



# Interactive Lecture

## Urogenital tract imaging

Done By

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Color Coding

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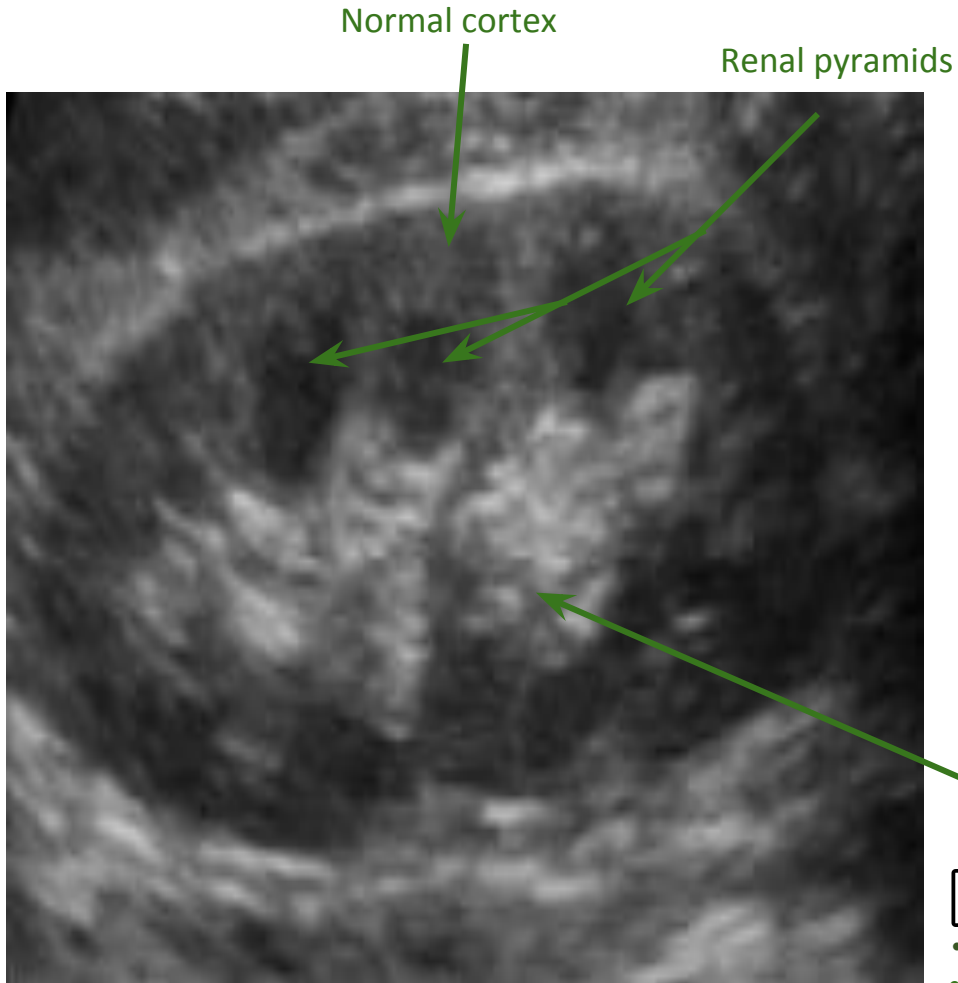
 CASE (1)



**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.

 CASE (1)



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

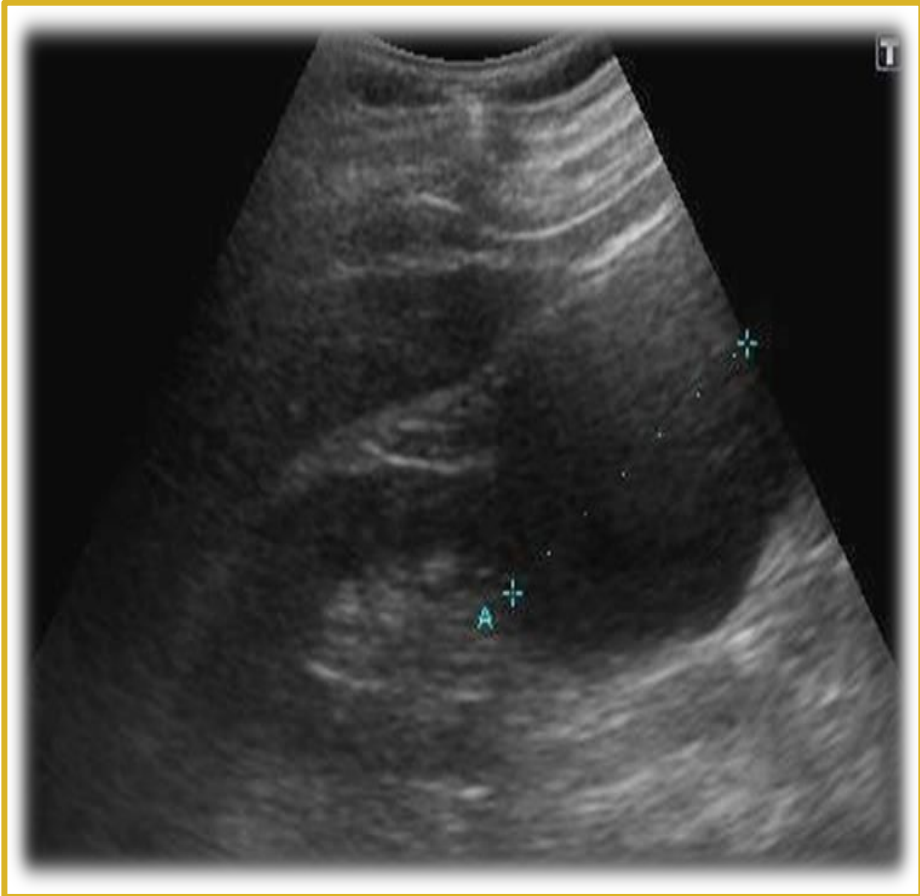
- a- Hydronephrosis.
- b- Normal.
- c- Renal mass.
- d- Upper pole renal stone.

normal kidney collecting system, which usually collapse so no hydronephrosis

 Notes

- There is good corticomedullary differentiation (we can tell that this is the cortex and this is the medulla).
- No dilatation
- We can not diagnose microstructural diseases like glomerulonephritis or autoimmune disease using US because there will be no changes that will be clear and appear in US.
- Normal US pic does not mean normal kidney but it means that the kidney has normal morphology.
- Doppler US can detect the function of the kidney by detecting the blood flow.

 CASE (2)

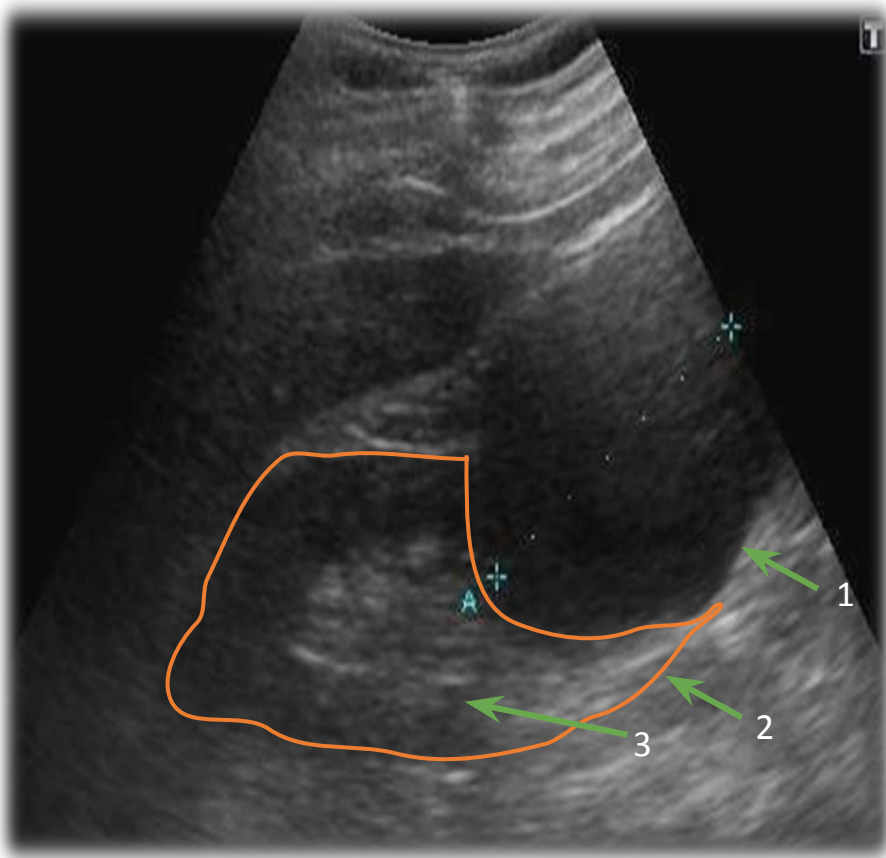


**Young Adult presented with right loin pain. Ultrasound exam was performed. Which of the following is the likely finding?**

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



## CASE (2)



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

- Normal.
- Hydronephrosis.
- Renal cyst.
- Lower pole renal stone.

### The Labels:

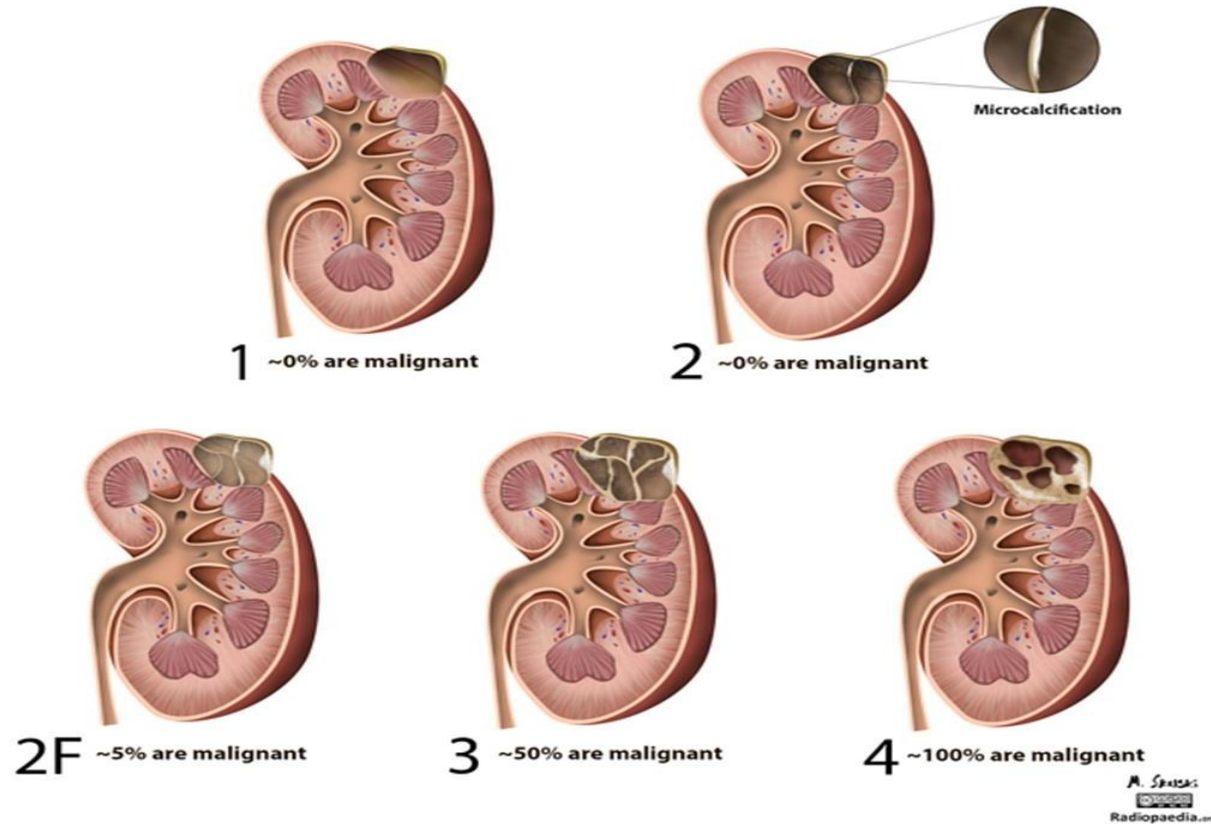
- (1) Clear THIN outline of the cyst. (This a mass, describe it: spherical, regular, well defined, anechoic ...so it is renal cysts)
- (2) The kidney (the orange line). (not 100% accurate outline)
- (3) Collecting system.



### Notes

- Always in US if it is longitudinal section the upper pole is in the left and the lower is in the right, so the cyst in the lower pole.
- 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.
- In ultrasound imaging you can not differentiate between left and right unless it was mention in question.

# Bosniak classification of renal cysts



just for your knowledge: (As a medical student we only have to know simple cyst (type 1), the other types are advanced.)

**Class 1: is a benign cyst which we usually see. it is round with thin walls, spherical, no interseptiation, no thickening and no calcification.**

Class 2: there is only one septation 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: thickened and necrotic, 100% are malignant.

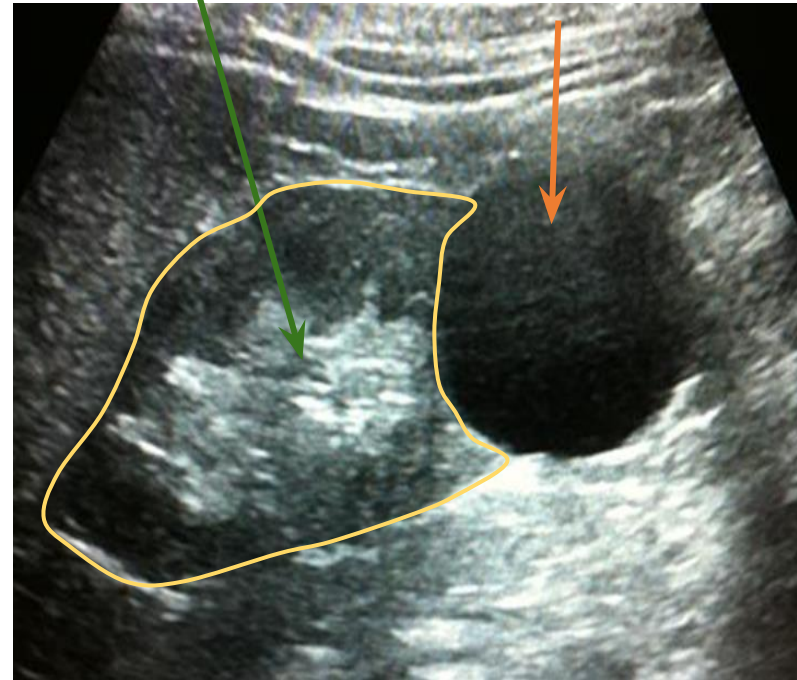
# Renal cysts (Thin borders)

The orange arrows



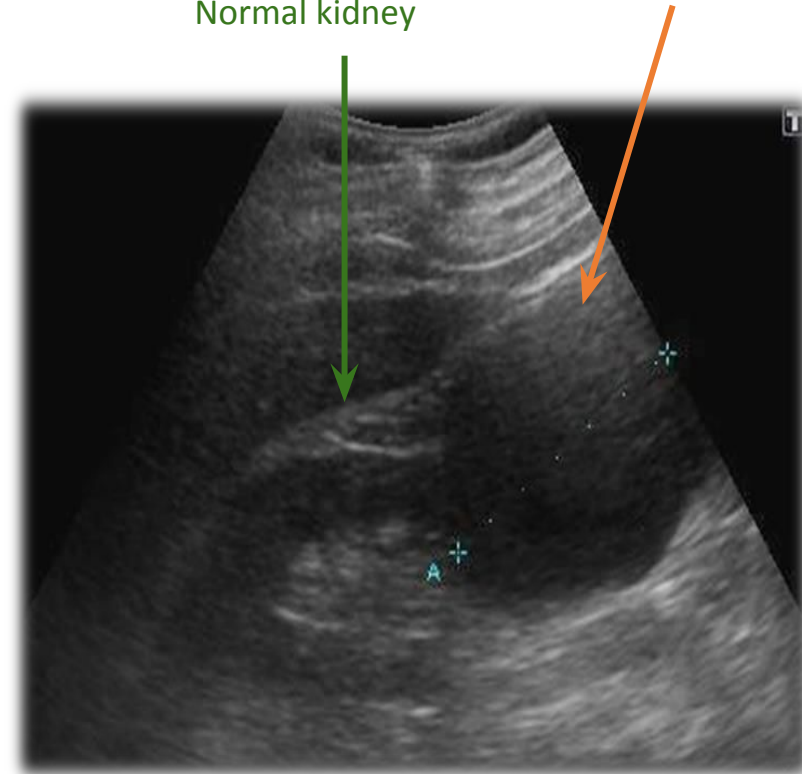
In a CT image with bowel contrast, we can see right kidney cyst (benign). Why we cannot see the left kidney? Because the left kidney is in an upper level compared to right kidney.

collecting system  
(normal kidney)



In ultrasound image, it is a benign renal cyst which is spherical, rounded, regular, no interseptation, no calcification and no thickening of the wall. it is large but still benign.

Normal kidney



-simple cyst at lower pole

 CASE (3)



**29 y/o female presented to the ER c/o sudden acute left flank pain radiated 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.

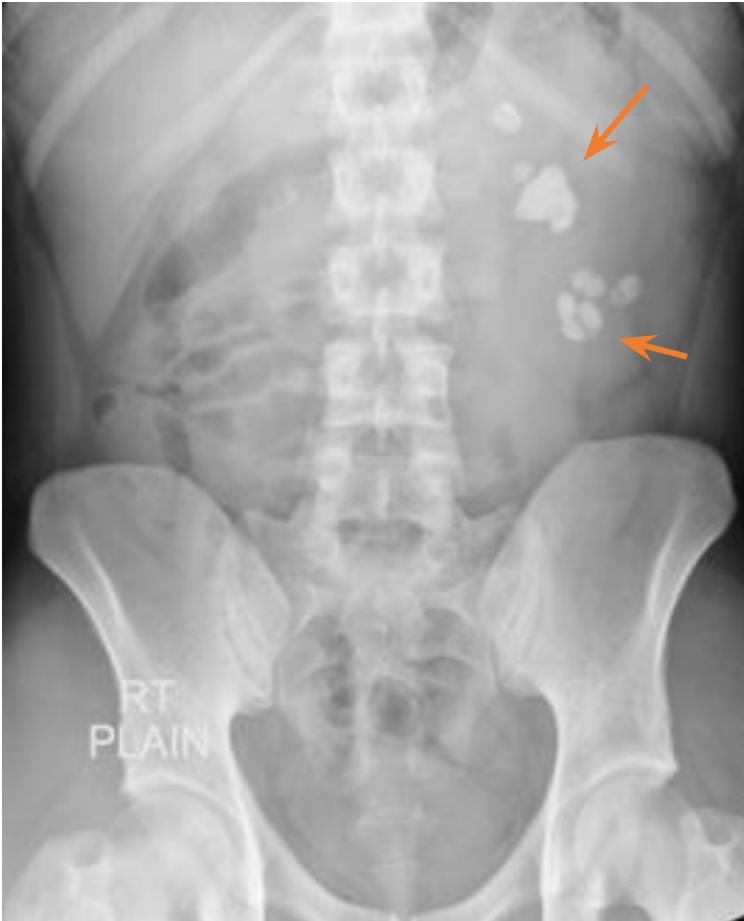
**29 y/o female presented to the ER c/o sudden acute left flank pain radiated to the groin associated with hematuria.**

**What is the major finding?**

- a- Renal mass.
- b- Renal cyst.
- c- Renal stone.
- d- Renal hemorrhage.



 CASE (3)



**29 y/o female presented to the ER c/o sudden acute left flank pain radiated to the groin associated with hematuria.**

**What is the name of the exam presented?**

- IVU. (there is no contrast, so it is not IVU)
- KUB. Kidney, Ureter & Bladder. KUB is other name for plain X-ray
- Double contrast exam.
- Single contrast exam.

**29 y/o female presented to the ER c/o sudden acute left flank pain radiated to the groin associated with hematuria.**

**What is the major finding?** Radio-opacity with this clinical scenario, it is a renal stone.

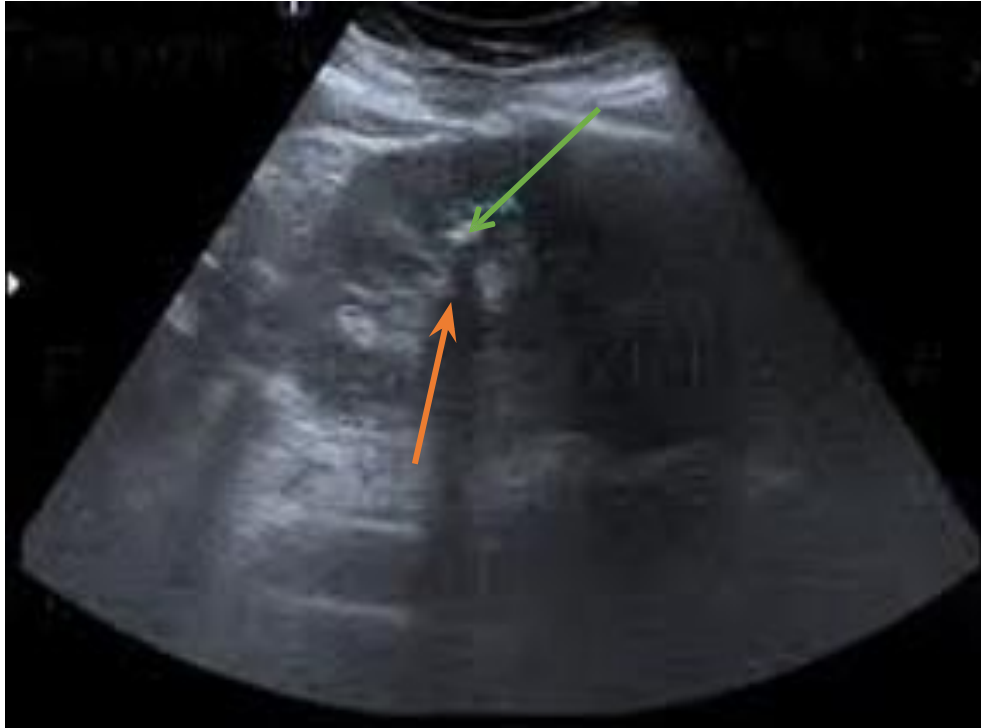
- Renal mass.
- Renal cyst.
- Renal stone.
- Renal hemorrhage.



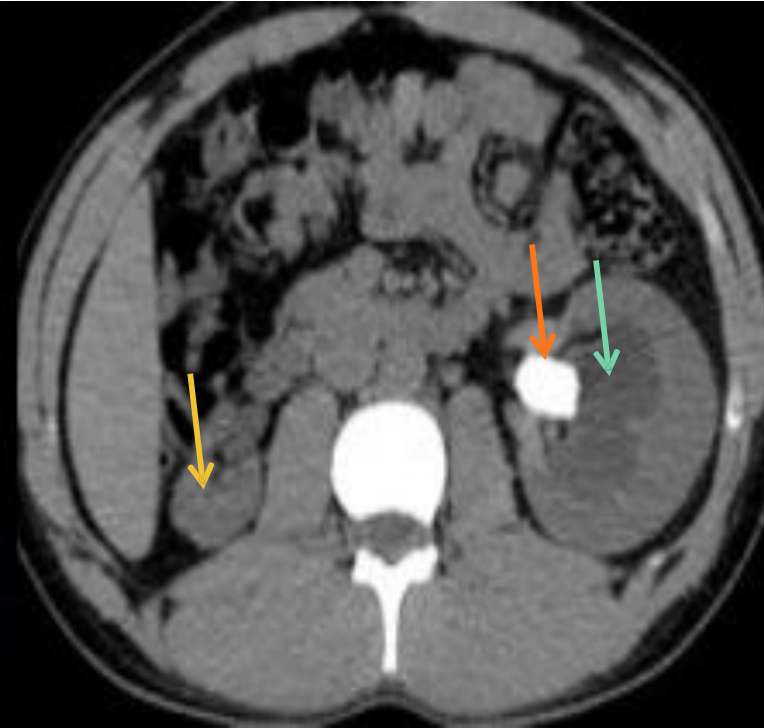
Notes

- 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.

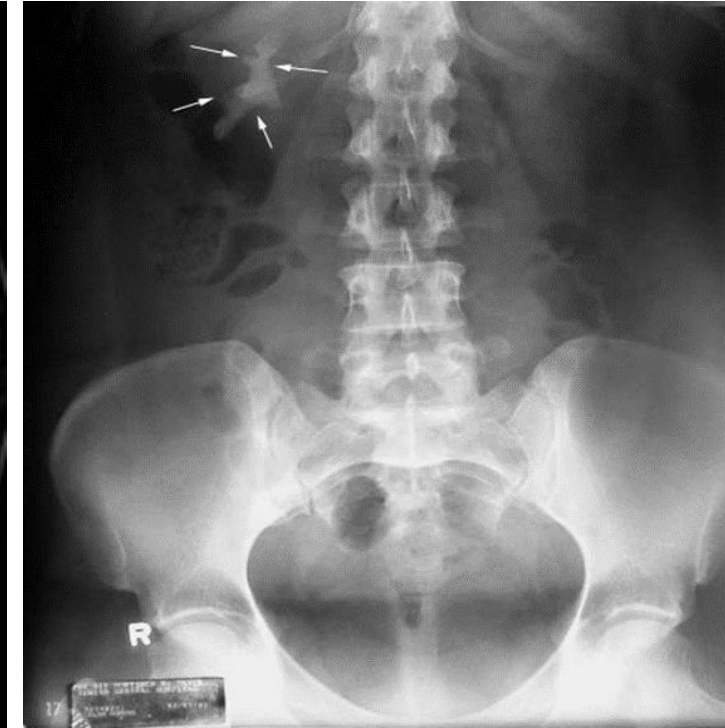
## 🌀 Stones in different modalities



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



CT/- contrast, Stone is in the left kidney in ureteropelvic junction (common site), with a clear obstruction, Dilatation of collecting system, atrophic R. kidney

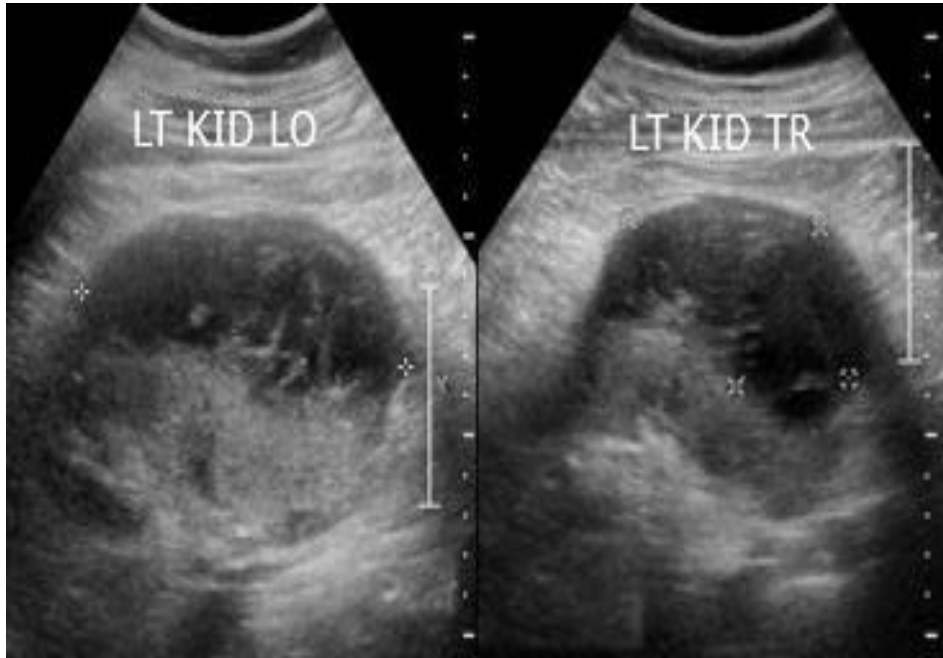


Staghorn stone filling more than 2 calyces and take their shape. it is chronic infected stone.

### 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 (4)

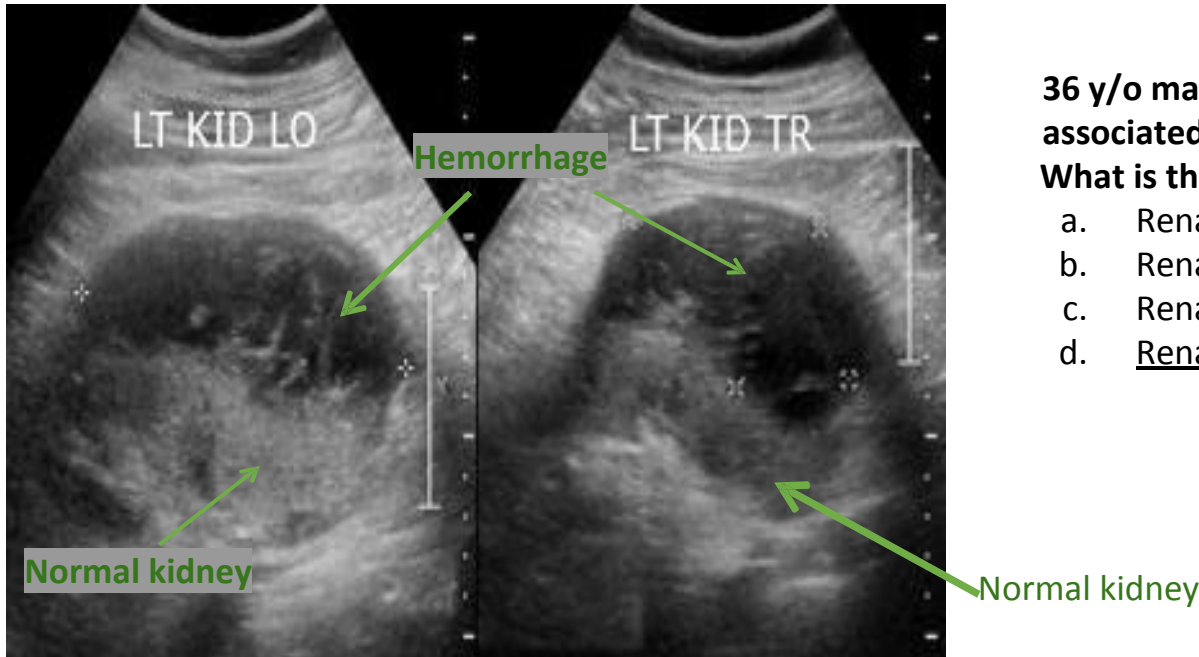


**36 y/o male presented to the ER c/o acute sudden left flank pain radiates to the groin associated with hematuria post RTA (road traffic accident). US was performed.**

**What is the major finding?**

- a. Renal mass.
- b. Renal cyst.
- c. Renal abscess.
- d. Renal hemorrhage.

 CASE (4)



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.

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.

## Subcapsular renal haematoma

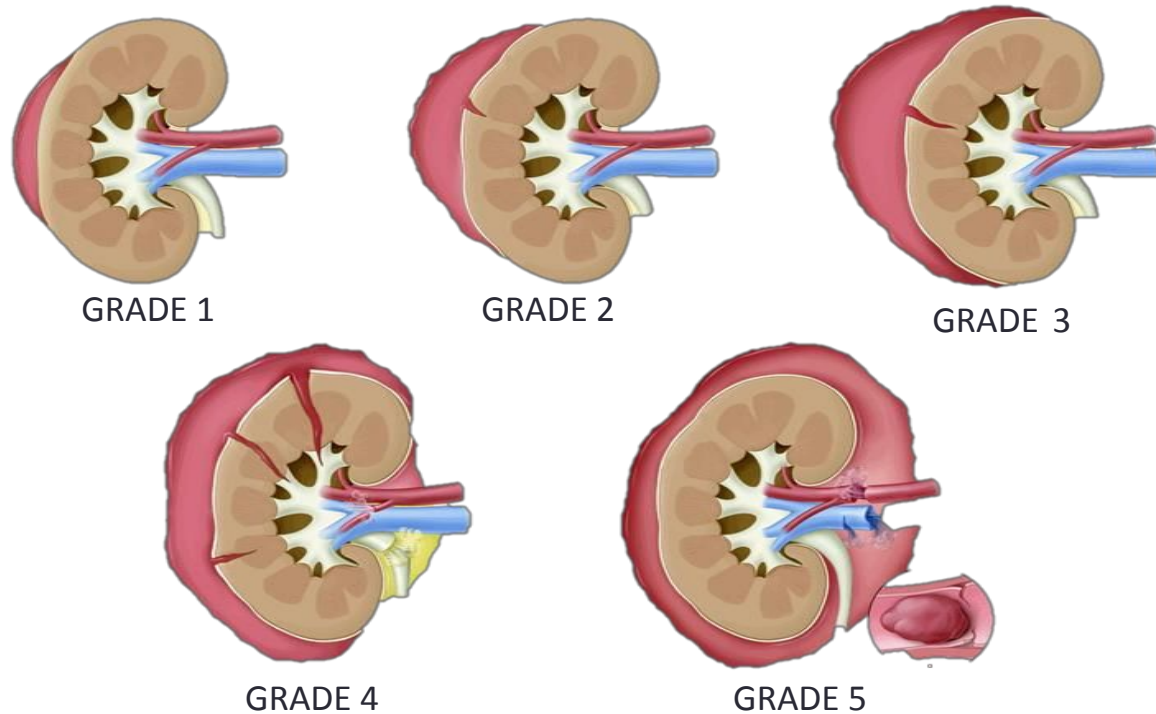


- CT with contrast was done, shows normal right kidney and a subcapsular haematoma located in the left kidney which is compressing renal cortex.
- If we leave it, it will lead to renal failure

this is left kidney

## Types of renal injury

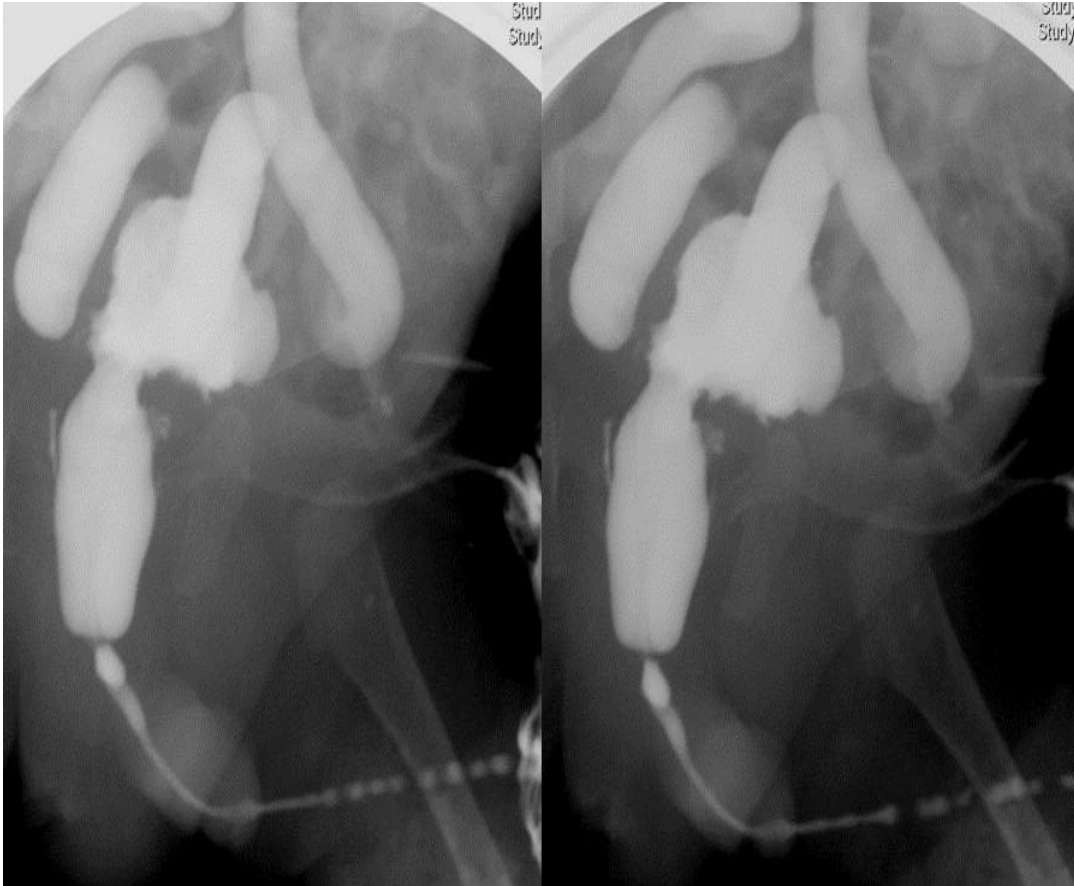
Not important, it won't come in the exam



**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: subcapsular 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 (5)



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

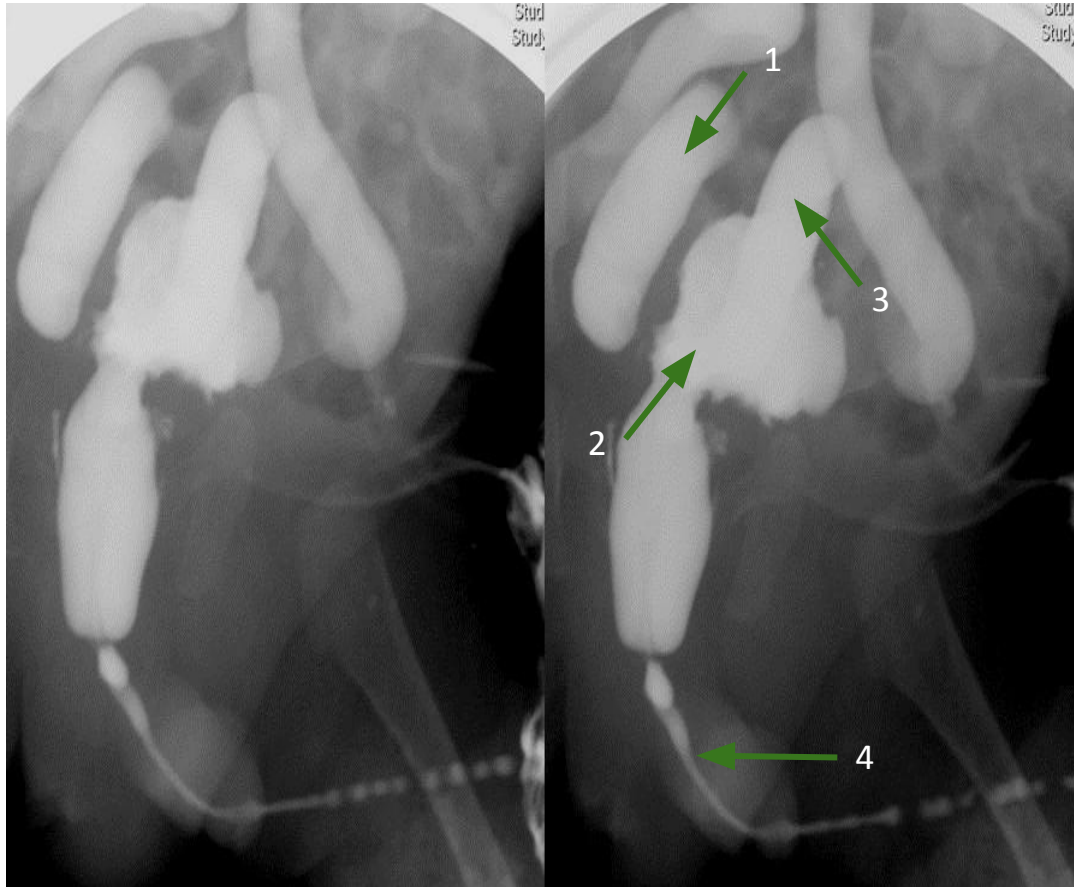
- a. Intravenous urography (IVU).
- b. CT with IV contrast.
- c. Voiding cystourethrogram.
- d. Scintigraphy.

**One month old boy with recurrent UTI. What is the abnormality seen?**

- a. Normal VCUG.
- b. Vesico-colonic fistula.
- c. Beaded urethral strictures.
- d. Vesicoureteric reflux.

## CASE (5)

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



### The Labels:

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

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

- Intravenous urography (IVU).
- CT with IV contrast.
- Voiding cystourethrogram.
- Scintigraphy.

**One month old boy with recurrent UTI. What is the abnormality seen?**

- Normal VCUG.
- Vesico-colonic fistula.
- Beaded urethral strictures.
- Vesicoureteric reflux.



### Notes

- Tortuous ureter, and dilated, > grade 5 vesicoureteral reflux.
- What I need you to know that 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.



 CASE (6)



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

**What is this imaging modality?**

- a. MRI with contrast.
- b. MRI without contrast.
- c. CT with contrast.
- d. CT without contrast.

**How do you describe this abnormality?**

- a. cortical mass.
- b. pelvicalyceal dilatation.
- c. hypoperfused lesion.
- d. perirenal hematoma.

**What is the most likely diagnosis?**

- a. renal carcinoma.
- b. pyelonephritis.
- c. type I cyst.
- d. traumatic lesion.

 CASE (6)



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

**What is this imaging modality?**

- a. MRI with contrast.
- b. MRI without contrast.
- c. CT with contrast. with contrast because we can see enhanced aorta.
- d. CT without contrast.

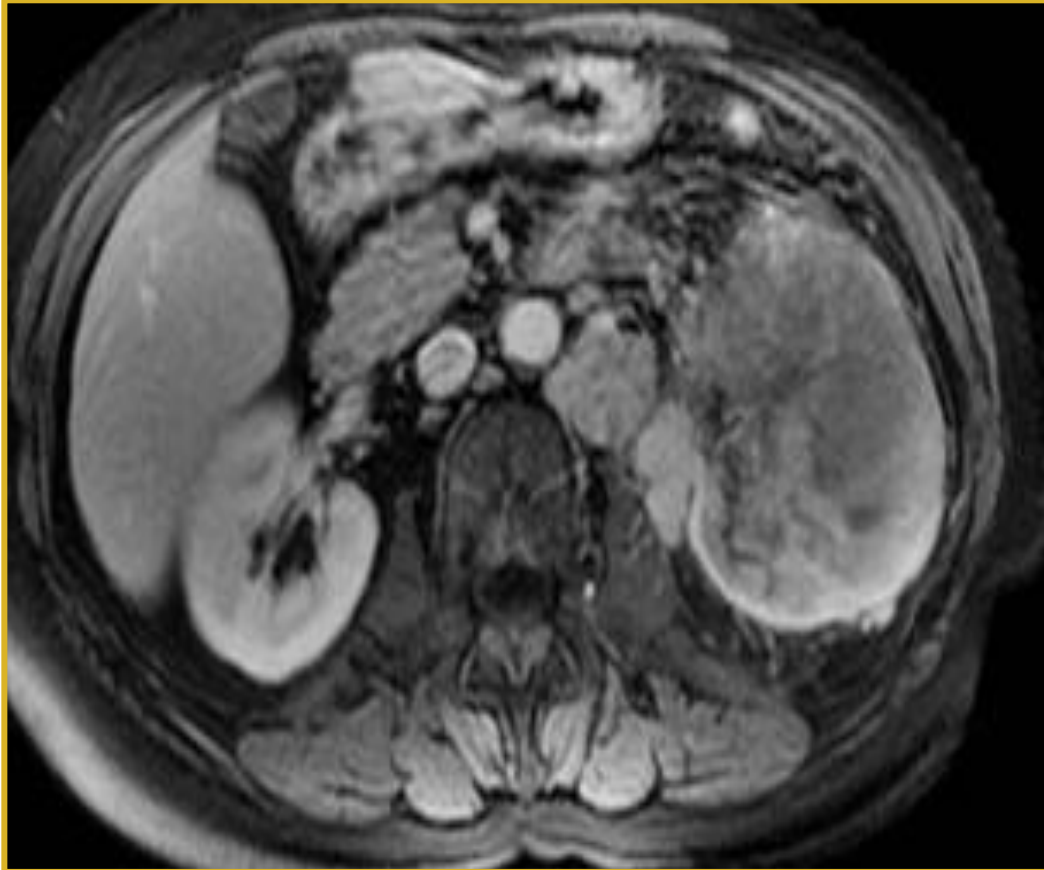
**How do you describe this abnormality?**

- a. cortical mass.
- b. pelvicalyceal dilatation.
- c. hypoperfused lesion. there is pyelonephritis, which is sub-functional and did not take the contrast
- d. perirenal hematoma.

**What is the most likely diagnosis?**

- a. renal carcinoma.
- b. pyelonephritis.
- c. type I cyst.
- d. traumatic lesion.

 CASE (7)



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

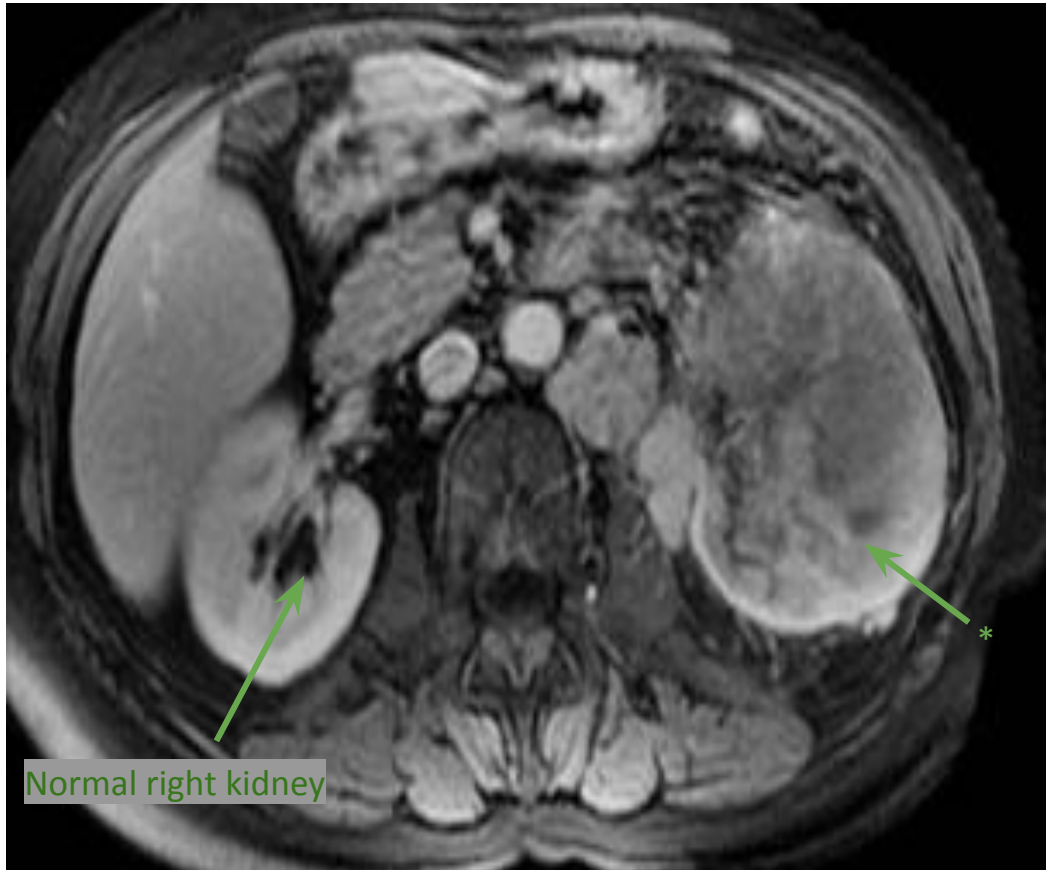
**What is the most likely diagnosis?**

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



## CASE (7)

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



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

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

Huge mass occupying left kidney, irregular anterior border taking the contrast in **heterogeneous pattern**, with areas of necrosis  
or we can say Left renal large irregular heterogeneous mass which enhanced heterogeneously with contrast.

**What is the most likely diagnosis?**

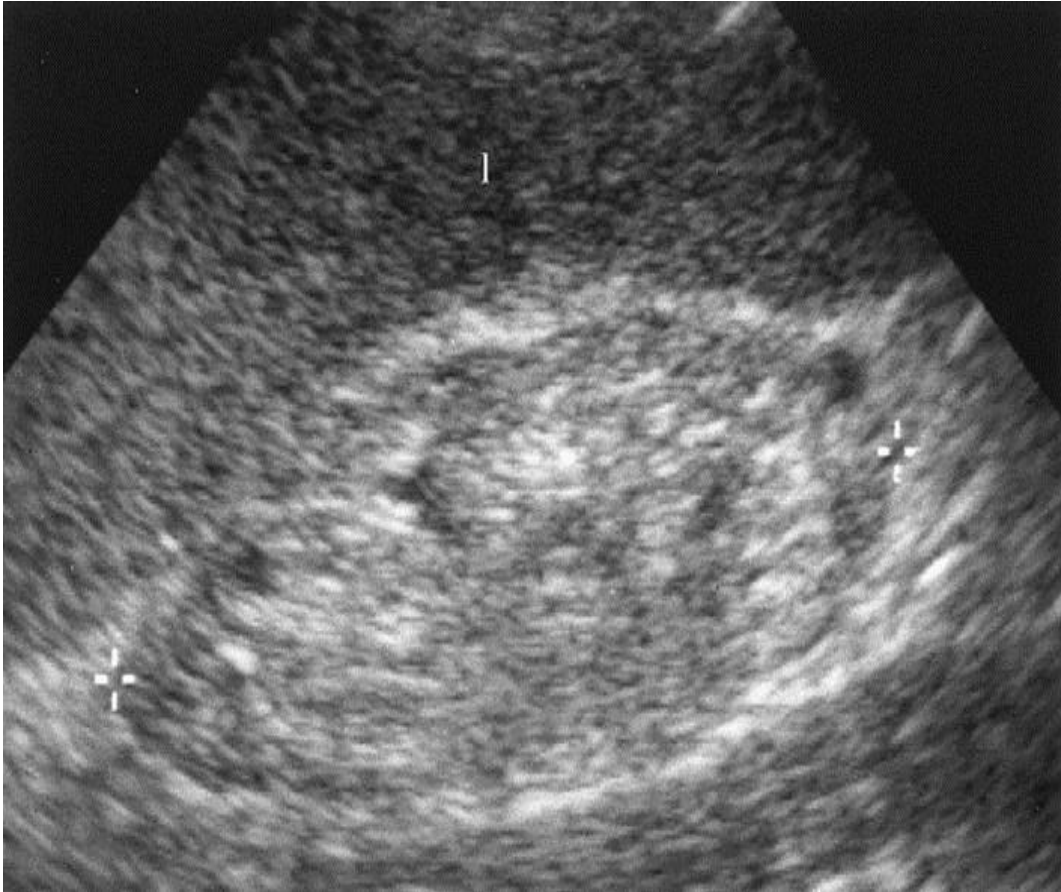
- Pyelonephritis.
- Renal adenocarcinoma.
- Transitional cell carcinoma.
- Angiomyolipoma.

\* 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 (8)

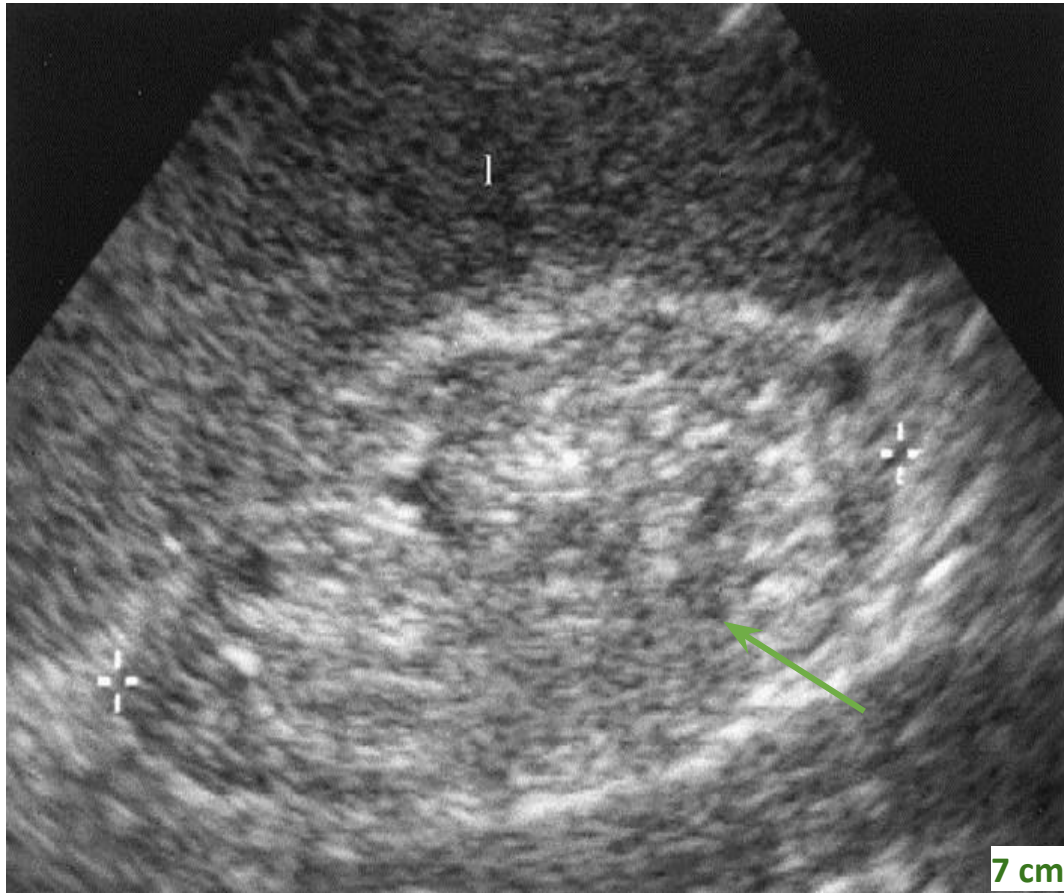


**81 y/o female diabetic patient came to clinic with general fatigue, itching, loss of appetite and easy bruising. Initial lab works show a creatinine level of 180  $\mu\text{mol/L}$ . What does US show?**

- a. normal kidney.
- b. hyperechogenic kidney.
- c. atrophic undifferentiated kidney.
- d. atrophic kidney with normal corticomedullary differentiation.



## CASE (8)



**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.

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

there is a kidney of 7 cm in longitudinal which is less than 9 cm so it is atrophic kidney.

 CASE (9)



**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.

**That is the major finding?**

- a. Normal.
- b. Left pelvicalyceal dilatation.
- c. Right ureteral dilatation.
- d. Filling defect in urinary bladder.

 CASE (9)



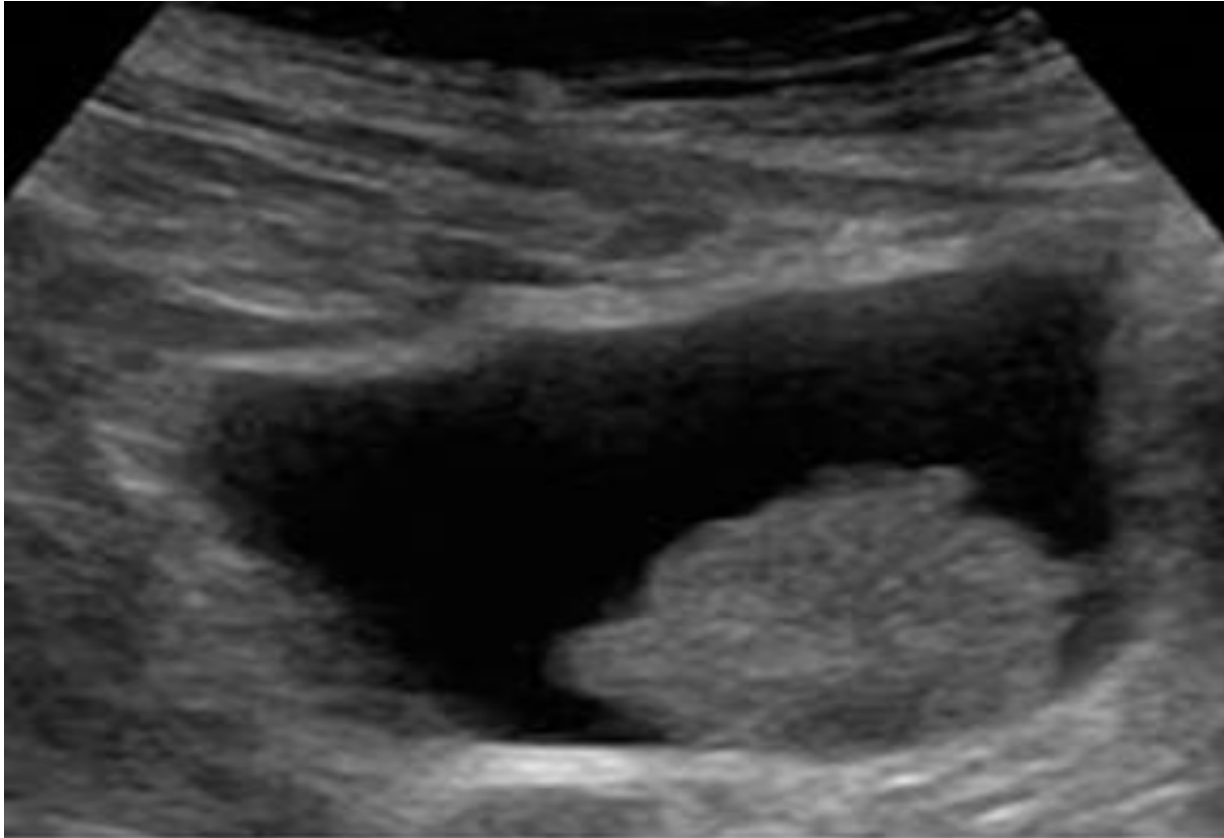
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- d. Scintigraphy.

**That is the major finding?**

- a. Normal.
- b. Left pelvicalyceal dilatation.
- c. Right ureteral dilatation.
- d. Filling defect in urinary bladder. usually bladder cancer (mass)





**US shows bladder mass. 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 (10)



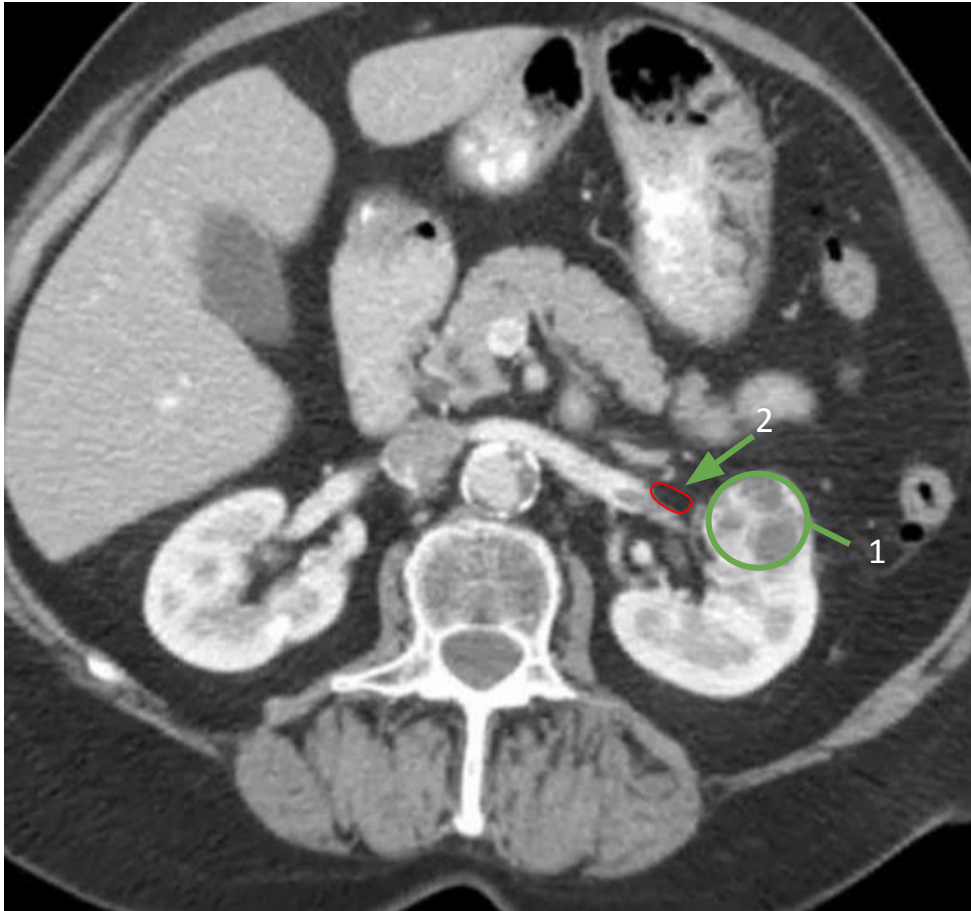
**73 y/o female came with painless hematuria & general fatigue. What is the major finding?**

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

**What other secondary finding do you observe?**

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

 CASE (10)



(red outline is an approximation)

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

- a. Bosniak type II renal cyst. *can not be A, because type 2 has only one septation*
- b. Malignant tumor.
- c. Focus of pyelonephritis. *can not be C, because there is no hypoperfused area.*
- d. Normal.

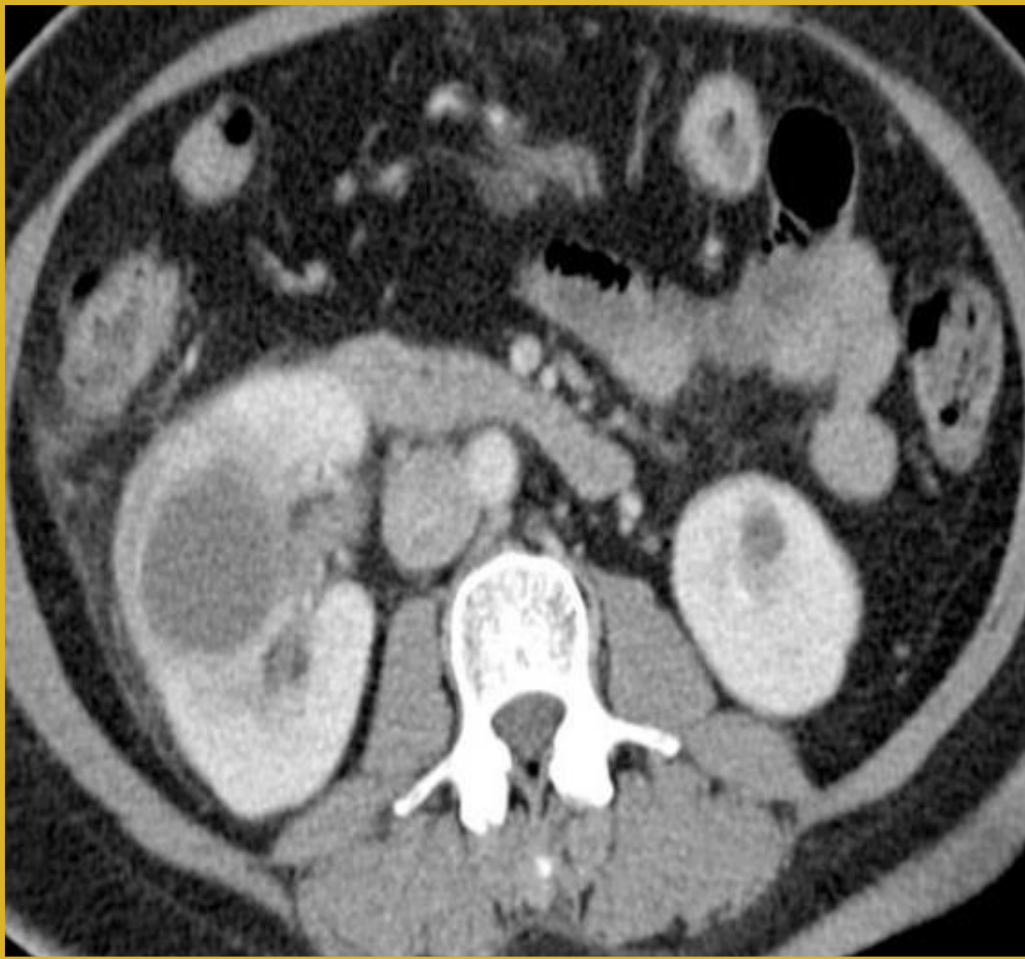
**What other secondary finding do you observe?**

- a. Perirenal hemorrhage.
- b. Mass effect on pancreas. *it is far from pancreas, and separated by fat.*
- c. Renal vein filling defect.
- d. Pelvicalyceal dilatation. *we will see hypodense tubular structure in pelves.  
-tumors tend to give rise to thrombus formation*

**The Labels:**

- (1) *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.*
- (2) *the abnormality is in the left kidney in anterior part.*

 **CASE (11)**



**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?**

**What is the most likely diagnosis in the right kidney?**

- a. Pyelonephritis.
- b. Renal abscess.
- c. Simple cyst.
- d. Pelvicalyceal dilatation.

 CASE (11)



The yellow circles represents the cyst wall.

**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?**

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.

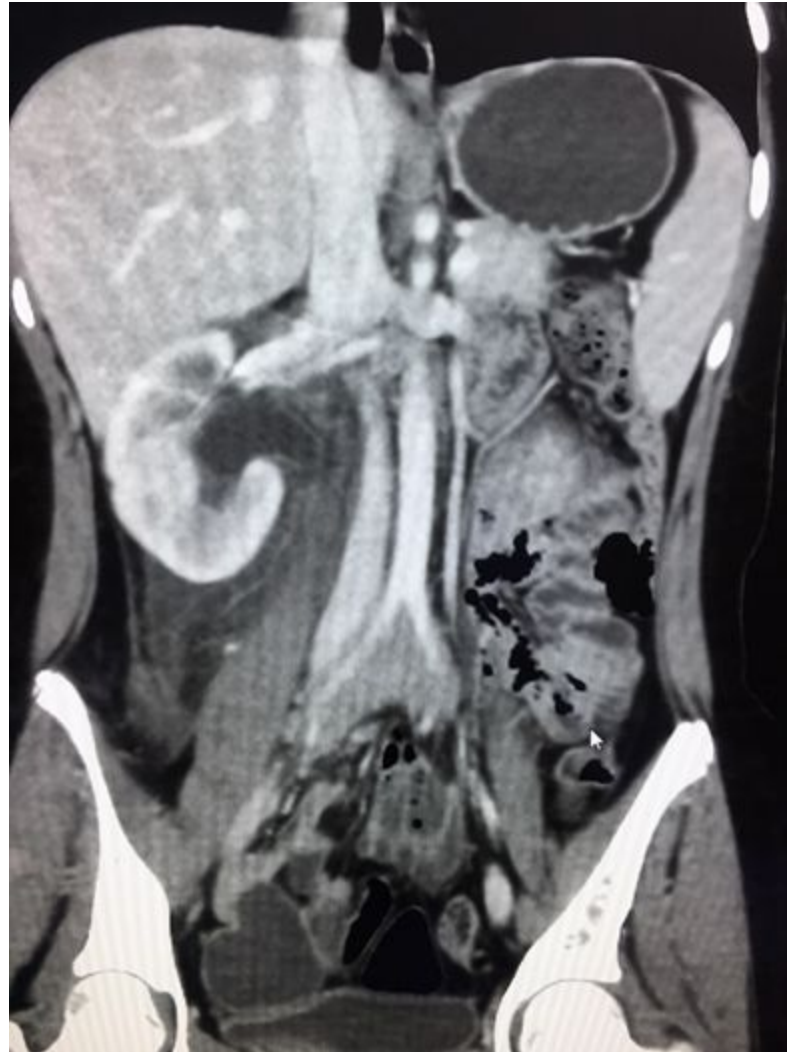
Also the left kidney has small spherical lesion which is most likely to be a cyst.

**What is the most likely diagnosis in the right kidney?**

- Pyelonephritis.
  - Renal abscess.
  - Simple cyst.
  - Pelvicalyceal dilatation.
- 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

Only in males' slides (Doctor skipped it)  
only pictures. no case or further information was provided



Only in males' slides (Doctor skipped it)  
only pictures. no case or further information was provided

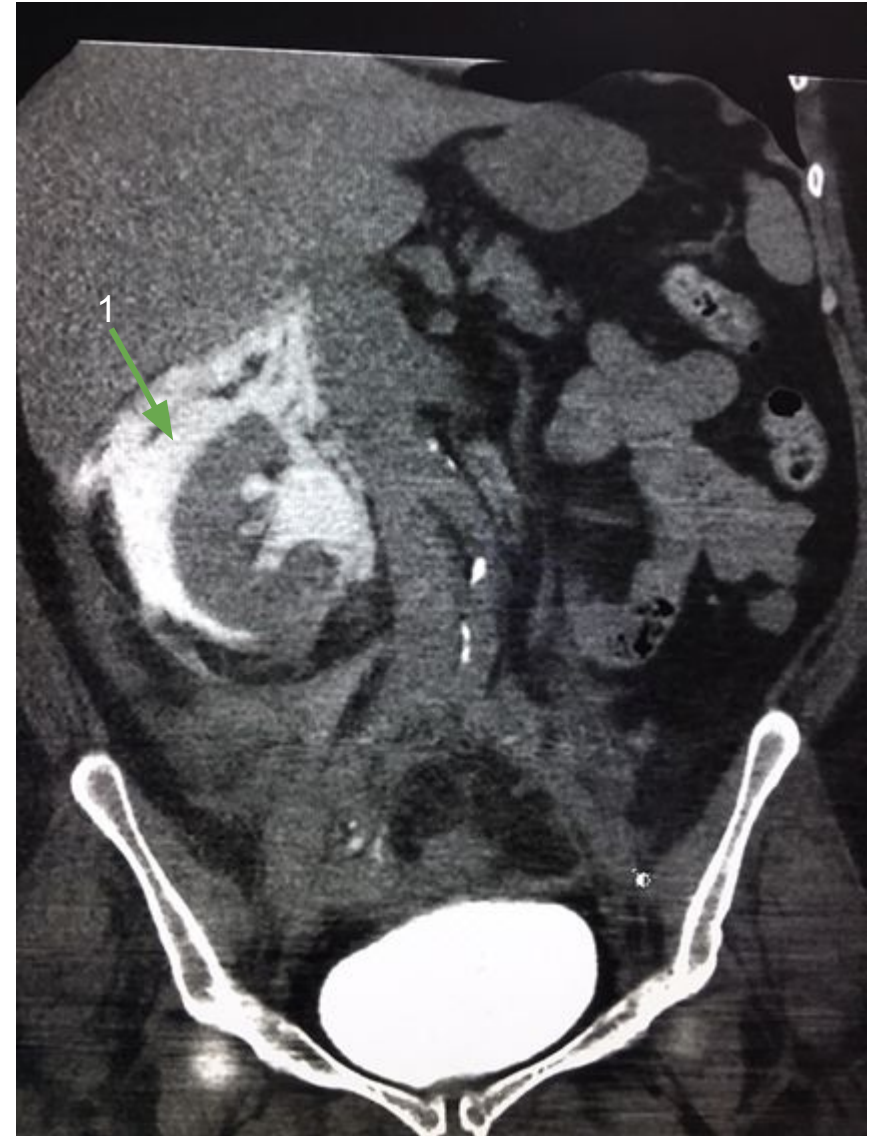


Only in males' slides

48 y/o female post hysterectomy

she presented with fever, we did US and there was a hydronephrosis (swelling of the kidney due to the build up of urine)  
then we gave her IV contrast and we found extravasation of the contrast around the kidney (1). Why?

The surgeon cut off the ureter by mistake while performing a hysterectomy procedure, then sutured it > obstruction > back up of urine to the kidney > enlargement of the kidney until it exploded > leakage of IV contrast





this is **NOT** extra slide



## MCQs by the doctor

**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: 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.

**Q4: One of the following is an absolute contraindication for MRI:**

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

**Q5: Which imaging modality is used to measure the renal split function?**

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

this is **NOT** extra slide



## MCQs by the doctor

**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).
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- 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. Because the junction between the ureter and bladder is relatively narrow even in normal anatomy. So, it might obstruct some stones down there.

**Q3: One of the following is a relative contraindication for CT with contrast:**

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

**Q4: One of the following is an absolute contraindication for MRI:**

- a. Claustrophobia.
- b. Cardiac pacemaker. Because of high magnetic field in MRI
- c. Pregnancy.
- d. Uncontrollable movement.

(Only in males' slides)

**Q5: Which imaging modality is used to measure the renal split function?**

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

End of the lecture, best of luck.  
Don't forget to give us your feedback.

**WE NEED**

**YOUR**

**FEEDBACK**

