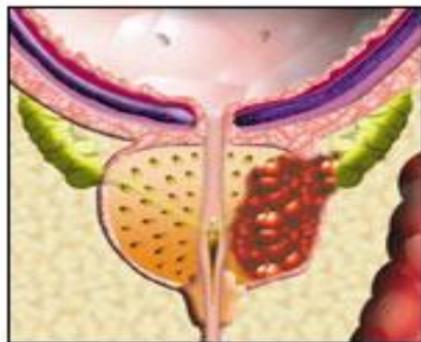
Rectum

External urinary  
sphincter muscle

**T2**



**T3**



**T4**



## “N”

**N0**: no regional lymph node metastasis •

**N1**: spread to regional lymph nodes •

## “M”

**M0**: there is no distant metastasis •

**M1**: there is distant metastasis •

**M1a**: non-regional L.N •

**M1b**: the cancer has spread to bone •

**M1c**: the cancer has spread to other sites (regardless of bone involvement) •

# Prostate cancer mortality risk

imp.

	Low risk	Moderate risk	High risk
PSA	<10	10-20	>20
Gleason score	<7	7	8-10
stage	T1-2a	T2b-T2c	T3/4

} All of them

} one of them

} one of them

\* This is what determines the management of the patient

Prognostic factors :  
Tumor stage, grade , PSA value and PSA doubling time



# Prognosis

- T1-T2: comparable to normal life expectancy
- T3-T4: 40-70% 10-yr survival
- N+ and/or M+: 4 % 5 yr survival

# Treatment

- **T1\T2 (localised,LOW-RISK)**  
if young consider radical prostatectomy (<70 y.o.)  
brachytherapy or radiation.

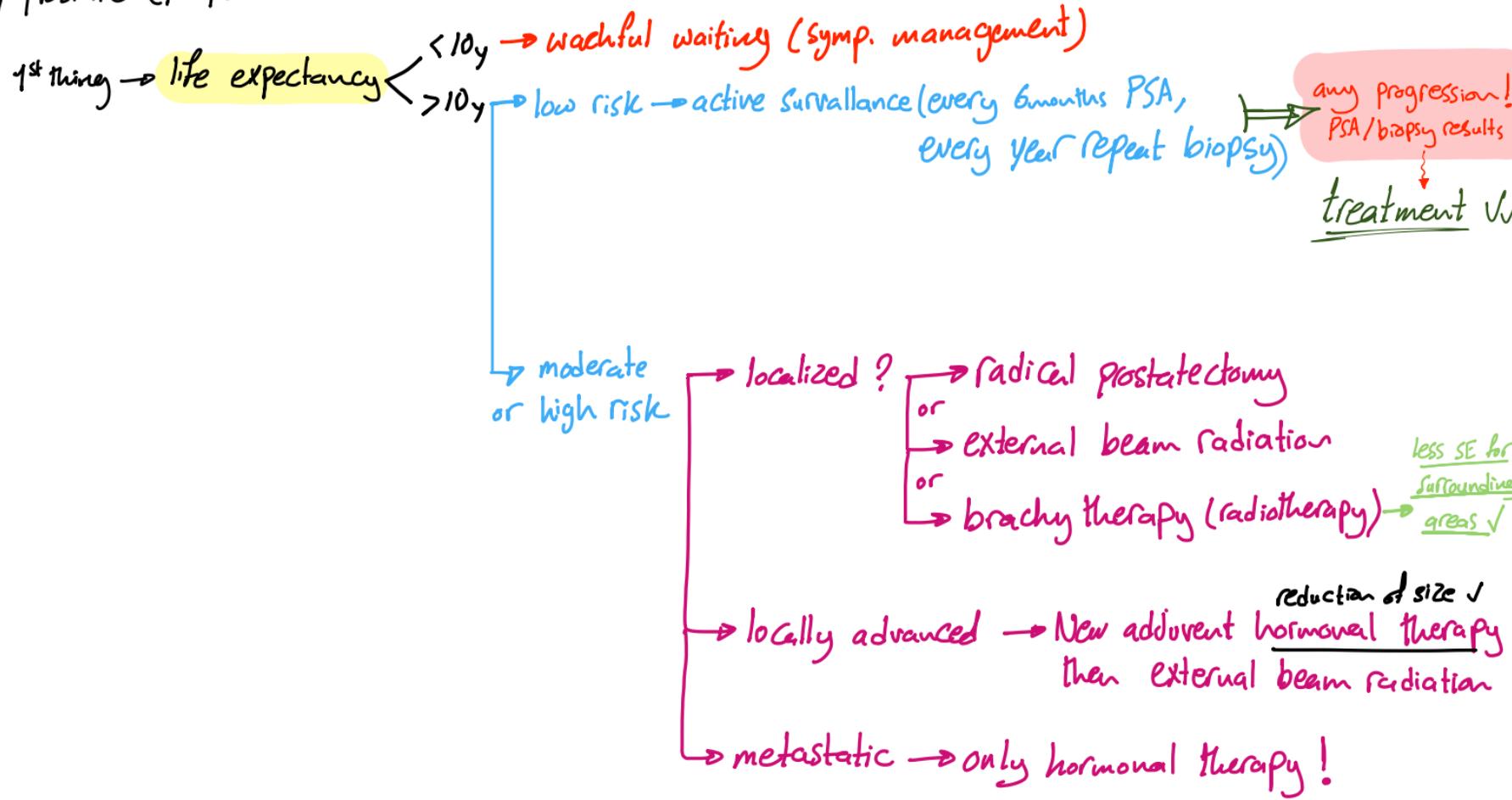
Older patients treated with watchful waiting or hormone treatment (if PSA>20) → Rarely treat localised cancer in the over 80s

- **T3\T4**  
Staging lymphadenectomy and radiation or hormonal

- **N>0 OR M>0**

Hormonal / palliative radiotherapy for mets  
Chemotherapy in advanced disease

\* prostate CA pt:



- Of circulating androgen, 95%, mainly testosterone, is produced by the
- Leydig cells of **the testes** under the influence of luteinizing hormone (LH).
- The anterior pituitary synthesizes LH, stimulated by LH-releasing hormone
- (LHRH) produced by the hypothalamus. The remaining 5% of circulating
- androgen is synthesized by adrenal cortex from cholesterol

- All prostate epithelial cells are dependent on androgens to grow or undergo programmed cell death

- **Androgen deprivation** results in a reduction in PSA and clinical improvement in the majority of patients.
- However, most will still die within 5 years **because of the development of androgen-independent growth**

# Hormonal Therapy (androgen deprivation):

- **Mechanisms of androgen deprivation**

- **Surgical castration:** bilateral orchiectomy *loss 95% of androgen (remaining 5% from adrenal)*
- **Medical castration:** LHRH agonists, LHRH antagonists, estrogens
- **Antiandrogens** (steroidal or nonsteroidal): androgen receptor blockade at target cell

*most imp.:* GnRH agonist <sup>xx</sup> (continuous-injection pattern) every 1 or 3 months

- inhibitors of steroidogenesis

- **Maximal androgen blockade (MAB):** medical or surgical castration plus anti-androgen

*xx AT the beginning: stimulation & enlarge suddenly even can cause pathological feature; bcz of this these drugs given simultaneously with androgen receptor blocker*

- ***Side effects of bilateral orchiectomy and LHRH agonists/antagonists***

- • Loss libido
- • Hot flushes
- • Weight gain and obesity
- • Gynecomastia
- • Anemia
- • mood changes
- • Metabolic syndrome (increased blood glucose and lipid profile)
- • Osteoporosis and pathological fracture occur in patients on long-term treatment

## • **Prognostic factors**

Predictors of poor hormone therapy response include the following:

- More than 5 metastatic lesions
- • Elevated alkaline phosphatase
- • Anemia at presentation
- • Poor performance status
- • Low serum testosterone
- • Failure of bone pain to improve within 3 months of treatment
- • Failure of PSA to normalize within 6 months of treatment

## ***Complications***

- These include ED, urinary retention, stress incontinence, and recto-urethral fistula (rare).

# General principles of management of localized prostate cancer



When considering treatment options for the man with localized prostate cancer, the following factors should be considered in the discussion: ♦

- Patient's life expectancy and overall health status
  - Tumor characteristics, including Gleason score, tumor stage, PSA levels, PSA velocity and PSA doubling times
  - Risk stratification
- 

# Treatment protocol of prostate cancer

- If life expectancy <10 years, Watchful waiting(symptomatic ttt)
- If life expectancy > 10 years, .....>>asses the risk

# Treatment

➤ **Low risk**

**Active surveillance:** PSA every 6 months and biopsy - 1 year

➤ **intermediate risk**

**Without metastasis:** Radical prostatectomy

**With metastasis:** Short course ADT (androgen deprivation therapy) then Radiotherapy

➤ **High risk:**

**Localized:** Radical prostatectomy + EBT (external beam radiotherapy)

**Locally advanced:** Neoadjuvant hormonal + EBT

**Metastasis:** Hormonal therapy only (GnRH agonist injection every 1-3 months or surgical castration (bilateral orchiectomy))

# watchful waiting and active surveillance

**Watchful waiting** is based on the premise that some **patients will not benefit** from definitive treatment of the primary prostate cancer .

**Active surveillance** is based on the concept that some, but not all patients **may derive benefit** from treatment of their primary prostate cancer. ♦

**Advantages of active surveillance** include **avoidance of possible side effects and costs** of definitive therapy that may be **unnecessary**, and maintaining quality of life.

**Disadvantages** include **possibly missing an opportunity for cure**, the risk of progression and/or metastasis, increased anxiety, increased physician visits and tests, and causing subsequent treatment to be more aggressive.

# watchful waiting and active surveillance

## Surveillance protocol: (low risk)

Patients must have clinically localized disease and be candidates for definitive treatment and choose observation.

- **DRE and PSA** as often as every 6 months but at least every 12 months
- Repeat **prostate needle biopsy within 6 months** of diagnosis if initial biopsy was <10 cores
- **Needle biopsy may be performed within 18 months** if >10 cores obtained initially, then done periodically

# radical prostatectomy

**Radical (total) prostatectomy** (RP) is excision of the **entire prostate**, including the **prostatic urethra**, with the **seminal vesicles**. It may be performed by **open retropubic**, **perineal**, **laparoscopic**, or **robotically** assisted laparoscopic approaches.

**RP is indicated** for the treatment of men in **good health** with localized prostate cancer whose **life expectancy exceeds 10 years**, with curative intent.

# radical prostatectomy

## Complication of the surgery :

1. intraoperative obturator nerve , ureteral or rectal injury  
**[early ]**
2. it results in high incidence of **impotence** but a low incidence of severe **stress incontinence** <2% **[late]**
3. **bladder neck stenosis** (bladder neck contracture) **[late]**
4. **bleeding** or **infection** may happen with any surgery

# radical external beam radiotherapy (EBRT)

## Indications

clinically localized prostate cancer  
life expectancy >5 years.

## Contraindications

- Severe lower urinary tract symptoms (risk of radiation cystitis)
- Inflammatory bowel disease (risk of radiation proctitis)
- Previous pelvic irradiation

# brachytherapy (BT)

This is ultrasound-guided trans perineal **implantation of radioactive seeds**.

- **Indications for BT as monotherapy**

BT is best for low-risk disease: localized T1–2a, Gleason <6, PSA <10 ng/ml prostate cancer, with a life expectancy >5 years.

- **Indications for BT with EBRT**

- In the non-protocol setting, patients with intermediate-risk prostate cancer are sometimes treated in combination: T2b–T2c, Gleason 7, PSA 10–20 ng/ml.

# brachytherapy (BT)

- **Contraindications to BT**

- **previous TURP** (risk of incontinence)
- **large-volume prostate** (>60 mg), which causes difficulty with seed placement
- moderate to severe lower **urinary tract symptoms** (risk of retention).
- **High-risk prostate cancer** does not do well with BT monotherapy and should not be performed

# Cryotherapy and HIFU

- These two **minimally invasive treatments** for localized prostate cancer
- they are viable **alternatives to radical surgery or radiotherapy** and that they are options for salvage treatment of organ-confined recurrent disease following radical radiotherapy

# Cryotherapy

- Cryotherapy, or cryoablation, for prostate cancer is the controlled freezing of the prostate gland. The freezing destroys cancer cells. Cryotherapy is done under anesthesia. This treatment is **for men who are not good candidates for surgery or radiotherapy because of other health issues**. For this procedure, the prostate is imaged and measured. Special needles called "cryoprobes" are placed in the prostate under the skin. The needles are guided by ultrasound, to direct the freezing process.
- **Complications** include ED, urinary retention, stress incontinence, and recto-urethral fistula (rare).

# High-intensity focused ultrasound (HIFU)

- HIFU has the potential of **selective destruction** of tissues at depth without damaging intervening structures. Tissue is heated to the point of coagulative necrosis by high-energy ultrasound transmitted to the prostate using a transrectal device.



# Benign scrotal swellings

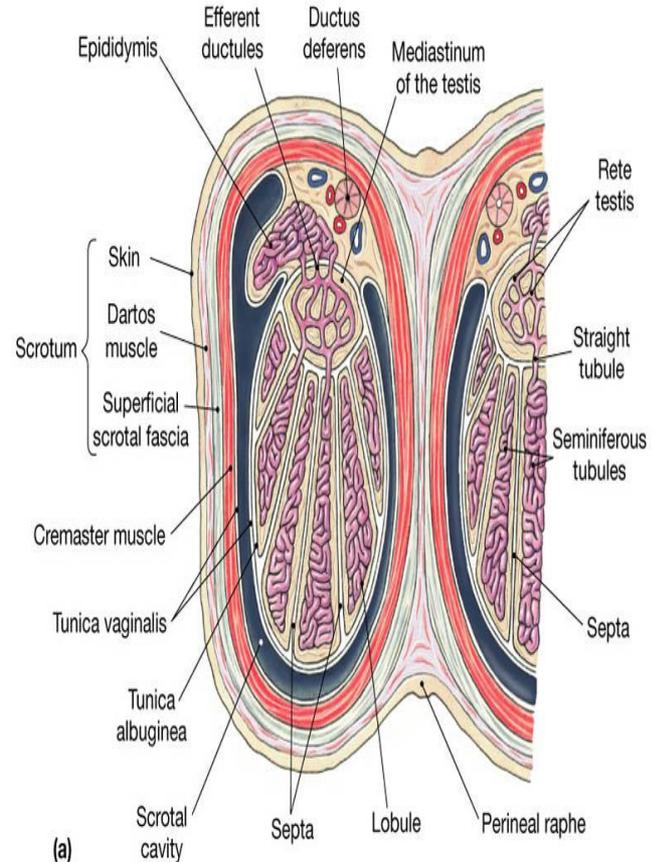
Yazeed Aldarabah

Rama Shmaileh

Sara Aljaafreh

# The wall of scrotum has the following layers

- 1-skin
- 2-superficial fascia( dartos muscle+colles fascia)
- 3-external spermatic fascia derived from the external oblique
- 4-cremasteric muscle derived from the internal oblique
- 5- internal spermatic fascia derived from the fascia transversalis
- 6-tunica vaginalis(remnant of Peritoneum )



## – The tunica vaginalis:

- is the lower expanded part of the processus vaginalis
- it becomes closed before birth thus it is closed sac,
- It is invaginated from behind by the testis (covers the **anterior, medial, and lateral surfaces** of testis).

## – Lymph Drainage:

- The penis and scrotum, including the tunica vaginalis, drains into the **superficial inguinal L.N.**

## – The cremaster muscle:

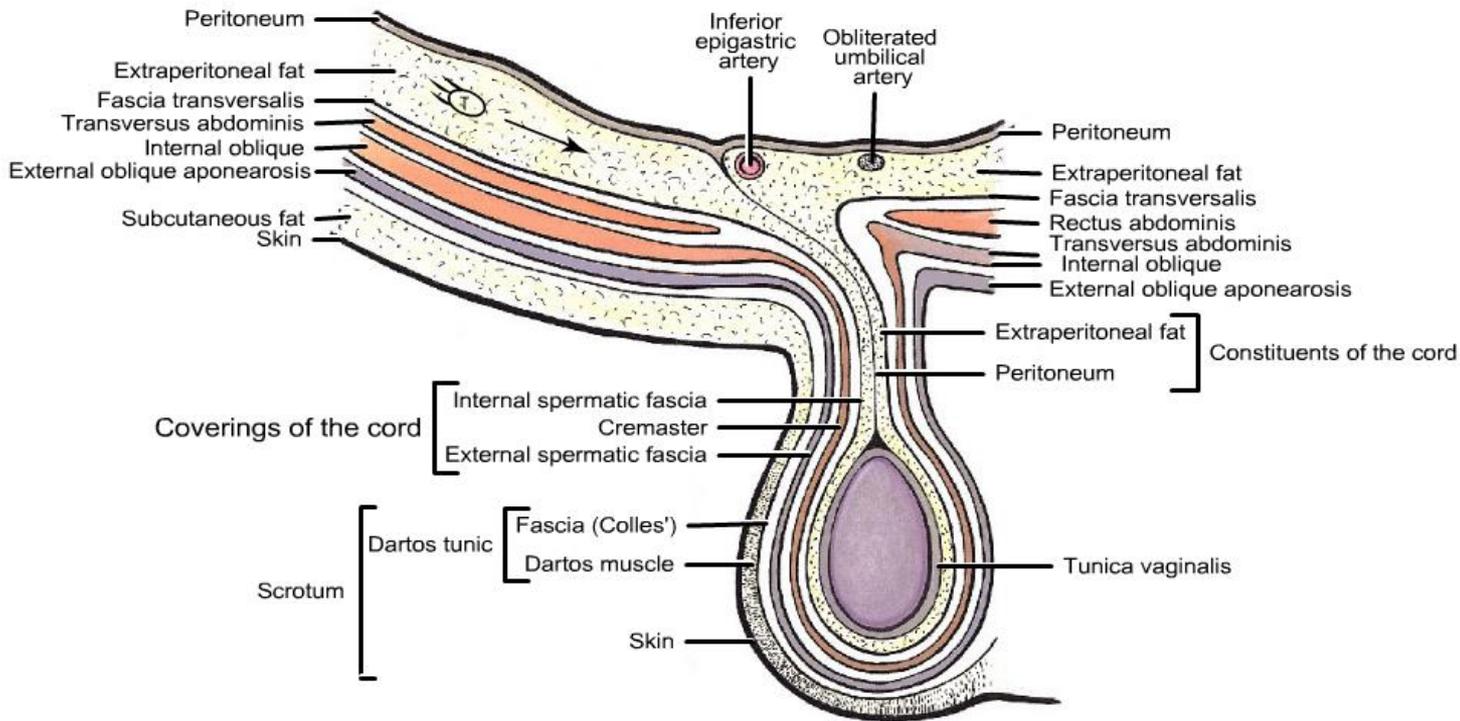
- Can be made to contract by stroking the skin on the medial aspect of the thigh i.e. **cremasteric reflex.**
- The function of the cremaster muscle is to raise the testis and the scrotum upward for warmth and for protection against injury.

3 covering sheaths of spermatic cord:

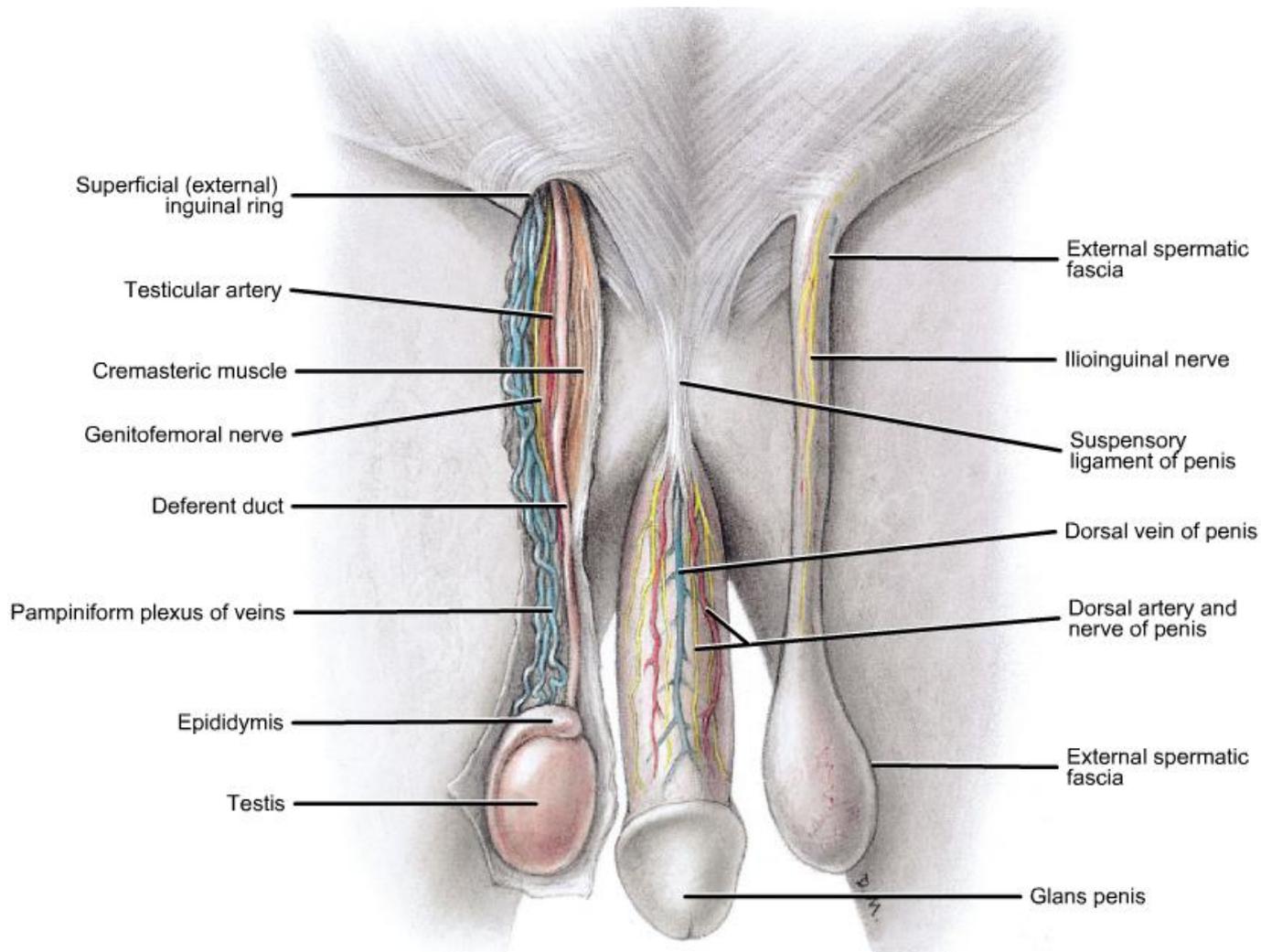
\* external cremasteric fascia → from external oblique M.

\* cremasteric M. → internal oblique M.

\* internal cremasteric fascia → transversus abdominis M.



*\* testes are at a temperature about 1-2°C lower than body temperature*



# Scrotal swellings

## Painless

- Hydrocele
- Spermatocele
- Varicocele
- Tumor (non hemorrhagic)
- Hernia

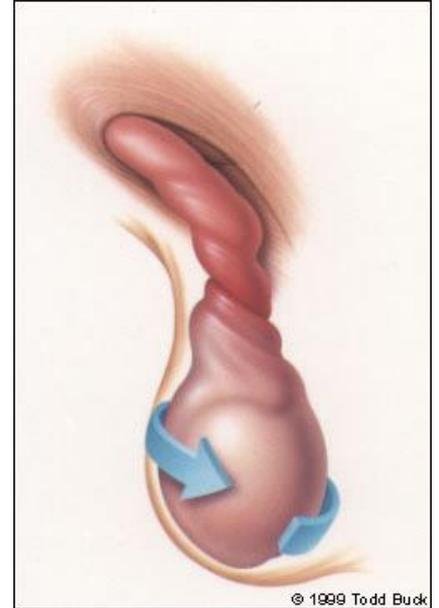
## Painful

- Epididymo-orchitis
- Torsion
- Tumor (hemorrhagic)
- Hematocele
- Strangulated indirect Hernia

# **PAINFUL SCROTAL SWELLING**

# 1-Testicular torsion

- It is an **Emergency**.
- Due to twisting of the spermatic cord with interference to the **arterial** blood supply+**venous** occlusion, obstructing the blood supply and venous return and if blood supply isn't restored within 4-6 hours we will lose the testicle.
- May have torsion of cord or appendages.
- Incidence is highest between **10-16** y.o. but may happen at any age.



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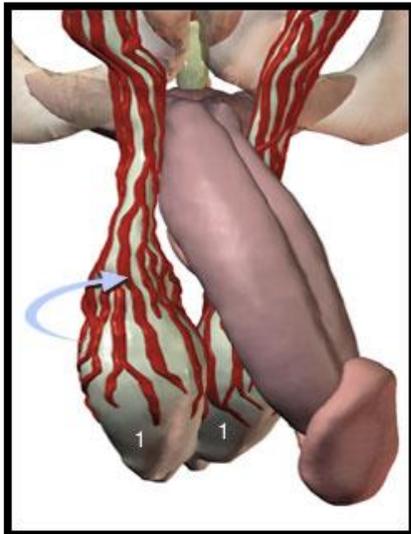
# Clinical Feature

- Testicular pain & swelling (**Sudden**) radiating to the groin, loin, or epigastrium
- sometimes a **history of minor trauma** to the testis
- previous similar episode
- **Most cases spontaneous torsion (50% in sleep).**

Other causes (**bell clapper deformity, cryptorchidism**)



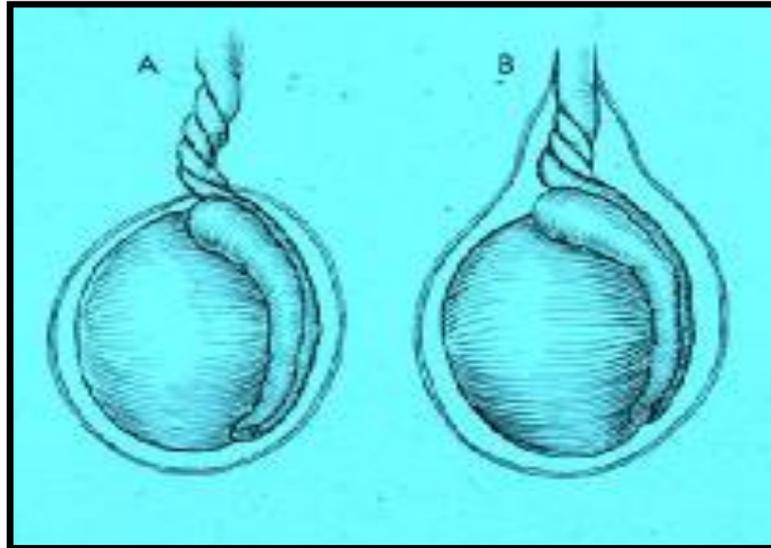
- Anterior surface of each testis run towards the midline.



# Types:

⊙ Extravaginal:  
exclusive to  
perinatal (torsion, the  
testis, spermatic cord and  
tunica vaginalis. It is  
usually ASYMPTOMATIC(  
we discover it early before  
appearance of symptoms  
)...and therefore could be  
managed by observation.

⊙ Intravaginal: 90%  
of adolescent age  
group.



A) extravaginal; (B)  
intravaginal

- On Examination:
- Swollen, painful, testis **drawn up** to the groin-  
**horizontal lie** .
- **Absent of cremastic reflex** on the affected site
- Elevation of scrotum doesn't provide relife of pain (**-ve prehn sign** )



- If you are in doubt in case of acute painful scrotum so the scrotum must be explored.
- If untreated infarction of testis will result (within 5-6h necrosis).
- Untwisting should be carried on within 6 hrs. of symptoms.



# management

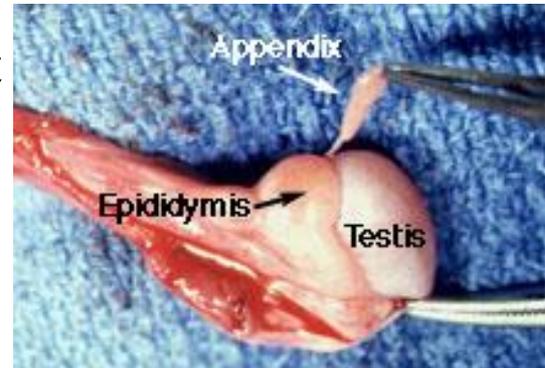
- Rx: EMERGENCY
- ✓ Explore the testis.
- ✓ Untwist the testis.
- ✓ If viable we fix it by anchoring it to scrotal septum and if the other testis is abnormal fix it(**orchiopexy**).
- ✓ If infarcted we remove it(**orchiectomy**).



After detorsion

## 2-Torsion of testicular appendage:

- **Most common** structure to twist is the appendix of the testis (pedunculated hydatid of morgagni )
- Usually a **more gradual** onset, pain **moderately** severe
- Clinically similer to testicular torsion but **vertical lie and cremastic reflex preserved**)
- **Blue dot sign.**
- Age:12 – 24 years age .



# Management

- If the diagnosis is in **question or refractory pain** , we do a surgical exploration.

Rx ;

- **conservatively** –analgesia (most will subside over 5-7 day)
- immediate operation with ligation and amputation of the twisted appendage.
- when the appendix torsion is late in presentation, it could resemble testicular torsion



# 3-Testicular trauma

- Usually in sports injuries or violence.
- may result in bleeding into the layers of tunica vaginalis resulting in **haematocele**.
- S&S: severe pain, scrotal swelling, bruising, tender, enlarged testi, **no translumination** .



# Management

- Investigation:
  - scrotal ultrasound (beware of an underlying malignancy).
- Treatment: CONSERVATIVE
  - Bed rest, ice pack, surgical repair
  - Scrotal elevation
  - Surgical exploration may be needed if:
    - 1- expanding scrotal hematoma
    - 2- To evacuate the haematocoele and to repair the split in tunica albuginea.
    - 3- very severe pain

# 4-Epididymitis

- DEFINITION:
  - Inflammation, Pain, Swelling of epididymis
  - **Acute**: Symptoms usually lasting < 6 weeks
  - **Chronic**: Symptoms usually lasting > 6 weeks
    - May be acute sub-acute chronic
- EPIDEMIOLOGY:
  - **Most common cause of acute scrotal pain**
  - Age: 16-30 y/o & 51-70 y/o
  - Incidence **parallels incidence of Chlamydia & GC**

# Epididymitis

- ETIOLOGY:

- **Retrograde** infection from the urinary tract.

- **Sexually active** – Chlamydia, Gonorrhoea, E.coli

- **Older men and children**- E.coli

- **Non-infectious** – post surgery, drugs

- SIGNS/SYMPTOMS:

- Scrotal pain- slow onset

- +/- Dysuria, frequency, Discharge, Fever

- Tenderness and swelling epididymis

# clinical features :

- pain, edematous, redness of the scrotum, often associated with pyrexia.
- +/- symptoms of UTI
- Enlarged tender testis and epididymis.
- In children differentiation from torsion is often impossible and scrotum should be explored.

**Prehn sign is +ve (prehn sign is when the pain is relieved by elevating the testicles)**

**Cremastric reflex +ve**

*dysuria*  
✦ UTI ass. with high fever chills & rigors → 3 imp. DDx

- Pyelonephritis
- prostatitis (acute)
- epididymitis

- A UTI associated with high fever, chills & rigors you need to look for 3 organs:
- Pyelonephritis (kidneys)
- Prostatitis
- Epididymitis

# Management

- Investigation:
  - CBC, Urinalysis, Urine Culture, Urethral Swab.
- Treatment:
  - Acute: Bed rest, Analgesia,
    - **< 35 y/o**
      - Ceftriaxone
      - Doxycycline
    - **> 50 y/o**
      - Treat responsible organism
      - ciprofloxacin /Quinolones
  - **Chronic**: TB-antituberculous drugs.
  - Orchidectomy if fails.



Testicular torsion	Epididymorchitis
Mechanical twist of the testicle	Inflammatory process
Acute onset severe pain	Gradual onset mild pain that increase with time
Afebrile	Associated with high fever, chills and rigors
w/o urinary symptoms	Associated with dysuria and frequency
Negative Prehn sign	Positive Prehn sign
Negative Cremasteric reflex	Positive Cremasteric reflex
Non-tender prostate	Tender prostate
Doppler: Decrease testicular flow	Doppler : increased testicular flow
Testicular position: elevated and more horizontal	Testicular position : normal (vertical)
Associated with nausea and vomiting due to severe pain	Not associated with nausea and vomiting

	<b>Testicular torsion</b>	<b>Epididymorchitis</b>
<b>Age</b>	(10-30) years	(16-30) & (51-70) years
<b>Pain</b>	Sudden onset not affected by position	Gradual onset worse when standing
<b>Onset</b>	After exercise, sleep or minor trauma	Rarely after sleep
<b>Time to presentation</b>	< 6 hours	> 24 hours
<b>Past episodes</b>	Frequently >2weeks past	Only if previous infection
<b>Severity</b>	Peaks in hours	Peaks in days
<b>Vomiting</b>	Common from pain	Unusual
<b>Fever</b>	Up to 20%	Up to 95%
<b>Swelling</b>	After 12 hours	Common
<b>Dysuria</b>	Rare	Common
<b>Urinanalysis</b>	30% have wbc/bacteria, voiding complication rare	50% may be normal , voiding complication common
<b>Physical exam</b>	- Cremasteric reflex - Prehn sign	+ Cremasteric reflex + Prehn sign
<b>Color Doppler</b>	Decreased testicular flow	Increased testicular flow
<b>Management</b>	Antibiotics, if it fails, we do orchidectomy	Surgery (Orchidopexy or Orchidectomy)

# 5- Orchitis

- DEFINITION:

- Inflammation or infection of the testicles
- may be related to epididymitis with Extension to testes

- Etiology:

- bacterial (E. coli, K. pneumoniae, P. aeruginosa, Staph. or Strep)

- *Usually* → viral (MUMPS VIRUS, EBV, coxsackievirus, arbovirus, enterovirus) especially isolated orchitis

# ORCHITIS

- SIGNS & SYMPTOMS:
  - similar to epididymitis
  - Pain
  - hematuria, ejaculation of blood
  - entire testes swollen- exquisitely tender
  - Systemic- fever chills, malaise

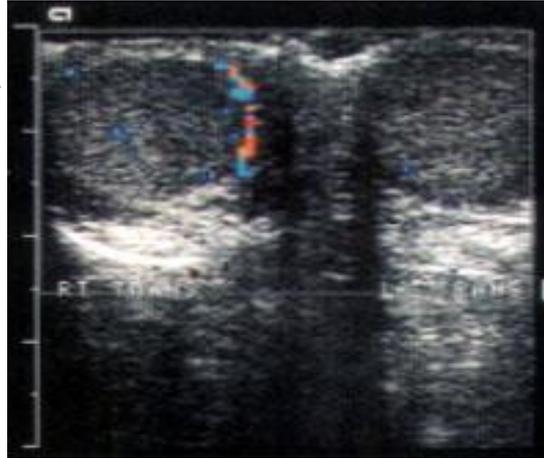
# Investigation:

- Urinalysis: bacteria, WBC's, crystals
  - commonly in epididymitis
- Obtain urine culture;(why ? If pt have +ve culture with epididymitis R/O congenital anomaly by US or MCUG (in pediatrics )
- CBC may be helpful
- Radiographic studies
  - Ultrasonography , Nuclear Scan(tc33)
  - Doppler US.

# Diagnostic test

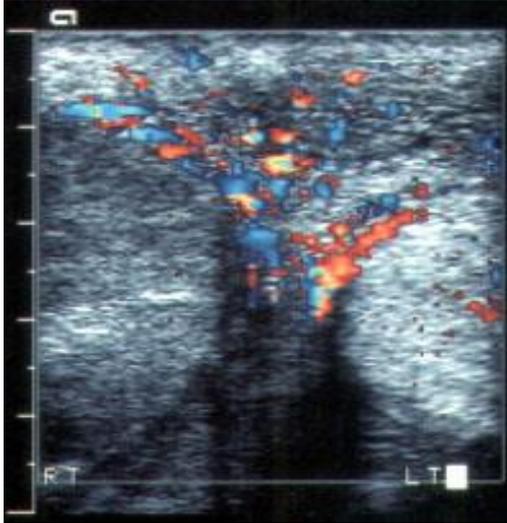
## Color Doppler ultrasound

- Noninvasive assessment of anatomy and determining the presence or absence of blood flow.
  - sensitivity: 88.9%
  - specificity of 98.8%
  - operator dependent.
- but its sensitivity for diagnosing torsion is only 80%



**FIGURE 1.** Color Doppler ultrasonogram showing **acute torsion** affecting the left testis in a 14-year-old boy who had acute pain for four hours. Note decreased blood flow in the left testis compared with the right testis

# Color Doppler ultrasound



**FIGURE 2.** Color Doppler ultrasonogram showing late **torsion** affecting the right testis in a 16-year-old boy who had pain for 24 hours. **Note increased blood flow around the right testis but absence of flow within the substance of the testis.**



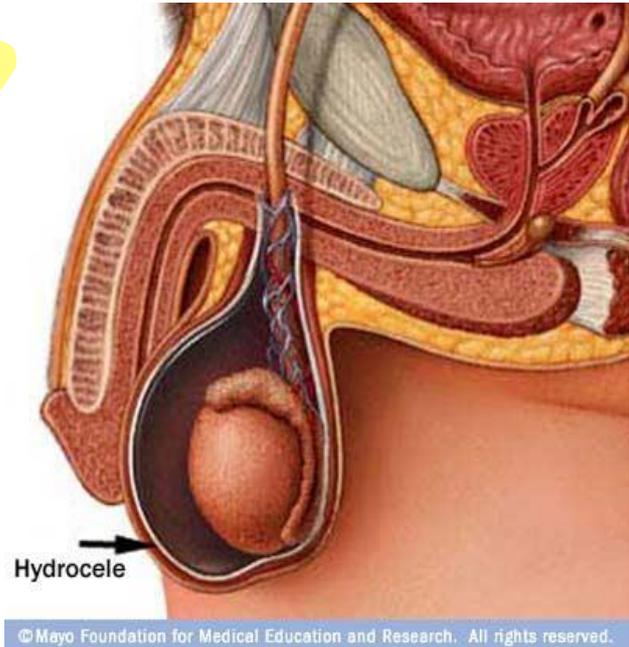
**FIGURE 3.** Color Doppler ultrasonogram showing inflammation (**epididymitis**) in a 16-year-old boy who had pain in the left testis for 24 hours. **Note increased blood flow in and around the left testis.**

**PAINLESS  
SCROTAL SWELLING**

# 1- Hydrocele

*no pain  
Swelling only*

- Is collection of abnormal quantity of serous fluid in the tunica vaginalis (between tunica albuginea & tunica vaginalis)
- If it contains pus or blood it is called **pyocele** or **haematocele** respectively.
- Hydrocele is more common than the two other varieties.



# etiology

## 1-primary

The cause is unknown.

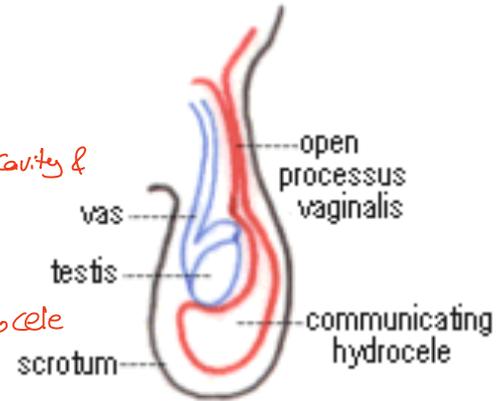
- It classified as follows;



1- **communicating**; <sup>in pediatrics</sup> → patent processus vaginalis

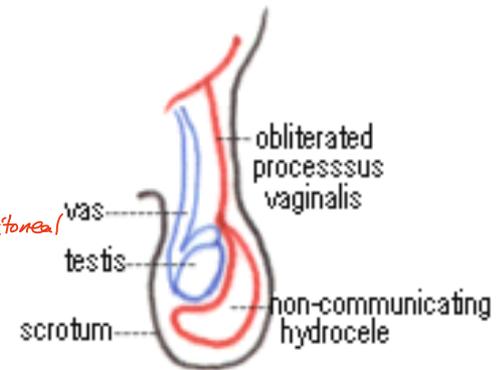
it connect with the peritoneal cavity, **patent processus vaginalis** → connection btw abd. cavity & scrotal cavity.

In pediatric, **change size during day (increase during crying and straining)** → on-off hydrocele



2- **noncommunicating**; it dose not connect with peritoneal cavity <sup>collection of fluid w/o communication with peritoneal cavity</sup>

In adult.



1- primary hydrocele → idiopathic

2- secondary; where the fluid accumulate secondary to pathology inside the testis like <sup>①</sup>epididymo-  
<sup>②</sup>orchitis, testicular tumor 5-10% and <sup>③</sup>trauma.

# Clinical presentation;

## ❖ Age;

- ❖ primary hydrocele are most common newborns
- ❖ Secondary are more common between 20 to 40 years.

## ❖ Symptoms;

1-painless swelling

2-frequent and painful micturation may occur if hydrocele is secondary to epididymo-orchitis

## ❖ Hydrocele doesn't affect fertility

# Clinical picture

## ❖ Examination;

- ❖ Position; the swelling usually **unilateral** but can be bilateral if communicating we **can't feel** the cord above the lump.
- ❖ Colour and temperature; normal
- ❖ Tenderness; primary are not tender but secondary may be tender
- ❖ Composition; fluctuant and have fluid thrill if large enough
- ❖ Reducibility; **can not reduced**
- ❖ **-ve cough impulse**
- ❖ **transilluminate** → in any pt with scrotal swelling

# Transillumination



# Mangement;

*although in Pediatrics: go through the inguinal Canal bcz we expecting patent processus vaginalis*

*although in Pediatrics: go through the inguinal Canal bcz we expecting patent processus vaginalis*

❖ **Primary;** in children we go through the inguinal canal

❖ **Communicating;**

❖ most neonatal hydrocele **resolve in first 2 year** of life if persists repair as herniotomy(**inguinal incision** ).

NEVER do surgery before 2 years of age

**EXCEPT in**

- 1- very large amount –
- 2- if can't differentiate between it and hernia
- 3- increase intrabdominal pressure

NEVER do needle aspiration EVEN in the non-communicating **type**(**cause it will reaccumulate**)

❖ **Noncommunicating;**

❖ usually resolves spontaneously

*✗ excision of of tunica vaginalis → to drain hydrocele inside it*

\*although in pediatrics: go through the inguinal canal bcz we expecting patent processus vaginalis

❖ In adult; <sup>Usually</sup> **surgical excision**; opening the tunica vaginalis longitudinally (**scrotal incision** <sup>in adults</sup>), emptying the hydrocele, everting the sac after excising the redundant sac and suturing the sac behind the cord thus obliterating the potential space

❖ **Secondary** treatment of the underlying condition

Case ;

40 y old man came with painless , transilluminate hydrocele .

What's your next step ?

A; scrotal US to R/O testicular tumor

## 2- Indirect inguinal hernia:

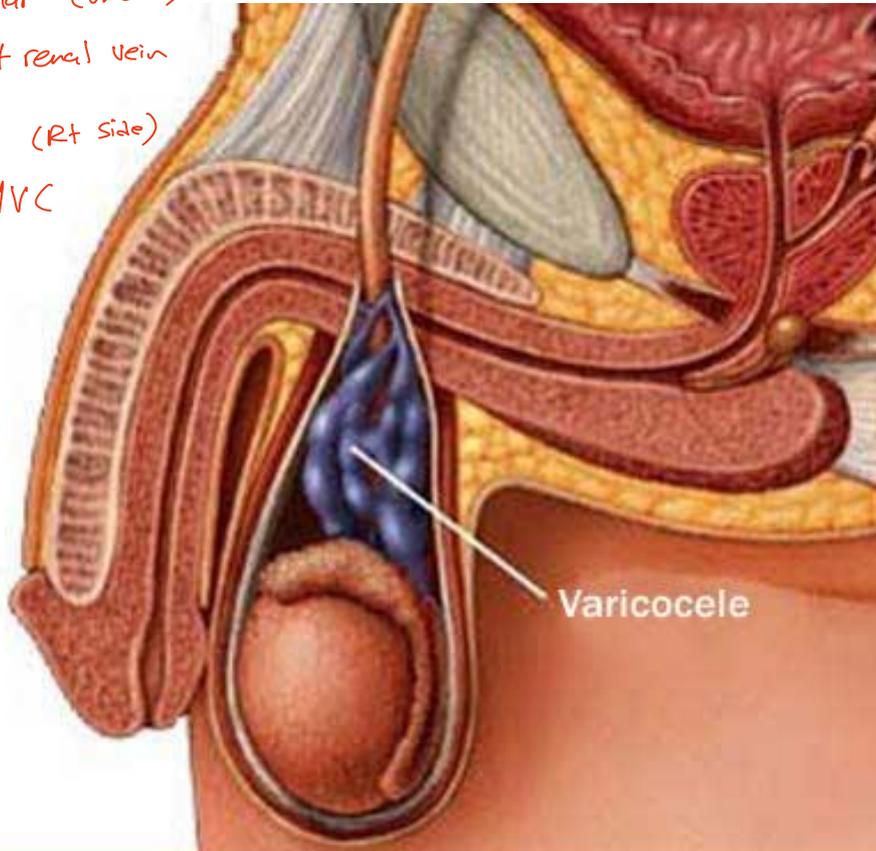
- most common ( young , Rt. Side )
- 10% bilateral .
- Hernia in babies are a result of persistent processus vaginalis.
- If strangulated >> painful and may cause testicular atrophy
- Surgery is usually recommended .

# Hernia / Hydrocele

	hydrocele	Reducible inguinal hernia	Incarcerated hernia
Age	Mostly < 1y	Any age	Any age
pain	-	-	+++
Diurnal changes	None or fluctuate	Protrudes on straining	Always protruded
site	scrotum	Groin+scrotum	Groin+scrotum
Ex	Can get above	Can't get above	Can't get above
Transillumination	++	- (except in infants)	- /+
reducible	No	Yes	No
Rx	Repair if persist >1-2 y	Elective repair	Immediate reduction ,urgent repair

# 3-Varicocele

- \* drainage of testicular (Lt side)  
directed up to Lt renal vein
- \* " " " (Rt side)  
" " " IVC



# Definition

- Is dilatation and tortuosity of the pampiniform plexus, which is the network of veins that drain the testicle.
- Due to defective valve or compression of the vein by a nearby structure.
- Very common; about 15% of men will have some degree of varicocele.
- More common on left side in 90% (why?? The longer course of the left spermatic vein and its insertion at a 90° angle into the left renal vein, predisposes to slower drainage and increased hydrostatic pressure.) of cases.
- Bilateral in up to 50% of cases.
- not painful but if long standing may cause a dull aching pain, fertility & subfertility issues, testicular atrophy and a mass (bag of worms)

## **Primary varicocele :**

+ve when standing only.

**Secondary varicocele :** when varicocele is +ve at BOTH standing and supine positions.

Secondary varicocele could be a **sign of a retroperitoneal mass** like Renal Cell Carcinoma, Wilms tumor and phaeochromocytoma

- **Do retroperitoneal US to rule out renal ca in 2 cases ;**

**1- varicocele on the rt side**

**2- secondary .**

**3- palpable abdominal mass**

**4- acute onset``**

\* examination → Standing & Supine positions

in Varicocele  
more ingorgement  
of veins

# Clinical feature

1. Appear on standing and disappear on lying down.
2. Heavy or dragging sensation in scrotum.
3. The veins often described as <sup>\* mass in scrotum:</sup> 'bag of worms' but feeling like a 'plate of lukewarm spaghetti'.
4. The affected testes may be small.
5. 90% of Bilateral varicocele may cause infertility.

\* long standing → dull aching pain

\* testicular atrophy

# Grading

- **Grade 0** - Subclinical varicocele, Dx by US or venography
- **Grade 1** <sup>→ only detected by U/S</sup> – palpable with Valsalva maneuver on standing
- **Grade 2** - Easily detected without Valsalva maneuver on standing
- **Grade 3** - Detected visually at a distance

Clinically detection

increasing severity

# ***Varicocele***



- **Diagnosis:**

- Clinical and US.

- **Treatment:**

- ✓ No treatment required in asymptomatic.

- ✓ **Indication of treatment** : *→ 25% of adults have varicocele → not all of them needs surgery*

- 1- **impaired sperm quality or quantity (fertility & subfertility issues)**

- 2- **pain** *→ Should be related directly to varicocele* or dull ache affect quality of life

- 3- **affected testis fail in grow in adolescent causing testicular atrophy** *or pediatric age group to avoid →*

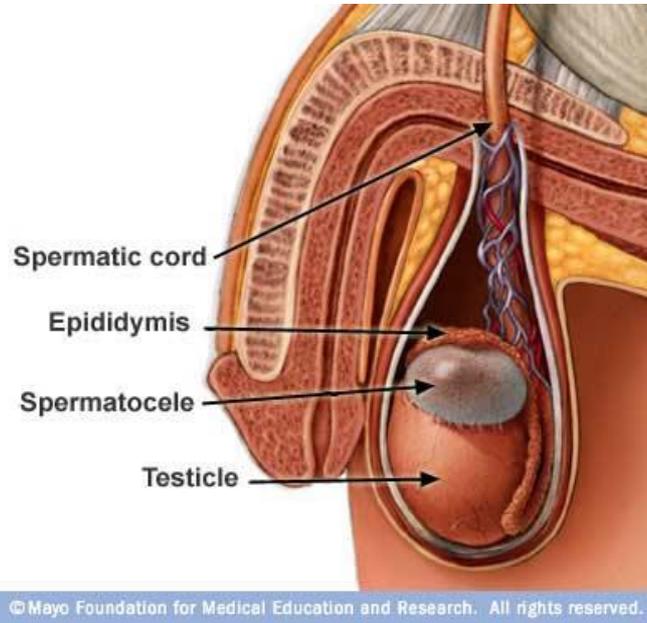
- 4- **discrepancy in size more than 20%**

- 4- **cosmetic indication**

- ✓ intervention required either by ~~embolization~~ and obliteration under radiological control or if **surgery** indicated **varicocelectomy** is via inguinal approach.

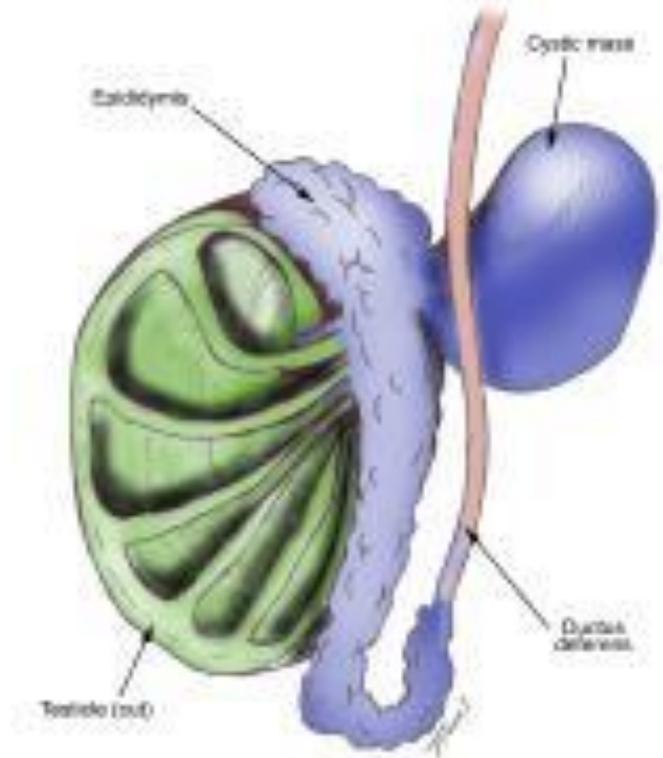
*best ttt is varicocele excision → ligation of spermatic veins in inguinal canal → so we prevent flow of blood in veins & prevent varicocele*

# 4- Epididymal cyst



# Epididymal cyst (spermatocele)

- Cysts arise from diverticula of the vasa efferentia, they are **fluid /sperm filled** cysts connected with epididymis.
- THEORIES:
  - 1- distal obstruction
  - 2- aneurysmal dilation of epididymis
  - 2-agglutinated germ cell
- May be small ,large ,multiple, uni or bilateral.
- Usually occur over 40 years.
- S&S: Scrotal swelling, slowly enlarges, painless.
- Lie **above and slightly behind the testes.**
- **You can get above it.**
- **transilluminated**



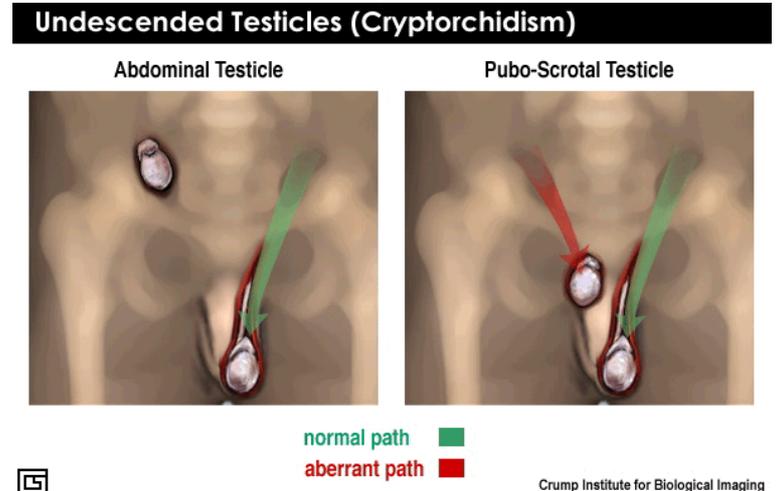
# Epididymal cyst

- Usually smooth and lobulated, fluctuant, transilluminates if contains clear fluid.
- **US TO RULE OUT MALIGNANCY**
- Rx : none unless **large or painful** ; **surgical excision**, and that will compromise the fertility of the testis. **In consent form we have to inform the patient about the sideeffect which is infertility.**
- **AVOID NEEDLE ASPIRATION AS IT CAN LEAD TO INFECTION AND SPILLING OF IRRITATING SPERM WITHIN SCROTUM**



# CRYPTORCHIDISM

- DEFINITION:
  - Undescended or “Hidden testis”
- EPIDEMIOLOGY:
  - Incidence-
  - 0.7-1% at age 1.
- ETIOLOGY:
  - Uncertain
- COMPLICATIONS:
  - Can lead to **infertility** and has a higher incidence of **malignancy**.
- Tx- Orchiopexy



# Anatomy & Physiology of erection and ejaculation

*\* definition of erectile dysfunction: inability to achieve  
or maintain erection sufficient for sexual relation*

minimal role  
in erection  
(contain Urethra)

The penile shaft is composed of 3 erectile columns, the 2 corpora cavernosa and the corpus spongiosum,

dorsal aspect

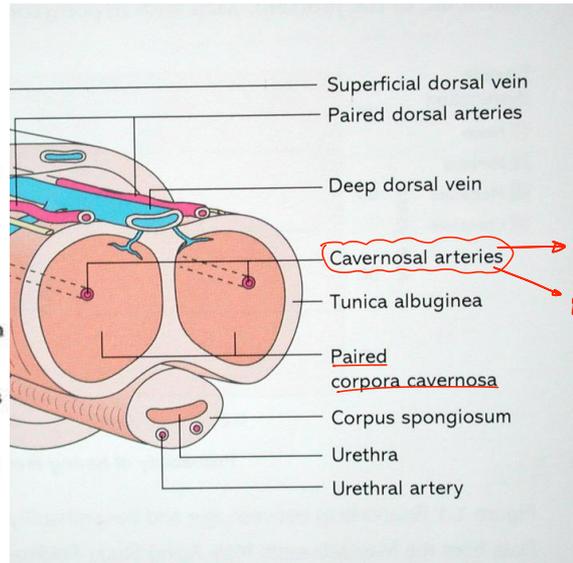
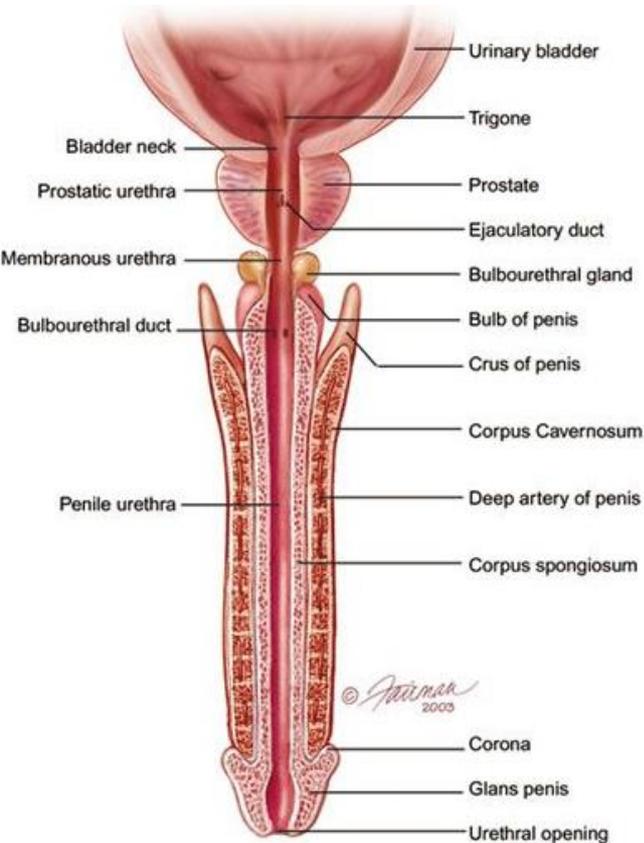
most imp. part of penis for erection

inside it there is sinus tissue that hold & contain blood at time of erection

The single corpus spongiosum lies in the ventral groove between the 2 corpora cavernosa. The urethra passes through the corpus spongiosum

The erectile tissue within the corpora contains arteries, nerves, muscle fibers, and venous sinuses lined with flat endothelial cells, and it fills the space of the corpora cavernosa.

# Anatomy of the penis



most imp. artery that induce blood entrapment in sinusoidal tissue  
branches of internal pudendal a.

# Arterial supply

The blood supply to deep structures of the penis is derived from a continuation of the internal pudendal artery, after it gives off the perineal branch. **Three branches of the internal pudendal artery flow to the penis**, as follows:

The artery of the bulb (**bulbourethral artery**) passes through the deep penile (Buck) fascia to enter and supply the bulb of the penis and penile (spongy) urethra

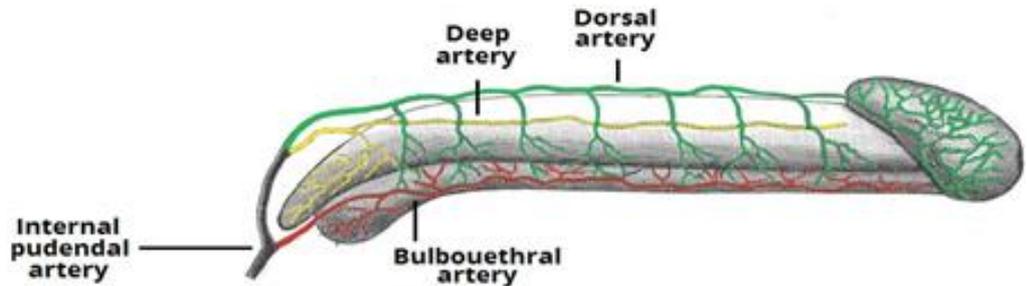
The **dorsal artery** travels along the dorsum of the penis between the dorsal nerve and deep dorsal vein and gives off circumflex branches that accompany the circumflex veins; the terminal branches are in the glans penis

**The deep penile (cavernosal) artery** is usually a single artery that arises on each side and enters the corpus cavernosum at the crus and runs the length of the penile shaft, giving off the helicine arteries, which are an integral component of the erectile process

Blood supply to the skin of the penis is from the left and right superficial external pudendal arteries, which arise from the femoral artery

# Arterial supply

- main artery is from the internal iliac :  
**internal pudendal artery**



- **Accessory arteries :**  
Obturator artery  
vesical arteries  
femoral arteries

# venous drainages

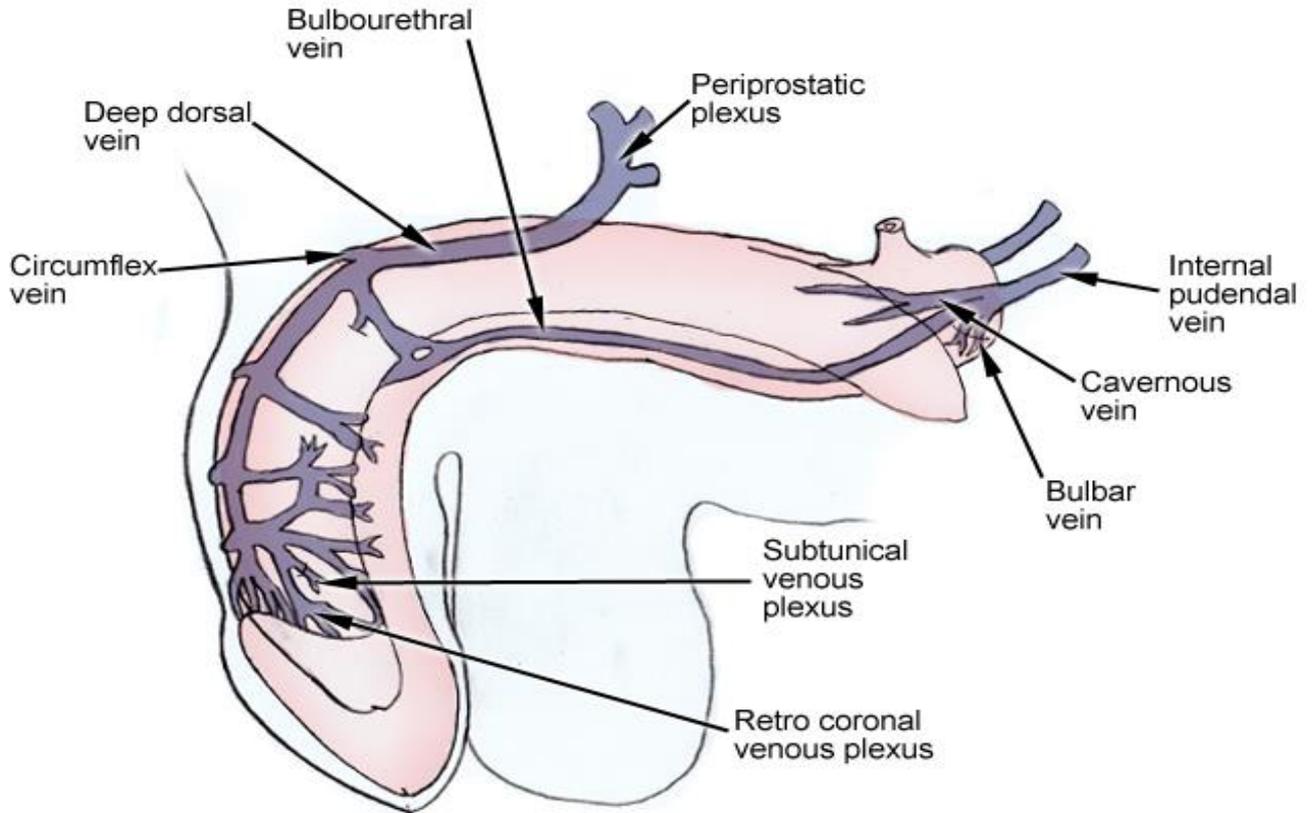
The penis is drained by 3 venous systems, the superficial, intermediate, and deep

**Superficial veins** are contained in the dartos fascia on the dorsolateral surface of the penis and coalesce at the base to form a **single superficial dorsal vein**, which usually **drains into the great saphenous veins via the superficial external pudendal veins**.

Dorsal penile veins ?????

These are the veins are going to be compressed  
to prohibit blood from draining

# Venous drainage



# Lymphatic drainage

Lymphatic drainage from the glans penis drains into large trunks in the area of the frenulum. These lymphatic vessels then circle to the dorsum of the corona and unite, coursing proximally beneath the deep penile (Buck) fascia, terminating mostly in the deep inguinal nodes of the femoral triangle. Some lymphatic drainage is to the presymphyseal lymph nodes and to the lateral lymph nodes of the external iliac lymphatics.

# Mechanism of erection

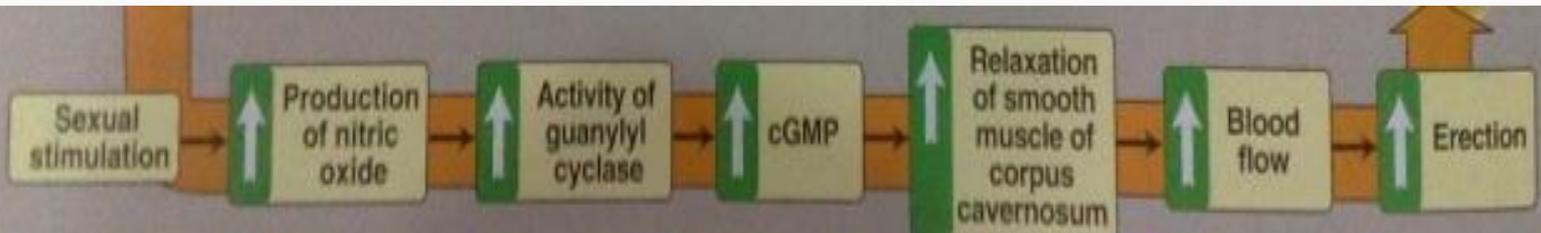
→ hydraulic process 2° to  
intrapment of blood in  
sinusoid tissue; blood  
induce elongation &  
hardening of penis  
⇒ so erection happen.

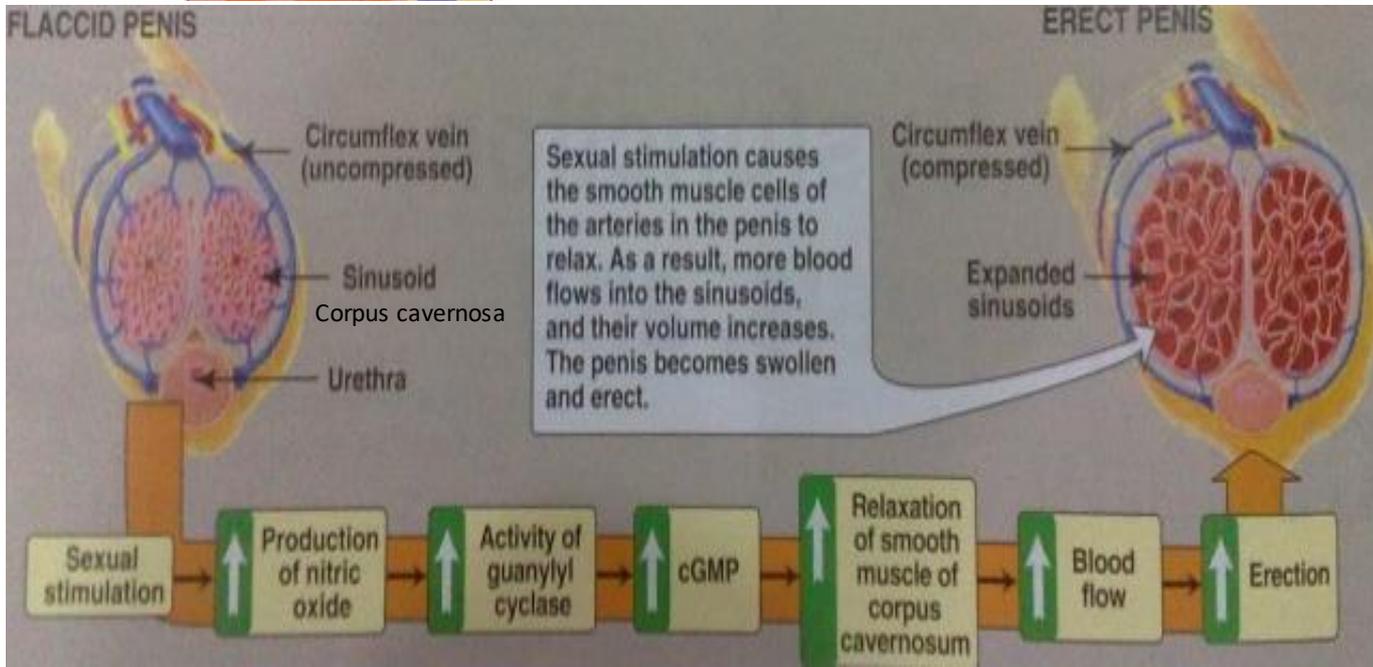
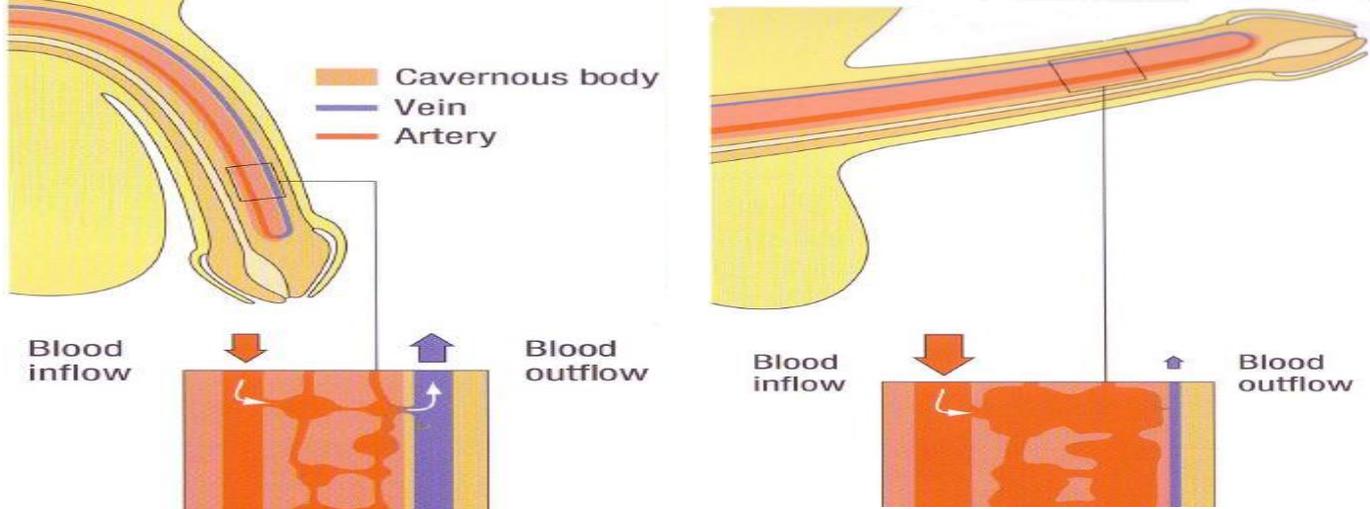
- **Neuroendocrine signals** from the brain, created by audiovisual or tactile stimuli, activate the autonomic nuclei of the spinal erection centre . Signals are relayed via the cavernosal nerve to the erectile tissue of the copora cavernosa, activating the veno-occlusive mechanism

# (Mechanism of Penile Erection)

- The stimulation result in the relaxation of smooth muscles of corpus cavernosum which leads to increase in the blood flow.
- This process is mediated by Nitric oxide(NO) which activates Guanylyl cyclase which forms Cyclic guanosine monophosphate(cGMP) from guanosine triphosphate(GTP), cGMP produces smooth muscle relaxation and decreases intracellular Ca concentration.
- The duration of action of cGMP is controlled by Phosphodiesterase (PDE), specially PDE-5 which is the isozyme responsible for the termination of cGMP in the corpus cavernosum.

*this will increase the sinusoidal space to adapt more blood*





\* after arterial dilatation & relaxation of sinusoidal tissue  
⇒ obstruction of venous outflow from penis; lead to one way blood flow into penis so this will induce erection

\* the name of vein usually closed during erection called emissary vein  
↓  
extremely imp., any problem leading to disease called venous leak or erectile dysfunction

# Innervation

## 1-stimulation (somatic)

- stimulation of genitals
- sensed by pudendal nerve
- conducted to S2-S4 via pudendal nerve

## 2-erection is caused by (parasympathetic)

### - parasympathetic arise in the (lateral horns grey matter of S2-S4)

- and then the pelvic splanchnic go to pre-aortic and prostatic plexuses go to penis
- NO causes vasodilation of deep penile arteries
- blood fill erectile tissue
- compression of veins

# Innervation

## **3-emission** (sympathetic)

is the beginning part of ejaculation and it is initiated by

## **sympathetic (lateral horns of T11-L2)**

- lumbar and sacral splanchnic to pre-aortic plexuses to spermatid tubes and then synapse and

- NE causes : peristaltic contractions of the ductus deferens , seminal vesicle , prostatic gland contracts and then ???>? you get contraction of the internal urethral sphincter

- semen don't mix with urine

- semen don't go retrogradely into the urinary bladder

## 4-ejaculation (sympathetic + somatic)

- constriction of internal urethral sphincter (sympathetic)
- impulse arising from ventral horn S2-S4
- pudendal nerve conducts the motor impulse causing
- rhythmic contractions of bulbospongiosus and ischiocavernosus muscles (somatic)

# Innervation

- Central: medial preoptic area (MPOA) and paraventricular nucleus (PVN) in the hypothalamus are important centres for sexual function and penile erection.

# Phases of erectile process

phase	term	description
0	<u>Flaccid phase</u> <i>N - inflow N - outflow</i>	Cavernosal <u>smooth muscle contracted</u> ; <u>sinusoids empty</u> ; <u>minimal arterial flow</u>
1	<u>Latent (filling) phase</u> <i>inflow &gt; outflow</i>	<u>Increased pudendal artery flow</u> ; <u>penile elongation</u> <i>excitement → cGMP release → induce smooth M. relaxation → lead to sinusoidal relaxation &amp; vasodilatation</i>
2	<u>Tumescent phase</u>	<u>Rising intracavernosal pressure</u> ; erection forming <i>more blood</i>
3	<u>Full erection phase</u>	<u>Increased cavernosal pressure</u> causes penis to become <u>fully erect</u>
4	<u>Rigid erection phase</u> <i>usually lasts for few seconds</i>	Further increases in pressure + <u>ischiocavernosal muscle contraction</u> <i>it is 2° to hardening the penis for few seconds and then disappear</i>
5	<u>Detumescence phase</u>	<u>Following ejaculation</u> , sympathetic discharge resumes; there is smooth muscle contraction and vasoconstriction; <u>reduced arterial flow</u> ; blood is expelled from sinusoidal spaces <i>base of p will be extremely tight after excitement relief &amp; ↓ → reduce the pressure ⇒ emissary vein will open to drain blood back to circulation</i>

01 Fardet 01 Venous closure (venous leak)

# Erectile dysfunction evaluation & treatment

**Fadi Abu-Tair**

\* 2 major causes of erectile dysfunction

arteriogenic  
erectile dys-  
-function

arterial inflow to penis (problem in)

DM, elderly, atherosclerosis → affect general arteries of body

Venous leak  
erectile dys-  
-function

or failure of venous closure (venous leak)

## Definition

Erectile dysfunction (ED) (also called **impotence**)

describes the 'consistent or recurrent inability to attain and/or maintain a penile erection sufficient for sexual intercourse

↳ most of cardiac, diabetic, hypertensive or comorbid pts  
usually they suffer from erectile dysfunction

# Epidemiology

## In men aged 40–70y

- mild ED is found in 17%
- moderate ED in 25%
- complete ED in 10%

**Incidence increases with age** with complete ED affecting

- 15% of men in their 70's
- 30–40% in their 80's

# Aetiology •

ED is generally divided into <sup>①</sup> psychogenic and <sup>②</sup> organic causes. It is often multifactorial.

	Psychogenic <i>sever stressful condition → may affect</i>	Organic
Proportion	10%	90%
Onset	Sudden	Gradual <i>increase narrowing lumen of arteries</i>
Frequency	Sporadic	All circumstances
Variation	With partner and circumstance	No
Age	Younger	Older
Organic Risk Factors (HTN, DM, Dyslipidemia)	No organic risk factors ( <i>healthy</i> )	Risk factors present
Nocturnal/AM erection	Present	Absent

organic causes : Gradual onset (unless associated with an obvious cause such as surgery, where onset is acute)

**Loss of spontaneous erections**

**Intact libido and ejaculatory function**

*\* Pt with erectile dysfunction → we have to ask specifically about nocturnal or early morning erection ⇒ Usually preserved in psychogenic while lost in organic*

# Causes of IMPOTENCE

<b>Inflammatory Iatrogenic</b>	Prostatitis pelvic surgery/pelvic radiation
<b>Mechanical</b>	Peyronie's disease
<b>Psychological</b>	Depression; anxiety; relationship difficulties; lack of attraction; stress
<b>Occlusive vascular factors</b>	<b>Arteriogenic:</b> hypertension; smoking; hyperlipidaemia; diabetes mellitus; peripheral vascular disease
	<b>Venogenic:</b> impairment of veno-occlusive mechanism (due to anatomical or degenerative changes)
<b>Trauma</b>	Pelvic fracture; spinal cord injury; penile trauma
<b>Extra factors</b>	<b>Other:</b> increasing age; chronic renal failure; cirrhosis
<b>Neurogenic</b>	<b>CNS:</b> multiple sclerosis (MS); Parkinson's disease; multi-system atrophy; tumour
	<b>Spinal cord:</b> spina bifida; MS; syringomyelia; tumour
	<b>PNS:</b> pelvic surgery or radiotherapy; peripheral neuropathy (diabetes, alcohol-related)
<b>Chemical</b>	Antihypertensives (beta-blockers, thiazides, ACE inhibitors)
	Anti-arrhythmics (amiodarone)
	Antidepressants (tricyclics, MAOIs, SSRIs)
	Anxiolytics (benzodiazepine)
	Anti-androgens (finasteride, cyproterone acetate)
	LHRH analogues
	Anticonvulsants (phenytoin, carbamazepine)
	Anti-Parkinson drugs (levodopa)
	Statins (atorvastatin – lipitor®)
Alcohol	
<b>Endocrine</b>	Hypogonadism; hyperprolactinaemia; hypo and hyperthyroidism; diabetes mellitus

\* we prefer to see 2 couples together.

# History → detailed

## Age

**Sexual:** onset of ED (sudden or gradual); duration of problem; presence of erections (nocturnal, early morning, spontaneous); ability to maintain erections (early collapse, not fully rigid); loss of libido; relationship issues (frequency of intercourse and sexual desire).

**Sexual function symptom questionnaires:** International Index of Erectile Function (IIEF)

**Medical and surgical:** enquire about risk factors, including diabetes mellitus (ED affects 50% overall and 30% of treated diabetics); cardiovascular disease; hypertension; peripheral vascular disease; endocrine or neurological disorders; pelvic and penile surgery, radiotherapy, or trauma (which damage innervation and blood supply to the pelvis and penis).

**Psychosocial:** assess for social stresses, anxiety, depression, coping problems, patient expectations, and relationship details.

**Drugs:** enquire about current medications and ED treatments already tried and their outcome.

**Social:** smoking, alcohol consumption.

family hx

morning erection

# Examination

- Full physical examination (cardiovascular, abdomen, neurological)
- DRE to assess the prostate; assess secondary sexual characteristics
- external genitalia assessment to document foreskin phimosis, penile deformities and lesions (Peyronie's plaques); confirm presence, size, and location of testicles.  
*fibrosis lead in  
Curvature in penis*
- The bulbocavernosus reflex can be performed to test integrity of spinal segments S2–4 (squeezing the glans causes anal sphincter and bulbocavernosal muscle contraction).

## Investigation

- Blood tests:** <sup>Anemia?</sup> fasting glucose; <sup>HbA1c</sup> serum (free) testosterone (taken 8.00–11.00 a.m.); <sup>Urin analysis</sup> fasting lipid profile are basic work-up tests. SHBG; U&E; LH/FSH; prolactin; PSA; thyroid function test should be selected according to patient's history and risk factor profile.
- Nocturnal penile tumescence and rigidity testing:** the Rigiscan device contains two rings that are placed around the base and distal penile shaft to measure tumescence and number, duration, and rigidity of nocturnal erections. Useful for diagnosing psychogenic ED and for illustrating this diagnosis to patients.
- Penile colour Doppler USS:** <sup>↳ during artificial erection (by vasoactive material)</sup> measures arterial peak systolic and end diastolic velocities, pre- and post-intracavernosal injection of PGE1.  
<sup>↳ to differentiate btw arteriogenic & venogenic erectile dysfunction</sup>
- Cavernosography:** <sup>↳ invasive</sup> imaging and measurement of penile blood flow after intracavernosal injection of contrast and induction of artificial erection, used to identify venous leaks.
- Penile arteriography:** reserved for trauma-related ED in younger men. Pudendal arteriography is performed before and after drug-induced erection to identify those requiring arterial bypass surgery (although this is less commonly indicated now with the advent of modern penile prostheses).
- **MRI:** useful for assessing penile fibrosis and severe cases of Peyronie's disease.

# Nocturnal penile tumescence



# treatment

*Started by behavioural modification*

- Correct any reversible causes (i.e. alter lifestyle, stop smoking, change medication, etc.)
- **Psychosexual therapy**
  - Aims to understand and address underlying psychological issues and provides information and treatment in the form of sex education, psychosexual counselling
  - instruction on improving partner communication skills
  - cognitive therapy and behavioural therapy (programmed relearning of couple's sexual relationship).
  - Pharmacotherapy may be a useful adjuvant.

*failed?*

*medical ttt*

drugs cause relaxation of the smooth M. so induce erection:

## 1-Phosphodiesterase type-5 (PDE5) inhibitors:

### first-line therapies

sildenafil (ViagraR), tadalafil (CialisR), varденаfil (LevitraR)

- enhance cavernosal smooth muscle relaxation
- by blocking the breakdown of cGMP by phosphodiesterase.
- Sexual stimulus is still required to initiate events.
- Success is reported in up to 80%.
- Early use of PDE5 inhibitors following radical prostatectomy can help optimize the return of spontaneous erections (penile rehabilitation).

### Contraindications:

- *patients taking nitrates*
- *recent myocardial infarction*
- *recent stroke* *bcz those drugs cause sudden drop in BP ⇒ double effect*
- **hypotension** → **Sudden drop in BP** ⇒ may lead to acute cardiac arrest
- *unstable angina, non-arteritic anterior ischaemic*
- *optic nerve neuropathy (NAION).*
- *Cautions: intermediate and high risk cardiovascular disease requires cardiac review prior to treatment*

**use with A-blockers, groups with predisposition to priapism.**

## 2-Dopamine receptor agonist: زمان

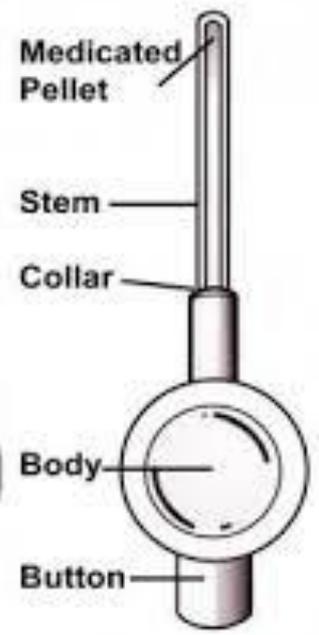
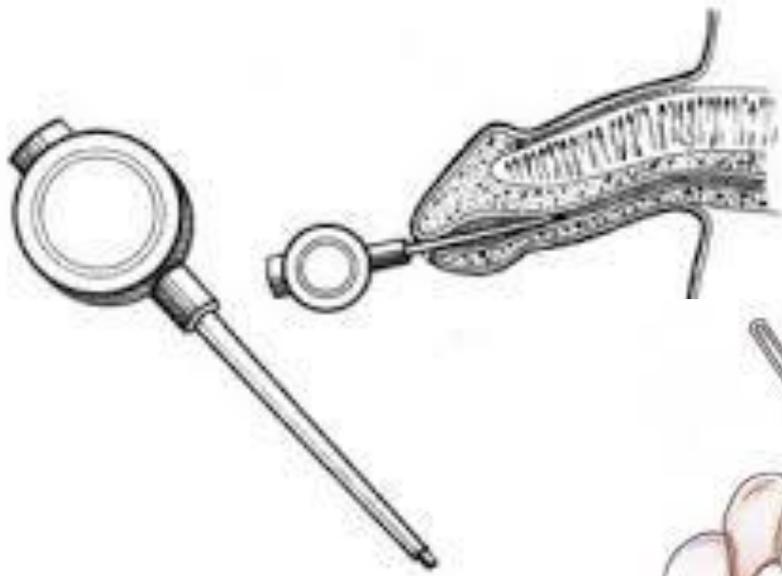
- *apomorphine (UprimaR)*
- *taken sublingually*
- acts centrally on dopaminergic receptors in the paraventricular nucleus of the hypothalamus
- enhance and coordinate the effect of sexual stimuli.
- *Side effects: nausea, headache, dizziness*
- *Not commonly used*

Uncommon

## 3-Intraurethral therapy:

\*injection of gel into urethra; absorption of this gel from urethra (PGE<sub>1</sub>) → Cause relaxation of arterial smooth M  
↳ more blood flow to penis

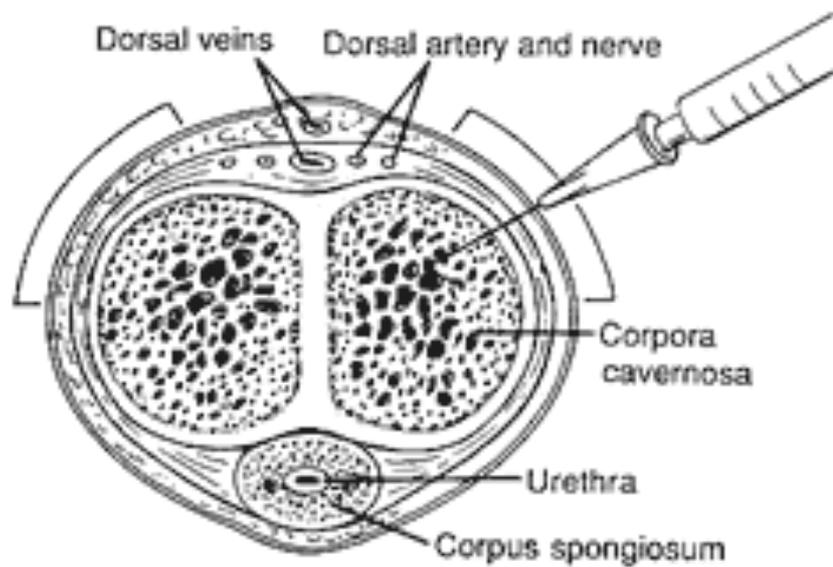
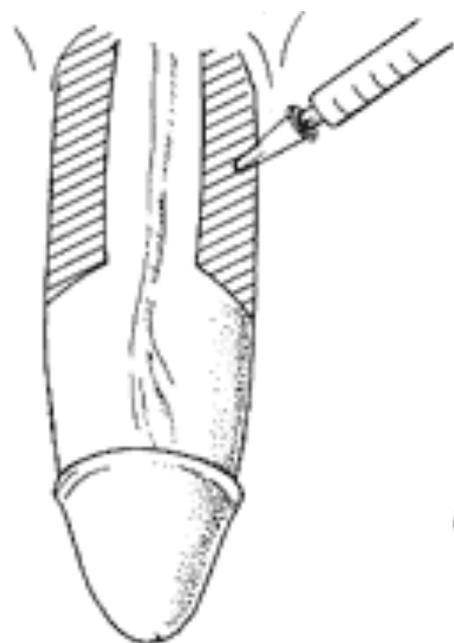
- second-line therapy when oral therapies have been ineffective.
- A synthetic prostaglandin E1 (PGE1) pellet (alprostadil)
- placed into the urethra via a specialized applicator (Medicated Urethral System for Erection (MUSE)<sup>TM</sup> device).
- Once inserted, the penis is gently rolled to encourage the pellet to dissolve into the urethral mucosa from where it enters the corpora.
- PGE1 acts to increase cAMP within the corporal smooth muscle, resulting in muscle relaxation.
- *Side effects: penile and urethral pain, priapism, local reactions.*



## invasive ← 4-Intracavernosal injection therapy

\* Syringe injected into the penis directed to cavernosal sinusoidal tissue  
\* Cause spontaneous erection

- Alprostadil (Caverjet™).
- Papaverine (PDE inhibitor).
- Usually given in combination with either phentolamine (A-adrenoceptor antagonist) or PGE1
- Who have failed oral or single-agent injectable therapies.
- Training of technique and first dose is given by a health professional.
- Needle is inserted at right angles into the corpus cavernosum on the lateral aspects of mid-penile shaft.
- Discontinuation rates from penile injection techniques are high.
- *Contraindications: sickle cell disease or high-risk candidate for priapism.*
- *Adverse effects: pain, priapism, haematoma*



## Vacuum erection device

→ painful

- Used when pharmacotherapies have failed. (SE on Pt bcz of medical ttt)
- It contains three components: a vacuum chamber, pump, and constriction band
- The penis is placed in the chamber and the vacuum created by the pump increases blood flow to the corpora cavernosa to induce an erection.
- The constriction band is placed onto the base of the penis to retain blood in the corpora and maintain rigidity.
- *Relative contraindication: anticoagulation therapy.*
- *Side effects: penile coldness, bruising.*

## Microvascular arterial bypass and venous ligation surgery

*Used in: specialist centres where there is a clear-cut diagnosis of a vascular disorder.*

Acts to increase arterial inflow and decrease venous outflow.

Rarely used now as it is uncommon for success rates to exceed 50%.

inflatable  
non-inflatable  
2 types  
Penile prosthesis → last step in treating Pt with erectile dysfunction  
→ Surgery  
into corpora cavernosa (in center)

medical Htt → بدل اقتصادي له  
young Pt → ضموماً في صلاة

- Semi-rigid, malleable, and inflatable penile prostheses
- other therapies have failed or are unsuitable
- Also indicated for Peyronie's disease, trauma, and penile fibrosis (i.e. secondary to priapism).
- The device is surgically implanted into the corpora to provide penile rigidity and generally has high satisfaction rates, up to 90%
- Side effects: infection, erosion, mechanical failure, penile shortening, glans may not fully engorge.

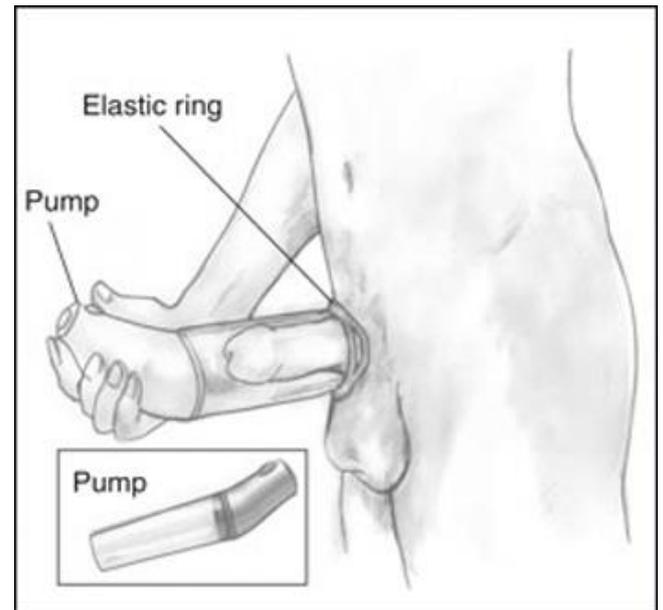
### Testosterone replacement therapy

- Indicated for hypogonadism
- available in oral, buccal, intramuscular, pellet, transdermal patch, and gel forms.
- Most guidelines recommend PSA, Hb, and LFT checks before and after starting treatment
- It can improve the results of PDE5 inhibitors in hypogonadal men.

## Penile prosthesis



## Vacuum erection device



# Peyronie's disease

*fibrosis appears in one side of the corpora cavernosa in tunica albuginea of penis*

An acquired benign penile condition characterized by deformity of the penile shaft secondary to the formation of a fibrous inelastic scar on the tunica albuginea.

## Epidemiology

Prevalence is 3–9%, predominantly affecting men aged 40–60y.

## Pathophysiology

excessive connective tissue (fibrosis) and increased cellularity with random orientation of collagen fibres. Dorsal penile plaques are most common (66%).

The corpus cavernosus underlying the lesion cannot lengthen fully on erection, resulting in penile curvature. *→ to one side*

The disorder has two phases:

- Active phase (1–6 months)
- Quiescent (stable) phase (9–12 months)

## Presented as

- penile pain, a palpable lump (plaque),
- penile curvature, ED (in 40%),

*\* may need excision of fibrosis (surgery)*

*\* indications of surgery:*

- curvature  $> 90^\circ$
- severe pain during erection
- erectile dysfunction



# Male Infertility

**Mohammad al- madhon**

**Raed ALI**

# Object....

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- Male reproductive physiology
- Etiology of infertility
- Evaluation of male infertility
  
- Investigation
- Treatment options for male infertility



# Male reproductive physiology

## How Does the Male Reproductive System Function?

The all male reproductive system is dependent on hormones, which are chemicals that regulate the activity of many different types of cells or organs. The primary hormones involved in the male reproductive system are follicle-stimulating hormone, luteinizing hormone, and testosterone



# Hypothalamic–pituitary–testicular axis

The hypothalamus secretes luteinizing hormone–releasing hormone

(**LHRH**), also known as gonadotrophin-releasing hormone (**GnRH**). This

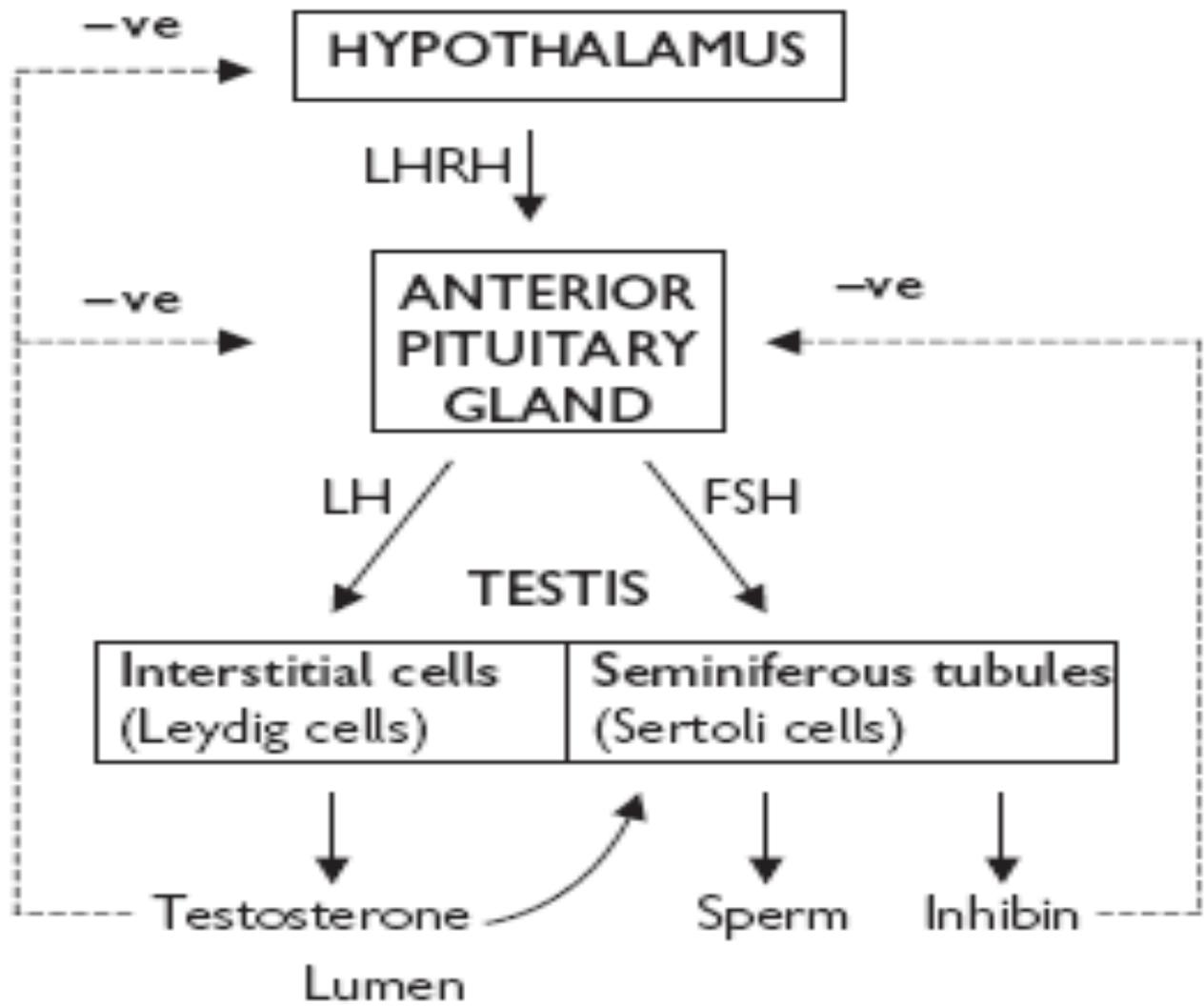
causes pulsatile release of anterior pituitary gonadotrophins, called follicle-

stimulating hormone (**FSH**) and luteinizing hormone (**LH**), which act

on the testis.

FSH stimulates the **seminiferous tubules** to secrete **inhibin** and produce

sperm; LH acts on **Leydig cells** to **produce testosterone**



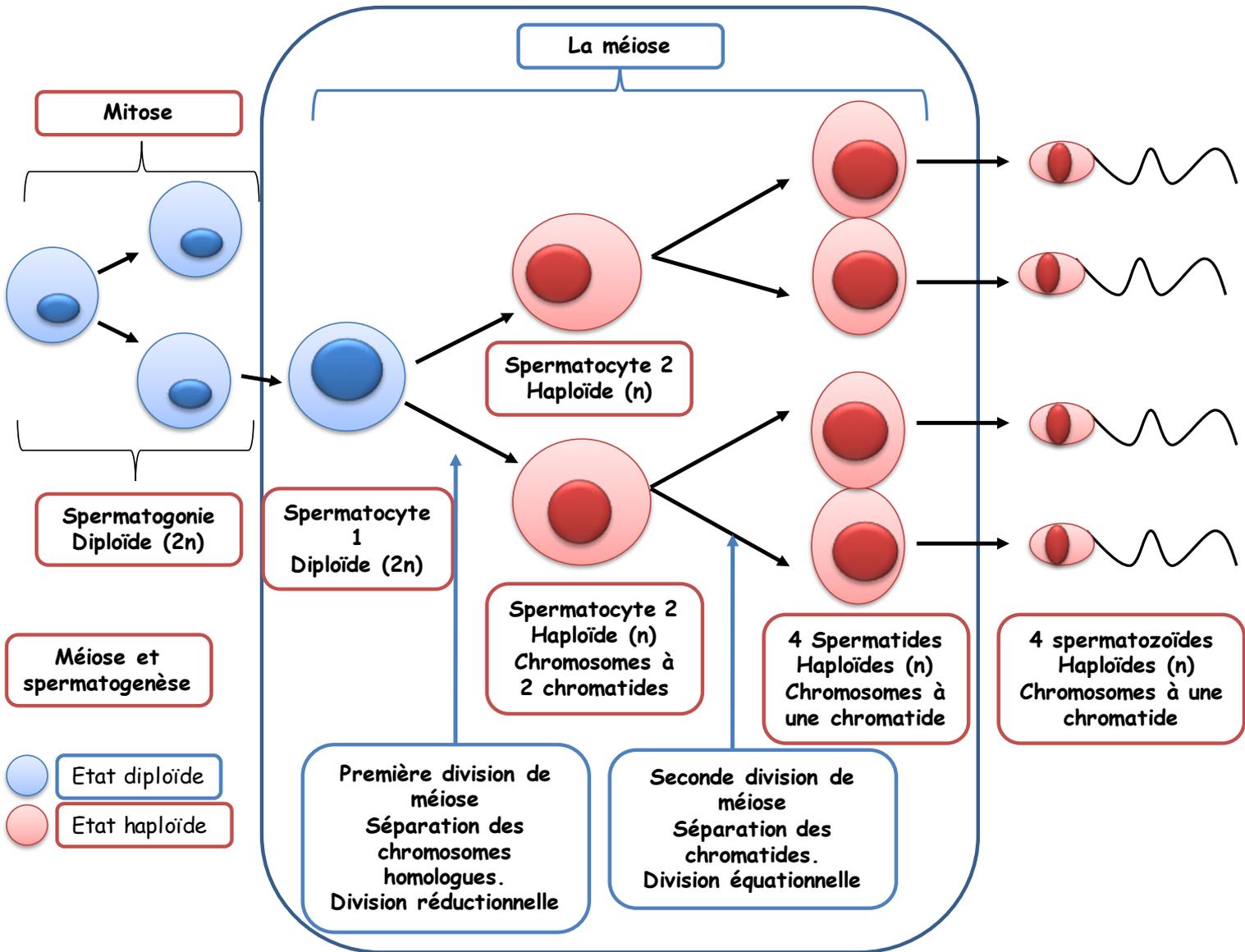


# Spermatogenesis

**Seminiferous tubules** are lined with **Sertoli cells**, which surround developing germ cells (spermatogonia) providing nutrients and stimulating factors, as well as secreting **androgen-binding factor** and **inhibin**. Primordial germ(spermatogonia) cells divide to form primary spermatocytes. These undergo a **first meiotic** division to create secondary spermatocytes (**46 chromosomes**), followed by a **second meiotic** division to form **spermatids (23 chromosomes)**. Finally, these differentiate into spermatozoa.

Spermatogenesis takes **74 days**. The **nonmotile** spermatozoa leave the seminiferous tubules and pass to the epididymis, where they undergo maturation (gain motility and the ability to fertilize). Ductal transit time takes another **2 weeks**, so the total time from beginning of spermatogenesis to ejaculation is **3 months**.

Motile sperm are stored in the **globus minor** of the epididymis until ejaculation. Spermatozoa that are not released are reabsorbed by **phagocytosis**.



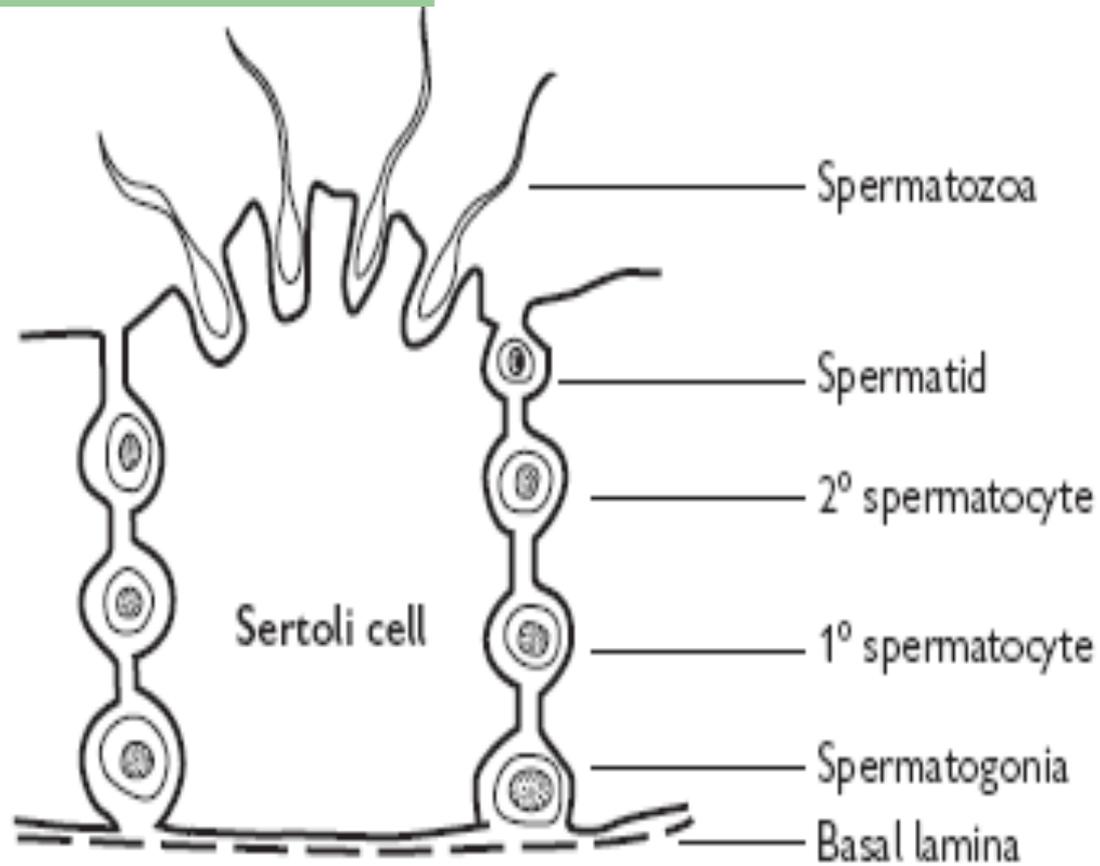


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**Figure 11.2** Spermatogenesis in the seminiferous tubules of the testis.



# Mature sperm

Mature sperm have a **head**, **middle piece**, and **tail**. The head is composed of a **nucleus** covered by an **acrosome cap**, containing vesicles filled with **lytic enzymes** that break down the outer layer of the female **ovum**. The middle piece contains **mitochondria** and contractile **filaments**, which extend into the **tail** to aid motility.

سؤال ٢٩٥ \* normal spermatogenesis in testicles +

" sperm maturation " " +

" " Storage " epididymis + with intact tube → facilitates move of sperm from epididymis to urethra



\*very fragile cells

Head:

Plasma membrane

Acrosomal cap

Nucleus

Middle piece:

Proximal centriole

Mitochondria

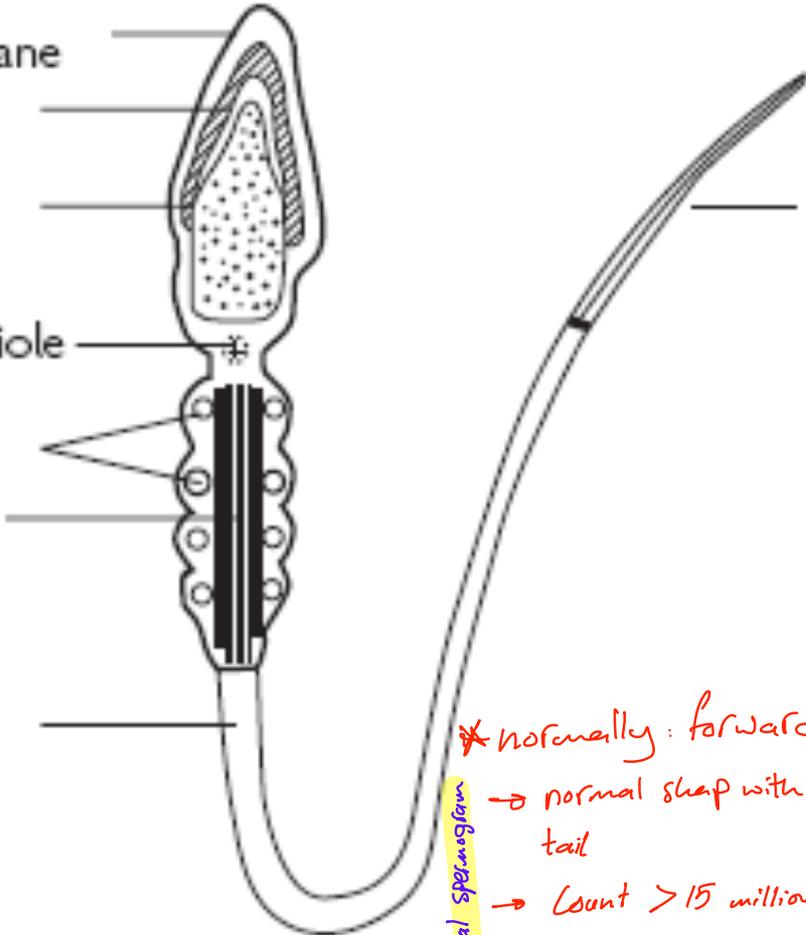
Microtubules

Tail:

Principal piece

Tail:

End piece



normal spermogram

- \* normally: forward motile sperms
- normal shape with normal head & normal tail
- Count > 15 million/ml of ejaculate
- with motility > 32% of ejaculate



# Etiology and evaluation of male infertility

## Definition of infertility

*Infertility is failure of conception after at least 12 months of unprotected intercourse*

. The chance of a normal couple conceiving is estimated at :

20–25% per month, 75% by 6 months, and 90% at 1 year. Up to 50% of infertility is due to male factors.

Up to 25% of couples may be affected at some point in their reproductive years.



# Pathophysiology

Failure of fertilization of the normal ovum is due to defective sperm development, function, or inadequate numbers

. There may be abnormalities :

of morphology (teratospermia) or motility (asthenospermia),  
low sperm numbers (oligospermia) <sup>< 15 millions</sup>, combined disorders  
(oligoasthenospermia), absent sperm (azoospermia).

Abnormal epididymis function may result in defective spermatozoa maturation or transport, or induce cell death.



# Etiology

- **Idiopathic** (25%)
- **Varicocele** (present in 40%)
- **Cryptorchidism** (undescended testes)
- **Functional sperm disorders**: immunological infertility (sperm antibodies); head or tail defects; Kartagener's syndrome
- **Erectile or ejaculatory problems**
- **Testicular injury**: orchitis



## Cont.

**Hormone excess:** excess prolactin (pituitary tumor)

- **Genetic disorders:** Klinefelter's syndrome (47XXY)
- **Male genital tract obstruction:** congenital absence of vas deferens
- **Systemic disease:** renal failure; liver cirrhosis; cystic fibrosis
- **Drugs:** chemotherapy; alcohol; marijuana; sulfasalazine; smoking
- **Environmental factors:** pesticides; heavy metals; hot baths



# History

age, life style, years of marriage, previous marriages, Previous fertility  
Primary infertility? Secondary infertility? Resident in the country?  
drug hx: anti-acid H<sub>2</sub>, antidepressant H<sub>2</sub>

- **sexual and reproductive**: duration of problem; frequency and timing of intercourse; previous successful conceptions; previous birth control; erectile or ejaculatory dysfunction.
- **Developmental**: age at puberty; history of cryptorchidism; gynecomastia
- **Medical and surgical**: orchitis; varicocele testicular torsion, trauma, or tumor; sexually transmitted diseases;

in inguinal canal, in scrotum, in testicles  
& mumps

for wife:

- had miscarriage before
- previously marriage
- regular cycle?
- Using drug?
- Pelvic / abd. Surgery
  - \*adhesion in fallopian tubes



# Cont.

- Drugs and environmental: previous chemotherapy; exposure to substances that impair spermatogenesis or erectile function; alcohol, smoking, occupation
- Family: hypogonadism; cryptorchidism  
↳ hx of infertility



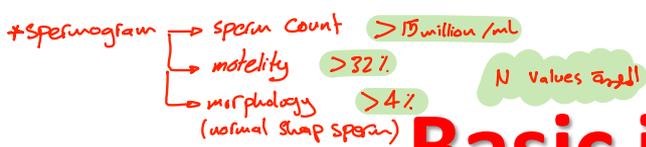
# Examination

↳ ass. normal sexual characteristic of male

- **Perform a full assessment of all systems** with attention to general appearance (evidence of secondary sexual development; signs of hypogonadism; gynecomastia).
- **scrotum** → both testicle located in?  
↳ Normal skin, hair, penile size, penile skin
- **Urogenital examination** should include assessment of the **penis**
- (Peyronie's plaque, phimosis, hypospadias); measurement of testicular consistency palpation of epididymis (tenderness, swelling) and spermatic cord (vas deferens present or absent, varicocele); and digital rectal examination of the prostate

# **Lab investigation of male infertility and Treatment options**

Saeed Abdel-kamel



# Basic investigations

- **Semen analysis** (Spermogram)

لا يتم الحكم على عينته واحدة

3 days - 3-10

- Obtain 2 or 3 specimens over several weeks, collected after 2-7 days of sexual abstinence. Deliver specimens to the laboratory within 1 hour. → 30 min أفضل ما نتأخر عنه

- The mixed agglutination reaction (MAR test) is used to detect antisperm antibodies.
- The presence of leukocytes or round cells in the ejaculate ( $>1 \times 10^6/\text{mL}$  of semen) suggests infection, and cultures should be requested

**Table 12.1 WHO semen analysis characteristics**

Semen analysis parameter	Lower reference limit (95% CI)
Serum volume	1.5mL (1.4–1.7)
pH	≥7.2
Total sperm count	39 x 10 <sup>6</sup> per ejaculate (33–46)
Sperm concentration	15 x 10 <sup>6</sup> per mL (12–16)
Motility	40% progressive + non-progressive (38–40) 32% progressive motility (31–34) Forward progression >grade 2
Sperm morphology	4% normal forms (3–4)
Vitality	58% live spermatozoa (55–63)
Time to liquefy <i>(agglutination or viscosity)</i>	5–25min <i>15–30min - Normally</i>
White blood cells (WBC) <i>- infection</i>	<1 x 10 <sup>6</sup> WBC per mL
MAR-test (for antisperm antibody)	<50% motile spermatozoa with bound particles
Zinc	≥2.4μmol per ejaculate
Semen fructose <i>- low: seminal fluid/seminal vesicle obstruction</i>	≥13μmol per ejaculate

Adapted from World Health Organization (WHO) 2010 lower reference limits (5th centile and their 95% CI) for semen characteristics

**Table 12.2** Grading of sperm motility

<b>Grade</b>	<b>Type of sperm motility</b>
0	No motility
1	Sluggish; no progressive movement
2	Slow, meandering forward progression
3	Moving in a straight line with moderate speed
4	Moving in a straight line at high speed

## • **Hormone measurement**

from pituitary  
gland 2° to GnRH  
from hypothalamus

from testicle

-Obtain serum **FSH**, **LH**, **testosterone** and **prolactin**, **TSH**

- Elevated serum FSH levels (2 x normal) suggest irreversible testicular failure.
- In cases of isolated low testosterone level, it is recommended that morning and free testosterone levels be tested.
- Elevated prolactin is associated with sexual dysfunction and low serum testosterone levels, and usually indicates the presence of a pituitary adenoma.



**Table 11.3** Clinical diagnosis on hormone assay

FSH*	LH**	Testosterone	Diagnosis
↑	Normal	Normal	Seminiferous tubule damage (defective spermatogenesis)
Normal	Normal	Normal	Normal; or bilateral genital tract obstruction
↑	↑	Normal/↓	Testicular failure
↓	↓	↓	Hypogonadotrophism

\* Follicle stimulation hormone.

\*\* Luteinizing hormone.

# Special investigations

- **Chromosomal analysis:** karyotyping to identify Klinefelter's syndrome in patients presenting with azoospermia (5–10% of azoospermic patients have Klinefelter's syndrome), small soft testes, gynaecomastia, d FSH/LH and d testosterone.
- **Y chromosome microdeletion assay:** to assess AZF—regions a, b, and c.
  1. - AZFa: microdeletion predicts no spermatogenesis.
  2. - AZFc: commonest molecular cause of male infertility (13% of non-obstructive azoospermics and 6% of oligozoospermics). Around 70% will have sperm on testis biopsy.
- **Post-orgasmic urine analysis:** the presence of >10–15 sperm per high powered field confirms the diagnosis of retrograde ejaculation.
- **Fructose:** Although the fructose test is not part of a routine semen analysis, it is **useful in cases of azoospermia** (absence of sperm in semen). In azoospermia secondary to the absence of vesicles or if there is an obstruction, no fructose is present. In testicular azoospermia, fructose is present.

# Testicular biopsy

- Performed for azoospermic patients to help differentiate between obstructive and non-obstructive causes.
- Simultaneous sperm retrieval can be carried out (testicular sperm extraction, TESE) for use in intracytoplasmic sperm injection (ICSI) treatment, either at the time or at a later date (following freezing and storage).
- The degree of spermatogenesis can be histologically scored (The Johnsen score). Only mature spermatozoa (score 8 or above) can be used for fertility treatment.

# Testicular biopsy

**Table 12.4** The Johnsen Score. Histological analysis of testicular biopsy<sup>1</sup>

10	Complete spermatogenesis, many spermatozoa
9	Many spermatozoa, disorganized germinal epithelium
8	Few spermatozoa (<5–10)
7	No spermatozoa but many spermatids
6	No spermatozoa and few spermatids (<5–10)
5	No spermatozoa or spermatids, but many spermatocytes
4	Few spermatocytes (<5), no spermatozoa or spermatids
3	Spermatogonia are the only germ cells
2	Sertoli cells only
1	No cells in tubules

# Radiologic Evaluation

- **Vasography**

- **Transrectal Ultrasonography** → to ass. prostate gland, seminal vesicle

- **Venography**

- **Scrotal Ultrasonography** → if you find testicular mass / testicular atrophy / varicocele / pathology in testicles

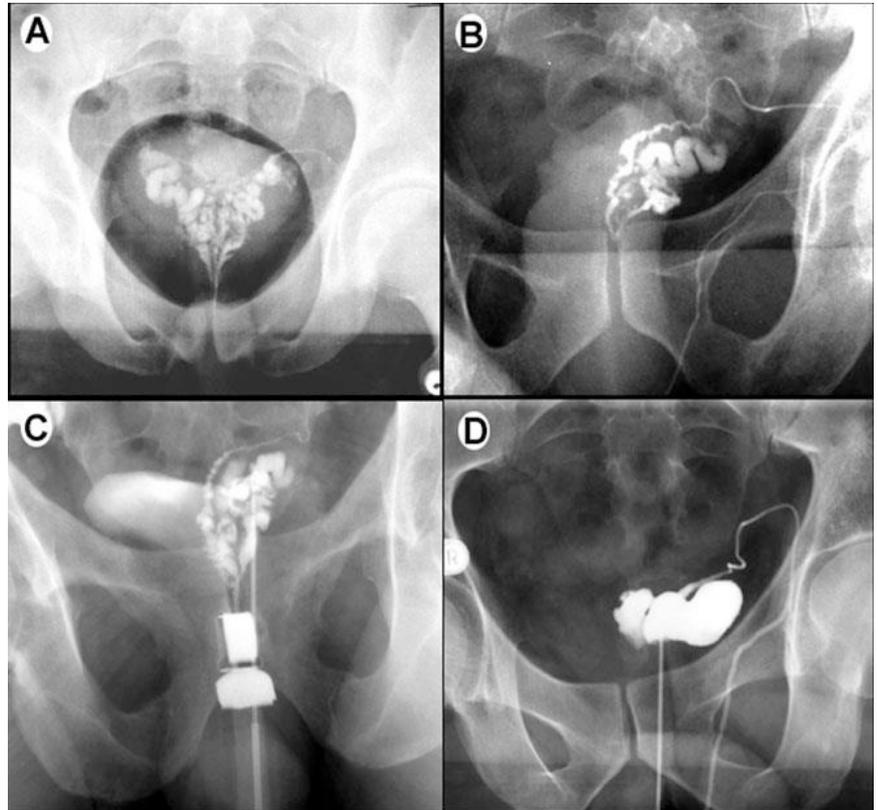
to rule out paratesticular pathology & to ass. size & morphology of testicles

# *Vasography*

- The traditional and most commonly employed radiologic imaging study employed for the evaluation of the vasal and ejaculatory duct patency is vasography.
- The vas deferens is punctured at the level of the scrotum and injected with contrast.
- A normal test shows the passage of contrast along the vas deferens, seminal vesicles, ejaculatory duct, and into the bladder, which rules out obstruction.
- Vasography is indicated to determine the site of obstruction in azoospermic patients who have active spermatogenesis documented by testis biopsy

# *Vasography*

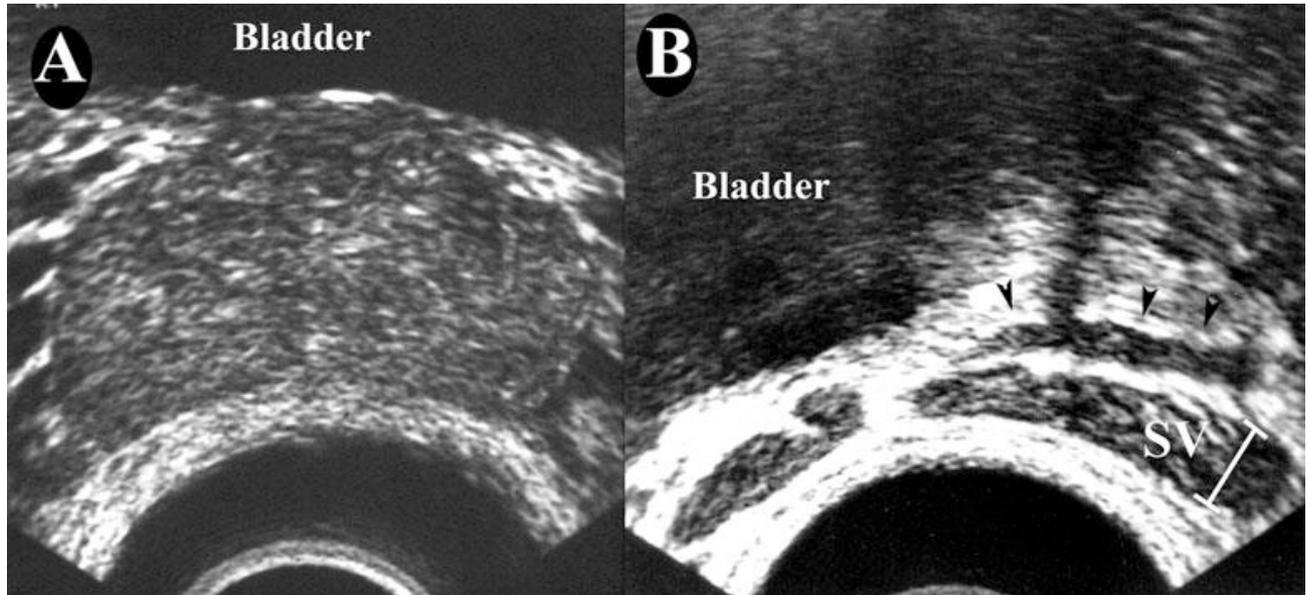
- A normal vasogram is documented when contrast agent is visualized throughout the length of the vas deferens, seminal vesicles, ejaculatory duct, and bladder



# *Transrectal Ultrasonography*

- TRUS allows for the anatomic visualization of the prostate, seminal vesicles, and ampullary portion of the vas deferens
- TRUS is indicated in azoospermic patients suspected of having ejaculatory duct obstruction .
- TRUS is indicated for low ejaculate volumes, to investigate seminal vesicle obstruction (>1.5cm width) or absence
- The normal diameter of the seminal vesicles on transverse imaging behind the bladder is up to 1.5 cm

# *Transrectal Ultrasonography*



# *Scrotal Ultrasonography*

- The main application of scrotal ultrasonography in male infertility has been for the diagnosis of varicoceles
- Color duplex scrotal ultrasonography has been applied as a noninvasive alternative to internal spermatic vein venography in an attempt to objectively diagnose varicoceles
- The initial criteria developed to diagnose a varicocele include the presence of numerous large veins (>3 mm) and reversal of blood flow with Valsalva maneuver

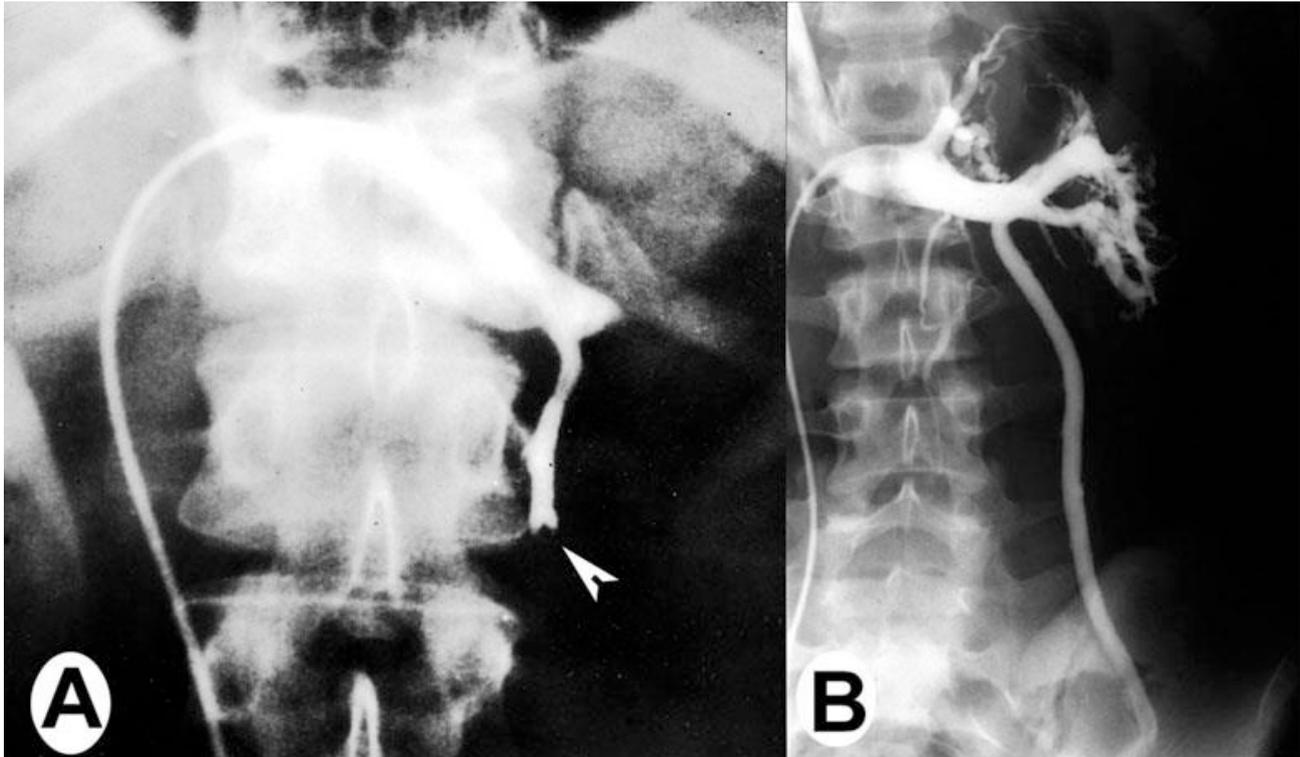
# *Scrotal Ultrasonography*

- Scrotal ultrasonography to detect testicular tumors should be restricted to patients with suggestive histories, physical examinations, or hormonal values.
- It should not be used as a routine examination to screen all infertile men.

# *Venography*

- Internal spermatic vein venography is used to both detect and potentially treat varicoceles
- The femoral vein approach is generally preferred, but the internal jugular approach is superior if embolization of bilateral varicoceles is being observed.

# *Venography*



***Treatment options for male  
factor infertility***

**General:** aim to identify and treat reversible causes of subfertility and improve semen quality. Advice on modification of lifestyle factors (i.e. reduce alcohol consumption, avoid hot baths). *↓ improvement of psychosocial conditions of Pt*

## Medical treatment:

- **Antibiotics:**

Treat any positive semen, urine, or urethral cultures with the appropriate antibiotics.

- **Hormonal:**

1. - **Secondary hypogonadism (pituitary intact):** may respond to administration of human chorionic gonadotrophin (HCG) which stimulates an increase in testosterone and testicular size.  
-- If the patient remains azoospermic after 6 months of treatment, FSH is added (human recombinant FSH or human menopausal gonadotrophin). Alternatively, pulsatile LHRH can be administered subcutaneously via a minipump (used for treating Kallman's syndrome).
2. - **Hyperprolactinaemia:** is treated with dopamine agonists. Arrange an MRI to rule out a pituitary tumour.

- **Antioestrogens (clomiphene citrate 25mg od):**

are used empirically to increase LHRH which stimulates endogenous gonadotrophin secretion. Used for idiopathic oligospermia.

- **Antioxidants:**

Vitamin E supplements have been shown to improve sperm function and IVF success rates; zinc and folic acid may increase sperm concentrations.

## **Erectile and ejaculatory dysfunction**

Erectile dysfunction may be treated conventionally (oral, intraurethral, intracavernosal drugs; vacuum devices or prostheses).

Ejaculatory failure may respond to sympathomimetic drugs (desipramine) or electroejaculation (used in spinal cord injury), where an electrical stimulus is delivered via a rectal probe to the postganglionic sympathetic nerves that innervate the prostate and seminal vesicles.

## ***Antisperm antibodies***

Corticosteroids have been used, but assisted conception methods are usually required.

# Surgical treatment

## - Genital tract obstruction

- 1. Epididymal obstruction:** can be overcome by microsurgical anastomosis between the epididymal tubule and vas (vasoepididymostomy).
- 2. Vas deferens obstruction:** is treated by microsurgical reanastomosis of ends of the vas (vasovasotomy) and is used for vasectomy reversal. Highest success rates for finding viable sperm occur in the first 8y postvasectomy (80–90%); overall pregnancy rates are 750%. Patency rates are better than pregnancy rates; success rates drop to 30% if >15y.
- 3. Post-vasectomy:** Ejaculatory duct obstruction: requires transurethral resection of the ejaculatory ducts (TURED).
- 4. Varicocele:** can be treated by embolization or open or laparoscopic surgical ligation.

✂ if failed (all measurement to achieve fertility) ↴

# Assisted reproductive techniques (ART)

## *Sperm extraction*

- sperm are removed directly from the epididymis by *PESA* or *MESA*.
- If these methods fail, *TESE* by conventional biopsy or microsurgical techniques, or aspiration (*TESA*) may be tried.
- Sperm undergo cryopreservation until required.
- Later, they are separated from seminal fluid by dilution and centrifuge methods, with further selection of motile sperm and normal forms using Percoll gradient techniques.

# Assisted conception

- ***Intrauterine insemination (IUI)***: Following ovarian stimulation, sperm are placed directly into the uterus.
- ***In vitro fertilization (IVF)***: Controlled ovarian stimulation produces oocytes that are then retrieved under transvaginal ultrasound guidance. Oocytes and sperm are placed in a Petri dish for fertilization to occur. Embryos are incubated and cultured for 2–3 days and then transferred to the uterine cavity. Pregnancy rates are 20–30% per cycle.
- ***Gamete intrafallopian transfer (GIFT)***: Oocytes and sperm are mixed and deposited into the fallopian tubes via laparoscopy. Variations include zygote intrafallopian transfer (ZIFT) and tubal embryo transfer (TET).
- ***Intracytoplasmic sperm injection (ICSI)***: A single spermatozoa is injected directly into the oocyte cytoplasm (through the intact zona pellucida). The advantage is that fewer sperm are needed. ICSI is always combined with IVF and the clinical pregnancy rate is 28–40% per cycle.



وما النصر إلا من عند الله