Radiology
Team 438

Urogenital tract imaging Interactive lectures

Lecture 9

Objectives

" اللهم لا سهل إلا ما جعلته سهلا وأنت تجعل الحزن إذا شئت سهلا "

DR:REGARDING THE QUIZ THIS LEC IS VERY IMOPORTANT FOCUS ON IT IF YOU STUDY IT YOU WELL BE FINE IN THE QUIZ

Also DR: Most likely “masses “ cases will come as CT image , not US

Color Index: -Main text -Males slides -Female slides -Dr’s notes -Important -Golden note -Extra

Team Leaders :

Reem Alamri

Nouf Alsubaie

Bander Alharbi

Done by :

Nouf Albrikan

Note taker :

Salem Alshihri

REVISED BY
MISHAL ALTHUNAYN & MUNEERAH ALSADHAN

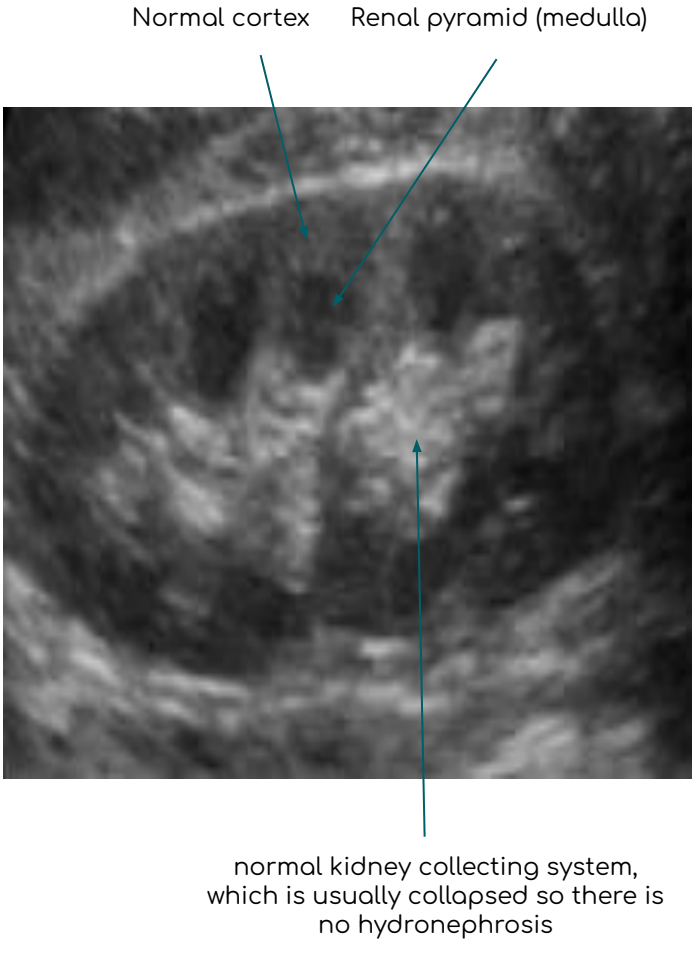
Cases

Case 1

Young Adult presented with right loin pain and microscopic 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.

The answer is B, There is good corticomedullary differentiation (we can tell that this is the cortex and this is the medulla). Why not A: because in hydronephrosis the kidney appear full black and enlarged
- the renal medulla is hypoechoic compared to the cortex



Case 2

A 2-year-old girl presented with repeated urinary tract infection (UTI). A voiding cystourethrogram (VCUG) is performed and shown below. What is the main radiological finding?

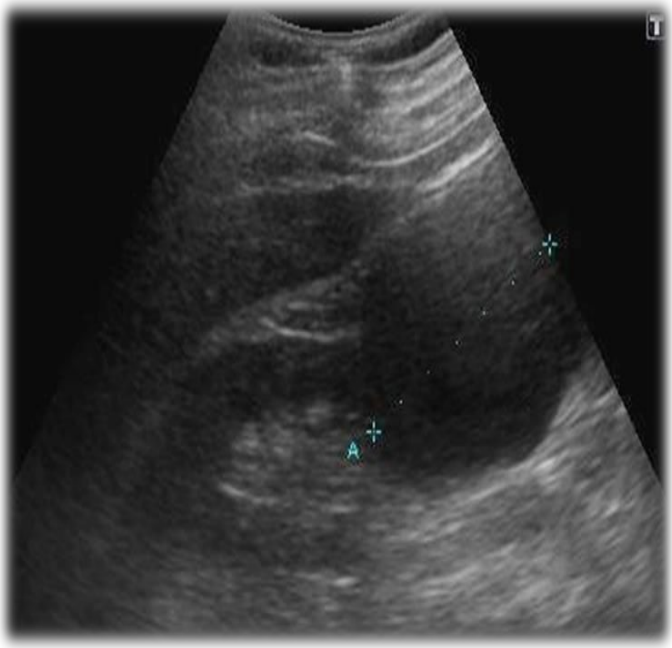
A. Normal kidneys.
B. Bilateral vesicoureteric reflux (VUR).
C. Bilateral nephrocalcinosis.
D. Right ureteral stricture.

The answer is B.

- Case 3

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

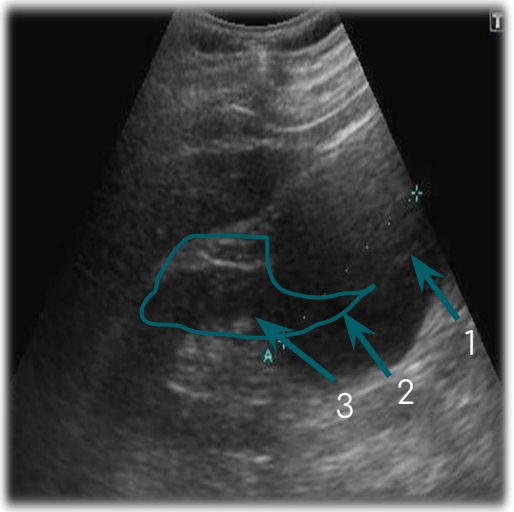
A. Normal
B. Hydronephrosis
C. Renal cyst
D. Lower pole renal stone



The answer is C, US sagittal section of kidney showing mass in lower part of kidney with no septation , no thickening of the wall and no calcification (anechoic)

437 note

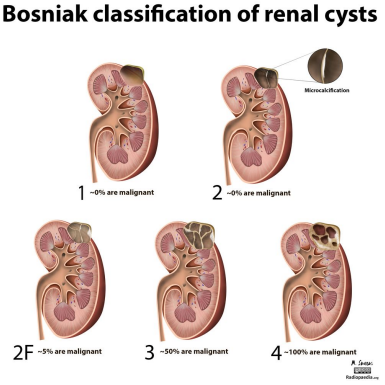
- Any black circle (anechoic) and well demarcated without any irregularity and calcification is renal cyst.
- Why couldn't be dilatation? In dilatation it will be diffuse and in the calyces but here is solitary anechoic dark structure In the cortex.
- the blue dots on previous pic represent the cyst.
- This cyst is simple not complex.
- How to locate the kidney demarcation is to know that you should see the kidney borders which is usually white (hyperechoic), and the cortex which is black (hypoechoic) and in the middle of it there is the collecting system which white (hyperechoic).
- Why the collecting system is hyperechoic? because the nature of the calyx tissue.



(1) Clear THIN outline of the cyst. (This a mass, describe it:
spherical, regular, well defined, anechoic ...so it is renal cysts)
(2) The kidney (not 100% accurate outline)
(3) Collecting system.

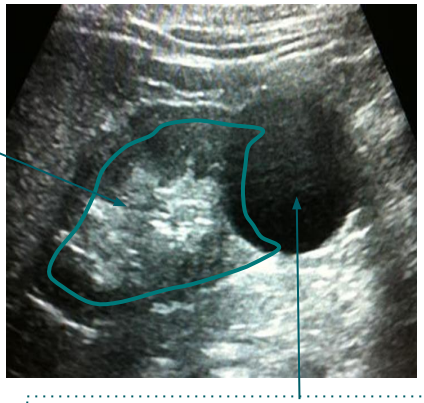
Bosniak classification:

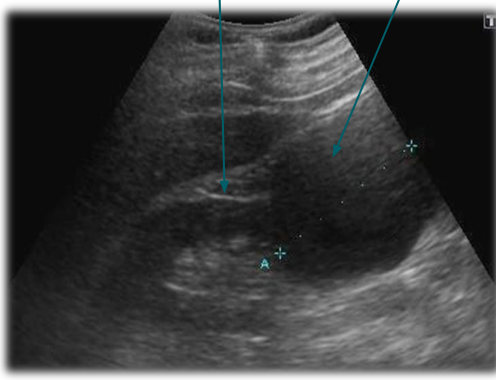
- Class 1:(the most common) is a benign cyst which we usually see. it is round with thin walls, spherical, no interseptiation, no thickening and no calcification. Also called simple cyst
- Class 2: there is only one septation(one septa) or microcalcification and it is not malignant also.
- Class 2F: more than one septation or calcification, and 5% are malignant.
- Class 3: when you see multiple septation and some of them are thickening, about 50% are malignant.
- Class 4: complete thickening of the septal wall and necrotic center, 100% are malignant.



Cases

- Case 3 continuation: Renal cysts (Thin borders)





In ultrasound image, showing round benign renal cyst which is spherical, rounded, regular, no intersepitation, no calcification and no thickening of the wall. it is large but still benign.cyst occupying lower pole of the kidney no further investigations required

In a CT image with bowl contrast, we can see right kidney cyst (benign) showing round hypodense mass not taking contrast and no thickening
Why we cannot see the left kidney? Because the left kidney is in an upper level compared to right kidney

- Case 4

29 y/o female presented to the ER c/o sudden acute left flank pain radiates to the groin associated with hematuria. What is the name of the exam presented?

A. IVU.
B. KUB.
C. Double contrast exam.
D. Single contrast exam.

The answer is B, shows Natural contrast of calcification=renal stone

What is the major finding?

A. Renal mass.
B. Renal cyst.
C. Renal stone.
D. Renal hemorrhage.

The answer is c , multiple stones in left kidney

437 note :

- The first imaging exam in ER is KUB.
- In general, we use KUB in ER, US in stone and obstruction and hydronephrosis, and CT for everything!
- We can see multiple stones in the left kidney.
- We can't see the kidney shadow that's why it is preferred to do CT without contrast to see if there is obstruction, if we want to see if there is dilatation we will start with US.
- In US we can't see the ureters.
- If we want to see the stone clearly we will do CT without contrast.

Cases

- Case 4 continuation: Stones in different modalities

The stone in US appears like hyperechoic structure with **shadow behind**, it is not obstructive because we don't see dilatation.

Staghorn stone it is chronic infected stone Which takes the morphology of the collecting renal system.

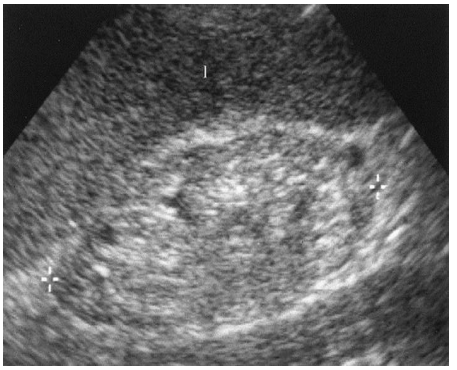
CT Without contrast, large calcification (**Stone**) is in the left kidney in ureteropelvic junction (common site), with a clear obstruction, Dilatation of collecting system(hydronephrosis), atrophic R. kidney.

Obstructing vs. Non-Obstructing Stones:
Kidney stones that block the flow of urine from the kidney or down the ureter are called obstructive kidney stones. Depending on stone size and location the blockage can be complete or partial. Non-obstructing stones do not block urine flow but can also cause symptoms that are commonly associated with kidney stones. A non-obstructive kidney stone may at some point start moving and become obstructive.

- Case 5

81 y/o female diabetic patient came to clinic with general fatigue, itching, loss of appetite and easy bruising. Initial lab works show a creatinine level of 180 Umol/L. What does US show?

A. normal kidney.
B. hyperechogenic kidney.
C. atrophic undifferentiated kidney.
D. atrophic kidney with normal corticomedullary differentiation.



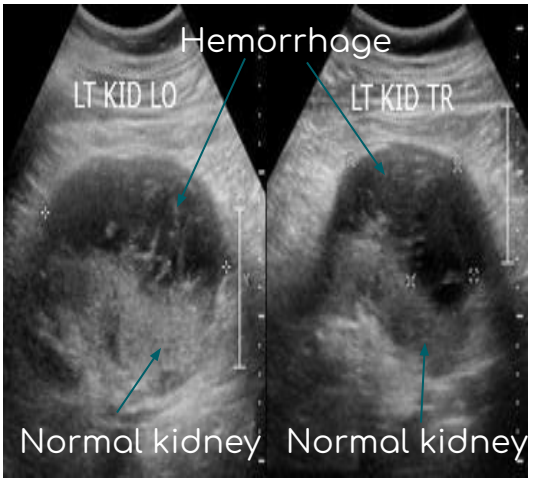
The answer is C poorly differentiated, atrophic kidney with no clear pelvis and cortices There is a kidney of 7 cm in longitudinal, which is less than 9 cm so it is atrophic kidney.

- There is no corticomedullary differentiation.
- Collecting system is not clearly seen.
- And atrophic kidney

- Case 6

36 y/o male presented to the ER c/o acute sudden left flank pain radiates to the groin associated with hematuria post RTA (road traffic accident). US was performed.
What is the major finding?

A. Renal mass.
B. Renal cyst.
C. Renal abscess.
D. Renal hemorrhage



The answer is D, (subcapsular renal hematoma that compressed the left kidney)

437 note :

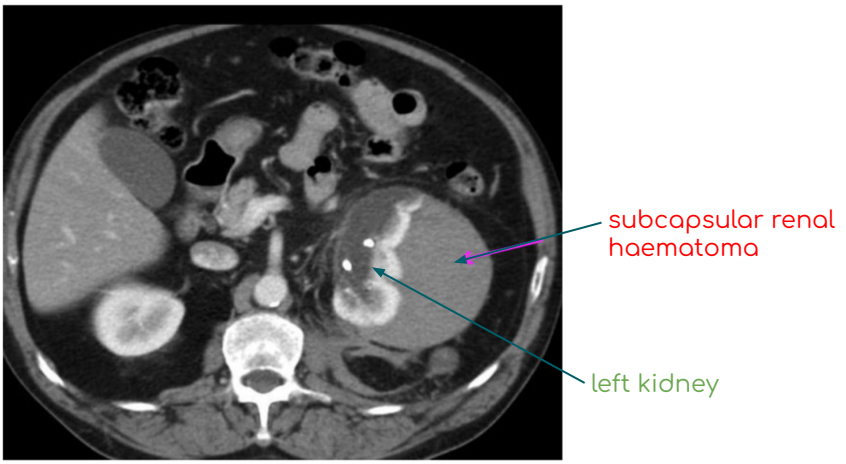
- We should first describe it as "collection" because we can't know if it's blood or abscess except based on the clinical scenario.

RTA: Road Traffic Accident, so you should suspect haemorrhage secondary to Trauma.
Always you have to correlate with the clinical scenario:

- The ***black area*** in the US image represent the haemorrhage.
- The blood is the hypoechoic part because it is fresh blood, if it is coagulated it will be heterogeneous and hyperechoic.

- Case 6 continuation: Subcapsular renal haematoma.

- **CT with contrast** was done, shows normal right kidney and a **subcapsular renal haematoma** located in the left kidney which is compressing renal cortex.
- If we leave it, it will lead to renal failure



- Case 6 continuation: Types of renal injury.

Grade 1	Subcapsular hematoma, only contusion (a bruise) of the kidney
Grade 2	Laceration in the cortex <1cm
Grade 3	>1cm but not extending into collecting system
Grade 4	Laceration with hematoma Extend to pelvicalyceal system the patient will have hematuria
Grade 5	Shattered kidney completely around the kidney

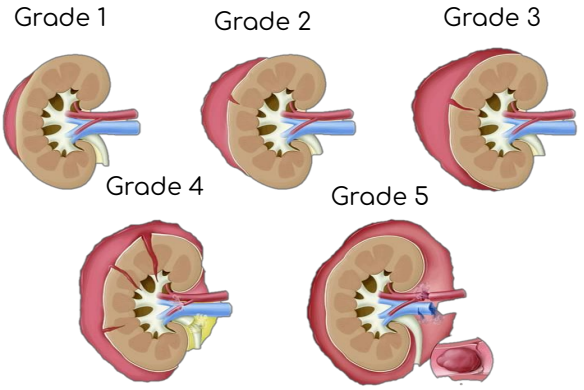


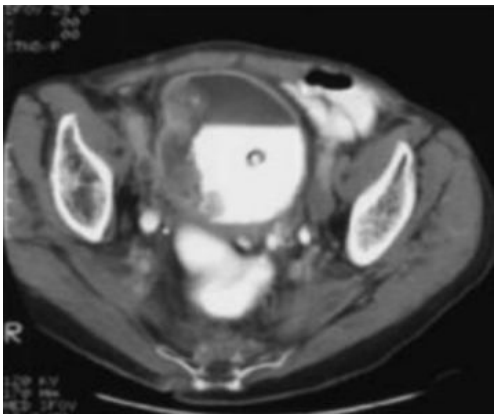
Table 11. Renal Injury Grades

Grade	Extent of renal injury
1	Contusion: microscopic or gross hematuria, no depiction of injury with any imaging method Hematoma: subscapular hematoma with no parenchymal laceration
2	Nonexpanding perirenal hematoma or cortical laceration less than 1 cm deep with no urinary extravasation
3	Parenchymal laceration extending greater than 1 cm into the cortex with no urinary extravasation
4	Parenchymal laceration extending through the cortico-medullary junction and into the collecting system
5	Multiple major lacerations resulting in a shattered kidney or avulsion of renal hilum that devascularizes the kidney

- Case 7

A 68 y/o smoker male presented with hematuria and urinary
frequency + urgency.
CT urography was done. What is the abnormality seen?

A. Renal mass.
B. Hydronephrosis..
C. Renal stones.
D. Urinary bladder mass.



The answer is D.

- Case 8

A pregnant lady presented with increasing left loin pain and
fever for 2 days. What is the abnormality seen in the below
shown ultrasound image?

A. Renal mass.
B. Renal cyst.
C. Hydronephrosis.
D. Renal stones.

The answer is C. (Anechoic and dilated ureters, dilated calyces, dilates pelvis → due to obstruction)

Case 9

One month old boy with recurrent UTI. What type of imaging is this?

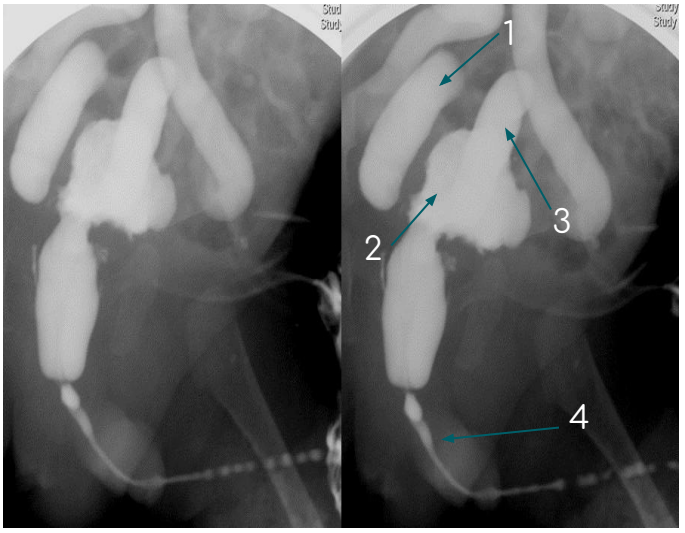
A. Intravenous urography (IVU)
B. CT with IV contrast.
C. Voiding cystourethrogram.
D. Scintigraphy.

The answer is C.

What is the abnormality seen?

A. Normal VCUG.
B. Vesico-colonic fistula.
C. Beaded urethral strictures.
D. Vesicoureteric reflux.

fistula is too advanced for your level. i'm not gonna ask about it.

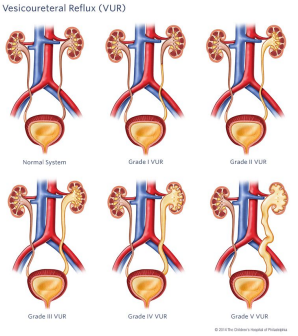


1)Right ureter. 2)Bladder. 3)Left ureter. 4) Catheter.

The answer is D

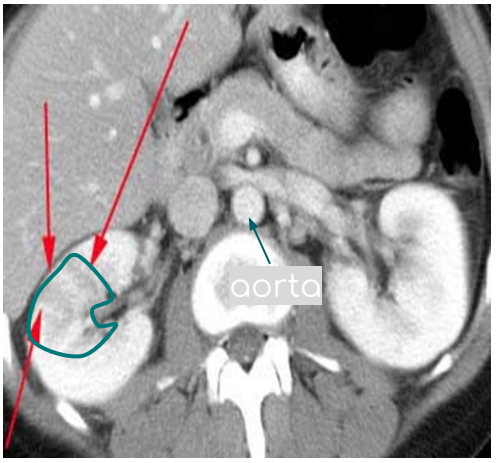
- Tortuous ureter, and dilated, > grade 5 vesicoureteral reflux.
- there is a test for **pediatric** age group called voiding cystourethrogram.
- what happen is: we inject contrast via the catheter inserted in urethra and then goes to the bladder of the child and wait until he/she voids urine. we do it when we suspect vesicoureteric reflux.
- normally: we see filled bladder only with prominent contour, we don't expect urine to back up into ureters, and when the child is voiding you observe the contrast voiding as well
- but in this disease: urine back up into ureters and you can observe a very dilated and large ureters.
- There is dilatation because of refluxed urine.
- In pediatric patients first exam that we think of is Voiding cystourethrogram

Extra



- Case 10

31 y/o patient came to ER with high grade fever, right flank pain and vomiting. In addition, she has urinary frequency since 3 days.



What is the most likely diagnosis?

A. renal carcinoma.
B. pyelonephritis.
C. type I cyst.
D. traumatic lesion.

The answer is B read the History.
What is this imaging modality?

A. MRI with contrast.
B. MRI without contrast.
C. CT with contrast.
D. CT without contrast

The answer is C, With contrast because we can see enhanced aorta.
How do you describe this abnormality?

A. cortical mass.
B. Pelvicalyceal dilatation.
C. hypoperfused lesion.
D. perirenal hematoma.

The answer is C, There is pyelonephritis, which is sub-functional and did not take the contrast. Why?
Because of reduce blood supply to that area

Dr description is: at the level of the right kidney there is Hypoperfused area with heterogeneous enhancement so this could be in correlation with history a pyelonephritis

Case 11

76 y/o male patient presented with painless hematuria and weight loss. How do you describe this lesion?

Describe the mass: there is a large mass occupying the left kidney and taking the contrast in heterogeneous way so in relation to history most likely diagnosis is Adenocarcinoma

438 note: Large heterogeneous mass with enlarged lymph nodes and fat stranding, the right kidney is normal

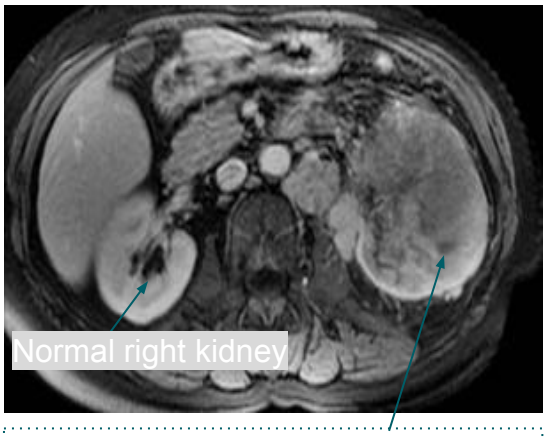
.

What is the most likely diagnosis?

A. Pyelonephritis.
B. Renal adenocarcinoma.
C. Transitional cell carcinoma.
D. Angiomyolipoma.

The answer is B

MRI (T1, + contrast), We know it's MRI because the bone (vertebra) isn't white as in CT.



We can see the difference between normal right kidney which is regular with clear pelvis and vessels, while it is distorted in the left.

437 note :
*Black patchy means necrosis in the centre (not taking the contrast).
We can correlate it with a clinical scenario which is painless hematuria.
more than 90% of renal tumors are renal cell adenocarcinoma. the transitional cell carcinoma are more in collecting system, and here we see the kidney itself and its cortex.

Case 12

67 y/o male patient came to ER with worsening hematuria. What is this exam?

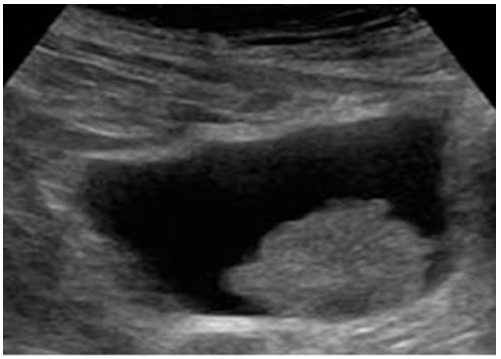
A. KUB.
B. IVP.
C. CT: coronal section.
D. Scintigraphy.

The answer is B

That is the major finding?

A. Normal.
B. Left pelvicalyceal dilatation.
C. Right ureteral dilatation.
D. Filling defect in urinary bladder

The answer is D, Usually bladder cancer (mass)



This US shows Hyperechoic mass, penetrating into the lumen of the urinary bladder indicating urinary bladder tumor.
Could this be blood clot?
Yes it could be blood clot, the only way that we can differentiate between blood clot and tumor in a US image is that the blood clot can move to other place but the tumor don't. So, we ask the patient to change his position and then we decide.

- Case 13

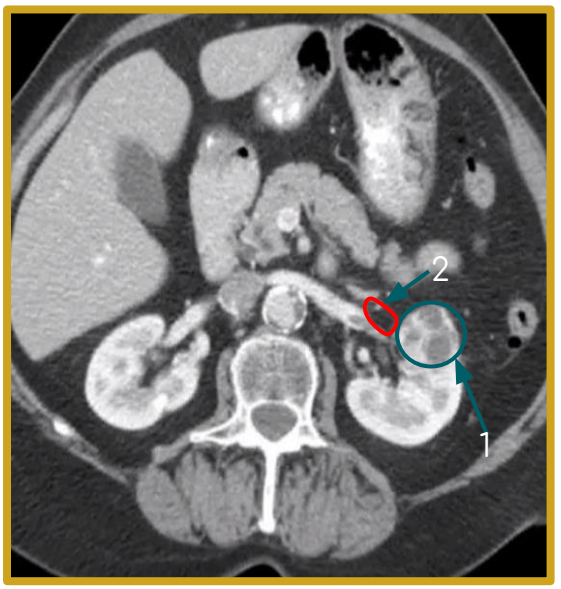
73 y/o female came with painless hematuria & general fatigue. What is the major finding?

a. Bosniak type II renal cyst.
b. Malignant tumor.
c. Focus of pyelonephritis.
d. Normal.

The answer is B,

438 NOTES

can not be A, because type 2 has only one septiation
can not be C, because there is no hypoperfused area.



(red outline is an approximation)

What other secondary finding do you observe?

a. Perirenal hemorrhage.
b. Mass effect on pancreas.
c. Renal vein filling defect.
d. Pelvicalyceal dilatation.

438 NOTES

Tumors tend to give rise to thrombus formation

The answer is C, Renal vein should be enhanced completely, so the filling defect is caused by a thrombus complication.

can not be B, because it is far from pancreas and separated by fat
can not be D, because we should see hypodense tubular structure in pelves.

Right kidney is normal,left kidney shows round mass occupying anterior part of the left kidney with multiple necrotic Foci and the mass is taking contrast in a heterogenous way.

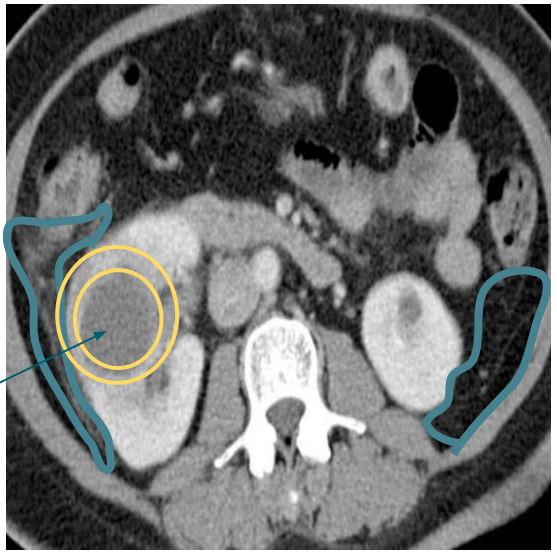
438 NOTES

(1) This is a solitary lesion with thickened wall septations, enhanced with
contrast with necrotic centers (necrotic = hypodense not taking the contrast, Forget about Bosniak classification, even if I put it with MCQ choices don't choose it, just think: is this tumor or a cyst?
(2) Renal vein thrombosis common in renal cell carcinoma.
- Compare it with the other renal vein to determine the defect.

The abnormality is in the left kidney in anterior part.

- Case 14

Middle aged diabetic male patient came to ER with a history of worsening fever and right abdominal pain since 2 weeks.
How do you describe the lesion in right kidney?



Congested kidney with mass occupying the right kidney, and central necrosis with thickened walls.
Well circumscribed homogeneous hypo-density spherical lesion (collection), (necrotic) in the right kidney, and the walls are well defined and
thickened and taking the contrast, other than that lesion the cortex is normal.

Also the left kidney has small spherical lesion which is most likely to be a
cyst.

What is the most likely diagnosis in the right kidney?

A. Pyelonephritis.
B. Renal abscess.
C. Simple cyst.
D. Pelvicalyceal dilatation.

Perirenal fat :
RK: appear stranding fat <-stranding usually is a sign of inflammation in any organ in general.
LK: clear black with no stranding.

The answer is B, Neglected case of pyelonephritis will develop into renal abscess and diabetics are prone to infection.

The yellow circles represents the abscess wall.

Cyst = non-infected collection.
Abscess = infected cyst.

IN U/S we say hyperechoic hypoechoic

IN CT we say Hyperdense and Hypodense

IN MRI we say Hypersignal Hyposignal

IN X RAY we say Radiopaque radiolucent

438 NOTES
A simple cyst will never cause pain and fever, even if looked like a simple
cyst on CT. Each kidney has a different abnormality, so please ALWAYS read the question carefully.
we diagnose the this case upon 4 things :
1- patient history. 2-thickness of the wall of the lesion 3- fat tissue around the kidney. <- compare perirenal fat between R and L 4- If we measured the density it will be higher than that of the cyst

Dr's MCQs

Q1: The first preliminary imaging modality in emergency department for a renal colic patient to generally assess renal stones is one of the following:

a. Intravenous urography (IVU).
b. Plain X-ray (KUB).
c. CT scan.
d. Ultrasound.

Q2: One of the following is a common site of urinary stone obstruction:

A. proximal ureter.
B. mid ureter.
C. junction of mid-distal ureter.
D. vesico-ureteric junction.

Q3:Which of the following is a cause of Unilateral large kidney?

A. Radiation nephritis
B. TB
C. Chronic Pyelonephritis
D. Renal Cell Carcinoma

Q4: One of the following is a relative contraindication for CT with contrast:

a. Intracranial aneurysm clip.
b. Renal failure.
c. Cardiac pacemaker.
d. High grade fever.

Q5: One of the following is an absolute contraindication for MRI:

a. Claustrophobia.
b. Cardiac pacemaker.
c. Pregnancy.
d. Uncontrollable movement

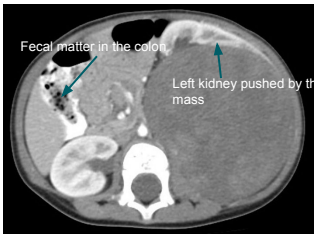
Q6: Which imaging modality is used to measure the renal split function?

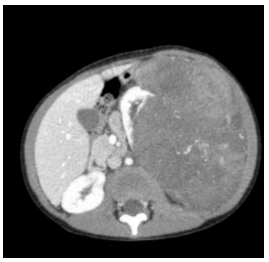
a. Ultrasound.
b. Magnetic resonance imaging.
c. Scintigraphy.
d. Voiding cystourethrogram.

ANSWER KEY:

1-B (CT without contrast is also acceptable to we will not bring a question like this in the exam.)
2-D (Because the junction between the ureter and bladder is relatively narrow even in normal anatomy. So,it might obstruct some stones down there.)
3-D The other choices will cause small kidneys
4-B (Because the kidney will not be able to
filter this contrast out! so we have to do
dialysis after that and give him bicarbonate and dehydrated first.)
5-B
6-C

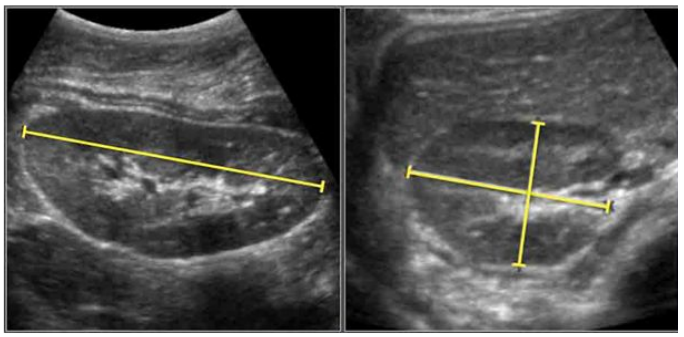
Describe what you see



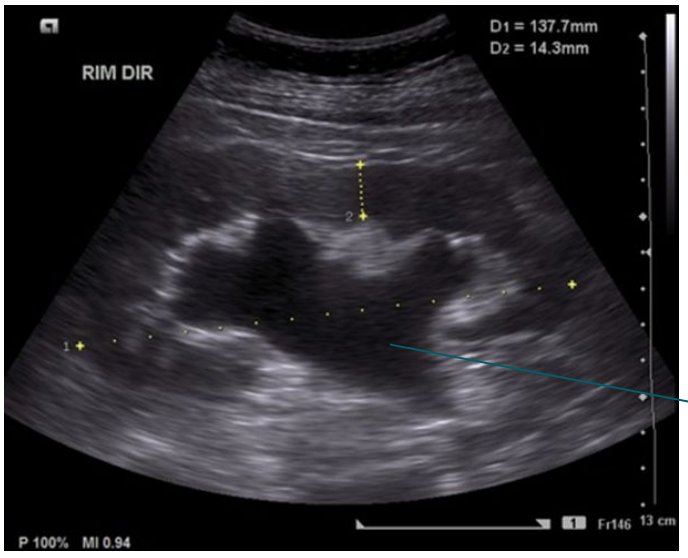


Young boy with left asymptomatic abdominal mass
1. left renal heterogenous mass, in the posterior aspect of the left kidney.
With vascularization
4. what's the most likely diagnosis ? you should answer Wilms tumor.

Normal kidney
Cortex is hypoechoic showing well differentiated medulla Cornec and collecting system with no dilation1. Normal size right kidney. 2. Regular borders. 4. No enlargement. 5. No hypoechoic structure. 6. No masses. 7. No hyperechoic structure with acoustic shadow. 8. No pelvic dilatation. Normally, we should not see urine, the collecting system is collapsed, flushing urine constantly; if there is an obstruction, we see the urine, otherwise we should not be"



Normal kidney

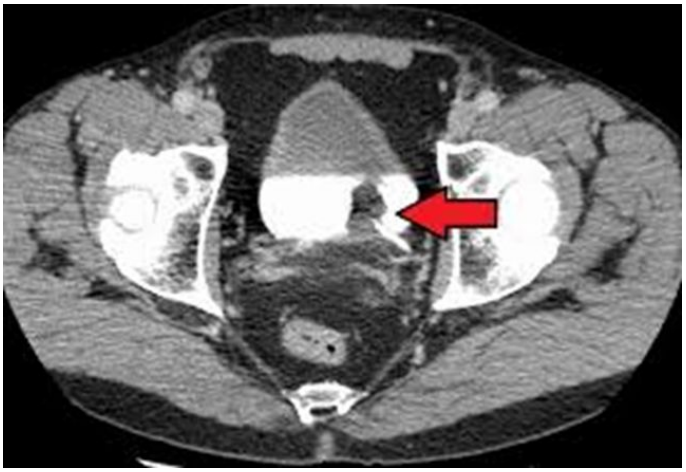


Irregular border mainly hydronephrosis showing dilated calyces. You always see black
1. Dilatation of pelvicalyceal system. reflecting obstruction.
2. We have to investigate the underlying cause.
3. US only for kidney and bladder, we can't investigate the ureters.
4. we go for CT without contrast.

here we can see the urine and it is unchoic . We see it because there is an obstruction

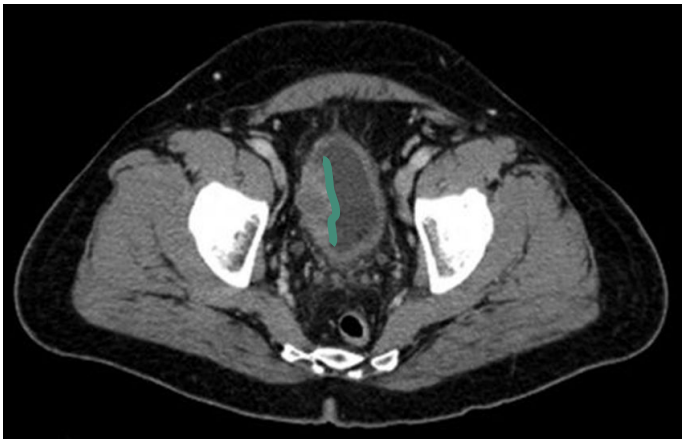
Describe what you see

dilatation of pelvicalyceal system. reflecting obstruction.(hydronephrosis)
1. dilatation of pelvicalyceal system. reflecting obstruction.
2. We have to investigate the underlying cause.
3. US only for kidney and bladder, we can't investigate the ureters.
4. we go for CT without contrast

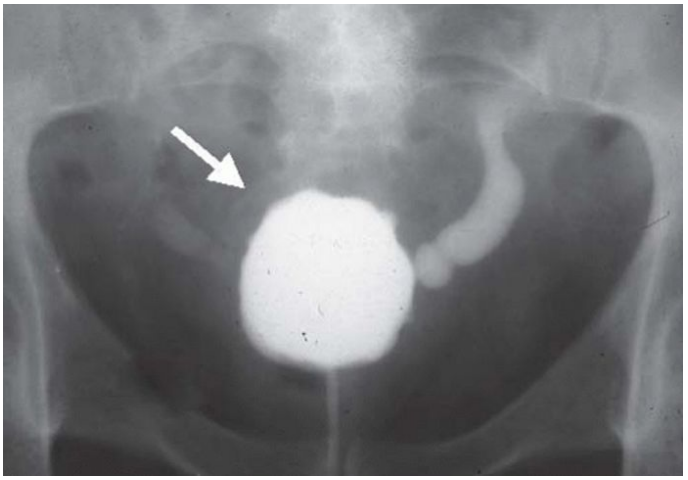


- this picture shows CT scan + contrast. Excretory phase.
- Filling defect in posterior wall of the bladder. Indicate mass in the left side of the bladder.
    - Urinary bladder tumor

1. this picture shows CT scan + contrast. Excretory phase.
2. Filling defect in posterior wall of the bladder. connected to posterior wall of the bladder.
3. If I told you the patient is 73 Years old. what's the diagnosis ? the answer is transitional cell carcinoma of the bladder.
4. We have to exclude blood clot.

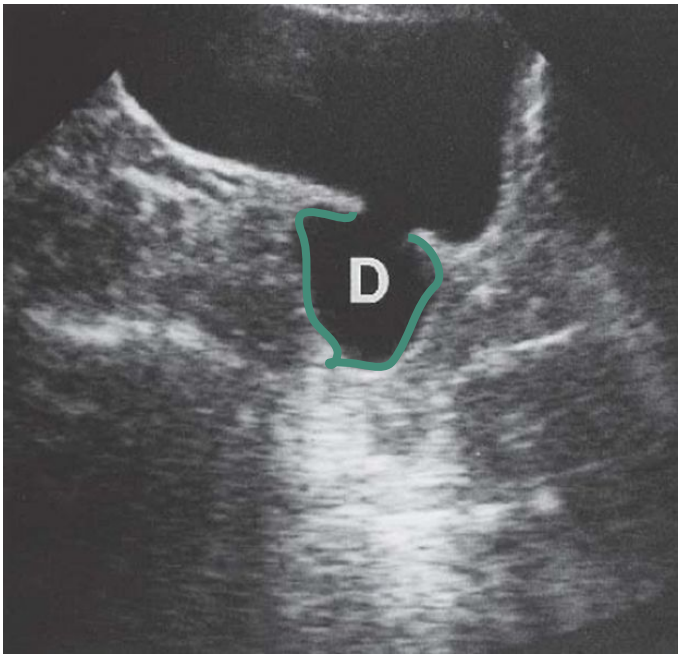


Irregular focal thickening of the right bladder wall indicating bladder mass.
If it was cystitis it would show whole thickening of the wall not focal.
-necrotic center.
-CT with contrast enhancement.
-what is the diagnosis ?
Transitional cell carcinoma

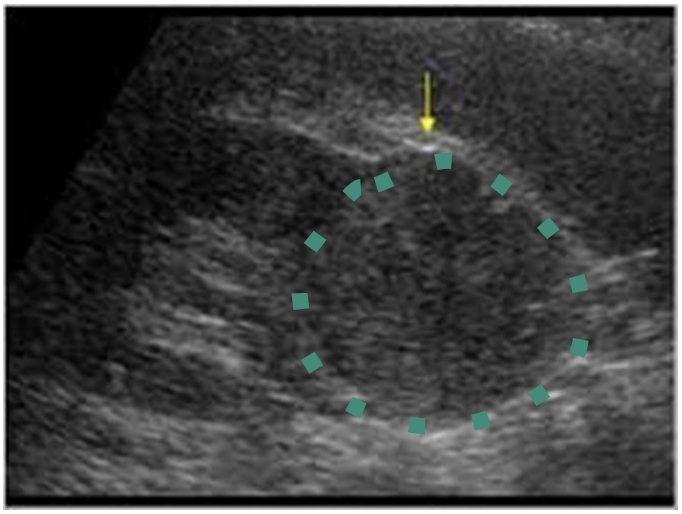


- 3 years old boy came with recurrent fever.
- Image: Voiding cystourethrogram.
- Finding: Vesicoureteral reflux. Contrast is refluxing on left ureter and slightly to the right ureter.
- Grade 3,4 on left.
- Grade 1,2 on right

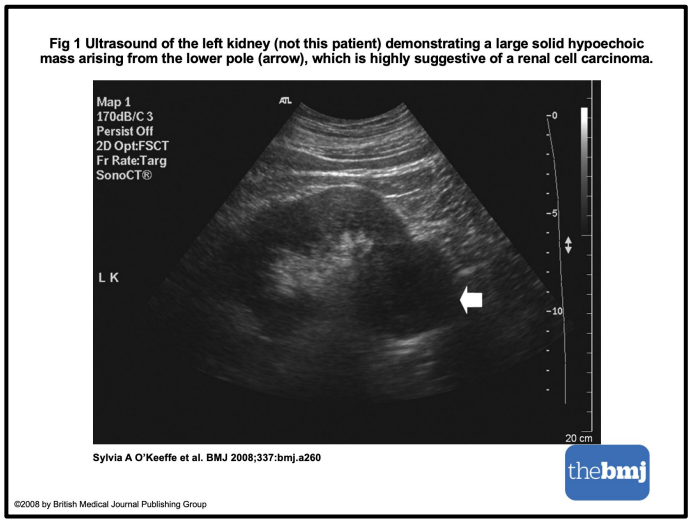
Describe what you see



US of urinary bladder sagittal section showing diverticula.
1. clear bladder.
2. filled with unchoic content (which is urine).
3. No inflammation.
4. No bladder wall thickening.
5. No masses.
6. No signs of cystitis.
7. (D) shows a urinary bladder diverticula (sinus). Outpouching structure

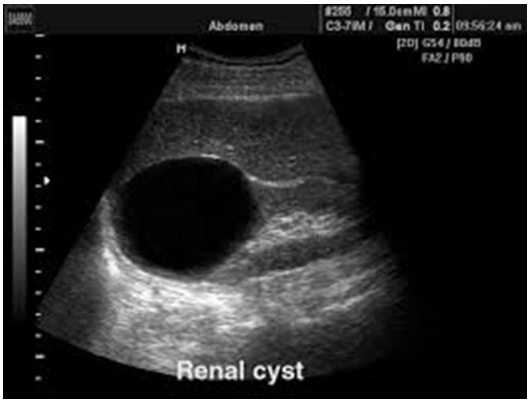


ultrasound of the kidney showing renal mass not a cyst, if it was a cyst it should be More black (anechoic)
- It's echogenic. Cyst is anechoic
- left pole of the kidney.
- it could be a tumor.



Mass

Describe what you see

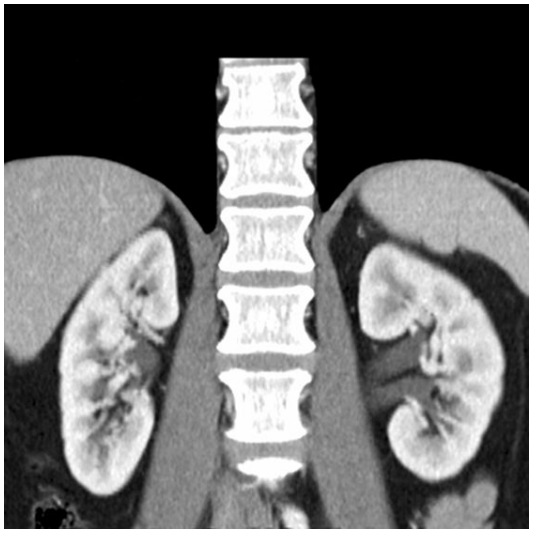


Simple renal Cyst occupying upper pole of kidney.
1. Look how black it is !
2. Benign simple cyst

Multiple renal cysts.
No dilatation of pelvocleacyal system.

Not important

Normal kidneys in CT scan with contrast "CT urography" in Excretory phase.
- No dilatation.
- Borders are regular.
- This is not mass! it's a contrast in excretory phase.



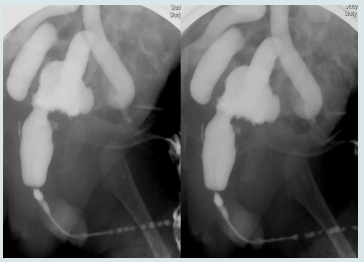
EXTRA 438
Coronal CT with contrast in corticomedullary phase OR in nephrogenic phase.
- contrast in medulla and cortex.
- will differentiated normal kidneys.
- contrast did not reach collecting system because it's nephrogenic phase.

Quiz

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

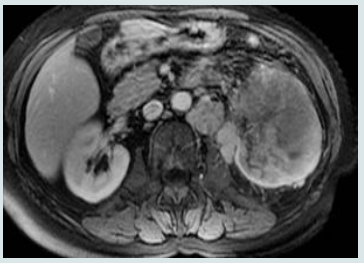
a. Hydronephrosis.
b. Normal.
c. Renal mass.
d. Upper pole renal stone.

2-One month old boy with recurrent UTI. What type of imaging is this?



a. Intravenous urography (IVU)
b. CT with IV contrast.
c. Voiding cystourethrogram.
d. Scintigraphy.

3-What is the most likely diagnosis?



a. Pyelonephritis.
b. Renal adenocarcinoma.
c. Transitional cell carcinoma.
d. Angiomyolipoma.

Quiz

4- 67 y/o male patient came to ER with worsening hematuria. What is this exam?

a. KUB.
b. IVP.
c. CT: coronal section.
d. Scintigraphy

5- 73 y/o female came with painless hematuria & general fatigue. What is the major finding?

a. Bosniak type II renal cyst.
b. Malignant tumor.
c. Focus of pyelonephritis.
d. Normal.

6- One of the following is a common site of urinary stone obstruction:

a. proximal ureter.
b. mid ureter.
c. junction of mid-distal ureter.
d. vesico-ureteric junction.

Answers:
1)b
2)c
3)b
4)b
5)b
6)d