



Team 437

Radiology

Radiology of the renal system

Colour Code

Important

Doctor's notes

Extra explanation



Objectives:

- Modality used for assessment of the urinary system
 - X-ray
 - US
 - CT
 - MRI
 - Nuclear
- Normal anatomy
- Common pathologies
 - Kidney
 - Ureter
 - Bladder
 - Urethra



Modalities used



Ultrasound

Pros (Advantages)

Portable

Inexpensive

No ionizing radiation

Cons (Disadvantages)

Time consuming

Operator dependent (depends on the skill of the operator).

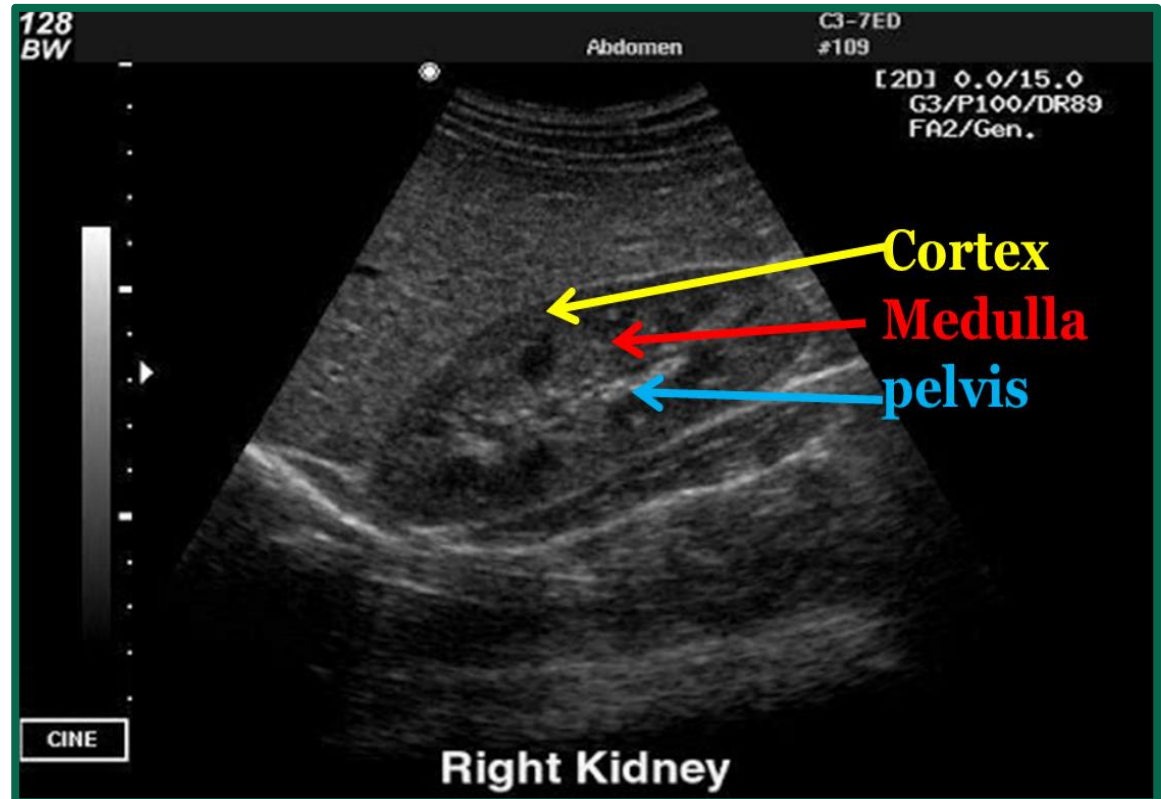


Image Key:

White = stones and calcification.

Grey = soft tissue.

Black = fluid.

-**Ultrasound:** Sound waves that reflect off dense surfaces, giving us a hyper-echoic view of the surface.

- Objects with less density appear in gray such as sub tissue
- Fluids such as water and urine will not reflect the sound wave
- The renal pelvis appears white because it is filled with fat

X-RAY

Not commonly used on the renal system.

Pros (Advantages)

Inexpensive

Quick

Cons (Disadvantages)

Ionizing radiation

Not definitive

Image Key:

White = bone and calcification.

Grey = soft tissue.

Black = air.

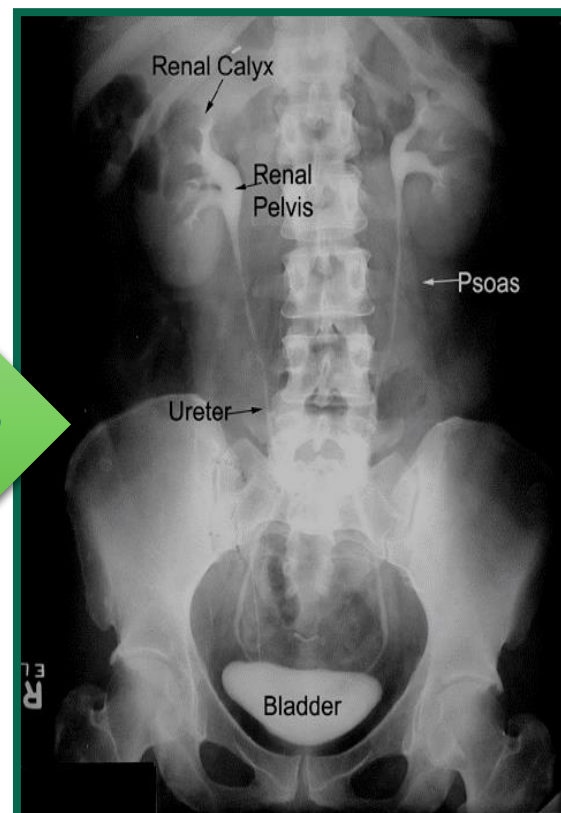
IVP

-Intravenous pyelogram commonly used on the renal system

-patient is given contrast which appears bright after entering the renal system

-you can tell if there is any stone or obstruction in the ureter

-contrast is given Intravenously, and it ends up being excreted by the kidneys



CT

Multi leveled X ray, which gives a more definitive and clearer images.

Pros (Advantages)

Quick

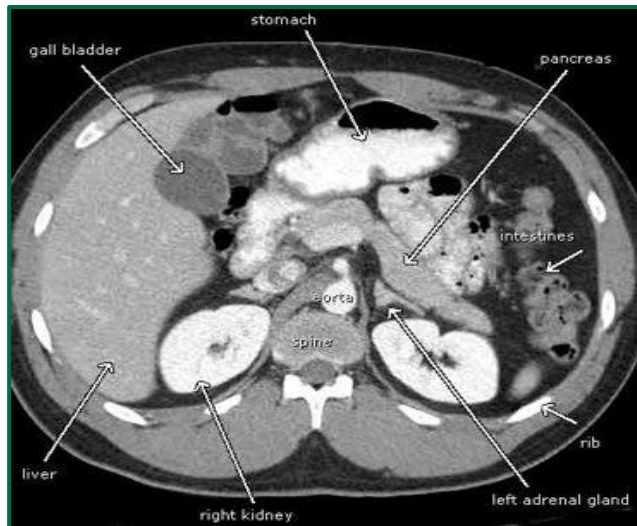
A lot of information(can view small structures in the kidney).

Cons (Disadvantages)

Ionizing radiation

Expensive

Image key: same as X ray
White = bones and calcification.
Grey = soft tissue.
Black = air.



MRI

Stands for (Magnetic Resonance Imaging)

Pros (Advantages)

No ionizing radiation(uses magnetic fields).

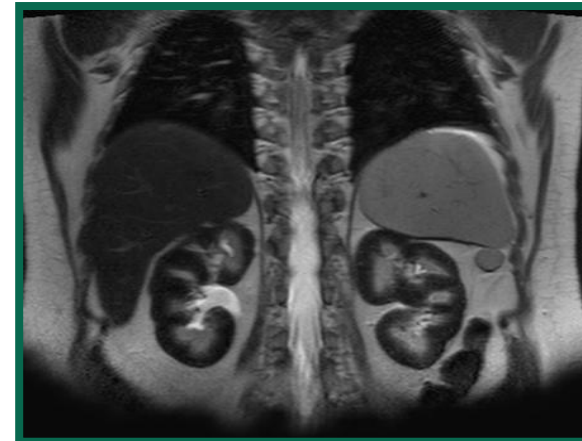
A lot of information(can be used in pregnancy).

Cons (Disadvantages)

Time consuming

Expensive

Image key:
White = high intensity.
Grey to black = low intensity.



Nuclear scans

Pros (Advantages)

assess the function

Cons (Disadvantages)

Time consuming

radioactive materials

-The patient is given radioactive materials which give off gamma rays, these rays can be detected by special cameras.

-This picture shows that the right kidney filtered the radioactive material while the left one did not.



Summary

modality	US	X-ray	CT	MRI	Nuclear
Pros	<ul style="list-style-type: none"> No Ionized radiation. Cheep. Portable. 	<ul style="list-style-type: none"> Cheep. Quick. 	<ul style="list-style-type: none"> Quick. Gives lots of information. 	<ul style="list-style-type: none"> No Ionized radiation. Gives lots of information. 	<ul style="list-style-type: none"> Assess the function.
Cons	<ul style="list-style-type: none"> Operator dependent. Time consuming. 	<ul style="list-style-type: none"> Ionized radiation. Not defective. 	<ul style="list-style-type: none"> Expensive. Ionized radiation. 	<ul style="list-style-type: none"> Expensive. Time consuming. 	<ul style="list-style-type: none"> Time consuming. Radioactive materials.

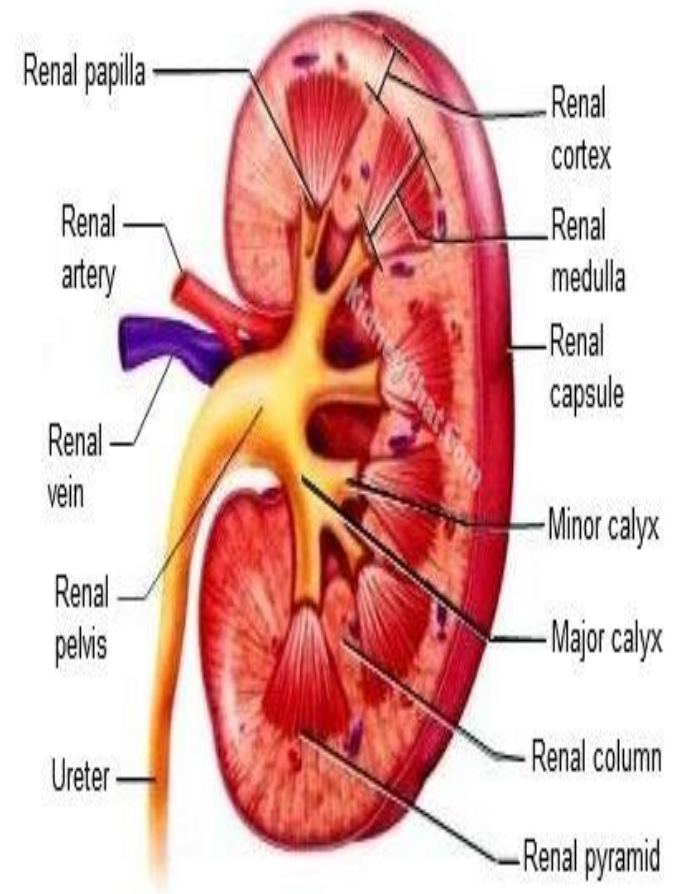
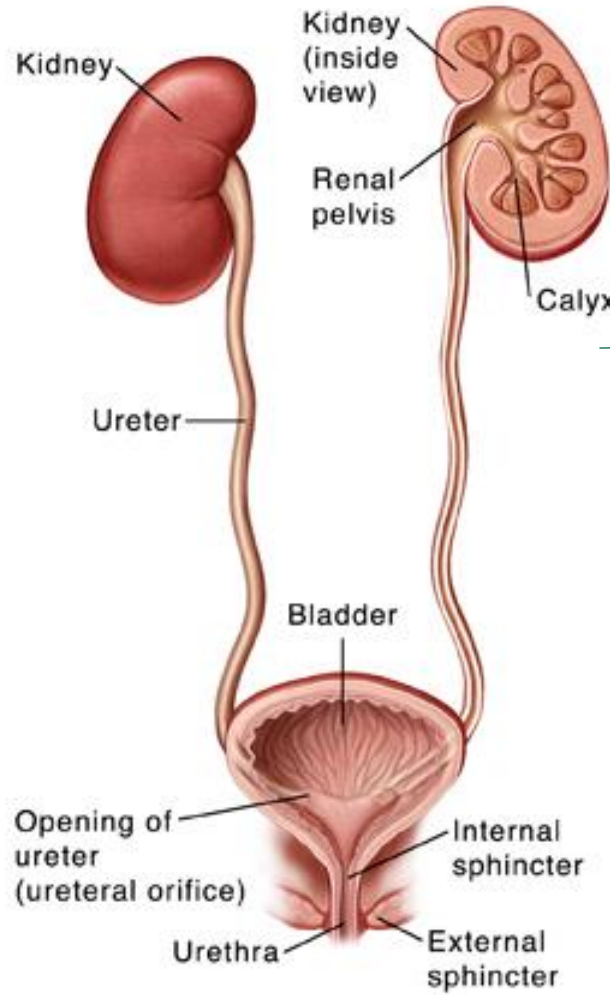
-Ultrasound and MRI are the only ones with no ionizing radiation

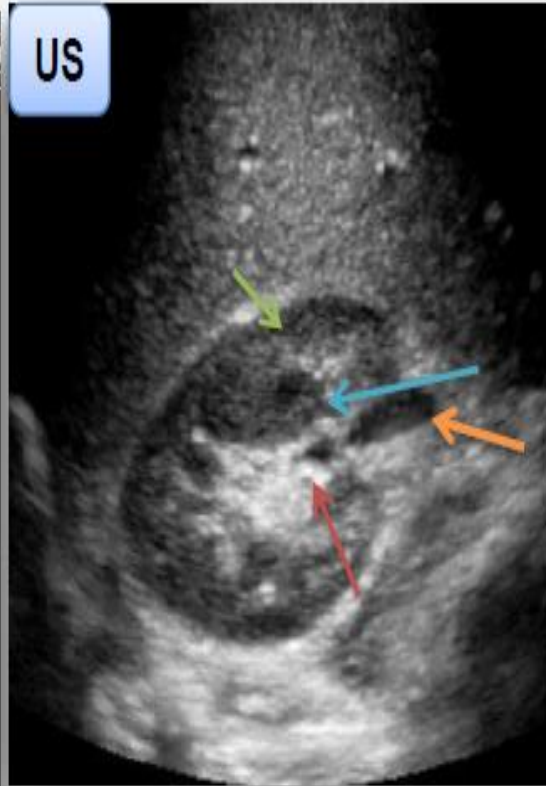
-Nuclear scan is the only one that can assess the function (not only the anatomic structure)



Urinary System Anatomy







- **Renal Cortex.**
- **Renal Permed or Medulla.**
- **Hilum or Pelvis.**
- **Ureter**



Urinary bladder



- Black in Ultrasound(because it's fluid)
- We use it to asses the amount of urine in bladder



- Smooth muscle of the bladder
- Tumors will cause irregularities



Common Kidney Pathologies



Cysts

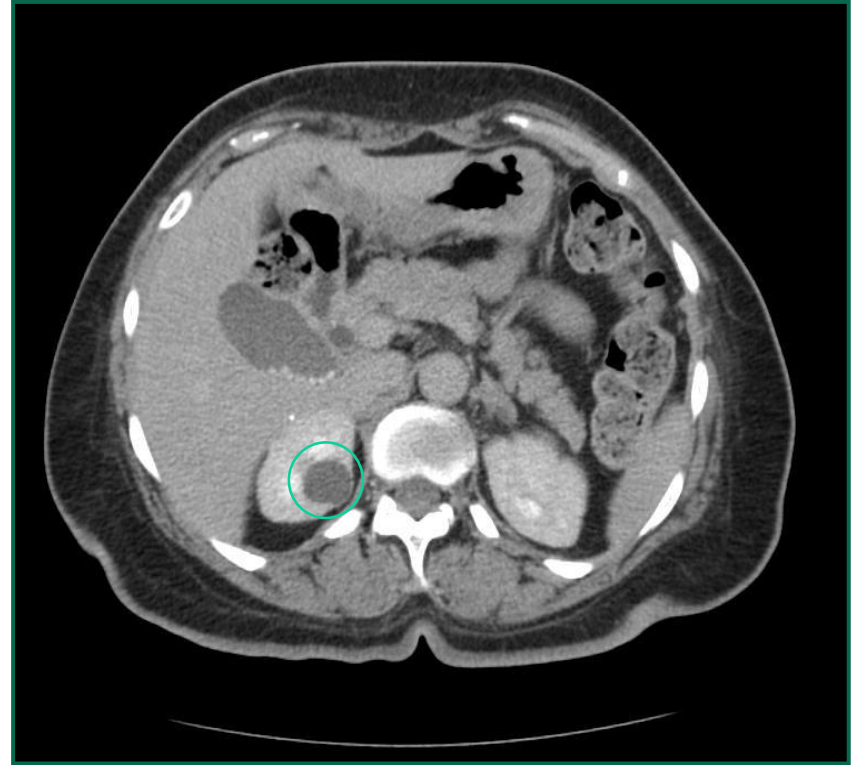
Cysts: are sac-like structures that may be filled with gas, liquid, or solid materials.

It is benign, common **and predominantly incidental.**



Anechoic circular mass , clear borders.

-Here it's cyst not tumor, why?
Because it has well demarcated fluid inside



Hypo-dense clear border
mass in right kidney.



Stones

- **Radio-opaque (calcium , struvite)**

(can be seen in X-RAY)

Struvite: (magnesium ammonium phosphate)

- **Radio-lucent (uric acid , cysteine)**

(can't be seen in X-RAY)



The best modality for the diagnosis of renal stones is **non-contrast CT**

-Contrast CT will mask the stones because the whole area will become bright

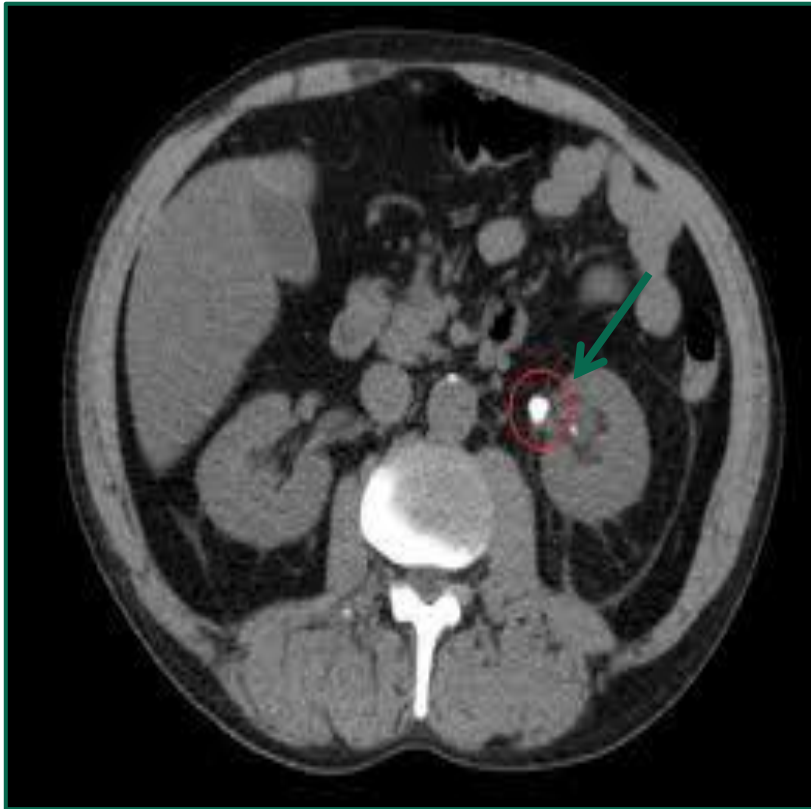
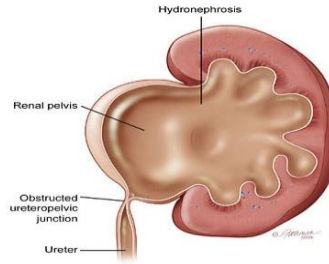
-In the other hand non-contrast CT will only make the stones appear bright as you can see in the picture.



Stones

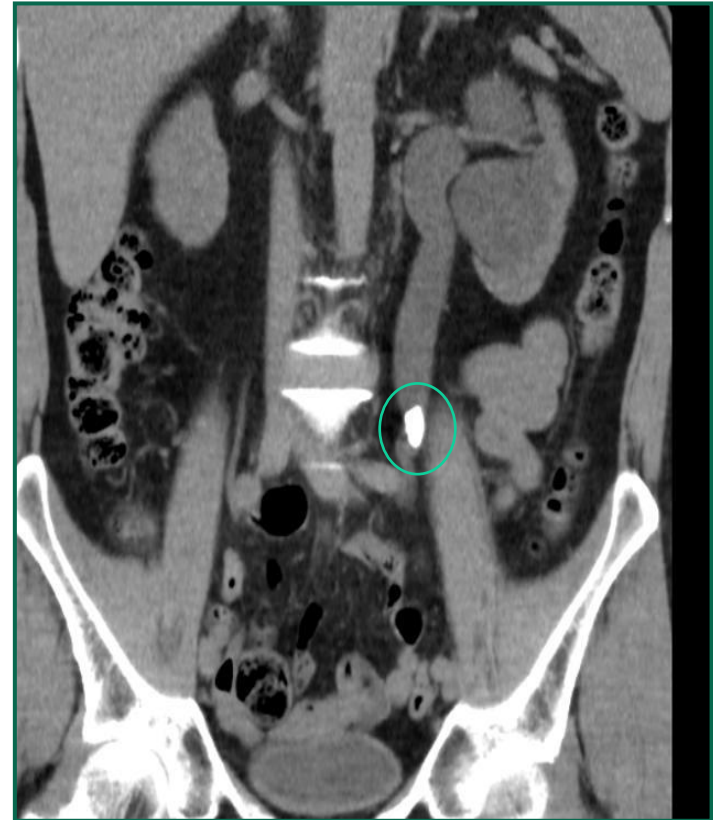
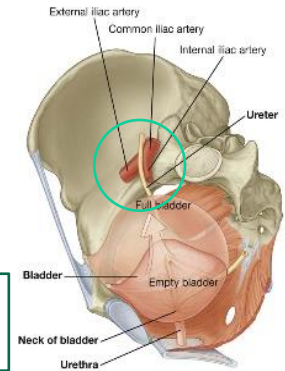
Uretropelvic junction.

-Here we have a stone in the Uretropelvic junction

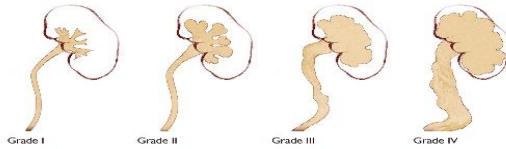


Pelvic brim junction: intersection of iliac arteries and ureter

-Here we have a stone in the Pelvic brim junction



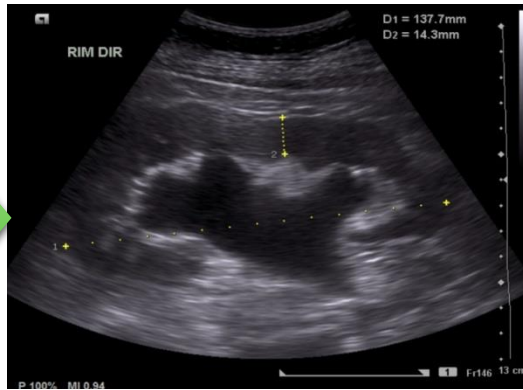
Hydronephrosis



-A block in the drainage of the renal system which causes the urine to accumulate in the renal pelvis.

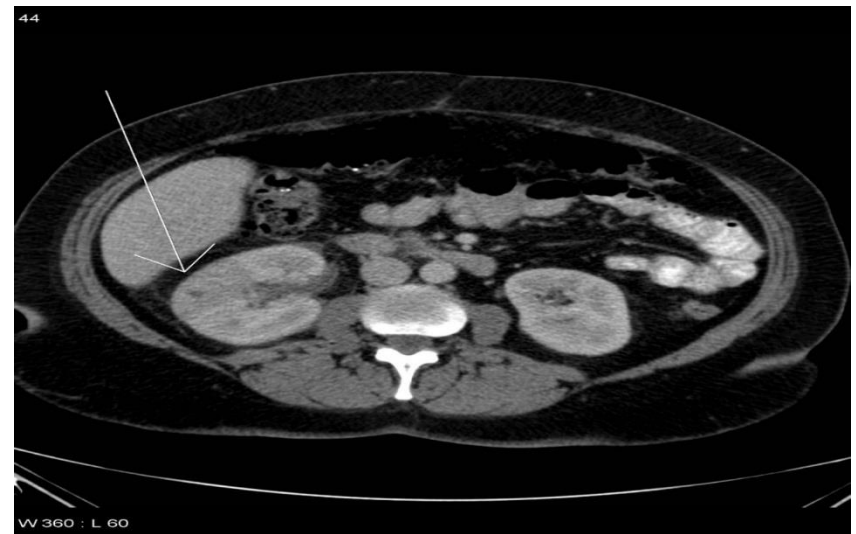
-When there is a complete obstruction to the ureter by a stone, the kidney eventually fills with urine and become swollen along the ureter

-You can notice how the kidney pelvis is dilated or extended if you compare it to the normal ultrasound



Pyelonephritis

- It is the infection of the kidney.
- 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.

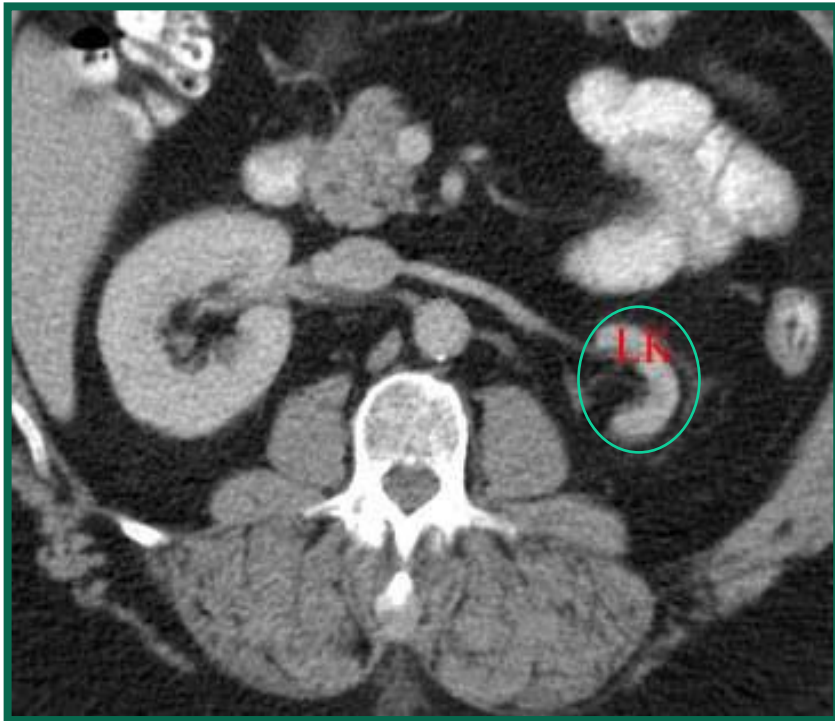


End-stage renal disease (ESRD)

-ESRD causes Kidney atrophy

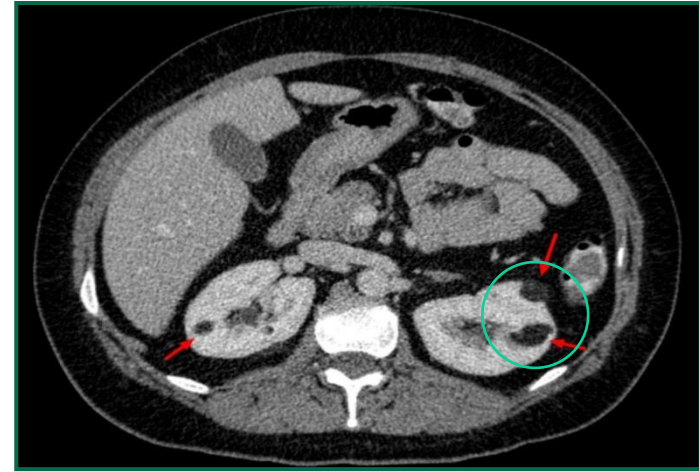
-In the picture below we can see atrophy in the left kidney

-The right kidney is trying to compensate, that's why it's hypertrophied

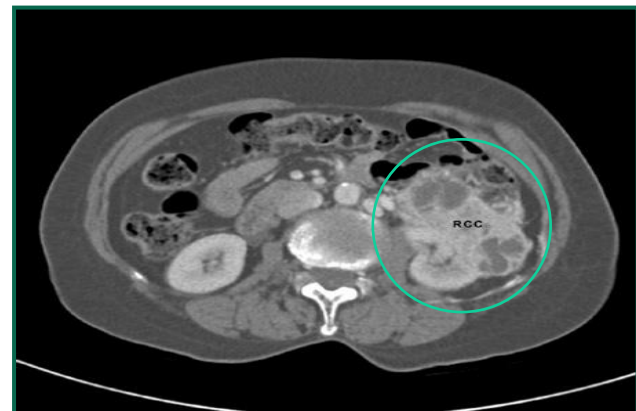


Tumors

1-Benign
most common type is
angiomyolipoma.

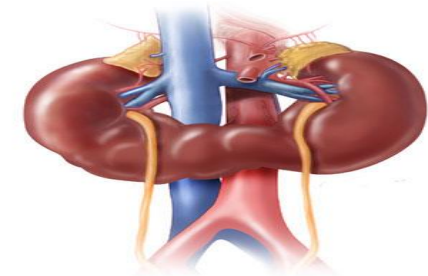
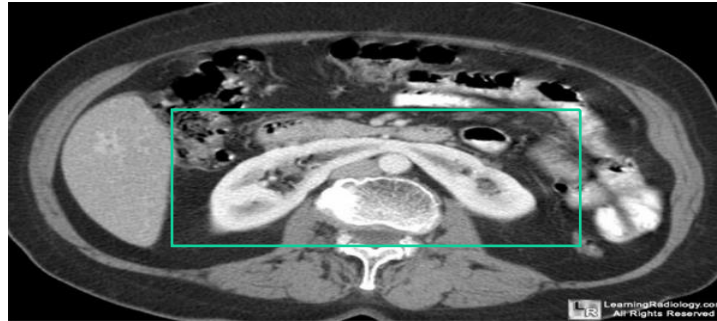


2-Malignant
most common type is
renal cell carcinoma.



Congenital kidney diseases

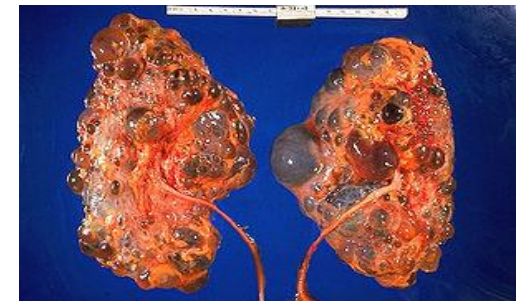
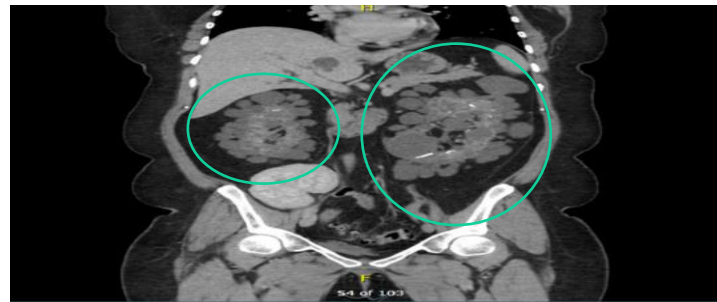
Horseshoe Kidney



Ectopic Kidney



Polycystic Kidney Disease



Common Ureter and Urinary bladder Pathologies



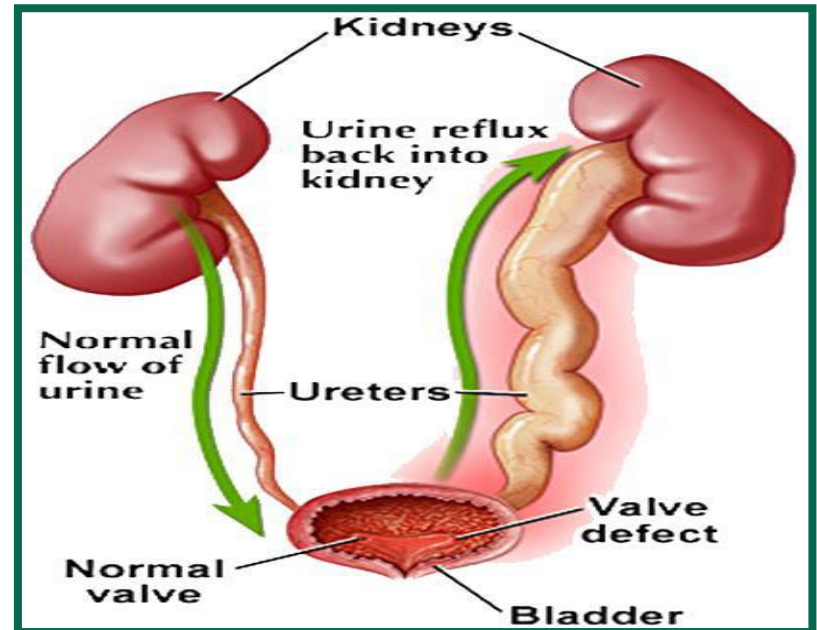
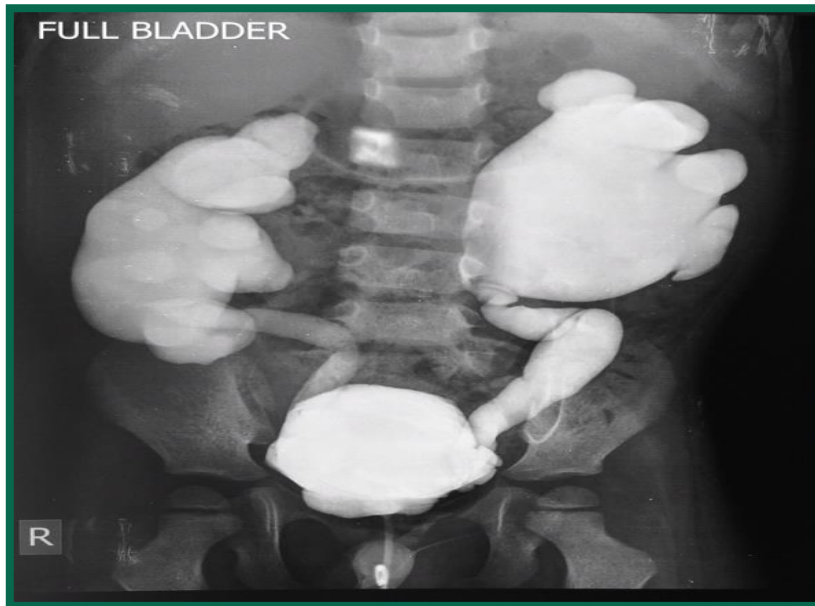
Ureter pathology

vesicoureteral reflux disease

-This disease characterized by backflow of the urine

-How do we diagnose it ?

By giving the patient contrast , after that we will see it go from the ureter back to kidney



Cystitis

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

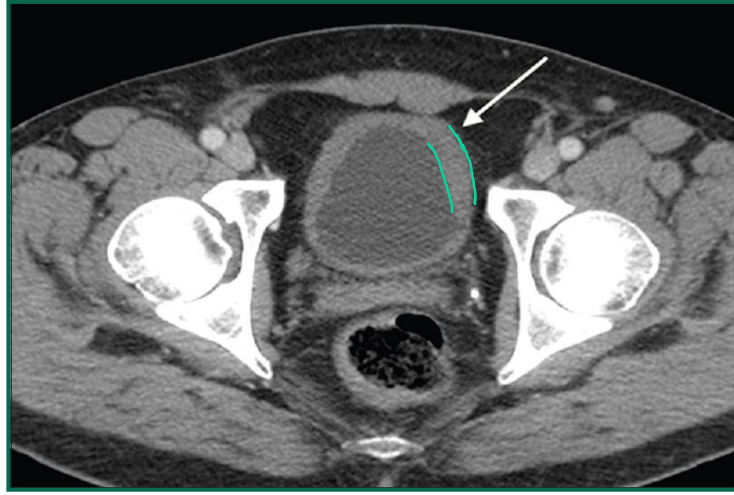
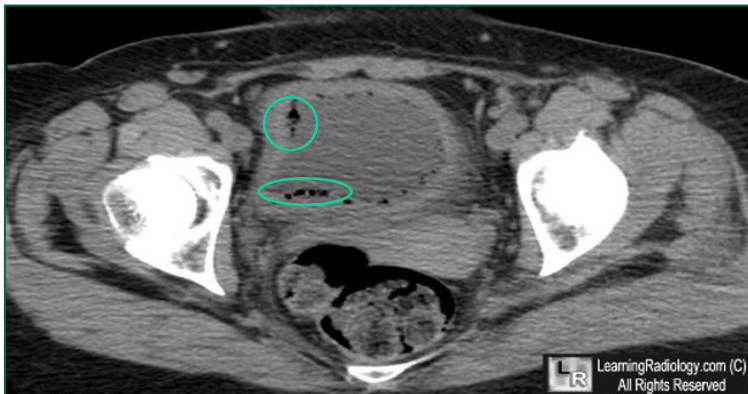


Image 2: This bladder has gas bubbles that could be due to inflammation or infection from 'gas producing' bacteria.



Benign Prostate Hypertrophy



-Hypertrophied prostate causing the bladder to be compressed



Quiz

1)What modality is cheap and with no Ionized radiation?

- A- Ultrasound
- B- X-ray
- C- CT-scan
- D- MRI

2)What modality is used to assess the function?

- A- Nuclear scan
- B- X-ray
- C- MRI
- D- CT scan

3)What modality is used with a lot of information and no Ionized radiation?

- A- X-ray
- B- Ultrasound
- C- MRI
- D- CT scan

4)What type of stones we can see under X-ray?

- A- Radio-opaque
- B- Radio-lucent

5)What is the best modality used to diagnose renal stones?

- A- Contrast CT
- B- Non-Contrast CT

6)What is the most common type of benign and malignant kidney tumors?

- A- Transitional cell carcinoma/Renal cell carcinoma
- B- Angiomyolipoma/Renal cell carcinoma



THANK YOU

For checking our work.

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