



MED439
KING SAUD UNIVERSITY



Radiology of Renal System

Objectives

Modality used for assessment of the urinary system

- X-ray
- US
- Ct
- MRI
- Nuclear

Normal anatomy

Common pathologies

- Kidney
- Ureter
- Bladder
- Urethra

Color index:

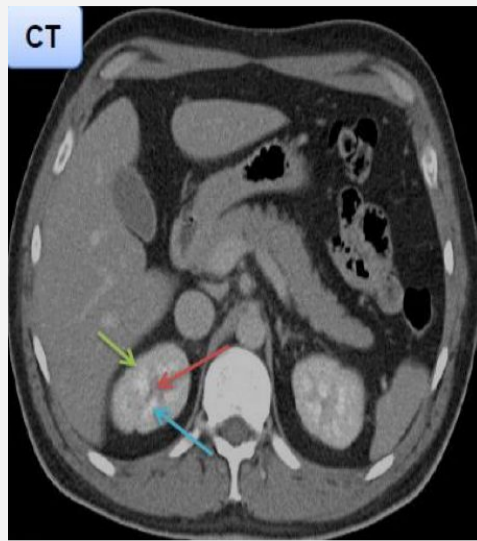
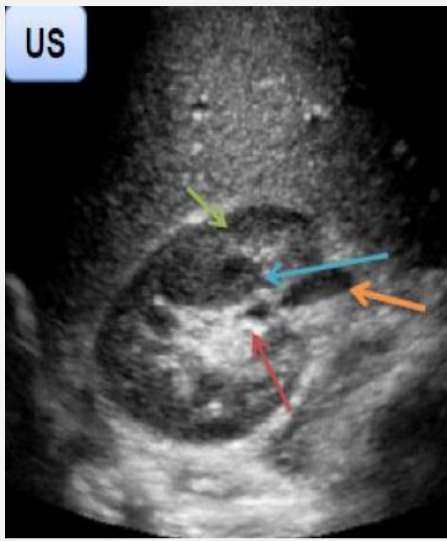
Black: Main text

Red: important

Gray: Notes & explanation

Kidney

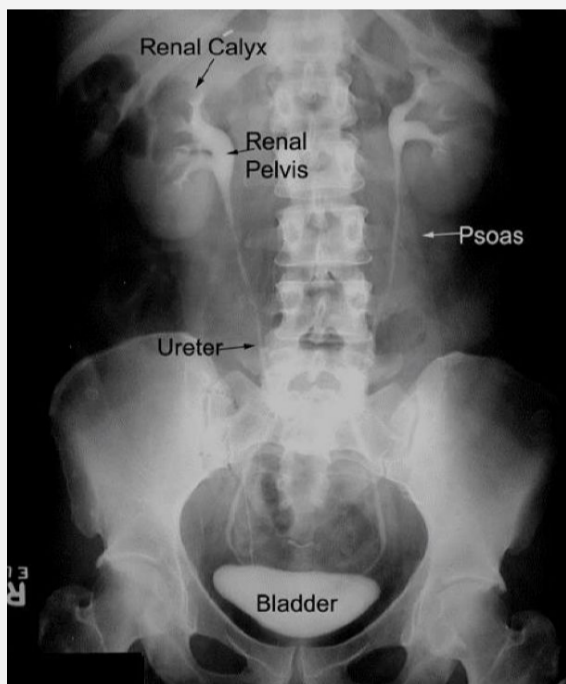
Renal Radiology



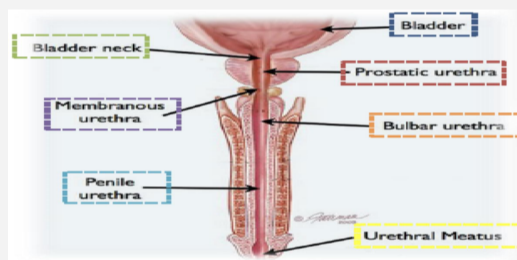
- Renal cortex
- Renal permed or medulla
- Hilum or pelvis
- Ureter

Ureter

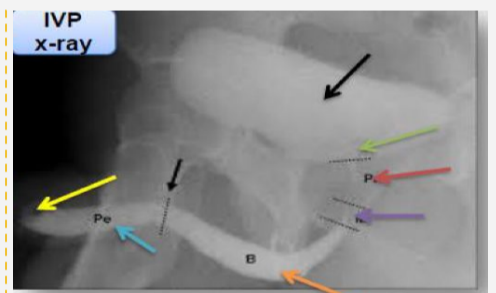
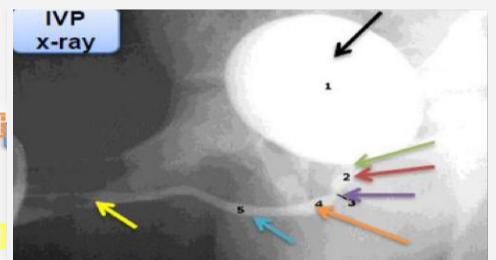
Urethra



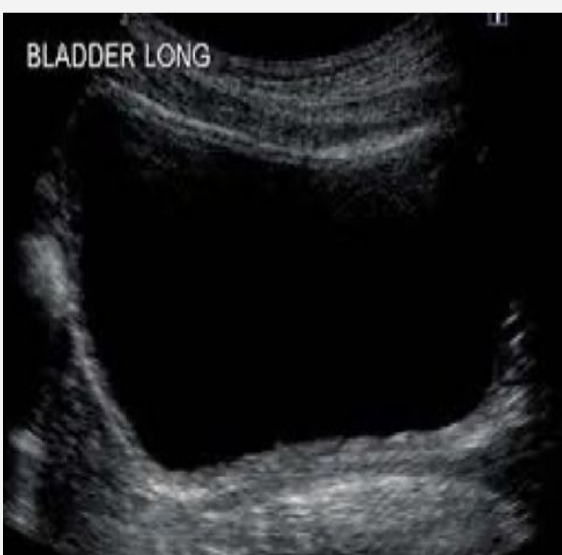
X-ray (IVP) used for patients that have urethral injury Showing a Cut off in the urethra





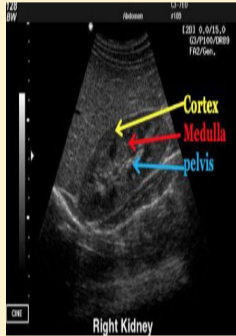

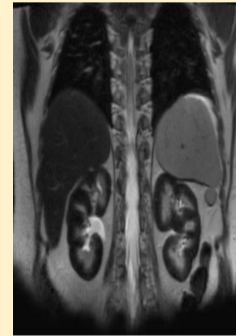

- Bladder
- Bladder neck
- Prostatic urethra
- Membranous urethra
- Bulbar urethra
- Penile urethra
- Urethra meatus



Urinary Bladder



Modalities used

Modalities	X-Ray	IVP	US	CT	MRI	Nuclear
Images						
Image key	<p>White: bone and calcification.</p> <p>Grey: soft tissue.</p> <p>Black: air</p>	<p>An intravenous pyelogram is an x-ray examination of kidneys, ureters and urinary bladder that use iodinated contrast material injected into veins. (so it's used to assess the excretion function)</p>	<p>White= stones and calcification, air. Grey= soft tissue. Black= fluid Note: renal fat hyperechoic on US</p>	<p>White= bone and calcification.</p> <p>Grey= soft tissue.</p> <p>Black= air</p>	<p>White = high intensity (fluid).</p> <p>Grey to black = low intensity.</p>	<p>Dark gray to black is the nuclear fluid flow pathway</p>
Pros	Inexpensive, quick		no ionizing radiation, inexpensive, portable	quick, a lot of information Easy performed	no ionizing radiation, a lot of information of soft tissue	assess the function NOT the Anatomy
Cons	Ionizing radiation, not definitive		operator dependent, time consuming	ionizing radiation, expensive	expensive, time consuming about 30 min	time consuming, radioactive materials Highest radiation dose

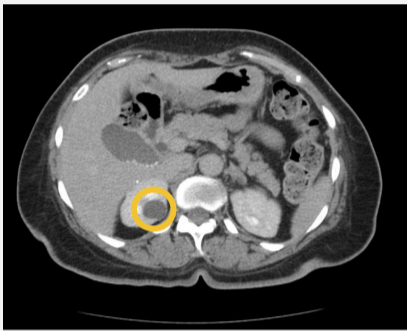
Common kidney pathologies

1) Cysts

(benign ,common ,bosniak classification)

The Bosniak classification system of renal cystic masses divides renal cystic masses into five categories based on imaging characteristics on contrast-enhanced CT. It is helpful in predicting a risk of malignancy and suggesting either follow up or treatment.

Ultrasound



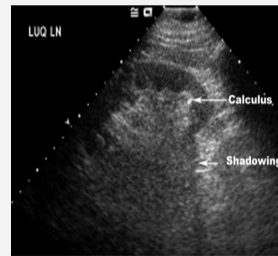
2) Stones

2.1-Radio-opaque (calcium ,struvite)

We can see Radio-opaque in x-ray

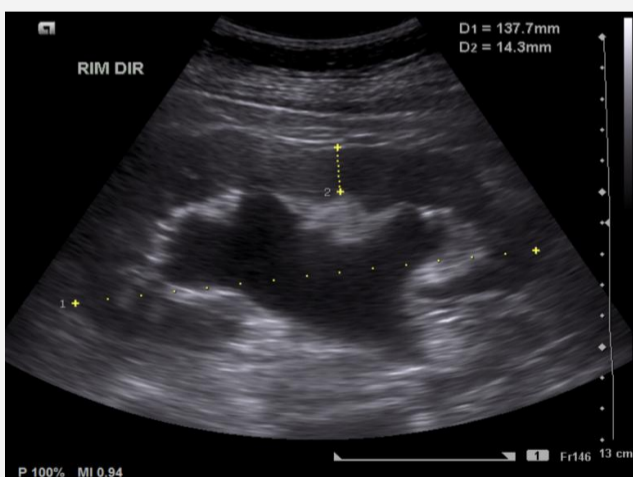
2.2-Radio-lucent (uric acid ,cysteine)

A patient has hematuria, flank pain, without fever and stones what is the best imaging technique for diagnosis?
CT without contrast



3) Hydronephrosis

Hydronephrosis is a condition that typically occurs when a kidney swells due to urine failing to properly drain from the kidney to the bladder, for diagnosis we use CT and US. Dilation of collecting system, proximal tubules and renal pelvis



4) Pyelonephritis

- is the **infection** of the kidney. (**Fever & Flank Pain**)
- Acute pyelonephritis results from bacterial invasion of the renal parenchyma. Bacteria usually reach the kidney by ascending from the lower urinary tract.
- CT scan for a patient with pyelonephritis, **we do it only if the patient doesn't respond to the treatment or he had a recurrent pyelonephritis & cystitis or complications (e.g.Abscess).**

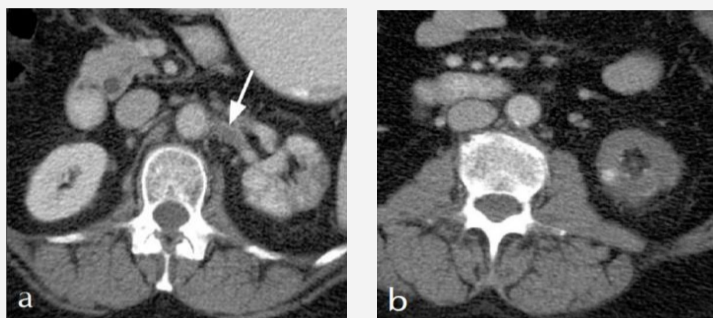


CT With contrast

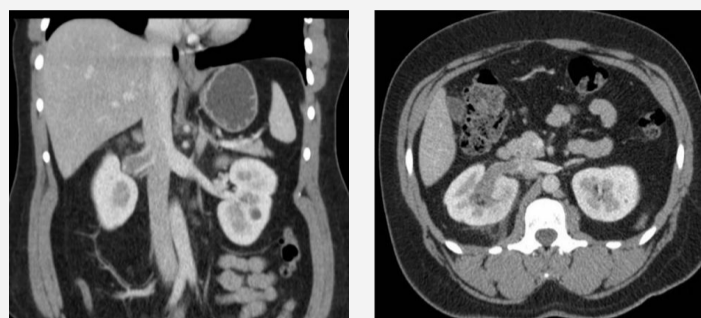
Common kidney pathologies cont..

5) Renal thrombosis

5.1) Artery



5.2) Vein



6) End-stage renal disease (ESRD)

is the last stage of chronic kidney disease (Atrophy) and (loss of differentiation between cortex and medulla)

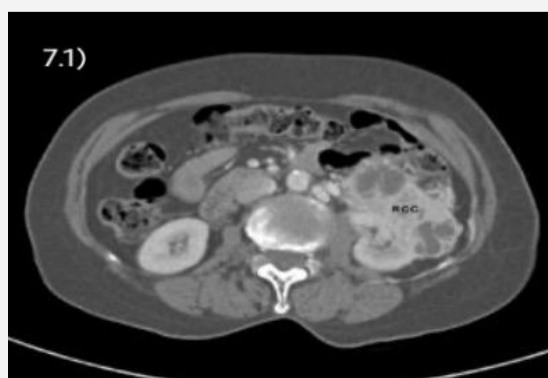


7) Tumors

7.1) **Benign, most common benign is angiomyolipoma** It a tumor that is composed of fat, vascular, and smooth muscle.



7.2) **Malignant, most common type is renal cell carcinoma**



8) Congenital

8.1) Horseshoe kidney



joining both kidneys

8.2) Ectopic Kidney



can be found anywhere in abdomen

8.3) Polycystic Kidney



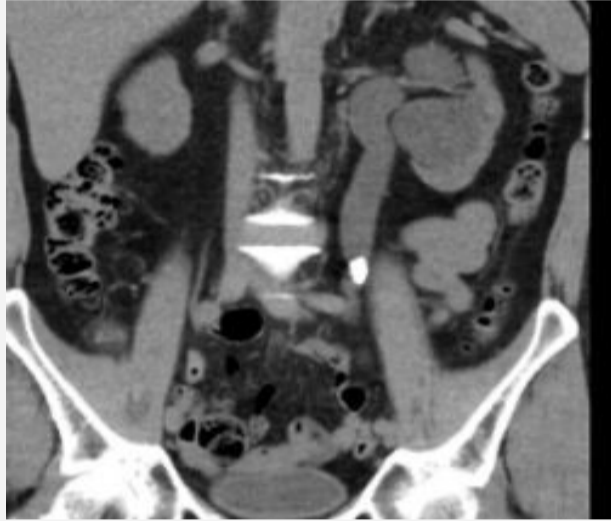
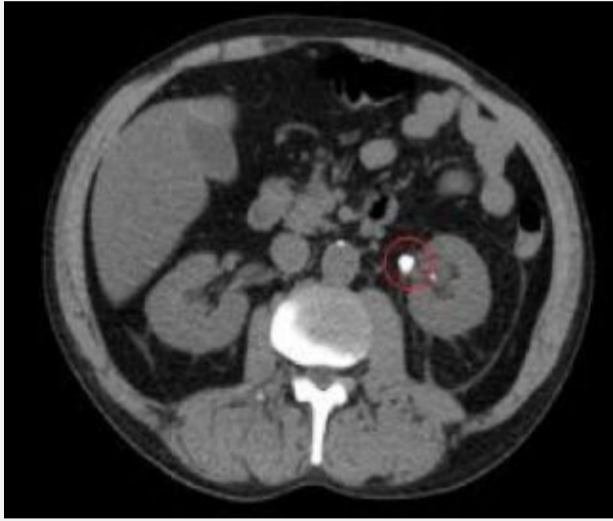
Kidney replaced by multiple cysts and significantly enlarged

Common Ureter pathologies

1) Ureteric Stone: (Flank pain)

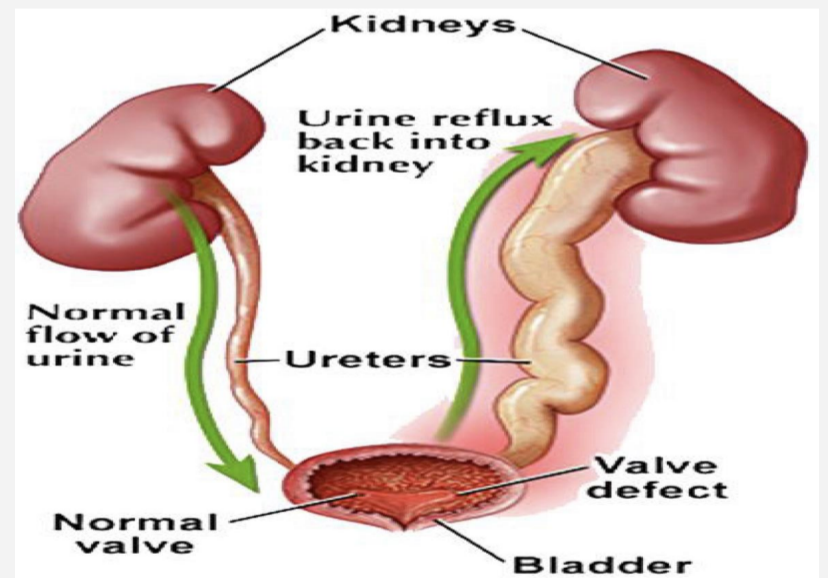
stones in the ureter will make a **obstruction** and block the urines way to the bladder, **which may cause Hydronephrosis** & hydroureter.

diagnosed by non contrast CT



2) Vesicoureteral reflux disease

a condition in which urine flows retrograde, or backward, from the bladder into the ureters/kidneys (usually affects children). **Diagnosed by IVP.**



3) Duplicating Collecting System

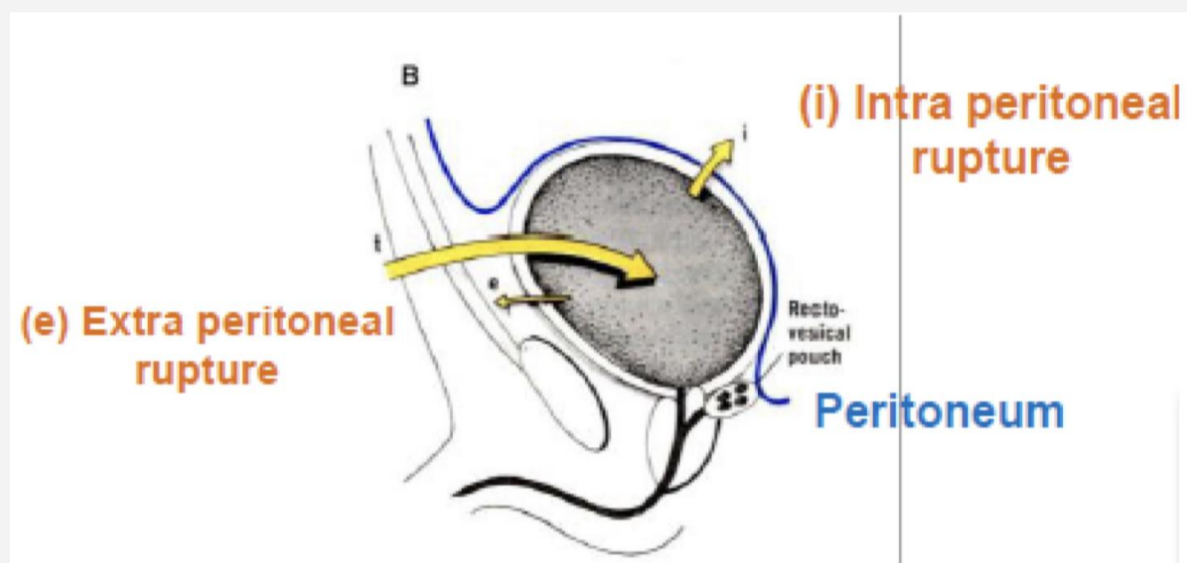
common congenital renal tract abnormalities, characterized by an incomplete fusion of upper and lower pole moieties result in a variety of complete or incomplete duplications of the collecting system.



Common Urinary bladder pathologies

1) Bladder rupture:

- The abdomen is lined with the peritoneum from inside.
- The bladder is located below the membrane of the peritoneum.

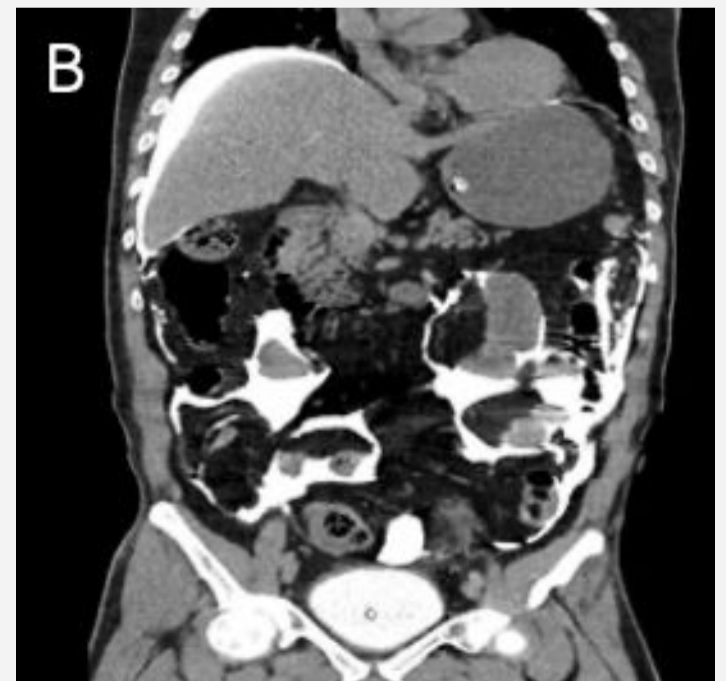


A) **Extra peritoneum:** any rupture or leakage to the content of the bladder **does not enter the peritoneum.** Patient does **not need surgery.**

B) **Intra peritoneum:** there is a **rupture in both bladder and peritoneum.** In this case, patient **will need surgery.**



Diagnosed by
CT with
contrast to
differentiate
between
extra or intra



Common Urinary bladder pathologies cont..

2) Cystitis: (Suprapubic pain) (Fever or without)

-Image 1: an inflamed urinary bladder
(thick surrounding walls)

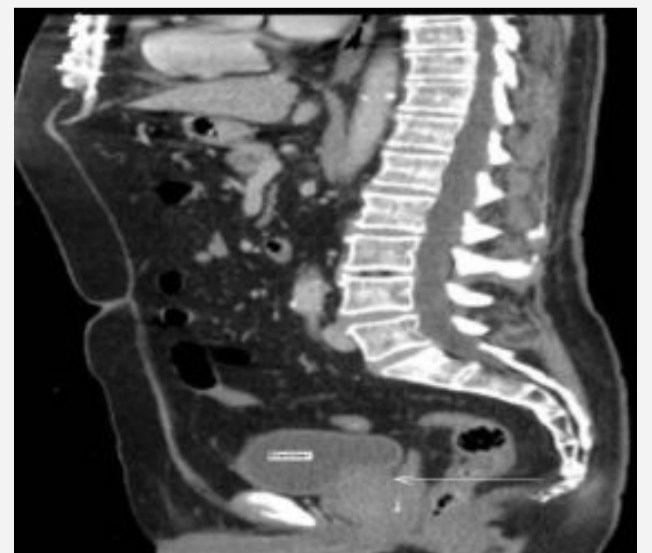
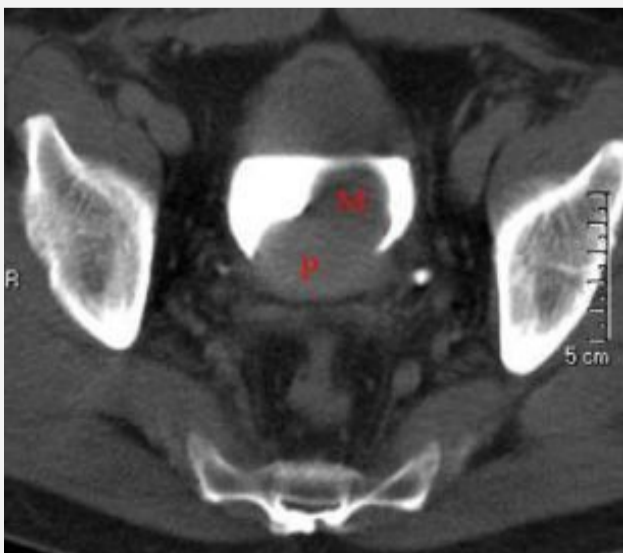


- Image 2: This bladder has **gas bubbles** that could be due to inflammation or infection from 'gas producing' bacteria



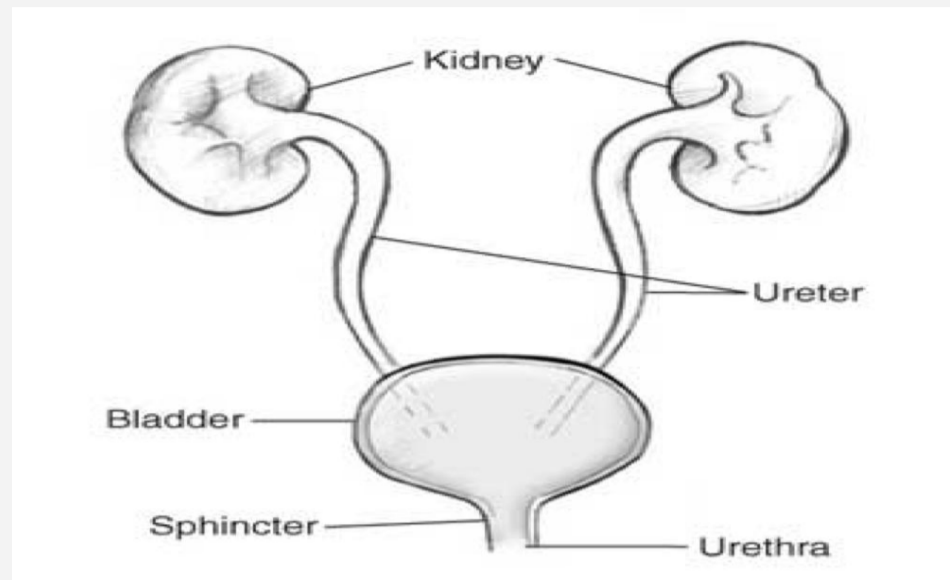
Common prostate pathologies

1) Benign prostate hypertrophy

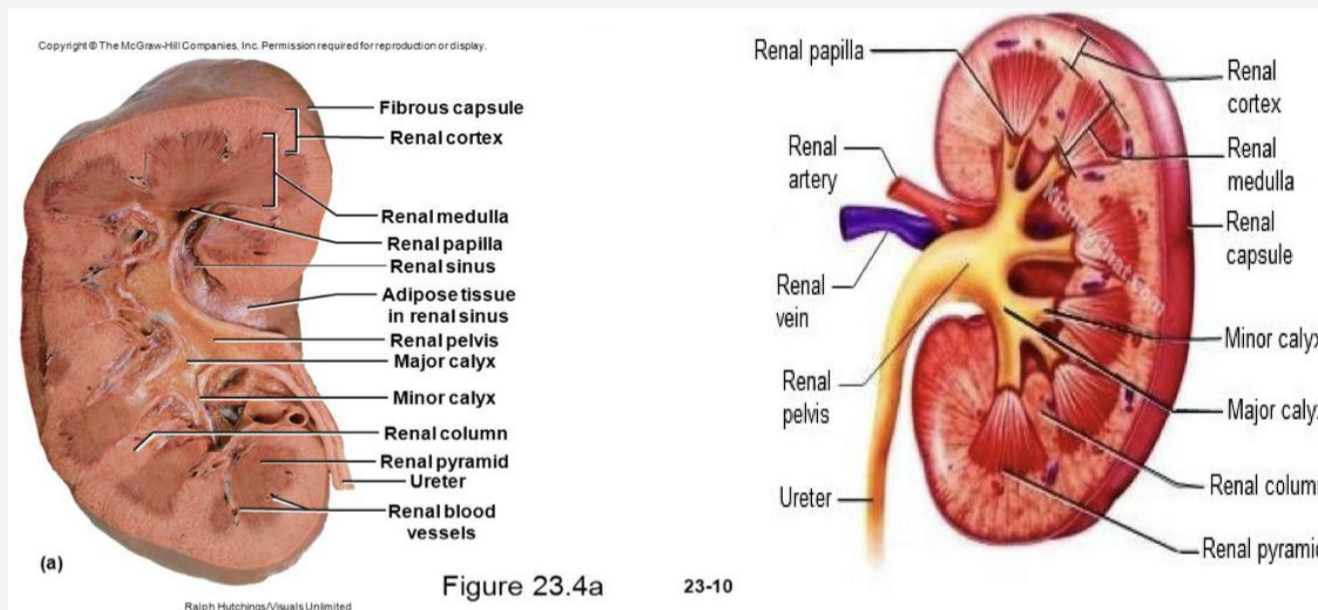


For your knowledge...

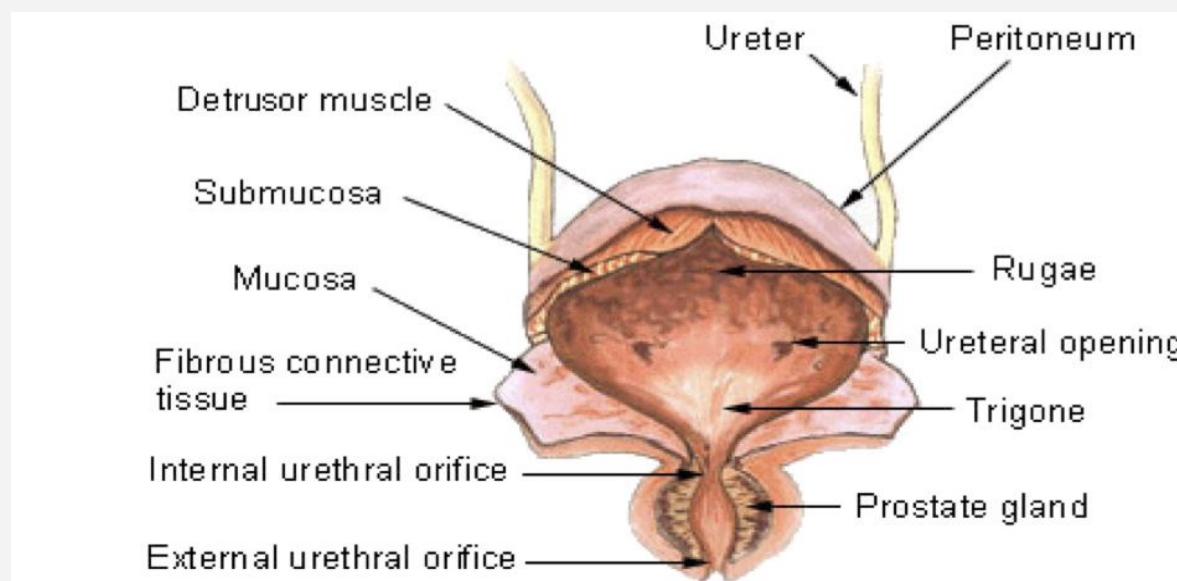
Anatomy of the urinary system




Gross Anatomy of Kidney



Anatomy of Urinary Bladder



MCQs

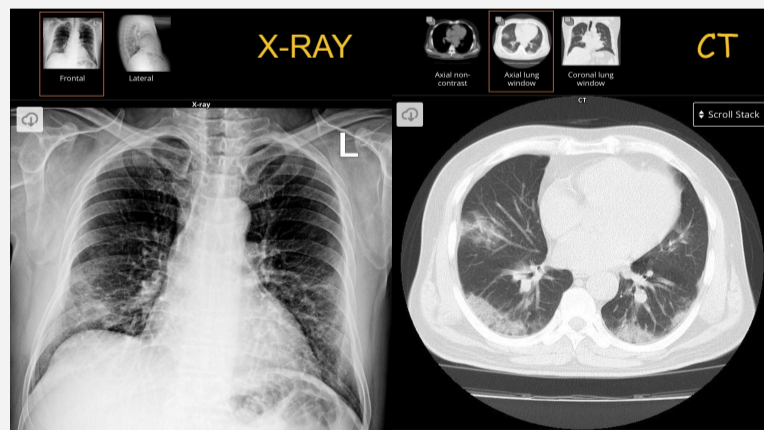
1. Initial best modalities for solid organ?			
A)US	B)CT	C)x-ray	D)MRI
2. Which modalities assess kidney function?			
A)CT	B)Nuclear scans	C)US	D)MRI
3. Patient come to emergency with trauma and you are suspecting stenosis or injury to the urethra what is the best modalities?			
A)IVP	B)CT with contrast	C)CT without contrast	D)US
4. Patient presenting with lower abdominal pain with no fever what is your diagnosis?			
A)Pyelonephritis	B)Hydronephrosis	C)cystitis	D)Ureteric Stone
5. Patient come to emergency and you suspect urinary bladder injury what is the best initial test ?			
A)IVP	B)CT with contrast	C)CT without contrast	D)US

5. 4. 3. 2. 1.
B C A B A



EXTRA: COVID-19's case

A 55-years-old Man came to hospital with **fever** and **non-productive** cough started for **5 days** ago.



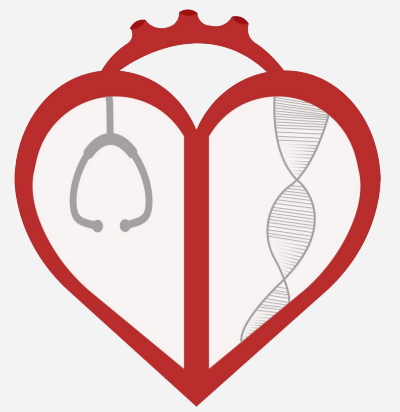
Patchy peripheral opacities are seen at the lung fields mid to lower zones.

Bilateral multi-lobar peripheral ground-glass and consolidative opacities are seen in both lungs, mostly mid to lower zones.

Non-specific mediastinal lymph nodes.

Case Discussion

The RT-PCR COVID-19 assay was positive, so this patient was deemed to have COVID-19 pneumonia.



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Editing file