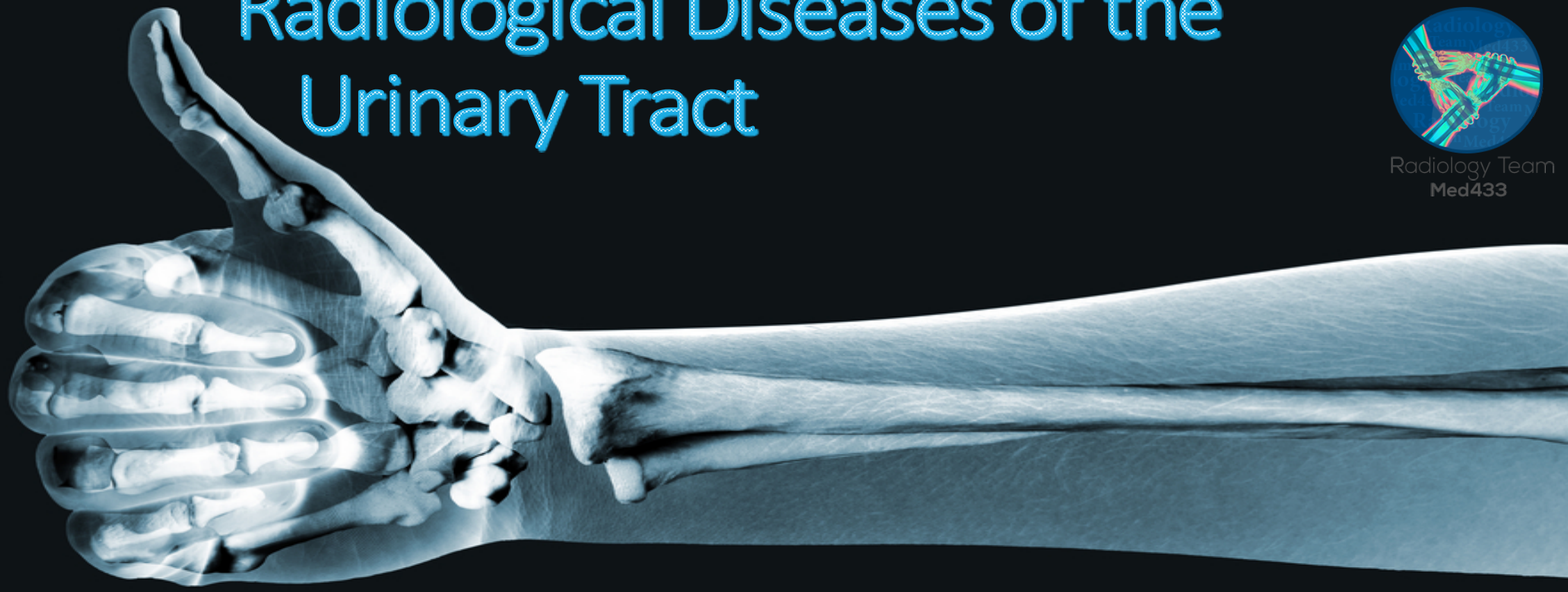
Lecture 9:

Radiological Diseases of the Urinary Tract



Radiology Team
Med433

● Slides ● Explanation ● Notes ● Additions ● Important

Renal Calculi

Questions to ask:

- Are urinary stones present?

-If YES , what is the level and size?

Usually if it's less than 5 mm will pass spontaneously, larger than 5 mm need intervention.

- Is obstruction present?

Maybe associated with hydronephrosis, hydroureter.

-If so, what is the level and severity?

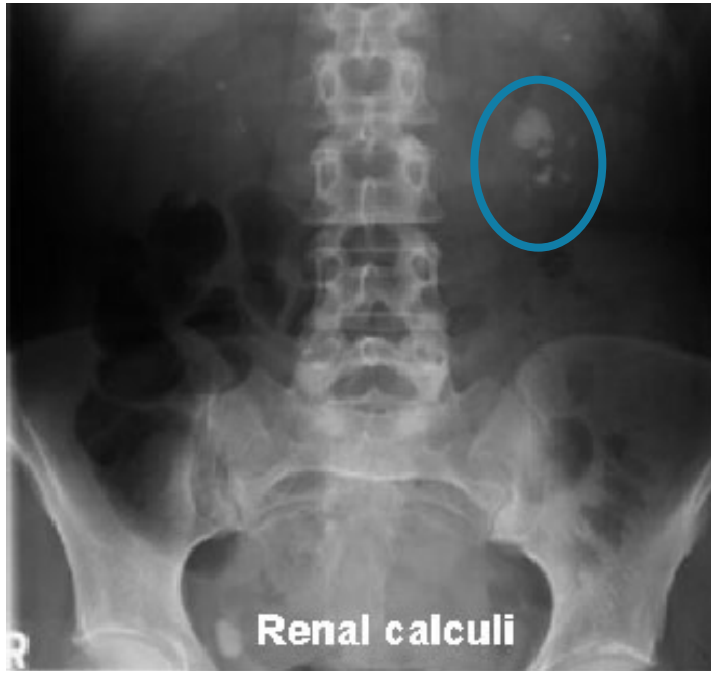
- Is urgent intervention required?

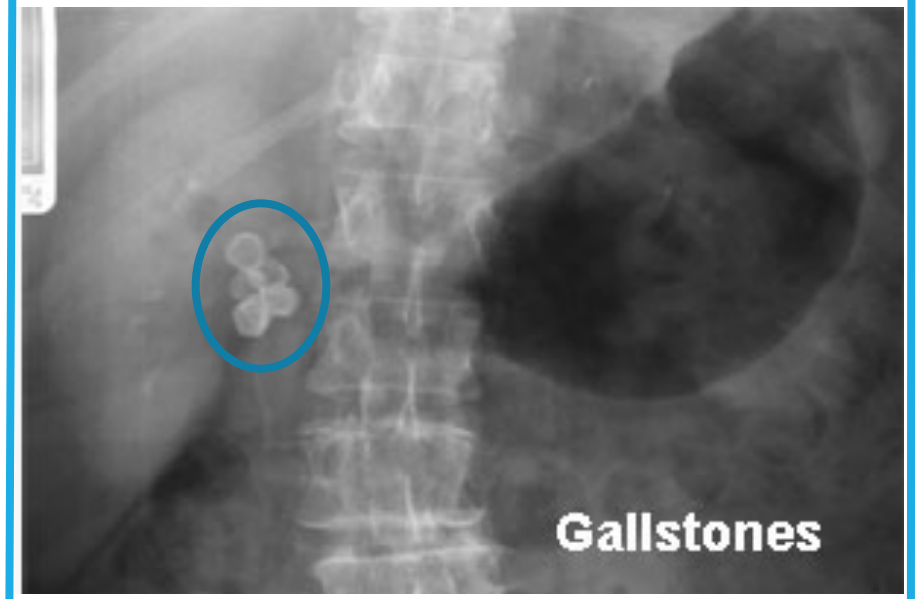
Factors include **urosepsis**, **solitary kidney**, severe pain not respond to analgesics.

- **Treatment :**

Ureteric stent or percutaneous nephrostomy.

Microscopic Hematuria





Renal stones

1. More dense and lower.
2. *Not rounded, not uniform even if they are multiple + they don't have the hypodensity in the center.*

Multiple opaque shadows are seen in the left side of the abdomen that mean there is stone in the lower pole of the left kidney.

Gallstones

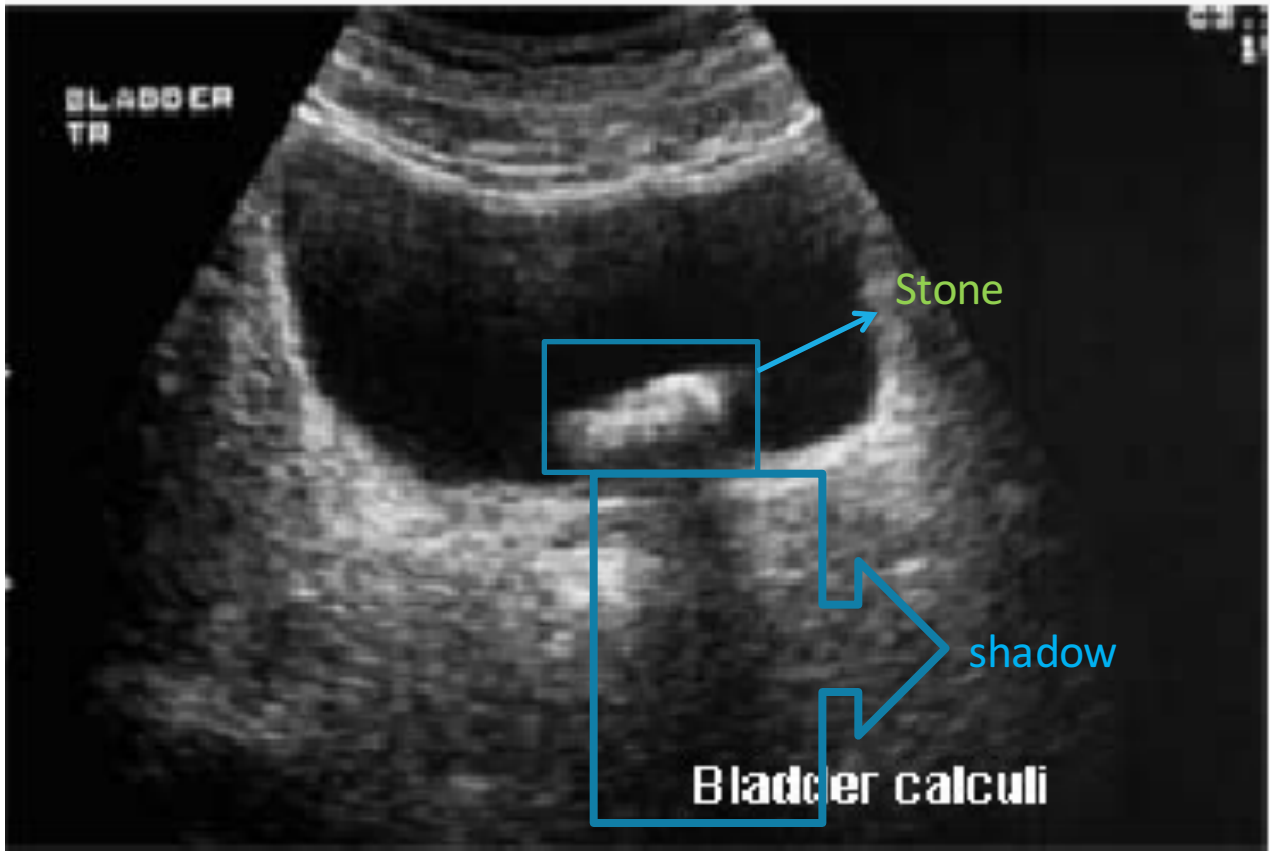
1. Round, radiolucenty in its middle.
2. *multiple but uniform in size + Hypodense in the center + hyperdense (bright) in the periphery.*

Multiple opaque shadows are seen close to the hilum of the right kidney. that mean there is stone.

It's named staghorn because resemble the staghorn of deers.

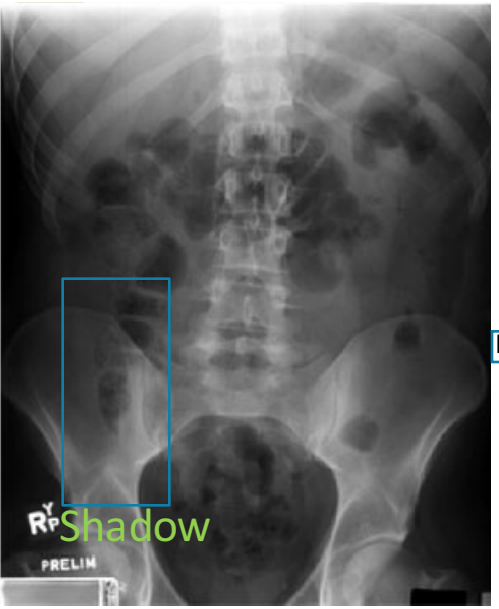
Microscopic Hematuria: Bladder Calculi

Plain film is **not sensitive**.
Patient will have microscopic hematuria.
Radiopaque shadow in the pelvis.

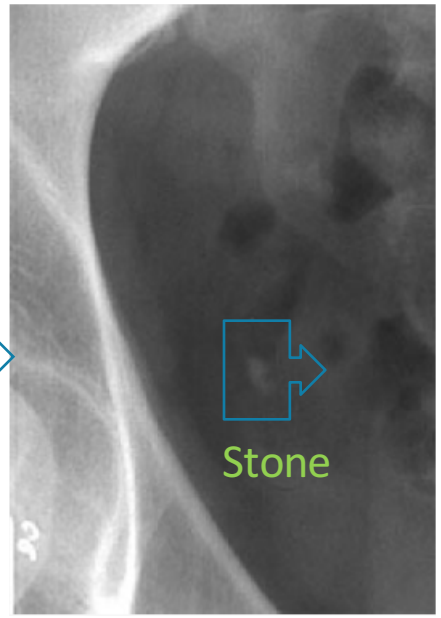


To be sure use ultrasound, there will be a shadow.

Renal Colic (cont.)



Magnify

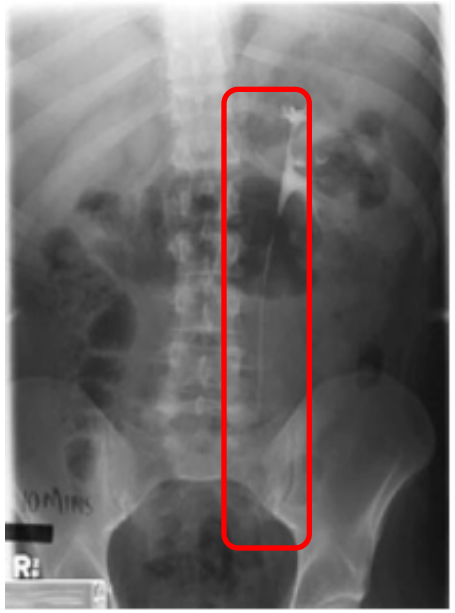


Preliminary film in a patient with **right renal colic**.
(worst pain)

preliminary radiographic: Imaging made before the administration of contrast material. Also called scout image. Then we will do it with contrast

IVP

Replaced by CT scan



10 minutes
Delayed function on right side

In the left side of 10 minutes film shows left pelviclyceal system and part of ureter is filled with contrast → left kidney is functioning well.

25 hours
Persistent nephrogram

in the right side of 10 minutes film shows no contrast → right kidney is not functioning well.

29 hours
Dilated ureter to stone

Renal Colic (cont.)

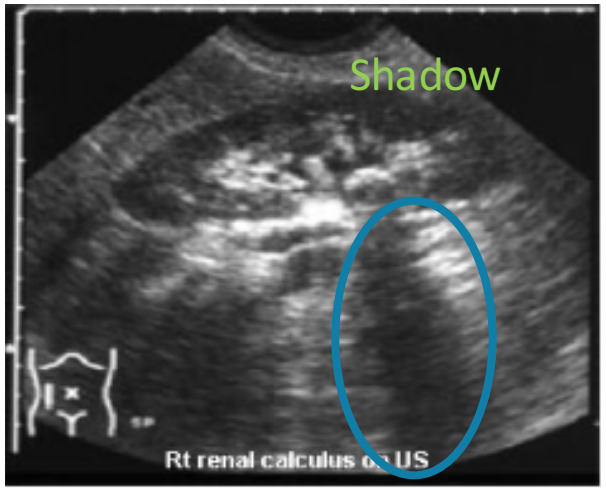
Radiopaque stone in distal ureter most likely at the vesicoureteral junction.

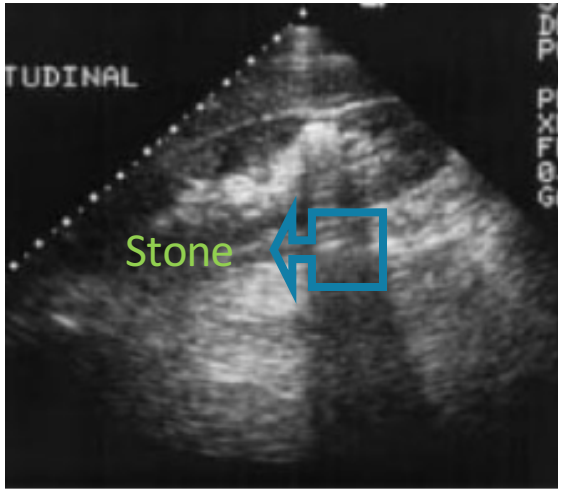
The dilated ureter

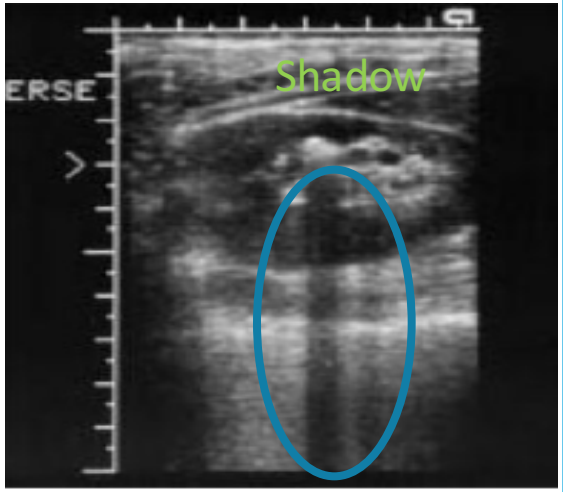
Radiolucent uric acid stones

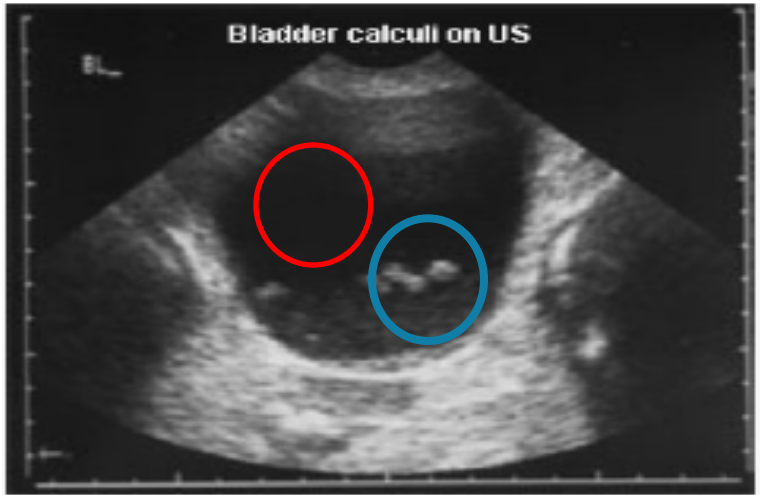
Renal Colic (cont.)

Ultrasound:









We can see the acoustic shadowing, indicating stones

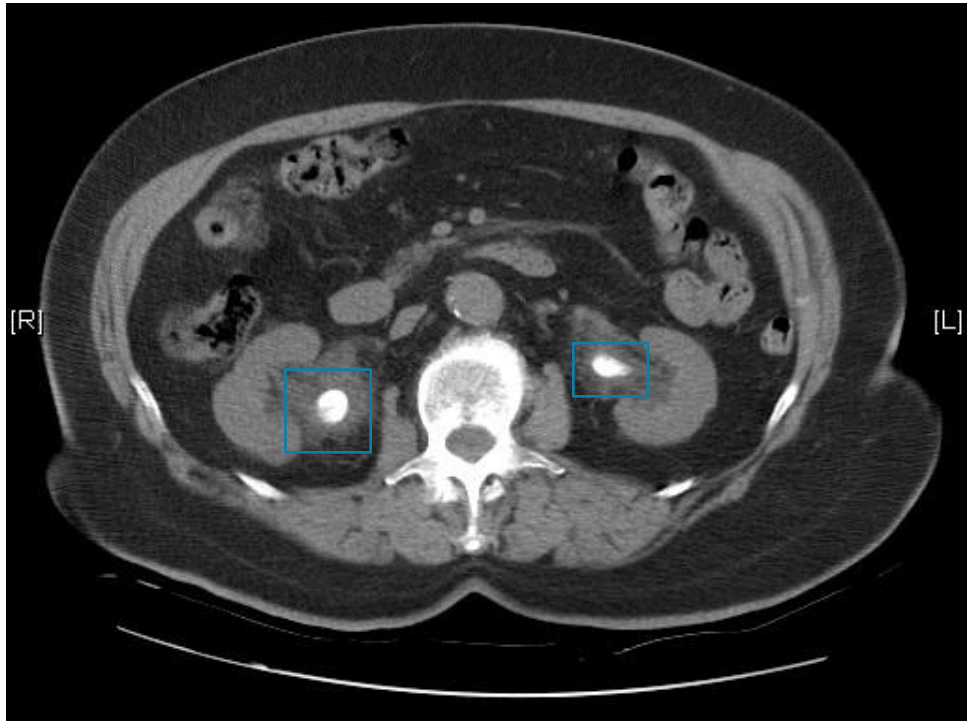
In ultrasound:

- Fluid (urine) will appear black
- Stones will appear white
- The reason of the absence of shadow is (the urine in the bladder is dark and the shadow is dark)

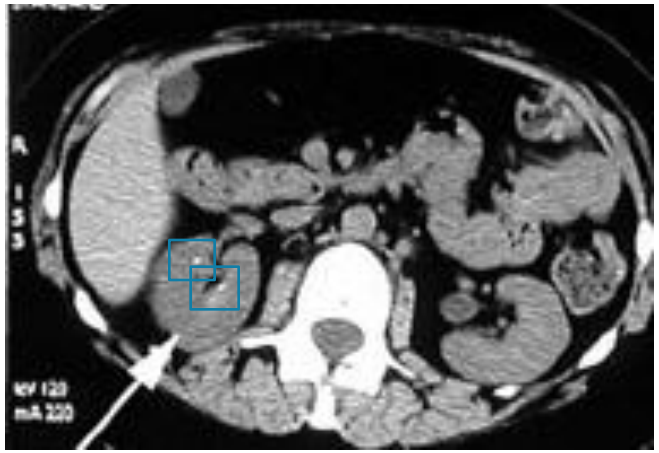
Renal Calculus

CT Scan: Best modality for renal stones

we do not start with it because(*ionized radiation*).

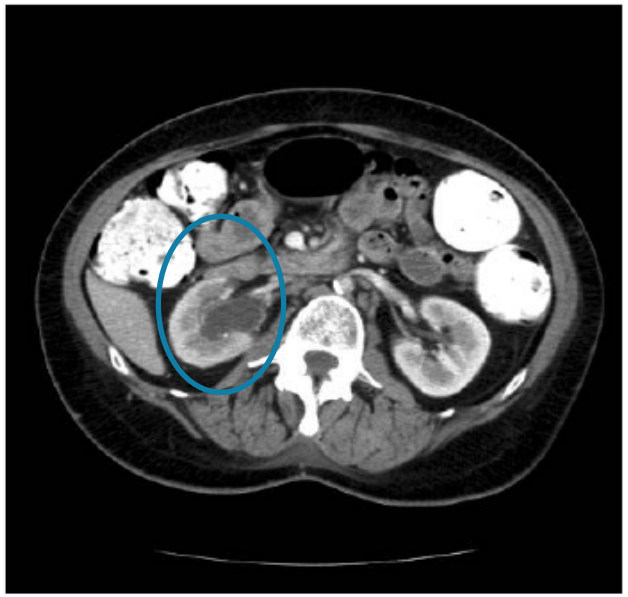


Stones at uretro-pelvic junction and it can cause obsruction.



Small dots in the right kidney which are small stones

A stone in the left kidney and mostly in the calyx.



Hydronephrosis:

- dilated pelvis of the right kidney indicating Hydronephrosis (water inside the kidney)
- *dilatation of renal pelvis and calyces*
- Left side is normal.

Note: Stones or tumor => obstruction may lead to Hydronephrosis

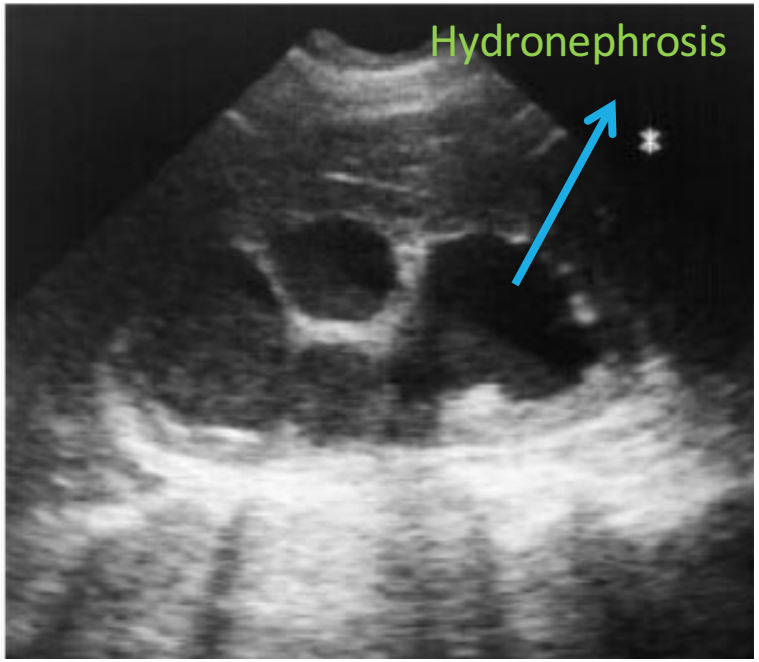
Both of them are not obstructive (no pain), but we have to manage them to avoid infection.

Management of Renal Stones:

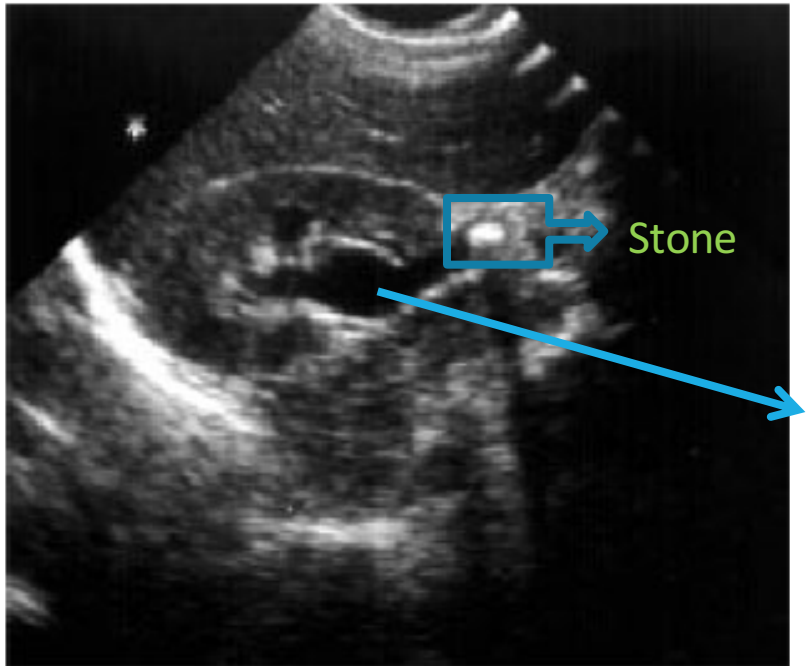
- Management dictated by size and location of stones
- Extracorporeal Shock Waves Lithotripsy (ESWL) monotherapy
  - (ESWL)uses shock waves to break a kidney stone into small pieces that can more easily travel through the urinary tract
- Ureteroscopy
- Percutaneous debulking and ESWL
- Surgery is rarely necessary
- Renal stones even if does not cause any symptoms, should be managed because they considered foreign bodies which the body may react against → lead to repeated infections.

Urosepsis

- Establish by clinical diagnosis:
- Primary infection is: Pyelonephritis, cystitis, prostitis
- Urosepsis and obstructed ureter is a urologic emergency!
- Renal US performed to rule out:
  - Renal obstruction
  - Renal or perirenal abscess

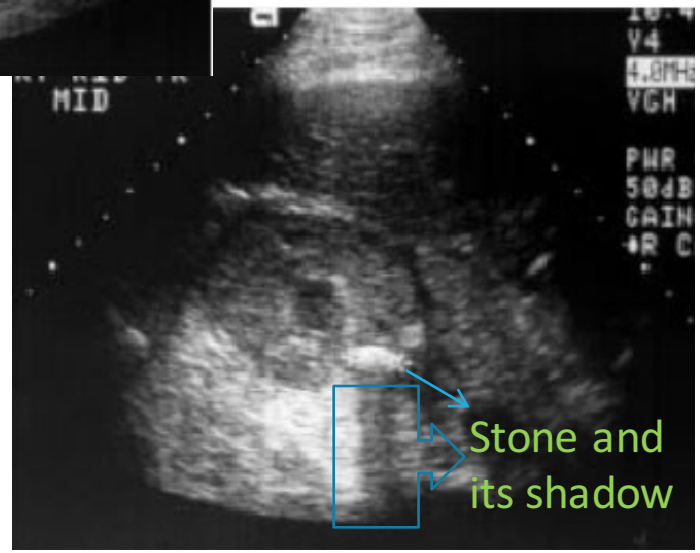


Left pyonephrosis:
The fluid is infected (NOT clear fluid) NOT totally black.

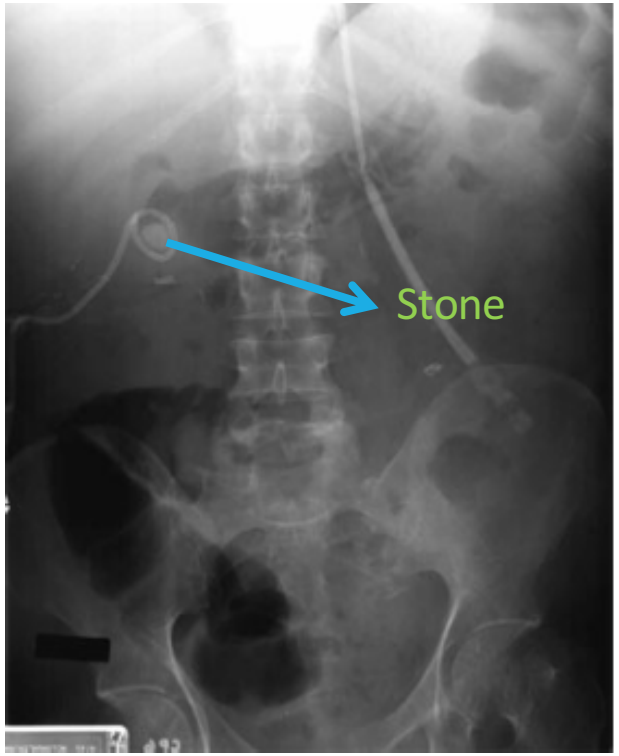


Right UPJ stone causing hydronephrosis

Urosepsis (cont.)



Ultrasound showing a **right pyonephrosis and obstructing UPJ stone**



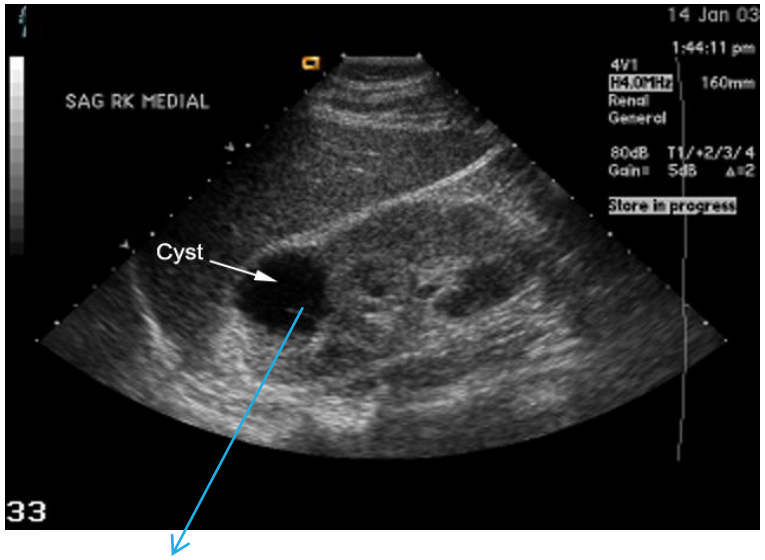
Percutaneous nephrostomy
for decompression

2 weeks post ESWL
Stone disappear

We insert a tube (catheter) Through the skin to the calyx to renal pelvis. This is called (nephrostomy tube). This is done to relive the pressure over the kidney. Later on you go for ESWL.

Approach to Renal Masses:

- Most renal masses are simple cysts
- Use US to characterize the mass:
  - Simple cyst: stop
  - Solid mass or atypical cyst: CT
- US and CT characterize > 90% of masses > 1.5 cm
- Biopsy is rarely warranted
- We don't do anything for renal cyst, unless it causes compression symptoms → we do drainage



Large Simple kidney cyst

Left renal mass on IVP

Simple cyst on ultrasound

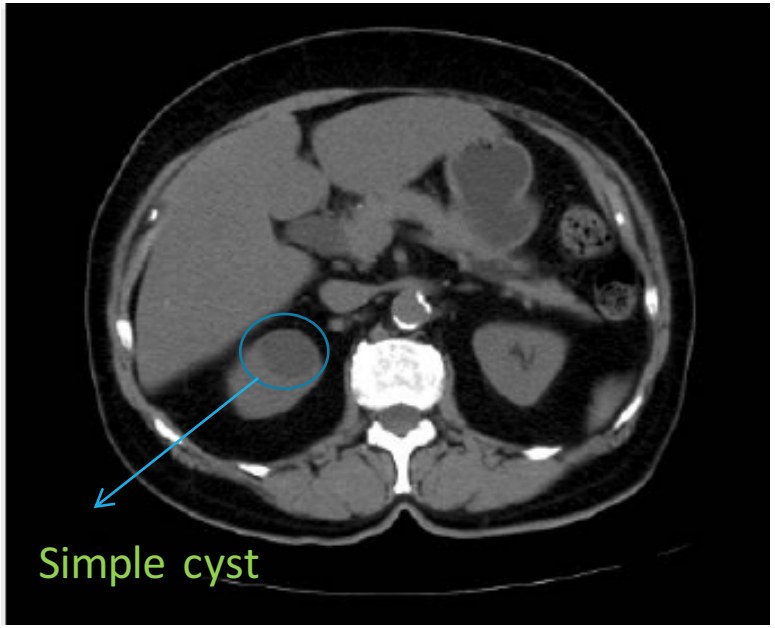
No nodularity nothing else to be done

Approach to Renal Masses (cont.)

1- Renal cyst

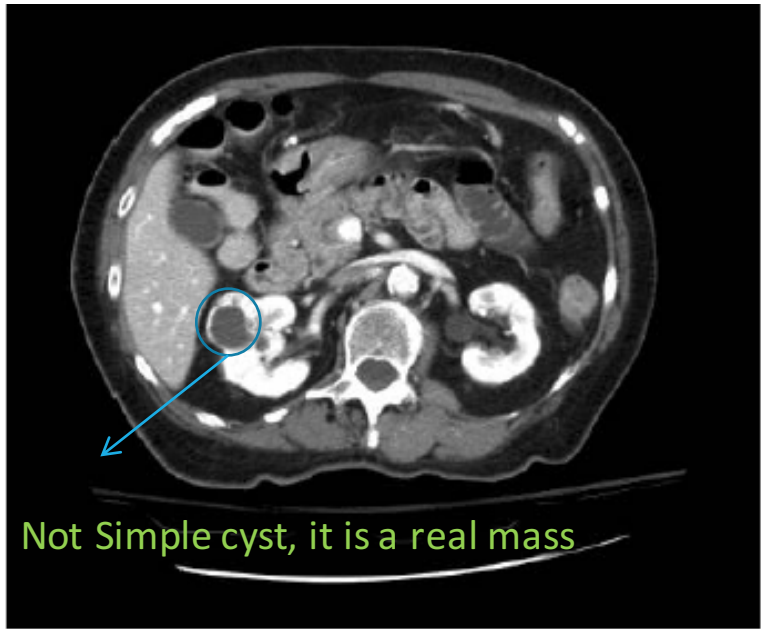
US will determine if the lesion is cystic or solid

1) Simple: spherical, echo- free fluid collection within a thin surrounding wall and will show good sound wave transmission
2) Complicated: will show the presence of echos within the cyst, will have a thick wall, and/ or show calcification in the wall



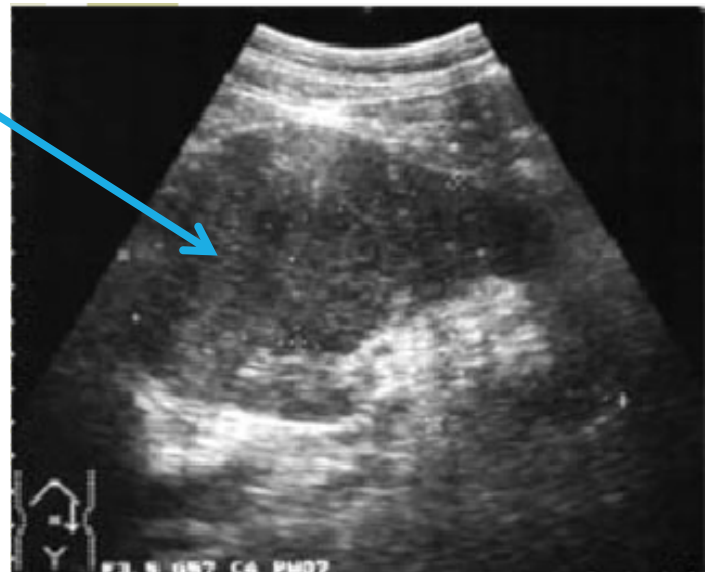
2- Renal carcinoma

If US indicate that the mass is solid, CT with IV contrast can characterize the tumor in greater detail – delineate extent. Show the degree of vascularity . Presence or absence of necrotic centre. Presence or absence of local invasion of adjacent structure.

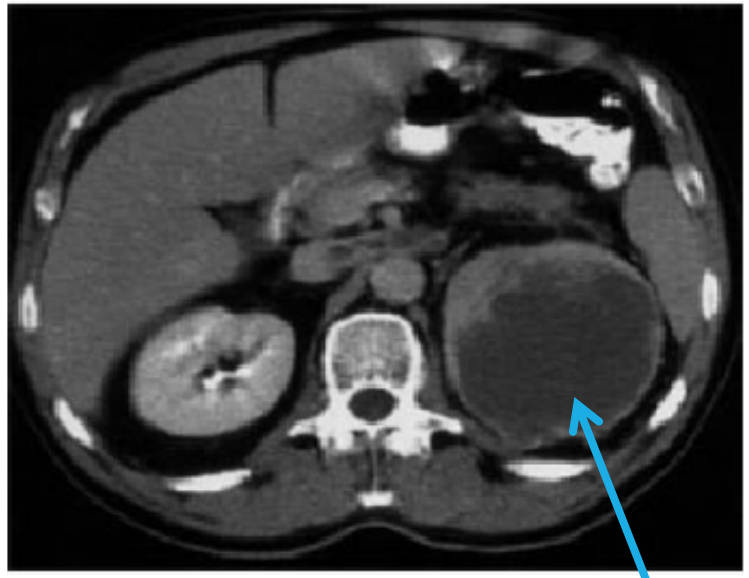


Renal Cell Carcinoma

Distortion of left pelvicalyceal system in IVP then do (US OR CT)



Solid left renal mass in a patient with micro hematuria



Renal Mass

Renal adenocarcinoma:

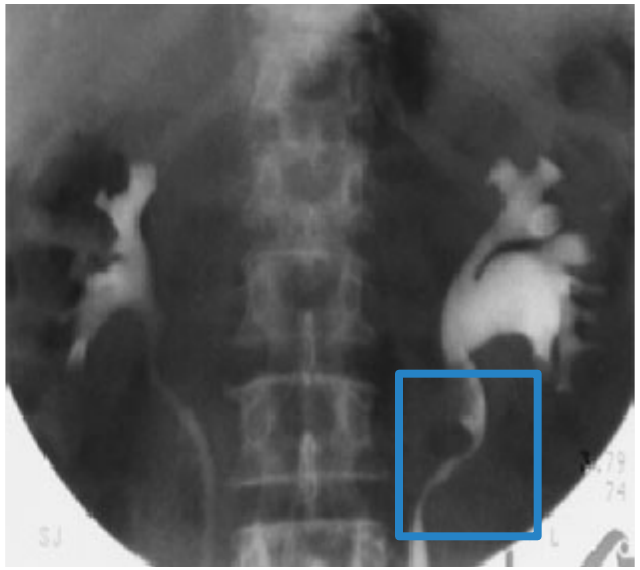
- 90% of all renal malignancies
- 15-30% metastatic at diagnosis
- Hematogenous and lymphatic spread
- 10% have venous invasion (renal vein or IVC)
- **Treatment:**
  - Radical nephrectomy
  - Partial nephrectomy
- **Appropriate imaging workup:**
  - Chest X-ray: pulmonary metastases
  - CT abdomen: local invasion, lymphadenopathy, venous extension
  - MRI abdomen: if there is renal failure, contrast allergy

Renal Angiomyolipoma:

- Benign hamartomatous tumor comprised of fat, smooth muscle and vessels
- Usually asymptomatic
- Occasionally present with hemorrhage when large or multiple
- Fat detected in 96% by CT (usually do not need surgical intervention).

Transitional Cell Carcinoma:

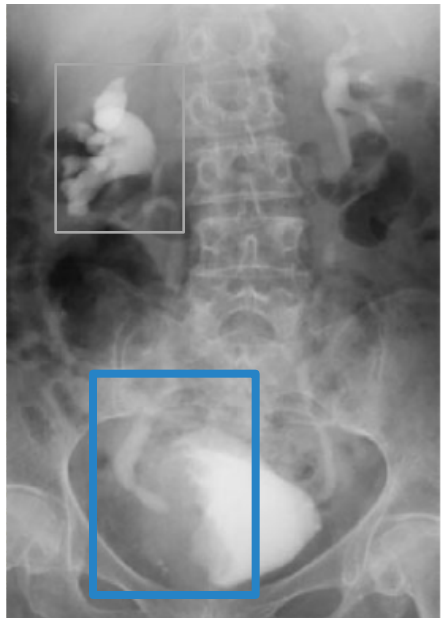
- Most common malignancy of ureter and bladder
- <10% of renal malignancies
- Typically present with gross hematuria
- CT for staging and surgical planning
- **Treatment**: radical nephrectomy



•IVP and retrograde pyelogram TCC proximal left ureter.
•Proximal left ureter show irregularity with a filling defect.

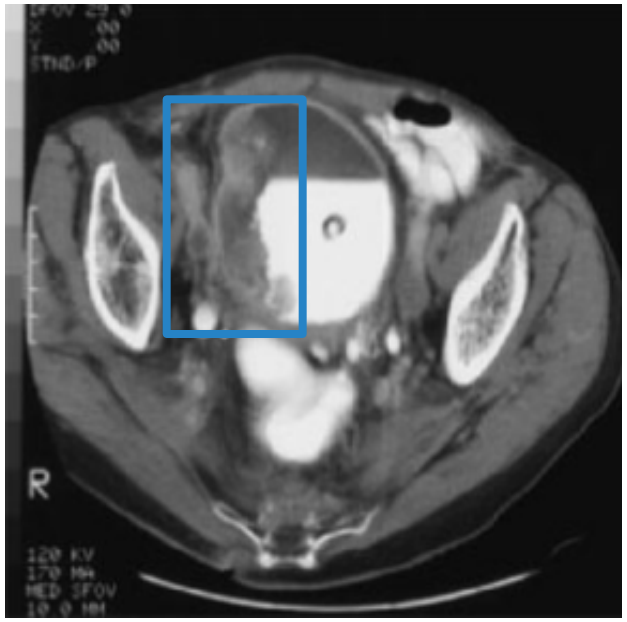
Small TCC of bladder in patient with hematuria.
Widened ureter on the left side because of bladder mass.

Transitional Cell Carcinoma: (cont.)



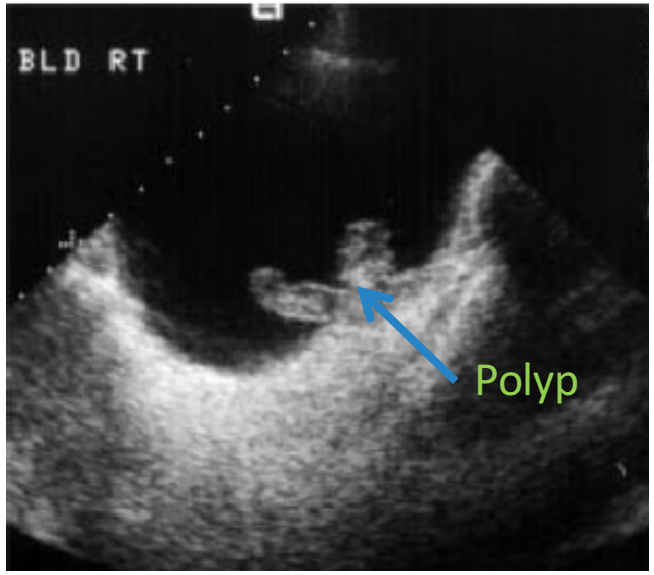
IVP

Dilation of pelvicalyceal due to distal obstruction .



pelvic CT

thickened irregular wall in the left.
contrast and urine are not mixed together



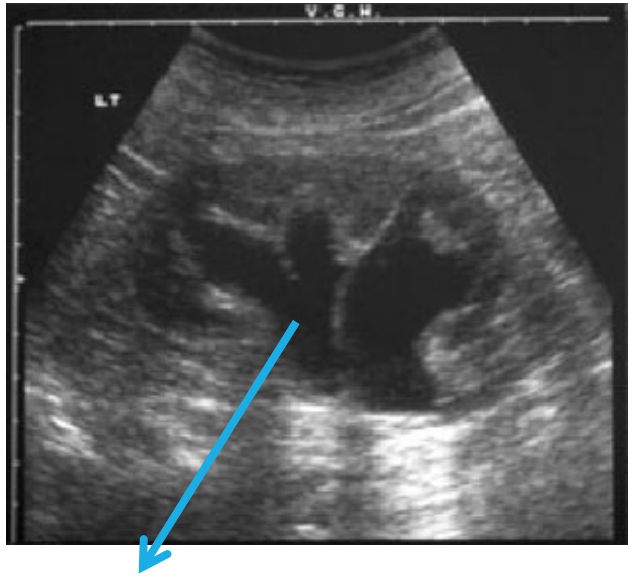
Bladder TCC in two patients

We can see large TCC occupy 1/3 of the bladder and obstructing distal right ureter.

Acute and Chronic Renal Failure

- **Clinical categories:**
  - Prerenal (dehydration, shock, cardiac failure)
  - Renal (parenchyma, diabetes, GN, drugs, renovascular)
  - Post renal (obstruction)
- IV contrast **contraindicated** if creatinine > 200 mmol/d
- **Use ultrasound to asses:**
  - Renal size
  - Parenchymal thickness
- Ultrasound guided renal biopsy to establish diagnosis

Acute	Chronic
kidney is enlarged in size	kidney is small in size
oedematous	No darkness in the cortex
obstruction	Bright echo pattern
	cysts can be seen.



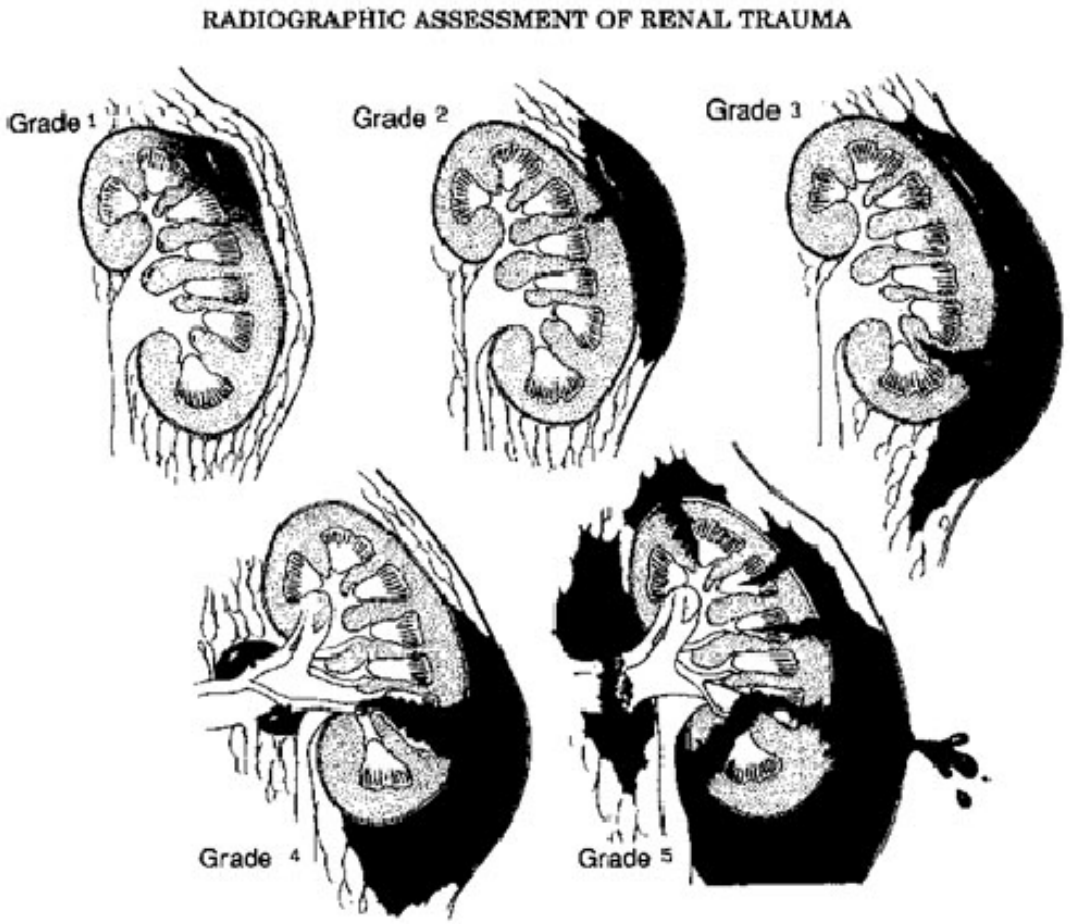
Hydronephrosis (post renal)
Acute, surgically treated

- Atrophic echogenic kidney about 5cm (normal 11cm).
- Renal parenchyma is small and white → chronic kidney disease.
- Medical renal disease (not surgical, treat underlying disease e.g. DM, HTN, glomerlunephritis, congenital dis...)

GU Trauma

Penetrating trauma (gunshot, stab)

- Unstable: Surgery or angiography to stop bleeding.
- Stable: CT (used to grade the injury)



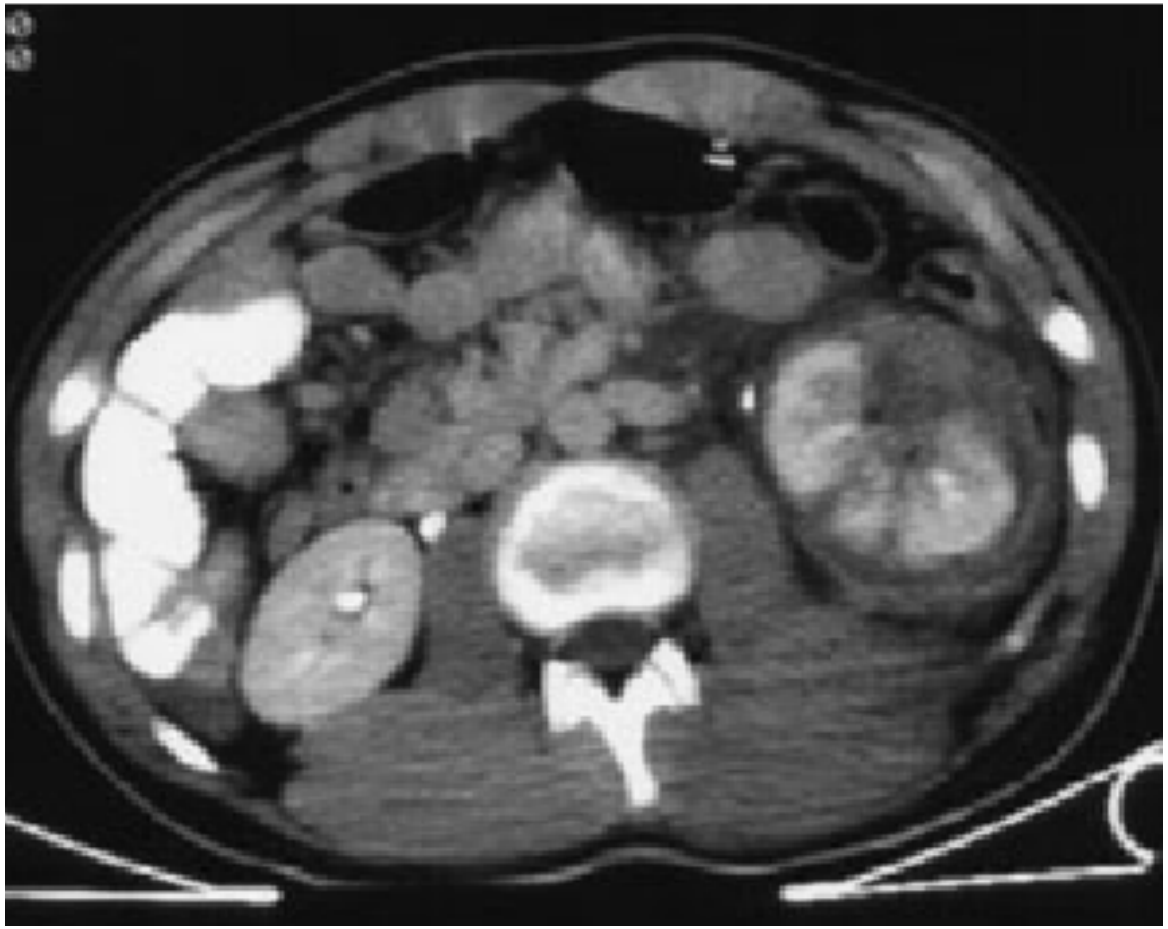
Grade 1	Hematoma
Grade 2	Hematoma enter cortex
Grade 3	Enter cortex and medulla
Grade 4	Extend to renal pelvis
Grade 5	Shattered kidney

GU Trauma (cont.)

CT

Angiogram

Grade 5 injury: thrombosed renal artery
-Worst type, shattered right kidney,
-significant hematuria,
-Left kidney is normal
-part of the renal artery can be seen.



Grade 4 injury: deep lacerations with perirenal hemorrhage

GU Trauma (cont.)

Urinary Bladder Injury: Do Cytogram

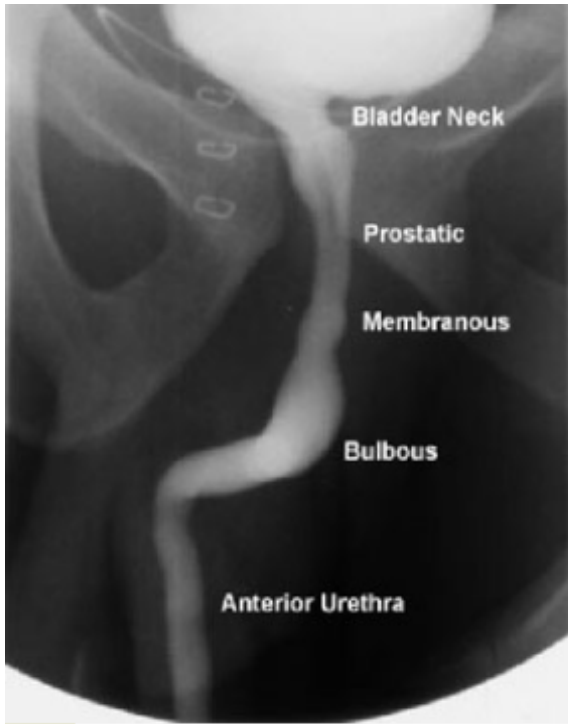
Extraperitoneal bladder rupture. contrast doesn't extend to the abdomen

Just apply catheter to drain, until the body heal the injury.

Intraperitoneal bladder rupture. contrast extends to the abdomen.

Surgical managment

Urethral Injury: Do Voiding Cysto-urethro-gram



Normal retrograde urethrogram

Traumatic rupture of bulbous urethra.

The contrast drained out of the urethra.

Thank You!

We hope you found this helpful and informative.

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