

Plain Film of the Urinary Tract = KUB

U/S is not the best study for the urinary tract but it is the most practical one, it is very good for the Kidneys especially in hydronephrosis, renal obstruction, masses & renal stones

While U/S is not useful for ureteric stones because the ureter is small, ureteric stones are small, and the ureter is covered by bowels so it cannot be seen clearly

Urinary system

US = Kid

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Interventional Radiology

Urinary tract investigation

Plain film:

- Renal calculi or calcification
- Stones in the ureters
- Bladder calcifications and calculi
- Bone abnormality or metastasis



Ultrasound of the urinary tract

- ❑ Ultrasound is one of the most valuable investigations of the urinary tract and the investigation of choice in children.
- ❑ It is very effective in evaluating renal size, masses, renal obstruction, bladder residual volume and prostatic size.

on the left side of the pic is the head of the Pt and on the right side is the feet, we can see the liver above, we can see the diaphragm and the kidney below and there is a stone and shadow

Normally, the Kidney has white color in the core which is fat surrounded by Medulla & Cortex

In Hydronephrosis, Fluid accumulates in the pelvicalyceal system so the white color of the core becomes Black

On U/S:
 White >>> Fat
 Black >>>> Fluid



In slide #5 there is a stone but no hydronephrosis so it is a nonobstructive stone

The shape of the kidney is different in slide #5 from Slide #6 why? Depending on the position of the probe

Left pic = dilatation of the calyceal system
(Hydronephrosis) Right pic = dilatation of the ureter as
well as the pelvicalyceal system due to obstruction in the
ureter below (Hydrouretronephrosis)



there is a white line seen at the left, this is the Diaphragm and the black lesion is a cyst which is very common (in 50% of people older than 50 years old)

Cyst = collection of urine

Bosnaik Classification of cysts helps to differentiate between cystic RCC and renal cyst depending on:

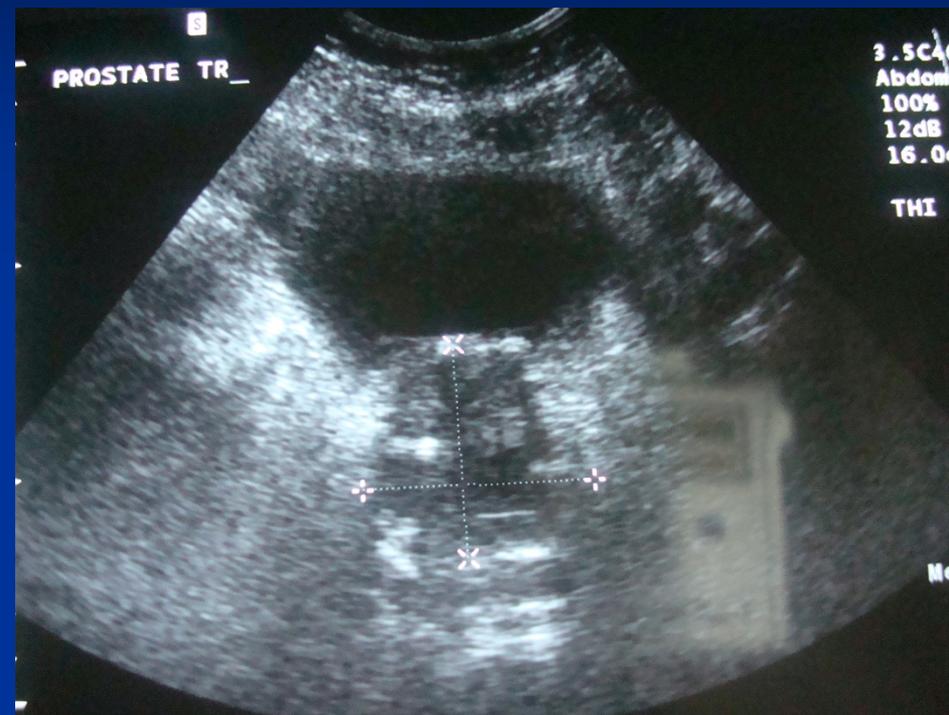
if the cyst was clear, thin wall, no septation and well-defined, this is Grade 1 no need for follow up (no risk of malignancy)

if the wall are thickened, septation, irregular with soft tissue components all indicate malignancy so follow up is needed



there is a solid echogenic mass next step is CT scan & Biopsy if CT wasn't available then biopsy





you can see the bladder (appears Dark) and on the right pic below the bladder, is an enlarged prostate Normally, prostate is hypoechoic (black) and smaller in size, but in old males, the prostate undergo dystrophic classification (becomes white) and get enlarged compressing the bladder and urethra. So what you see in the pic is residual post void volume.

CT of the urinary tract

CT is excellent modality for assessment of:

- Renal masses.
- Obstruction.
- Retroperitoneal disease.
- Staging of renal and bladder neoplasms.
- Tumor invasion into the renal vein or IVC
- Evaluation after trauma or surgery.

When should MRI be used to evaluate the kidneys ?

- ❑ When a renal mass or abscess is suspected but intravenous contrast cannot be administered, because of either contrast allergy or abnormal renal function, in this case MRI can be performed.
- ❑ Gadolinium, the contrast agent for MRI, can be safely administered in such circumstances.
- ❑ In the last few years, some studies reported that gadolinium might cause nephrogenic systemic fibrosis in patients with renal failure.

CT scan helps to detect invasion of renal vein or IVC. What is the importance of this? if there is invasion then the Pt is non-operable (Stage 4 RCC)

MRI the contrast is called Gadolinium Which is safer gadolinium or NICM ??? it depends... if the Pt has complete renal failure , give NICM and then he can do Dialysis, in this case, giving gadolinium will cause nephrogenic systemic fibrosis. So gadolinium is contraindicated in complete RF But if the Pt has abnormal kidney function (renal impairment) then gadolinium is safer than NICM Depending on GFR, to give NICM, GFR should be > 60 and to give gadolinium, GFR should be > 30

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بالجسم ما بطلع
بالغسيل, اما الثاني
بطلع

Urinary tract calculi

- ❑ The majority of renal stones are composed of **calcium** (about 90 %) and are visible on **plain film (radio-opaque)** .
- ❑ Stones composed of **uric acid** are not visible on plain film (**radiolucent**) .
- ❑ Stones composed of **cystine** are minimally dense on plain film (**semi-opaque**) .

Urinary tract calculi /2

What is the initial imaging test usually ordered to find urinary tract stones ?

- ✓ Plain radiograph (KUB), because the majority of stones are radio-opaque
- ✓ Other calcifications may be confused with urinary tract stones such as a **phlebolith** in the pelvis , which is a venous calcification , often with a lucent center .

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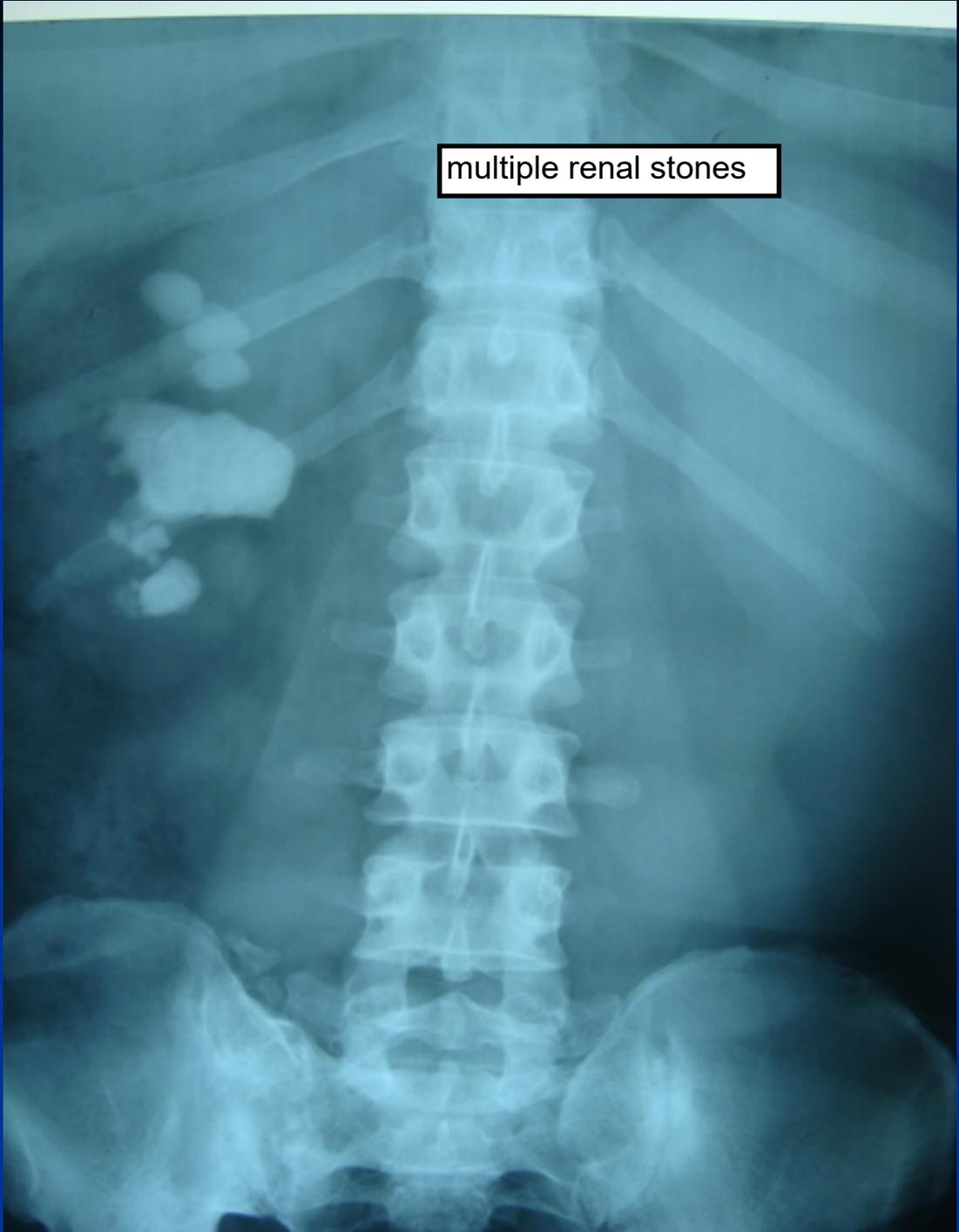
KUB, if you saw a stone on KUB, next step is U/S to check if it is obstructing or not (even though CT is better but U/S is less harmful to the Pt and cheap)



R

IVU for the same Pt in slide #14 but now the stone cannot be seen due to the contrast (both are white), here the stone is in the lumen not in the wall. When do radiopaque renal stones appear as a filling defect in contrast???

When they are in the wall of the structure (kidneys, bladder,.....) while radiolucent stones appear on X-ray with contrast



multiple renal stones

multiple renal stones



uteric stone





Intravenous urography (IVU)

Intravenous pyelography (IVP)

Is a radiological procedure used to visualize abnormalities of the urinary system, including the kidneys, ureters, and bladder by using intravenous contrast.

Indication:

- ❖ Haematuria
- ❖ Renal colic or calculi
- ❖ Suspected stone in the ureters
- ❖ Renal trauma

is KUB + IV contrast

IVU need to prepare the Pt one day before the procedure by giving Laxative (Castor Oil) to empty his/her bowel so that renal system would appear clearly

IVU /continuation

- After a preliminary control film of the abdomen, ~~50 ml~~ of contrast medium is injected intravenously.
- Contrast is excreted by glomerular filtration.
- **Films after 5, 10, and 15 minutes** are taken and reveal contrast in the pelvi-calyceal systems, ureters, and in the bladder.
- Post-micturition film is taken to assess bladder residual volume.
- Renal obstruction may require a delayed films.

The Dose of the contrast : 1 cc/kg for adults 1.5 cc/kg for infants but up to 100 cc (maximum upper limit) example 70 kg adult = give 70 cc 90 Kg adult = give 90 cc 110 Kg adult = give 100 cc

IVU Technique the Pt lie supine and first do KUB before giving the contrast, then give the contrast and take an image immediately (this is only to see the kidneys shadow (perfusion) excretion of the contrast has not started yet) then you should take an image every 5 min but the standard is 5 min, 10 min, 15 min finally after micturition take an image to check the bladder residual volume

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CONTROL

Scale 99%
W 17
C 22

نفس الحجم هيك بتميز

control film
taken before
administration
of the contrast

Peristalsis

17
1000
02
00001
KAD 01 #1



normal IVU : Areas of constrictions in the ureter with no contrast are normal (caused by peristalsis) and not actual narrowing or stone because you can see the ureter below it and the ureter above it is not dilated





multiple urinary bladder stones appear as a filling defect



bladder stones
+ diverticulum



Micturating cystogram (MCUG)

- ❖ Is the study of the urinary bladder and urethra with contrast medium.
- ❖ The bladder is filled with contrast via a urethral catheter. Films of the bladder are obtained.
- ❖ After removal of the catheter, patient is asked to void and films are taken during micturation to assess the bladder neck and urethra, as well as reflux. study of refluxes (have many grades)
- ❖ Examination of the urethra in **oblique position** is necessary, particularly in suspected posterior urethral valves in infants and small children, as they are usually only demonstrated during micturation.



CONTROL



to determine if it is IVU or MCUG you should ask the question “ did the Pt have his right kidney removed?”
if yes = IVU if no = MCUG with left ureteric reflux



8:51:19 AM



V: 75
As: 1
: 50

kV: 75
H: 0 % mAs: 0.6
F: 30 % D: 50

Urethrogram

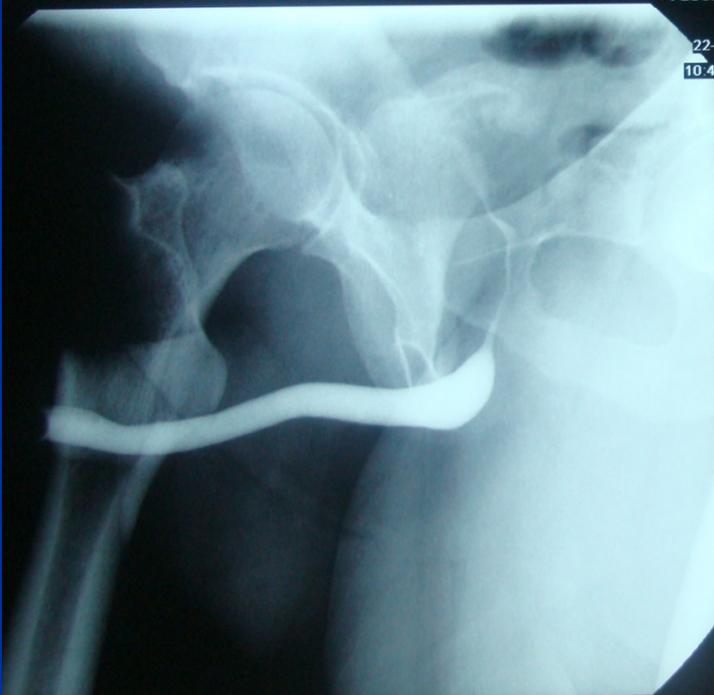
- ❑ The **adult male urethra** can be studied by ascending urethrogram.
- ❑ Contrast is injected through foley catheter inserted into the meatus, and its balloon inflated with 1 to 2ml of sterile water placed in the navicular fossa.
- ❑ Films are taken to the urethra in **oblique position** during contrast injection.
- ❑ The most common indication for urethrogram is **urethral strictures**.

Urethrogram: study Male urethra (because diseases mostly affect the male urethra since female urethra is short) in the west, the cause of urethral strictures is usually STD in our communities, it is usually instrumentation Parts of the male urethra: Penile, bulbar (both form the anterior urethra) , prostatic , membranous (both form the posterior urethra)

MAJED

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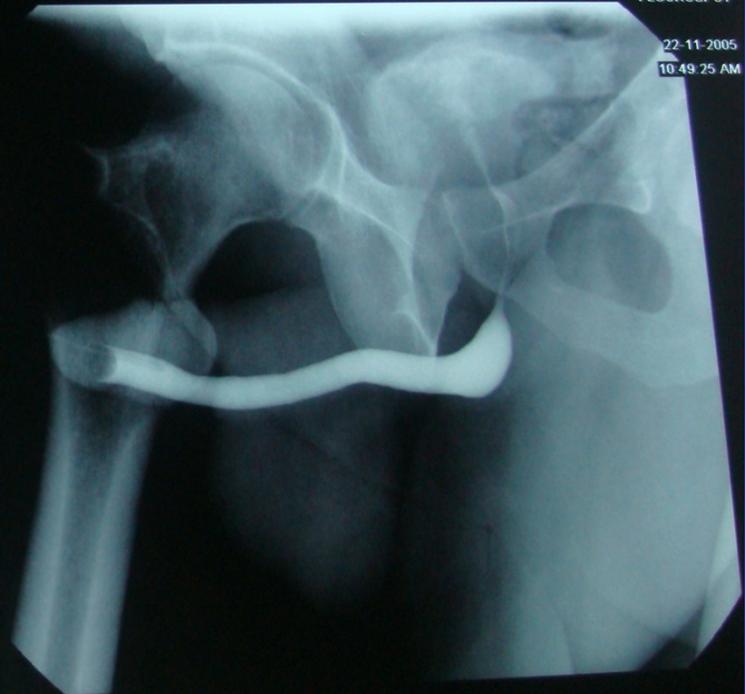
H: 0 %
F: 30 %
C: 700
B: 306

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kV: 81
mAs: 5.2
D: 50

4

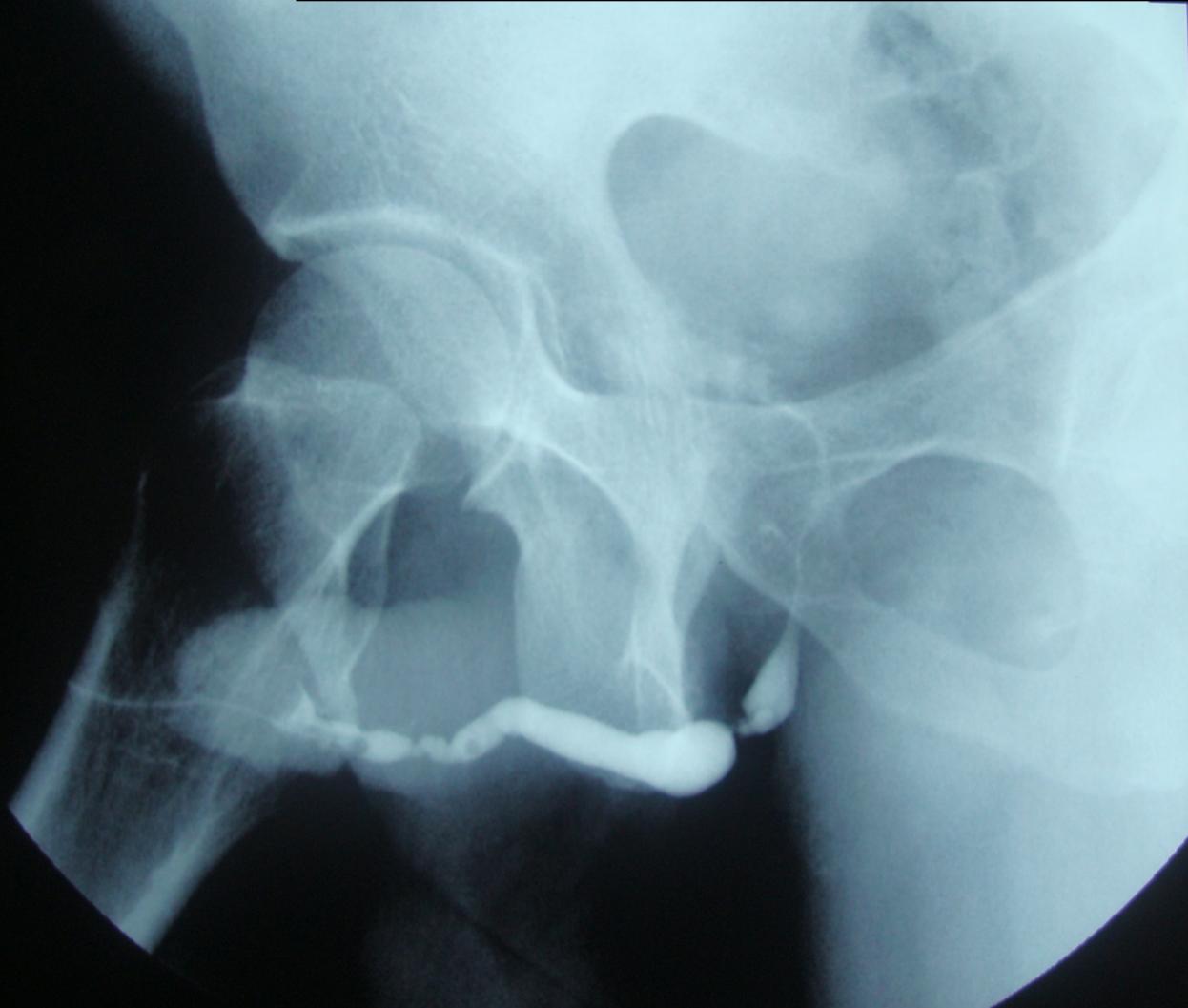
narrowing of the urethra (stricture) The only stones not visible on CT scan or any other imaging modality are stones caused by anti-HIV drug called Indinavir

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81
As: 2.6
50

H: 30 %
F: 30 %

narrowing of the urethra (stricture) The only stones not visible on CT scan or any other imaging modality are stones caused by anti-HIV drug called Indinavir



kV: 81
mAs: 6.5
D: 50

H: 0 %
F: 30 %
C: 810

sensitive, initial, most common

Urinary tract stones and CT

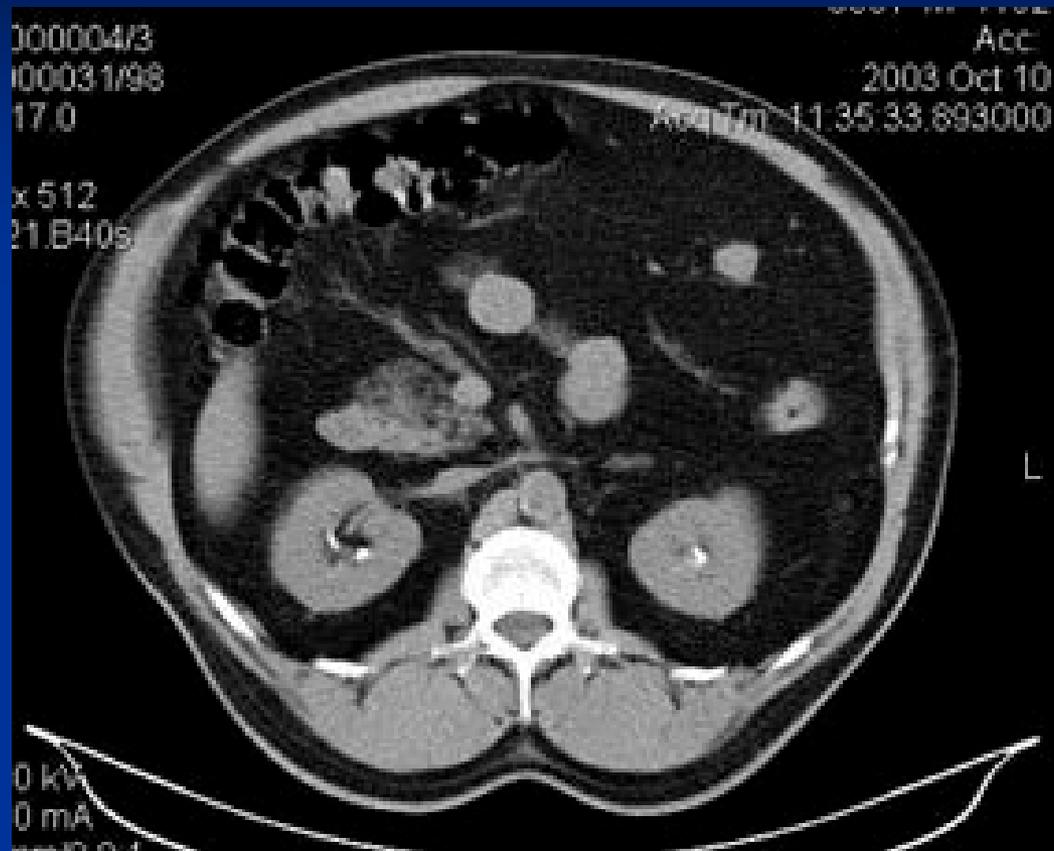
What is the most sensitive radiological test for urinary tract stone ?

CT , performed without intravenous contrast, is highly sensitive for detecting urinary tract stone.

initial > x-ray

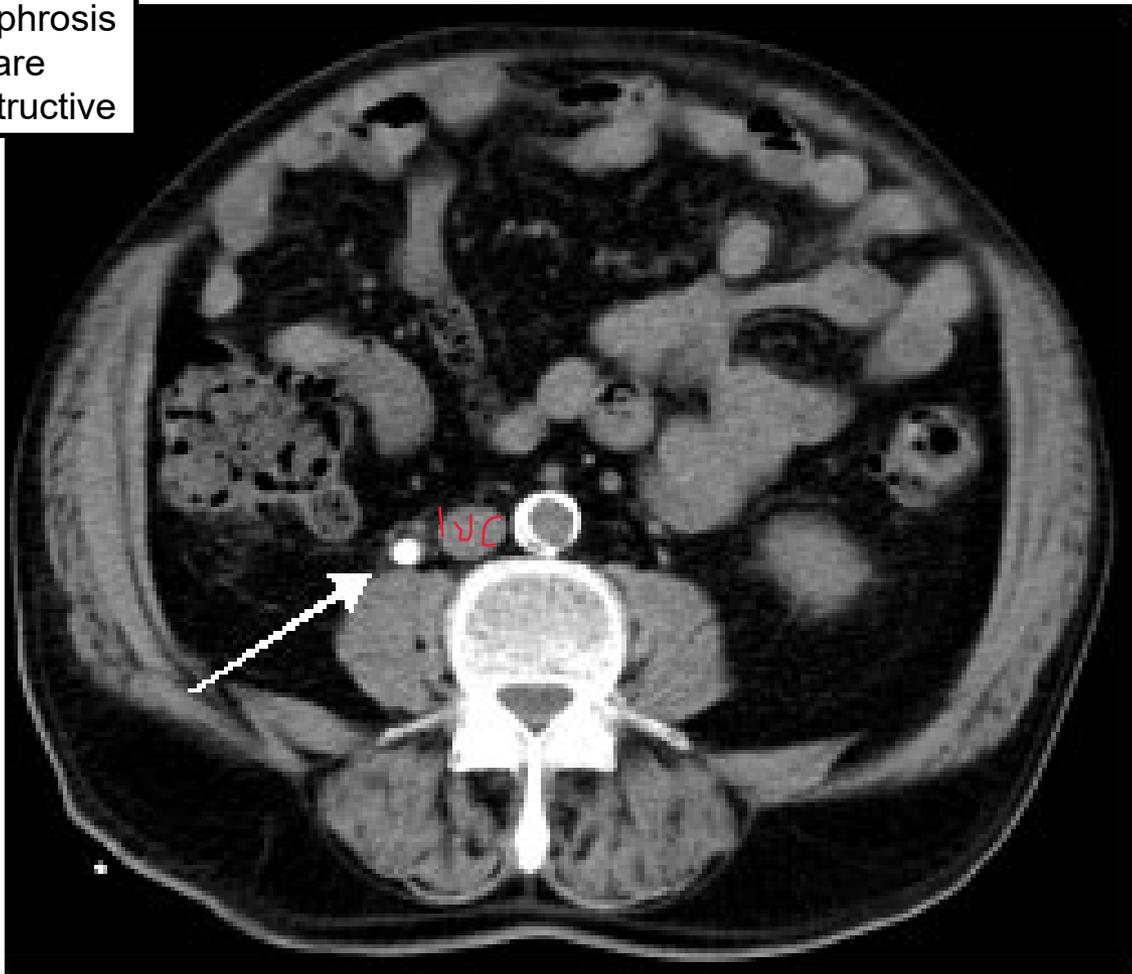
Are any urinary tract stones radiolucent on CT ?

No , virtually all urinary tract stones , regardless of their composition are visible on CT .



renal stones, no hydronephrosis so they are non-obstructive

uteric stone on
the right, no
hydronephrosis
so they are
non-obstructive



URINARY OBSTRUCTION

- ❖ Obstruction of the renal tract may occur at many sites.
- ❖ The most common causes are:
 - Urinary tract stones.
 - Urinary tract strictures.
 - Urinary tract tumors. -
 - Prostatic hypertrophy or cancer. -

Urinary Obstruction Hydronephrosis:
can damage the kidneys but kidneys can withstand 6-10 hrs before the damage starts How can we know when did the obstruction start? it causes very very sever pain, the Pt will come directly to the hospital, renal stone pain is worse than labor pain

Urinary obstruction / 2

Why is it important to recognize renal obstruction ?

Because over time, obstructed kidneys may lose function permanently.

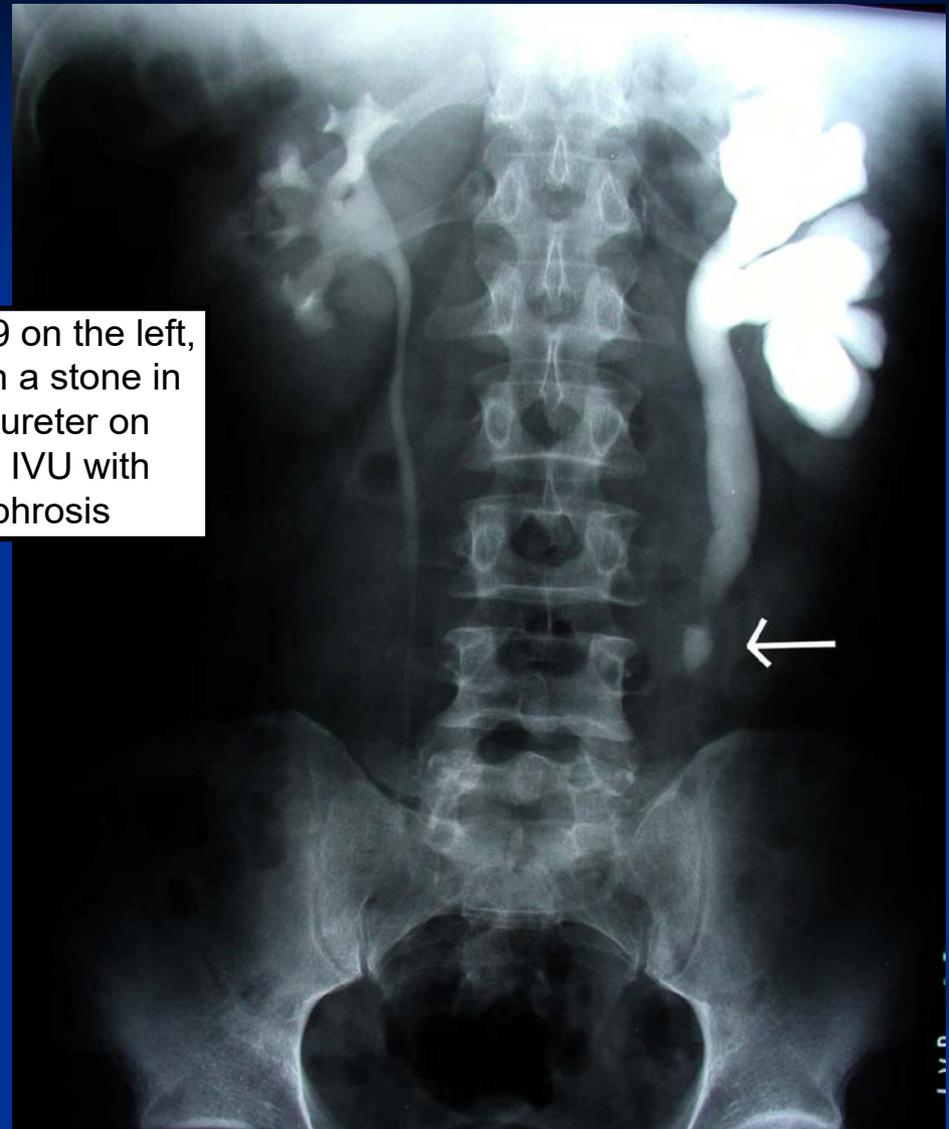
renal stones worst pain ever, so he will go immediately to hospital we give analgesia

What is the best initial imaging test for suspected renal obstruction ?

Ultrasound. It is relatively inexpensive, safe, and effective. The cause of obstruction also may be identified.



Slide #39 on the left,
KUB with a stone in
the right ureter on
the right, IVU with
hydronephrosis







Benign renal lesions

What is the most common renal mass ?

The most common mass is a simple cyst.

- They are more common in older patients and are found in approximately 50% of the population over 50 years of age.
- They are usually cortical in position and an incidental finding.

Benign renal lesions /2

What is the best way to confirm that a renal mass is a simple cyst ?

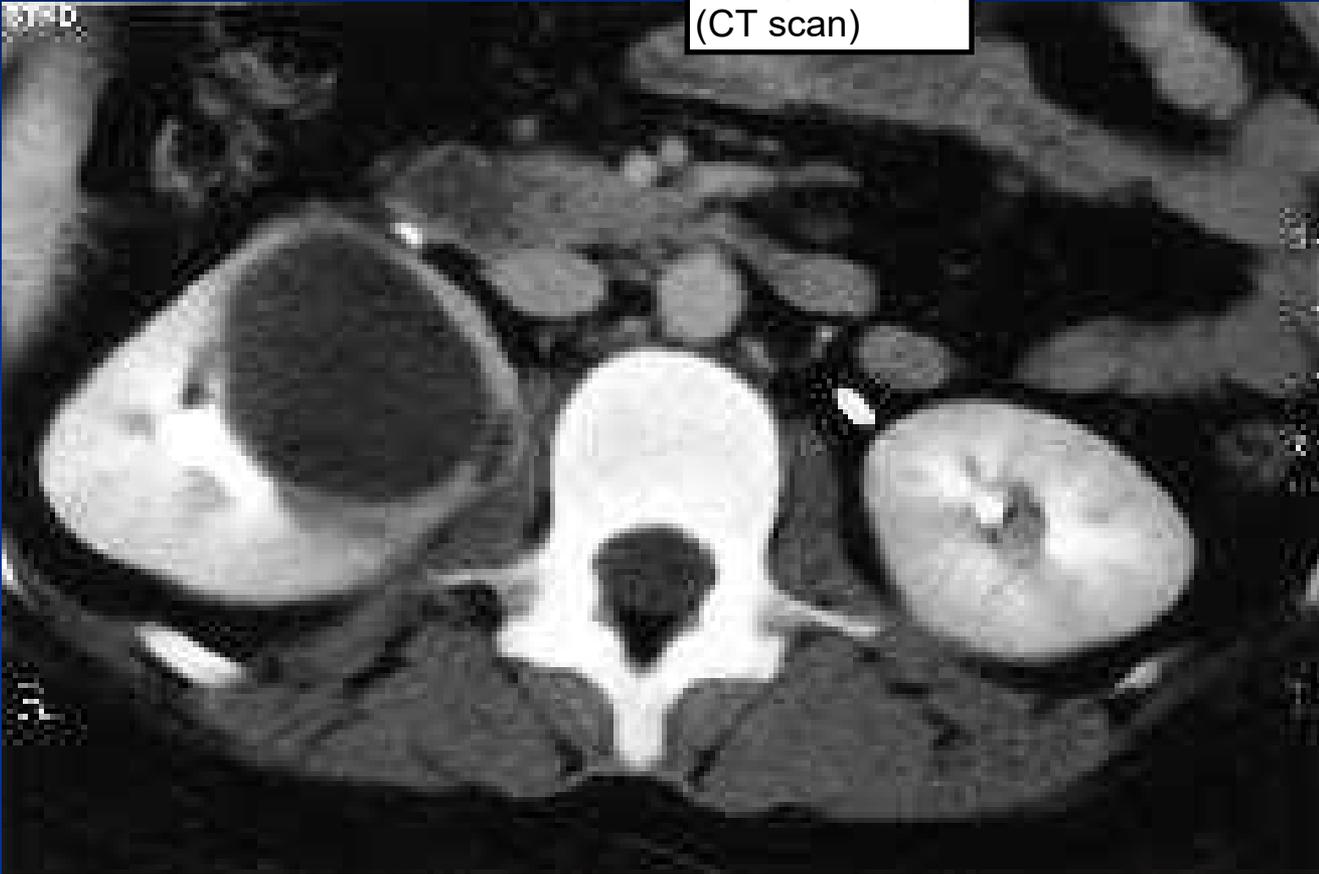
Ultrasound.

- ❑ The ultrasound appearance of a simple cyst is that of a well-defined round mass with very thin wall, smooth margin and no internal echoes.



Slide #44 U/S showing benign simple cyst; well-defined, not septated, thin wall

simple cyst on
the right kidney
(CT scan)



Polycystic kidneys disease

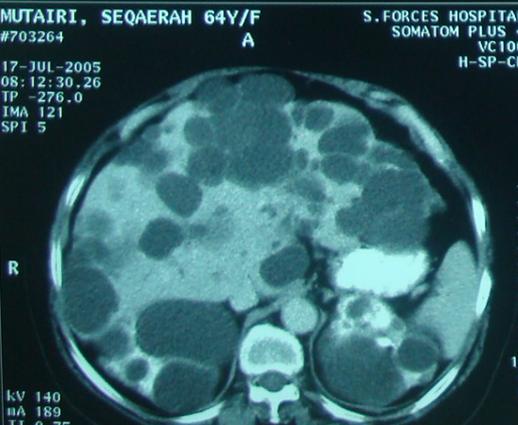
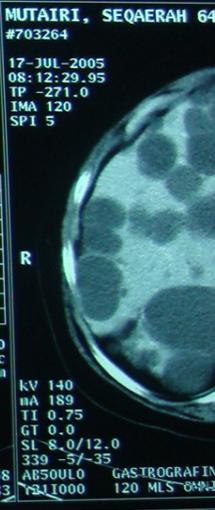
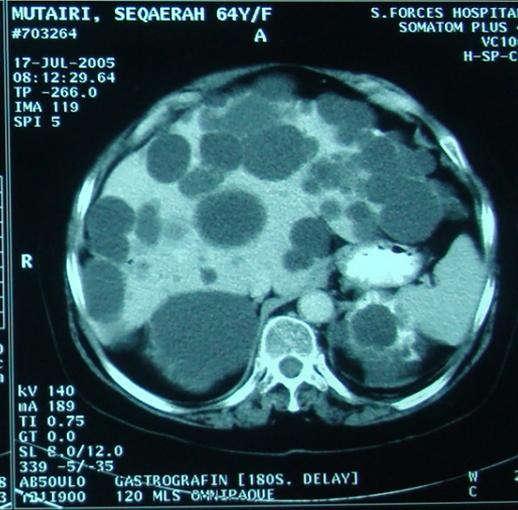
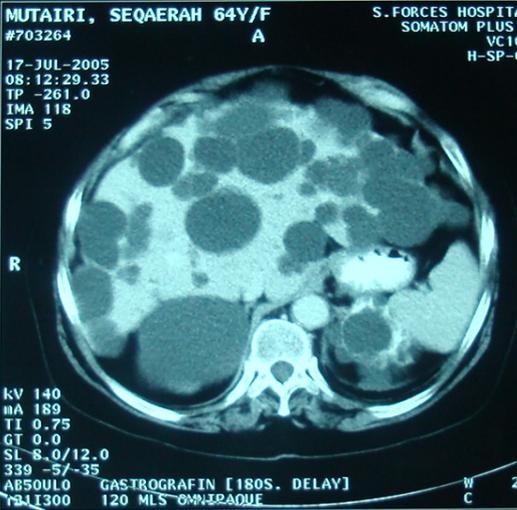
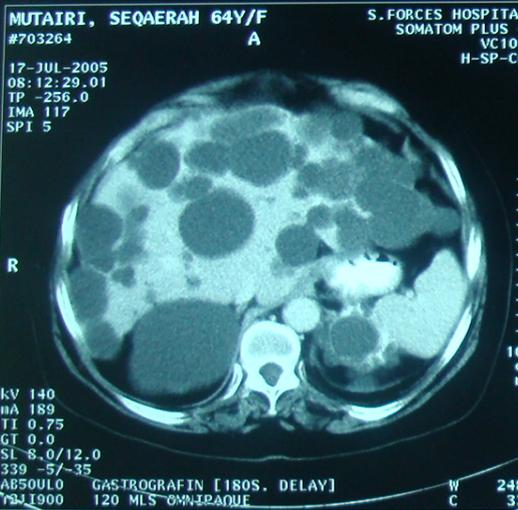
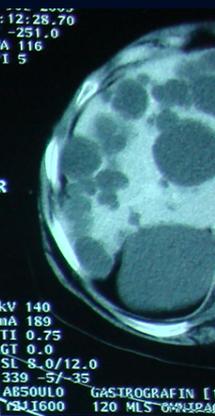
- Adult polycystic kidney disease is a congenital renal parenchymal disorder.
- Usually both kidneys are involved.
- In some cases, there is associated cysts in the liver and more rarely in the spleen and pancreas.

Polycystic Kidney Disease:
multiple cysts in both kidneys, but can also affect the liver, spleen and pancreas How to differentiate them from hydatid cysts?? hydatid cysts are calcified with “water lily Sign”

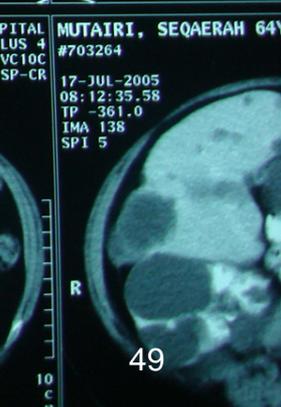
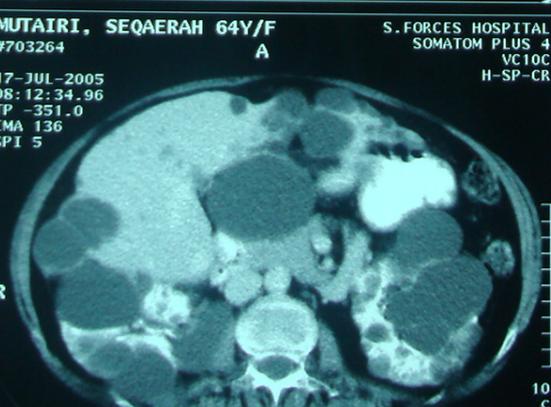
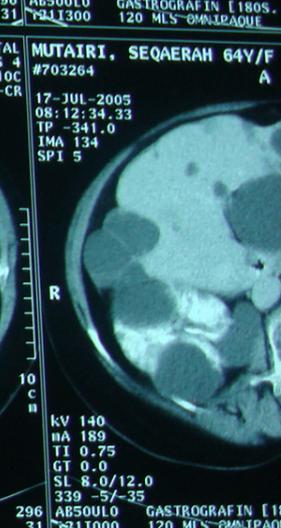
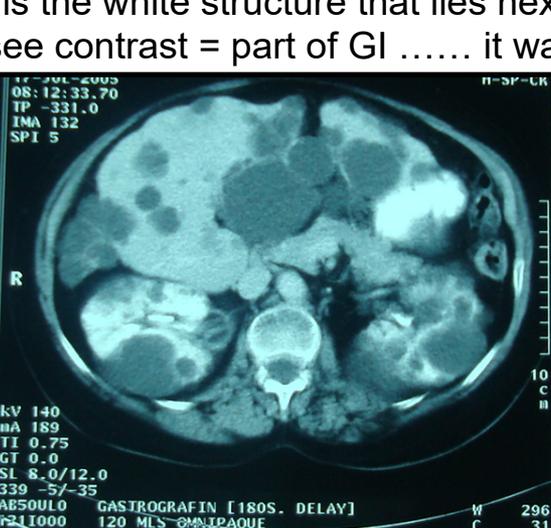
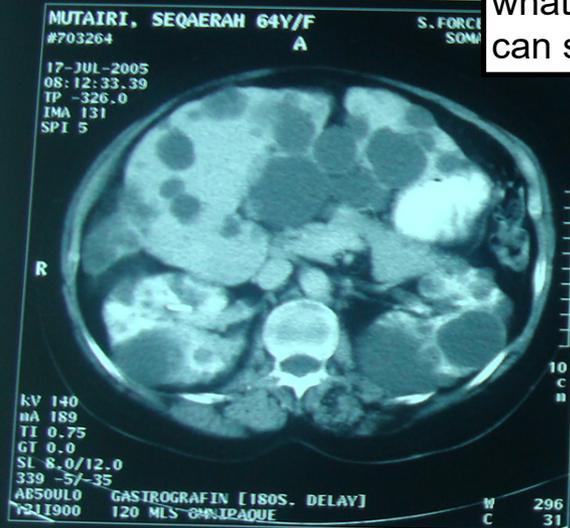
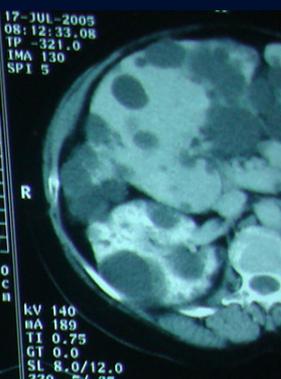
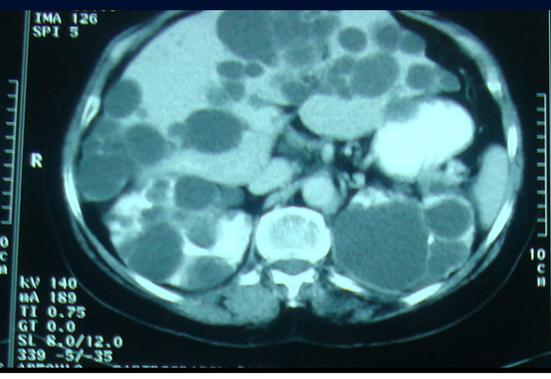
Polycystic kidney disease / 2

Radiological features on Ultrasound and CT:

- Kidneys are enlarged with lobulated contours.
- The renal parenchyma is replaced by multiple cysts of varying size, causing distortion of the collecting system.
- Spontaneous hemorrhage into some of the cysts may occur.



what is the white structure that lies next to the liver? since we can see contrast = part of GI it was the stomach



Malignant renal tumors

Malignant Renal Tumors

1- Renal Cell Carcinoma 1/3-1/2 of cases are associated with Von Hippel Lindau disease

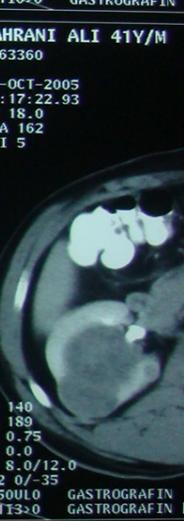
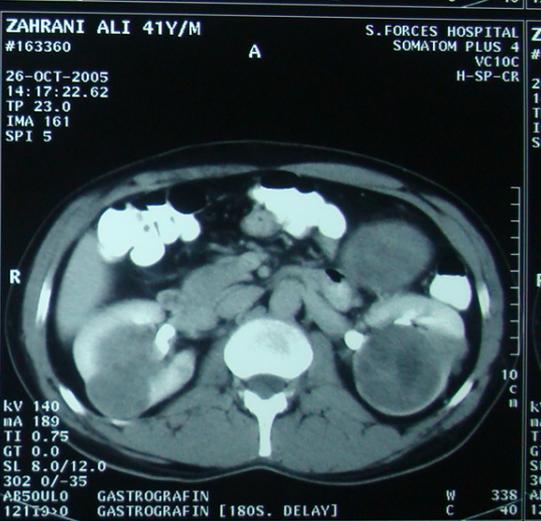
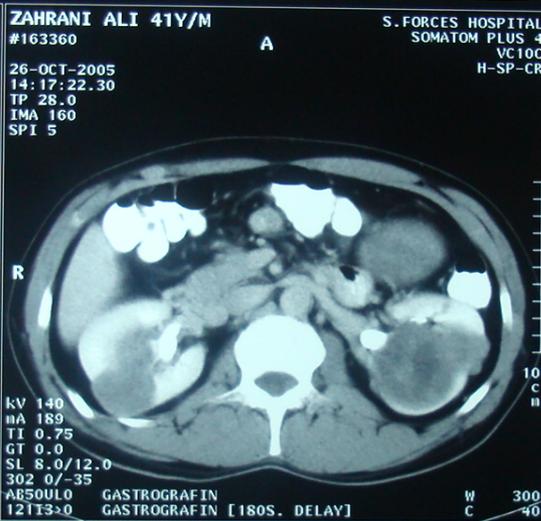
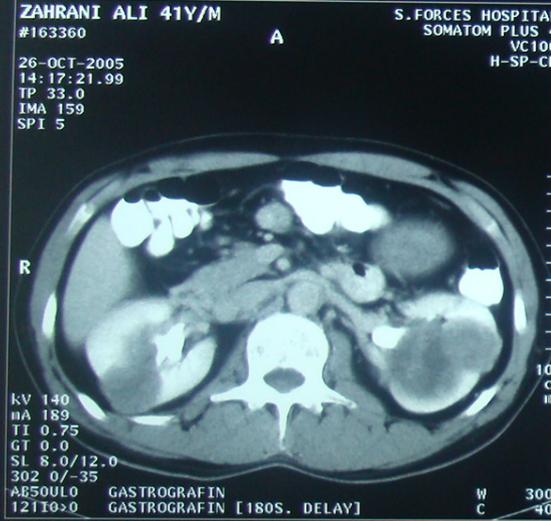
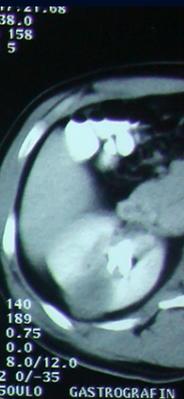
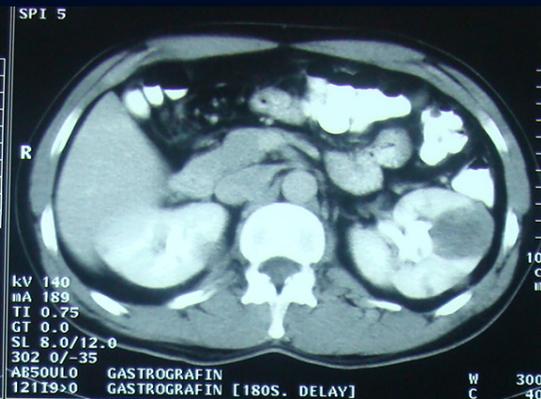
2- Transitional Cell Carcinoma

- Renal cell carcinomas (RCC) or Hypernephroma: account for 85% of renal tumors.
 - ❖ Are bilateral in 4% of cases.
 - ❖ Von Hippel- Lindau disease is associated with RCC in one third to one half of patients.
 - ❖ Patients with polycystic kidney disease and chronic renal failure may also be associated with RCC.
- Transitional cell carcinoma: are relatively rare and represent 7% of all renal tumors.



tumor
invasion to
renal vein

in the lower pic in the right, there is renal
vein invasion = non-operable



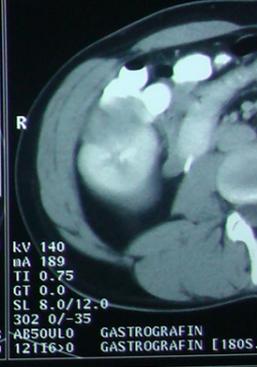


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TP -7.0
IMA 167
SPI 5

ZAHRANI ALI 41Y/M
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14:17:24.81
TP -12.0
IMA 168
SPI 5

ZAHRANI ALI 41Y/M
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26-OCT-2005
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TP -17.0
IMA 169
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TP -22.0
IMA 170
SPI 5



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IMA 171
SPI 5

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IMA 172
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IMA 173
SPI 5

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TP -47.0
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SPI 5



film from IVU study
(hint: contrast)
describe the finding: filling defect in the bladder most likely to be stone, tumor

how to differentiate, we move the pt, stone will move, while the tumor will not



A scenic landscape featuring a large body of water in the foreground, a dense forest of evergreen trees in the middle ground, and a range of snow-capped mountains in the background. The scene is framed by dark evergreen branches on the left and right sides. The text "Thank You" is overlaid in the center in a red, rounded font with a white outline.

Thank
You