



431

Radiology Team

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Lecture 10: Radiology of Urinary System Diseases (Interactive Lecture)



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◆ Important

◆ Doctor's notes

◆ Team's notes

➤ OBJECTIVES:-

- ❖ To review the role of imaging in the urogenital disorders.
- ❖ Recognize the normal appearances of structures imaged in each modality.
- ❖ Stress upon the importance of systemic approach in the interpretation.

“Where to look & what to look for”

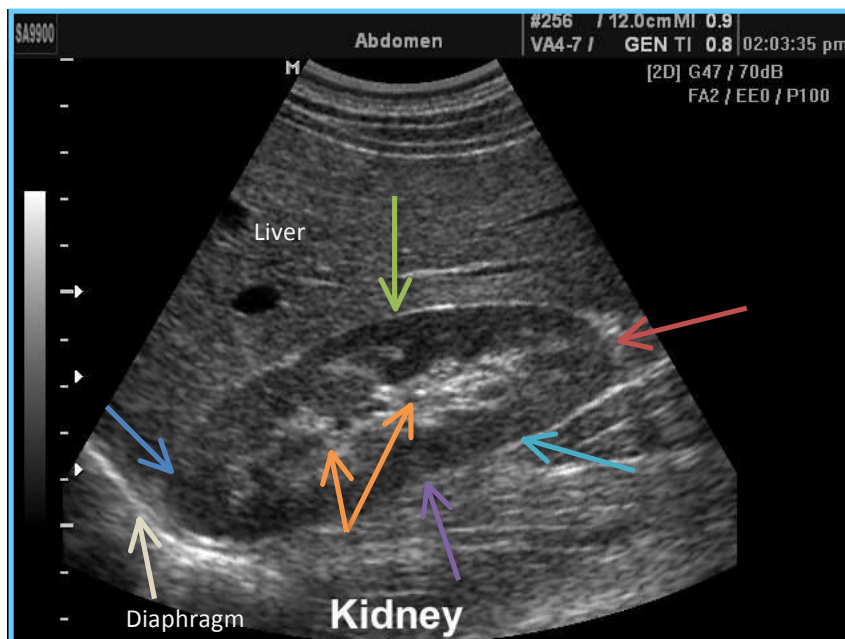
➤ Imaging Modalities Utilized in Imaging the Urinary Tract:-

- ❖ Ultrasound. “Simple, cheap, safe and non-invasive >> most commonly utilized in imaging the KIDNEY and bladder and other solid organs in the pelvic region such as prostate and ovaries.”
- ❖ Plain X-Ray.
- ❖ Computed Tomography (CT).
- ❖ Magnetic Resonance Imaging (MRI).
- ❖ Nuclear Studies.
- ❖ Angiography.

CT & MRI >> usually reserved for further investigation in a lesion that is sealed in an US or when you need more characterization of the lesion.

➤ Normal ULTRASOUND Anatomy:-

- ❖ Scan Usually Performed In Both Longitudinal (long axis) & Transverse (short axis) Planes.



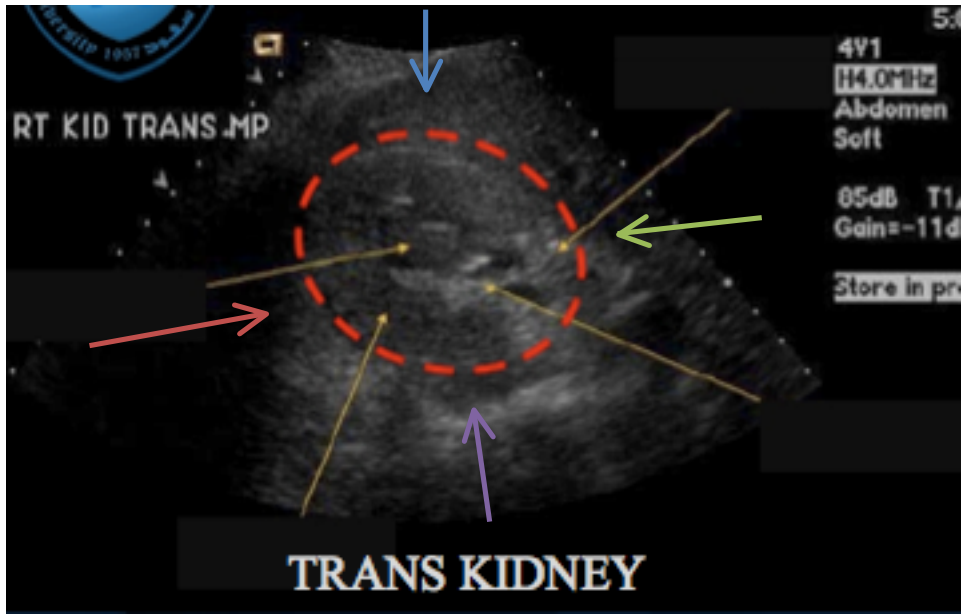
Longitudinal Right Kidney:- “oval shaped”

- Upper (superior) Pole.
- Lower (inferior) Pole. [It's more anterior than the upper]
- Anterior pole.
- Posterior pole.
- Cortex >> Hypoechoic (grey)
- Medulla (sinus fat) >> Hyperechoic (fat = white)
- Collecting system (calyces) >> anechoic (appearing as black spots inside the medulla because of the fluid inside)

*When we take a longitudinal scan -> the kidney looks oval in shape.

*When we take a transverse scan -> the kidney appears as a rounded structure.

The pyramids appear black (like the calyces), however, they are found at the junction between the cortex and medullary portion, NOT inside the medulla.

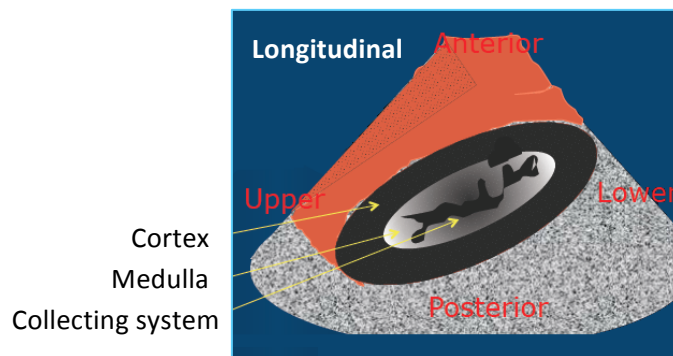


Transverse **Right** Kidney:-
 “circular = rounded”

- Anterior
- Right (Lateral)
- Left (Medial)
- Posterior

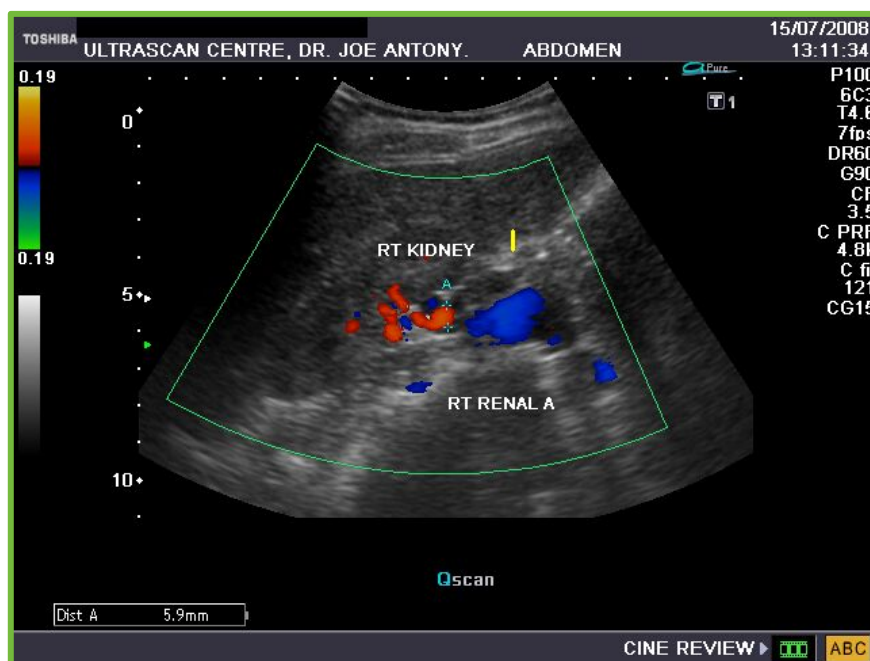
*In transverse, there are no “superior” and “inferior” poles; we have “right” and “left” instead.

*Here, we expect the hilum to be on the medial aspect.



How can we differentiate between the urine in the calyces and the blood in the vascular structure (renal artery and renal vein) in the hilum??

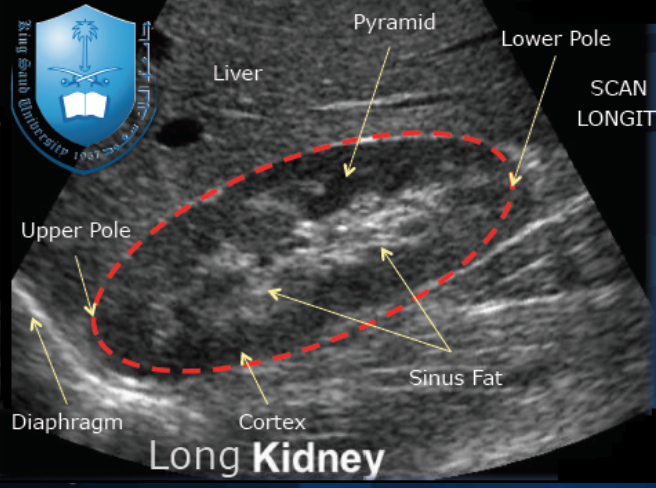
By using **DOPPLER**, it can clarify the flow of the fluid within the tubular structure, because the blood moves between the veins and artery it will produce colors “Flow >> color”, while the urine is stagnant in the collecting ducts and will be black.



➤ Case No. 1

CASE NO. 1

Young Adult presented with right loin pain and hematuria. Ultrasound Exam was performed. Which of the following is the likely finding?



a- Hydronephrosis
b- Normal.
c- Renal mass.
d- Upper pole renal stone.

A A AL-BOUKAI-4

Answer >>

B

➤ Case No. 2

- Adult patient presented with right loin pain and hematuria. What would be the most appropriate imaging modality to be utilized?

- A- Plain abdominal x-ray.
- B- Non-enhanced CT scan for KUB region.**
- C- Contrast enhanced CT scan for KUB region.
- D- MRI of the KUB region.
- E- Ultrasound of the kidney.

Explanation: Since the patient is referred for hematuria, and one of the possibilities is a stone, and it could be in the kidney or ureter or bladder.

The US is the most appropriate for the KIDNEY and BLADDER (however in the URETER it can be missed)

So **B** is the answer, because we want to look for a possible stone in the KUB region.

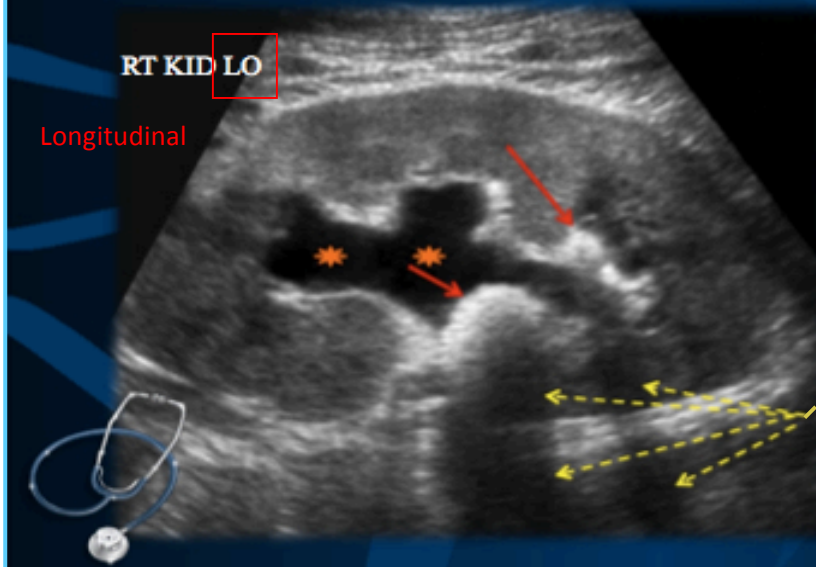
Plain x-ray used to be the method, however due to the fact that stones can be radiolucent we might miss the stone.



CASE NO. 2

Adult patient presented with right loin pain and hematuria.
What are the expected ultrasound finding in renal stones?

2 Important signs supporting the presence of a stone



Ultrasound findings:

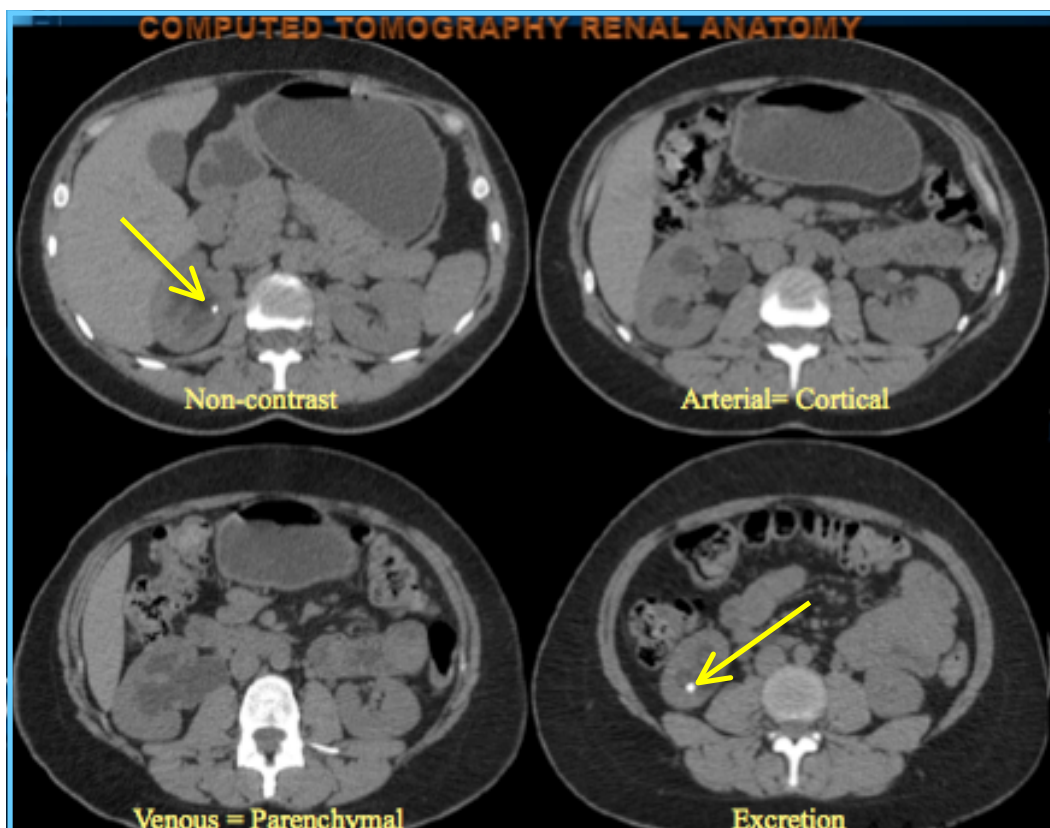
- ✓✓ Echogenic focus/foci reflecting stone(s)
- ✓✓ Mid/ lower pole
- ✓✓ Acoustic shadowing
- ✓✓ Hydronephrosis

A A AL-BOUKAI-

- On Ultrasound:-

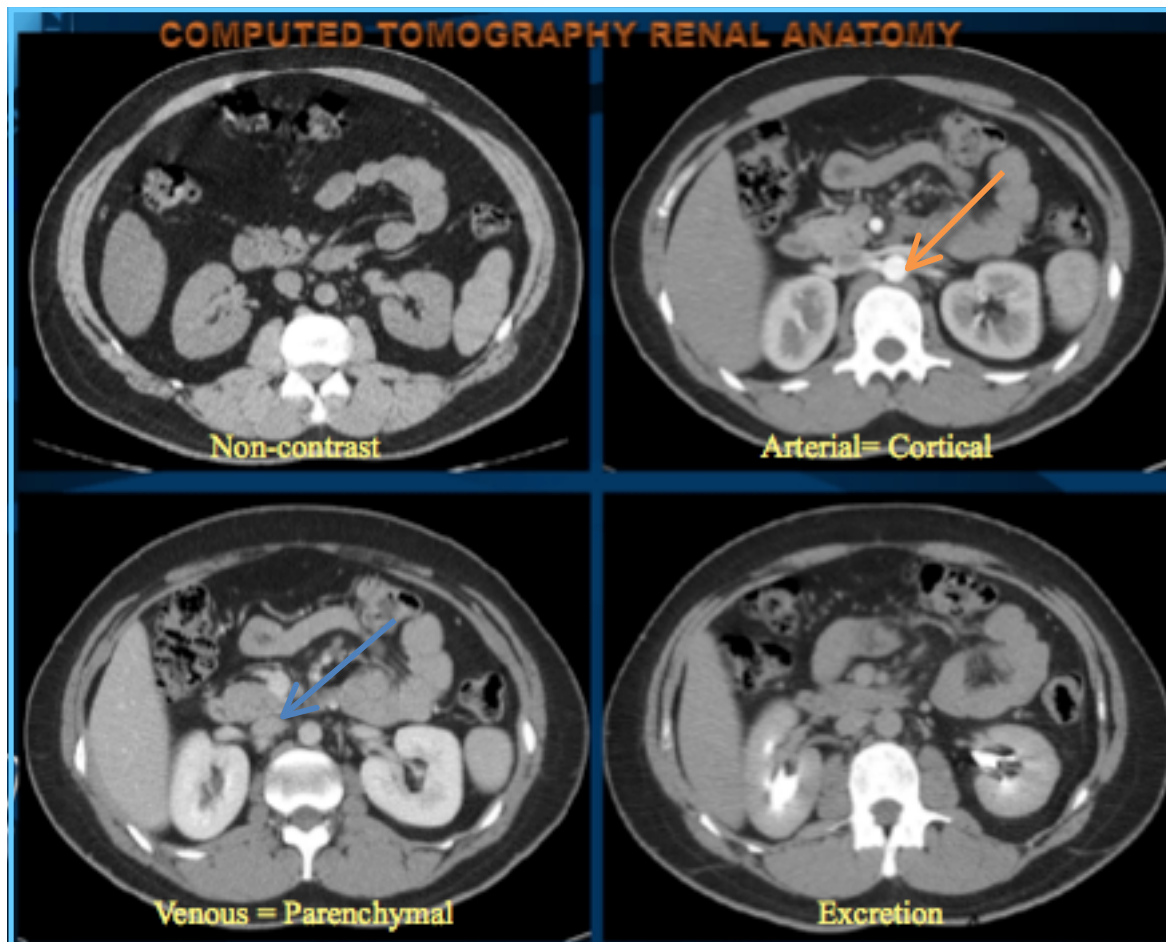
- Stones are **hyperechoic** "white".
- **Posterior acoustic shadowing** is due to the presence of calcification.
- Dilated collecting system >> **Hydronephrosis**.

So the reason for the pain and hematuria are **renal stones**.



**Non-Enhanced
(No Contrast)**

For the presence or absence of stones we use non contrast CT, because any high density seen will represent the stone.



- What are the expected CT SCAN finding in renal stones?

CT is a **multi phasic** procedure; it has 3 phases that are viewed by using contrast.

Once we give a contrast we should start imaging the patient IMMEDIATELY.

- **Arterial phase** (contrast will be in the **Aorta** and it will appear white). The arterial phase is also called the **cortical phase**, because the cortex is very clear (the high density portion).
- In 50-60 seconds the contrast will reach the **venous phase** (IVC and portal vein will appear whitish). The venous phase is called the **Parenchymal phase**, the medulla and the cortex **isoechoic** “same density”
- After 10 minutes the contrast will reach the collecting system, which is **excretory phase** (inside the calyces).

What is the importance of a multi phase CT?

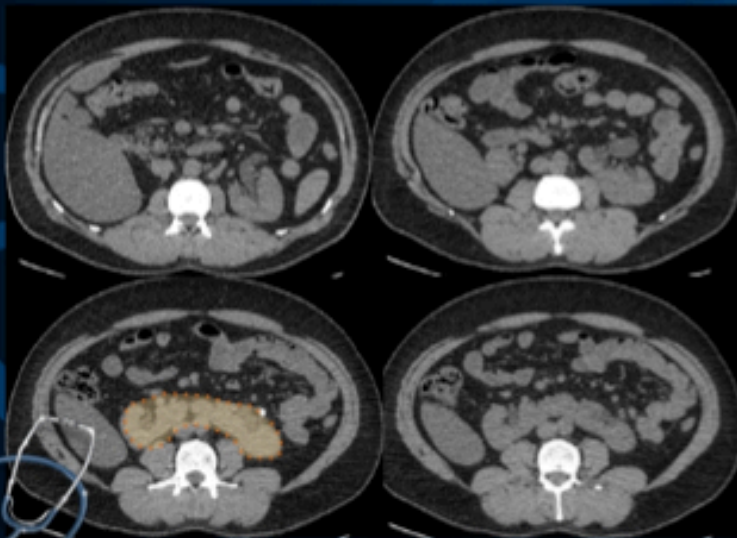
- The importance of the **arterial-venous** phases to clarify the **function of mass**, whether it has a vascular enhancement and if it’s arterial or venous (function of the mass). The **delayed or excretory** phase is important to evaluate the presence or absence of **obstruction** of the collecting system.
- Another importance is when there’s a patient with **trauma**, and **there’s laceration or rupture of the kidney or collecting system**, you won’t see the size of the injury to the collecting system from the arterial or venous phase, you have to do a **delayed scan to see the leak of the contrast in the excretory phase**.

➤ Case No. 3



CASE NO. 3

Young adult presents with left loin pain. CT kidney performed.
What is the abnormality seen in the kidneys?



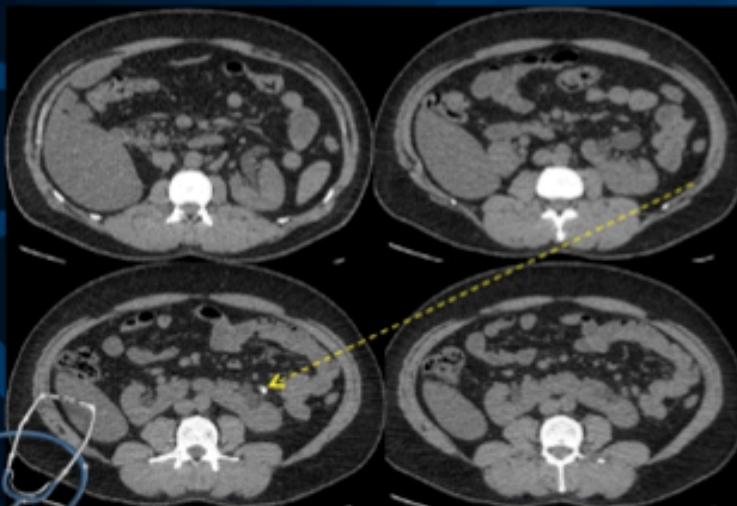
- a- Normal
- b- Horseshoe kidneys.
- c- Atrophied kidneys.
- d- Cross fused ectopic kidneys.

The answer is **B**.



CASE NO. 3

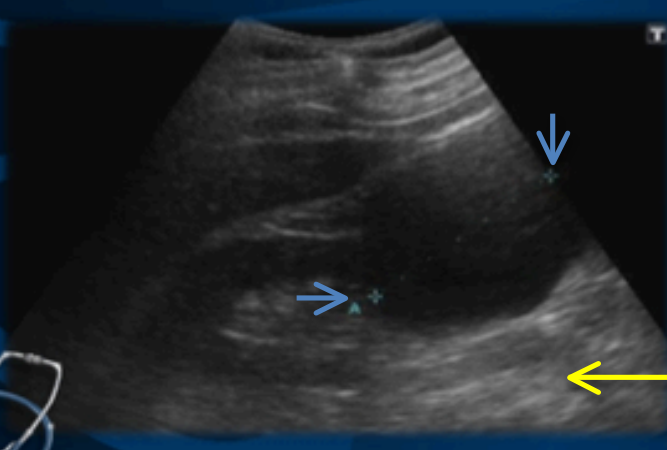
Young adult presents with left loin pain. CT kidney performed.
What is the likely cause of the pain?



- a- Stone
- b- Horseshoe kidneys.
- c- Hemorrhage.
- d- Cross fused ectopic kidneys.

The answer is **A**. Notice that the question asked the cause of the pain.

➤ Case No. 4, CYSTS:-



CASE NO. 4

Female patient presented with right loin pain and hematuria. Ultrasound Exam was performed. Which of the following is the likely finding?

a- Normal.
b- Hydronephrosis.
c- Renal cyst.
d- Lower pole renal stone.

The answer is **C**.

Large black mass on lower pole, with **acoustic enhancement** >>> fluid filled mass >> CYST.

Echo texture:-

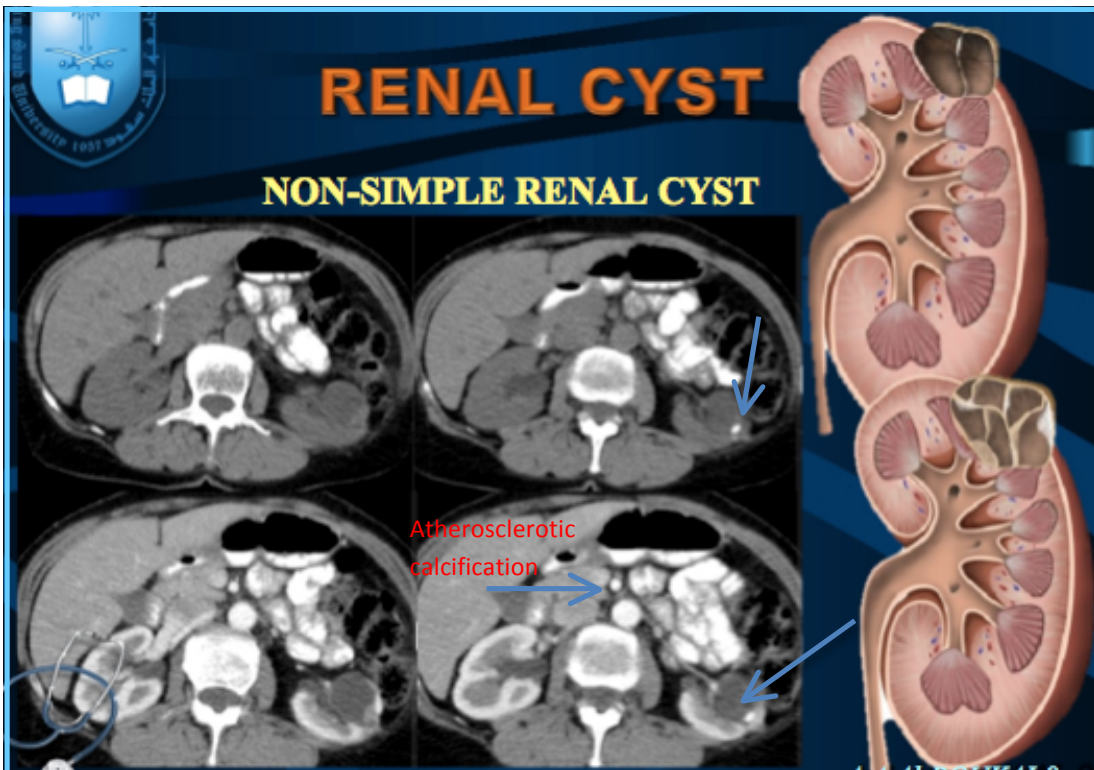
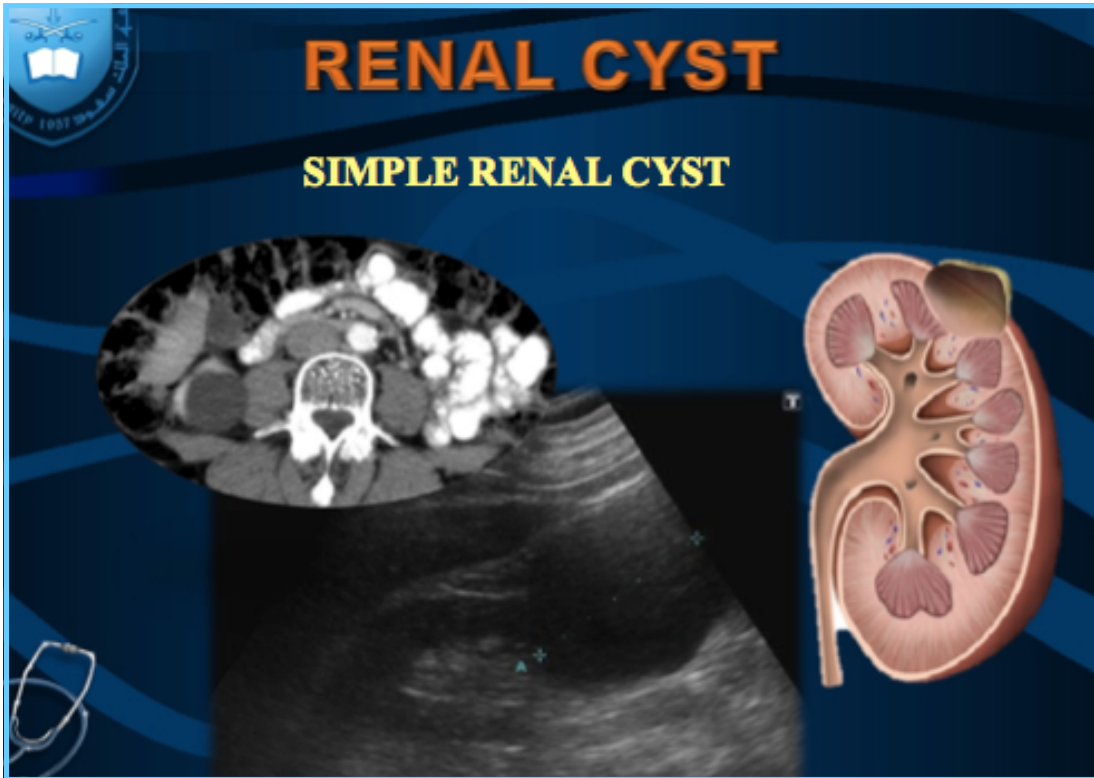
- Black → sonolucent, echo void → Fluid.
- Grey → hypoechoic → Soft tissue lesion.
- White → hyperechoic → Stone.

Posterior Shadow:-

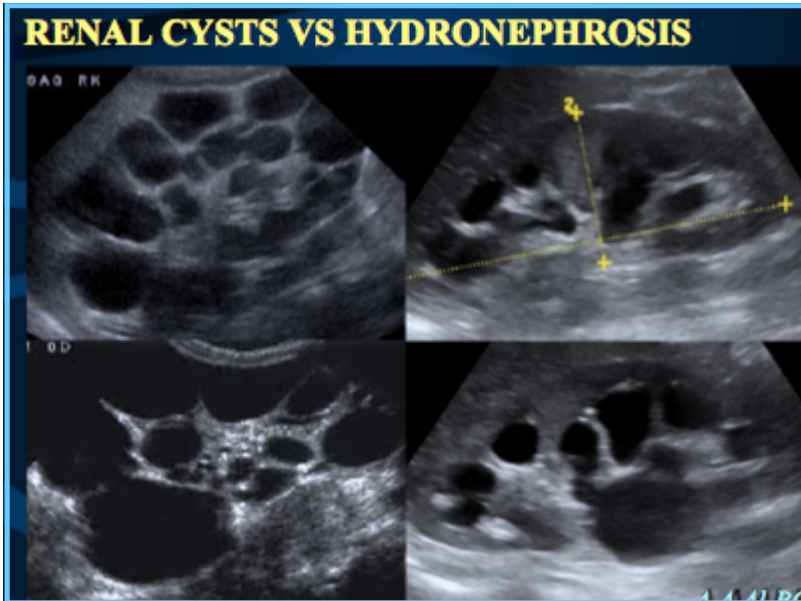
- Acoustic enhancement → White → presence of cyst.
- Acoustic shadowing → Black → presence of a stone.

Cysts are generally classified as simple or complex:-

- Simple Cyst → **Round or oval shape, with thin walls, and posterior acoustic enhancement.** Frequently seen in incidental findings in old patients, no need for intervention just a yearly follow up.
- Complicated → **Mural wall thickening or presence of calcification or septation within the cyst.** Further assessment by CT or MRI, and according to that the management will be either surgical resection or close monitoring.




- CT scan shows a mass in the left kidney, with calcification and septae → non-simple cyst.
- There's also an atherosclerotic calcification → which indicates that it might be an old patient.
- Thickening of the wall of cyst → it could be a cystic renal tumor and surgery is indicated.



Communication between cysts indicates →HYDRONEPHROSIS

In multi cystic lesion of the kidney: cysts are separated from each other with NO communication.

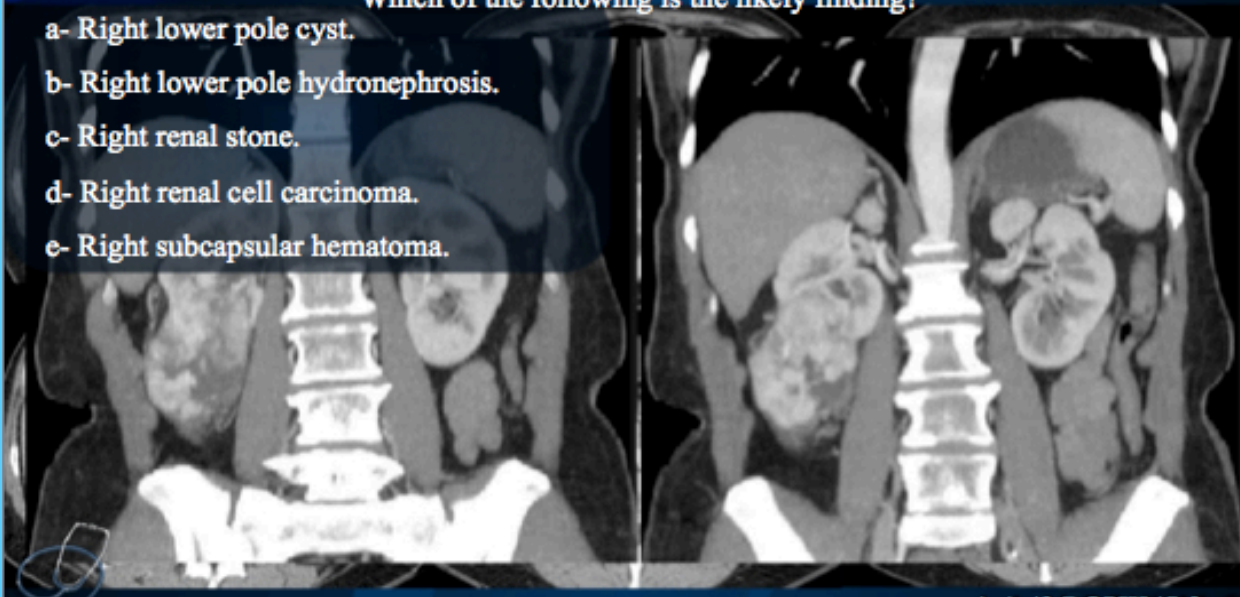
➤ Case No. 5



CASE NO. 5

Female patient presented with painless hematuria.
 Ultrasound Exam heterogeneous lesion.
 Which of the following is the likely finding?

- a- Right lower pole cyst.
- b- Right lower pole hydronephrosis.
- c- Right renal stone.
- d- Right renal cell carcinoma.
- e- Right subcapsular hematoma.




No cortico-medullary differentiation, there's a heterogeneous area of high density and low density >>> renal cell carcinoma **D.**

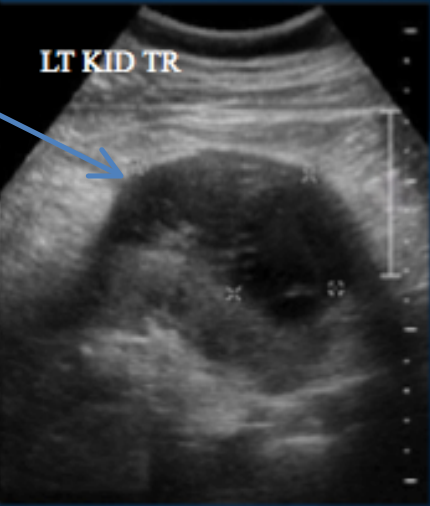
➤ Case No. 6

CASE NO. 6

54 YO presented with aggravating left flank pain and gross hematuria after ESWL.
Which of the following is the likely cause of his presentation?

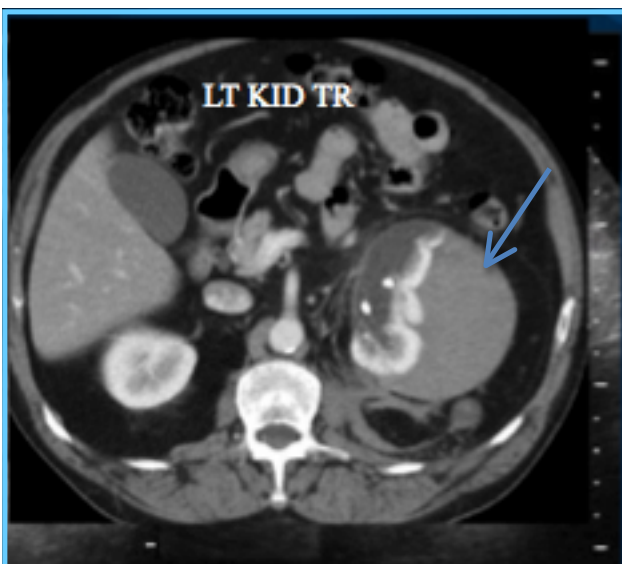


LT KID LO



LT KID TR

- a- Hydronephrosis
- b- Renal cyst.
- c- Renal mass.
- d- Renal hematoma.



On US → Black area in the anterior portion of the kidney.

In the CT scan → a large soft tissue lesion compresses the left kidney.

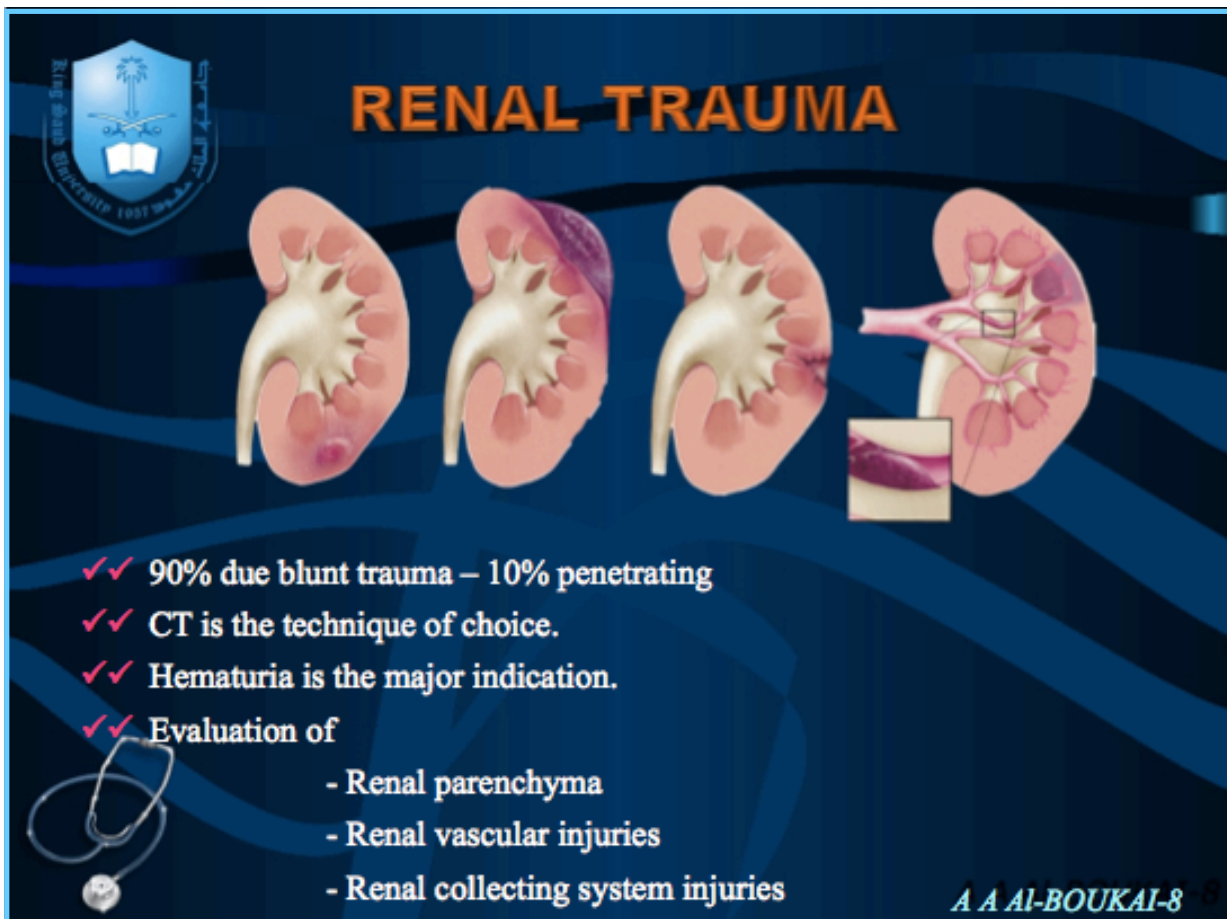
Since on US it was BLACK and in the CT scan the fluid appears high density >>>>>> **BLOOD**

This is called: **Subcapsular Hematoma**

The answer is D.

ESWL → Extracorporeal shock wave lithotripsy.

➤ Renal Trauma:-



Renal trauma can be :-

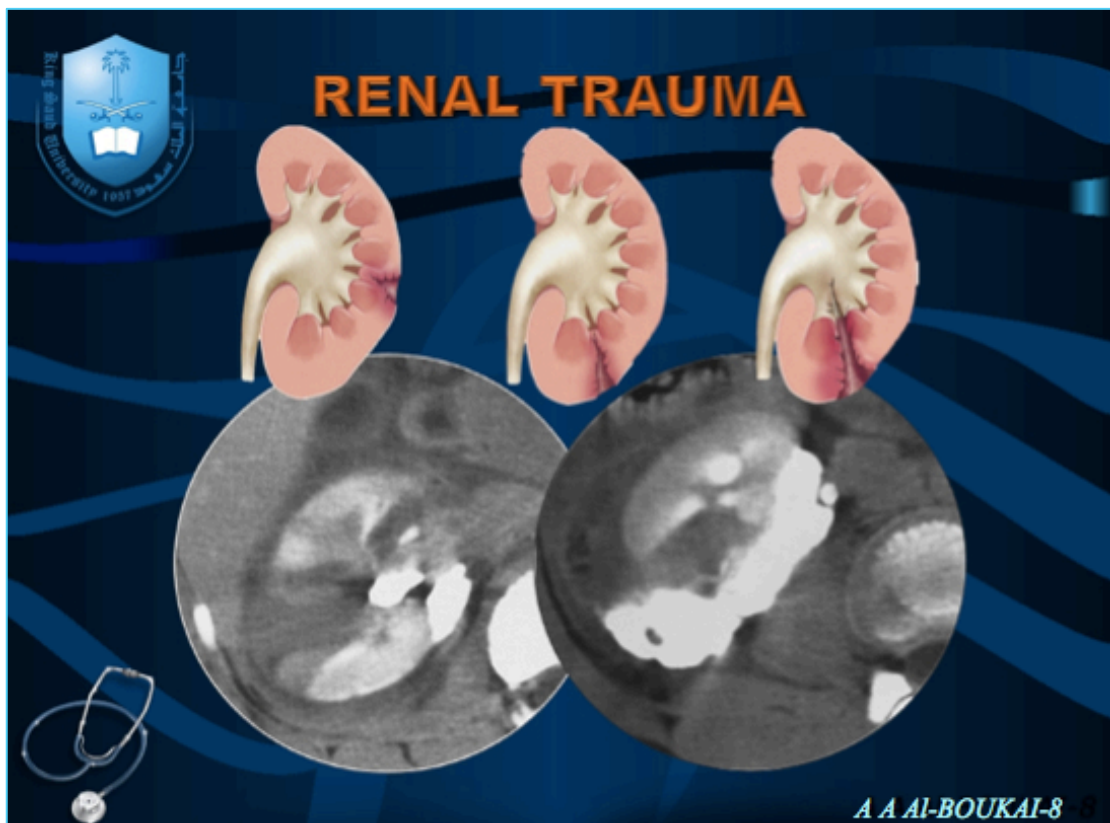
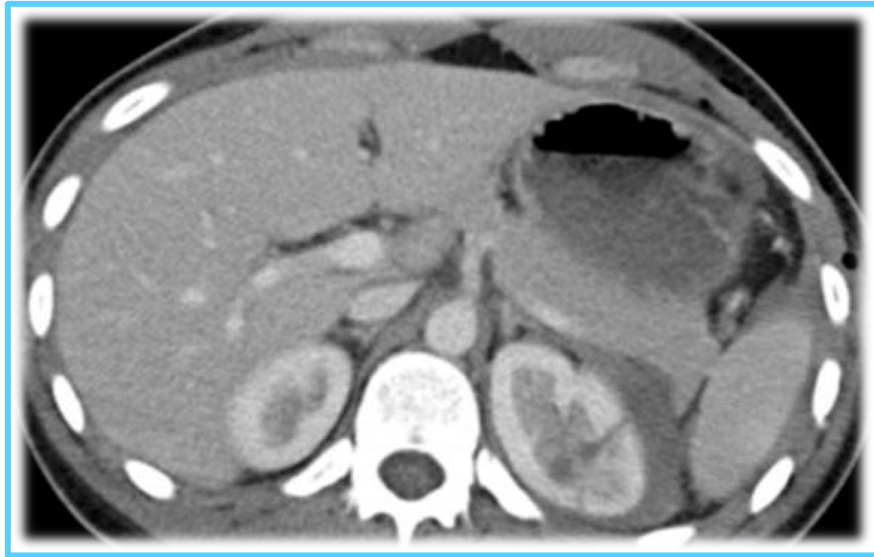
- Intraparenchymal hematoma
- Subcapsular hematoma
- Minor laceration of the cortex
- Major laceration of the cortex that extends into the collecting system.

We use a multi phasic CT with contrast to evaluate :-

Renal Parenchyma → for presence or absence of renal hematoma within the renal parenchyma.

Vascular structures → evaluate the renal artery and renal vein, and if they're involved in the renal trauma and, if there's any laceration of the artery or vein.

Collecting system → for possible involvement in the trauma.



There's a leak of contrast → laceration in the collecting system → immediate surgical intervention.

Good
Luck!

