# * GUT

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DONE BY ☺

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TO all my love brothers and sisters

* In this file I used the outlines from the doctors slides and used my ( and also my friends ) personal notes and text books to try to cover the subjects as good as possible .

* Sorry I don't hold responsibility for any missing information or perhaps – I say perhaps – wrong material. ***I swear the Gad*** that I tried my best to present this lecture in the best way and I hope that what I wrote in enough to cover the subject .

★ شكرا خاص للدكتور محمد الشرقاوي على مساعدته لي .. ومراجعته واعتماده للنوتات وحذف الغير مطلوب من نص وصور.

* شكر خاص لزميلي خالد العودان على كتابة نوتاته

اخوكم .. عبد العزيز السعد ☺ dr.zee zu
(rad Gp)

# * BASIC ANATOMY

- GENITO-URINARY SYSTEM
  - KIDNEYS
  - URETERS
  - URINARY BLADDER
- SUPRARENAL GLANDS
- MALE GENITAL SYSTEM
  - TESTICLES
- FEMALE GENITAL SYSTEM
  - UTERUS, FALLOPIAN TUBES AND OVARIES.

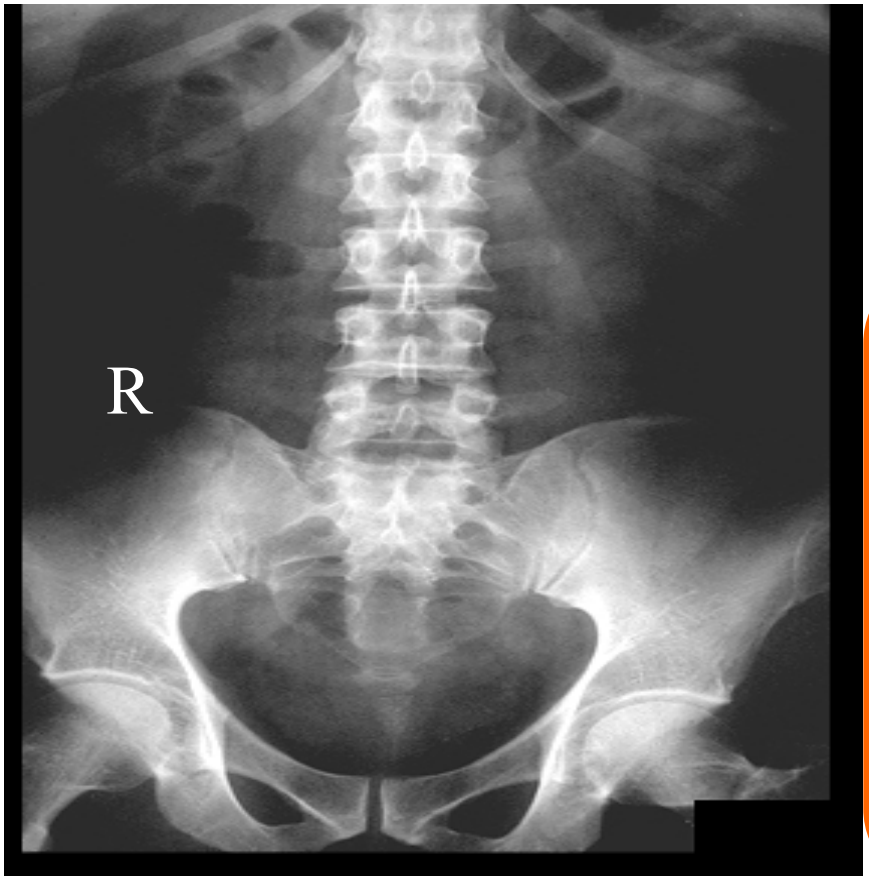
☒ THE KIDNEYS are retroperitoneal organs that function in electrolyte homeostasis and waste excretion, emptying medially into the ureters, which course inferiorly into the pelvis and enter the urinary bladder, where the urine is temporarily stored until it is cleared to the exterior through the urethra. The adrenal, or suprarenal glands are related to the kidneys more by proximity than function, producing steroids (cortex) and catecholamine (medulla).

# * GU Investigation

- **Ionizing radiation**
  - Plain film (KUB)
  - IVU(IVP)
  - CT scan
  - Isotopic scan
  - Angiography
- **Nonionizing Radiation**
  - Ultrasound
  - MRI

# * KUB

- Conventional plain film of the ***urinary tract*** called a KUB (Kidneys, Ureters, Bladder)



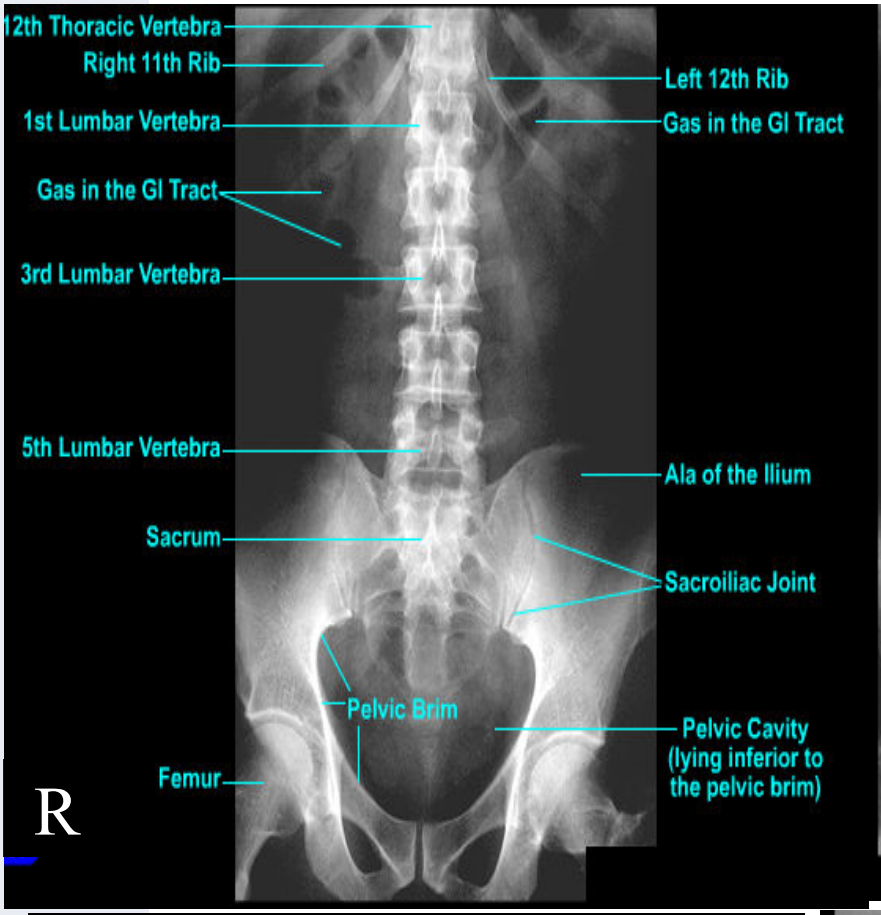

**Note**

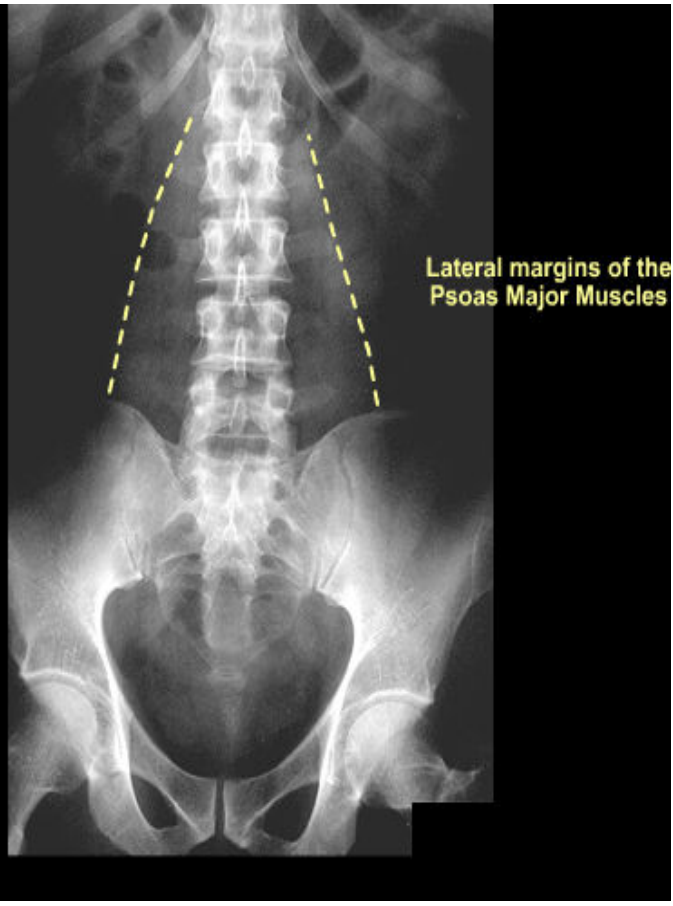
**Supradrenal glands are NOT part of the GUT but for the close relation we include them in the image reading .**

**Note**

**When looking at a GUT film, we shouldn't forget that we're looking at an abdominal X-ray & identify pathologies there too e.g.**
**1- an enlarged Psoas muscle +kidney enlargement -> mostly->renal TB, Spine TB**
**2- also lesion in the spine + lesion in the kidney -> renal TB ,spine TB**
**3- Osteoporosis , pts with renal failure may have it , so look for abnormal bone density..**

# * PLAIN FILM (KUB)



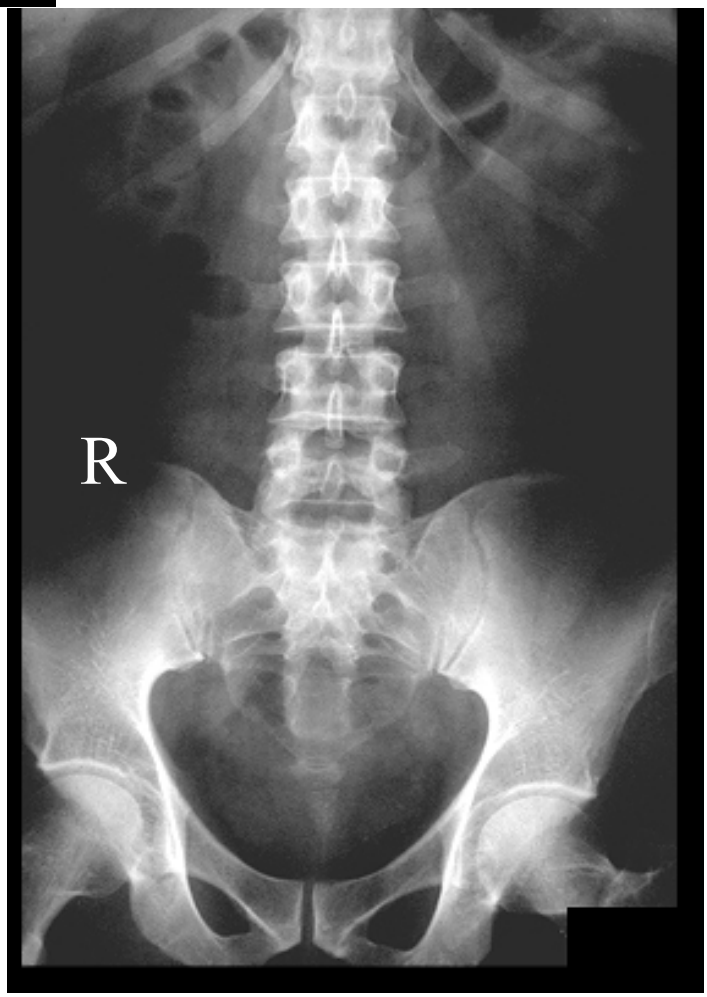




Plain film, AP view of the abdomen. Note:

1) The bony landmarks in the film. The lumbar vertebrae and ala (wings) of the ilium contribute to the walls of the abdomen.

2) Portions of the gastrointestinal tract are evident by their natural gas content.

3) The lateral borders of the large psoas major muscles, which contribute to the posterior abdominal wall.




## Note

*** Basic anatomy :KUB يعني اللي تقدر تشوفها بـ**
**- Kidney shadows**
**- Ureter calculi**
**- Urinary bladder m if there is any calcification or calculi**
**- bony landmarks**

# * RADIOOPAQUE

## Basic Terminology

Radiopaque - not readily penetrable by radiation and thus causing significant attenuation, which in turn results in an image on exposed film that is toward the white (light) end of the spectrum. Bone is among the most radiopaque structures. (synonym = radiodense)

Radiopaque bones of the hand.

MCQ : the radiolucens is air

**Note**

**In X-ray and CT :**
**Radiolucent -> allow X-ray to pass ->black in color -> e.g. air , cartilage, soft tissue**
**Radiopaque -> don't allow X-ray to pass -> white in color -> e.g. bone**
**In US: hyperechoic-->white e.g. fat , stone**
**hypoechoic --> black e.g. fluid ( echolucent )**
**So If the stone does not appear in x-ray so try the US**
**In the plain film we can only look at the organ's shadow not the organs themselves**

# * INTRAVENOUS UROGRAM (PYELOGRAM) (IVP

Intravenous urogram is for kidney , ureter & bladder(all the UT) , also called an intra venous pyelogram (IVP) is for kidney & ureter .

## DESCRIPTION :

- 50-100 ml of contrast is injected intravenously . A molecule of the contrast contains iodine (often 3 atoms ) and has a molecular weight of around 800 . Glomeruli allow molecules of this size to be freely fileered . it isnot reabsorbed or secreted by the collecting tublules . it does , however, become more concentrated because water is reabsorbed .the contrast fills the nephrons to give a nephrogram and later passes into the pelvicalyceal systems , ureters, and bladder to complete the urogram .

## PREPARATION :

- A bowel prep.is sometimes useful ; fluids are better not restricted .

## ADVANTAGES :

- Some clinicians feel comfortable seeing the whole urinary tract on a single film .

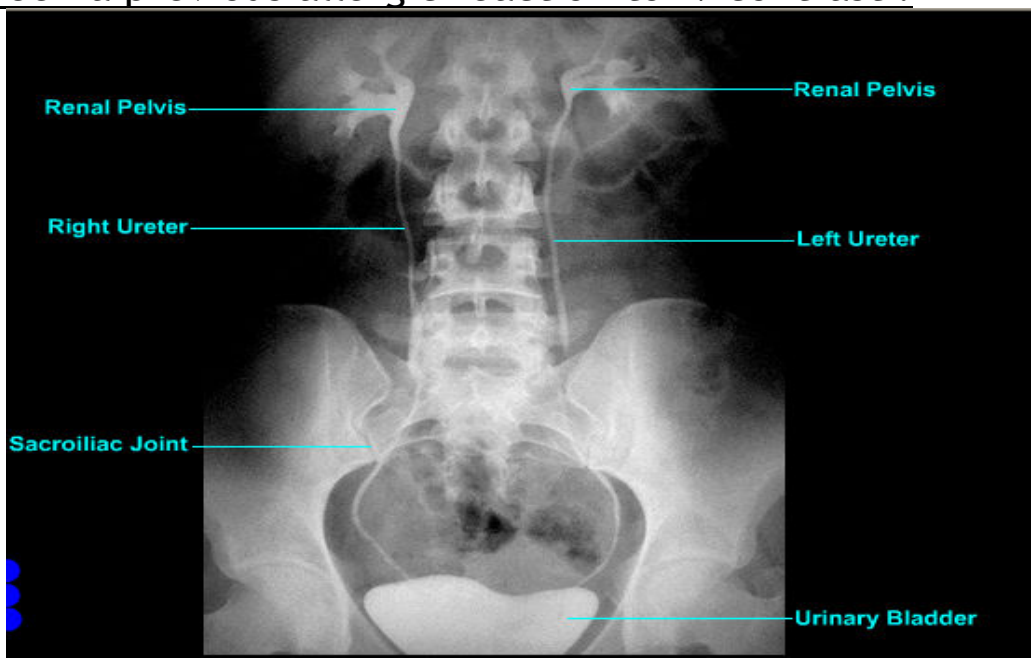
## DISADVANTAGES:

- you may need to wait up to 24 hours for the contrast to show the site of obstraction .

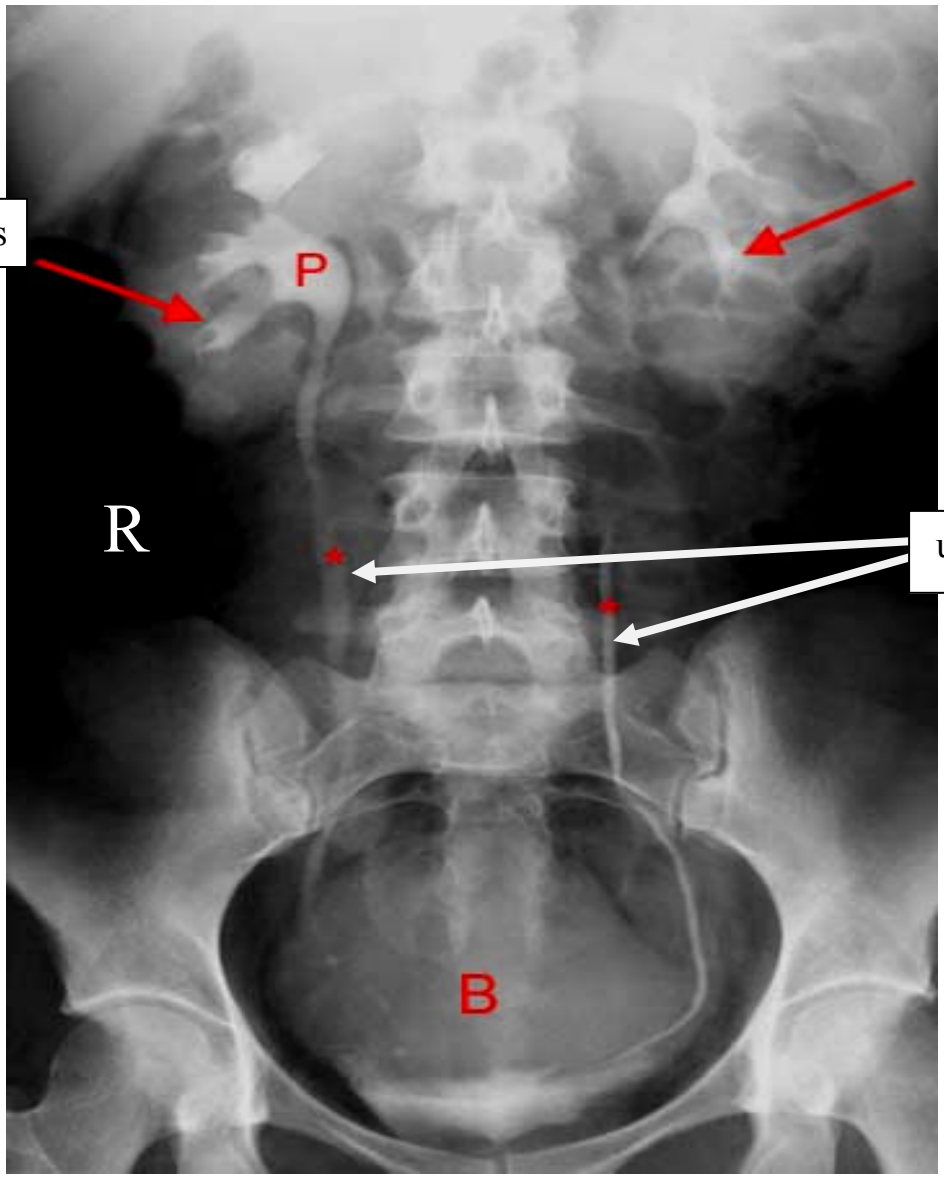
## CONTRAINDICATION : ( MCQ)

-If there has been a previous allergic reaction to IV contrast .
- renal failure
- pregnancy

So we use US



# * Intravenous urogram (IVU)




This is a normal excretory phase of an IVU (intravenous urogram). This film was taken approximately 10 minutes **following IV injection of iodinated contrast** material . The kidneys are excreting contrast into non dilated calyces (arrows), renal pelvis (p), ureters (*) and bladder (B). **Remember** the basic anatomy of kidney.

**Note**

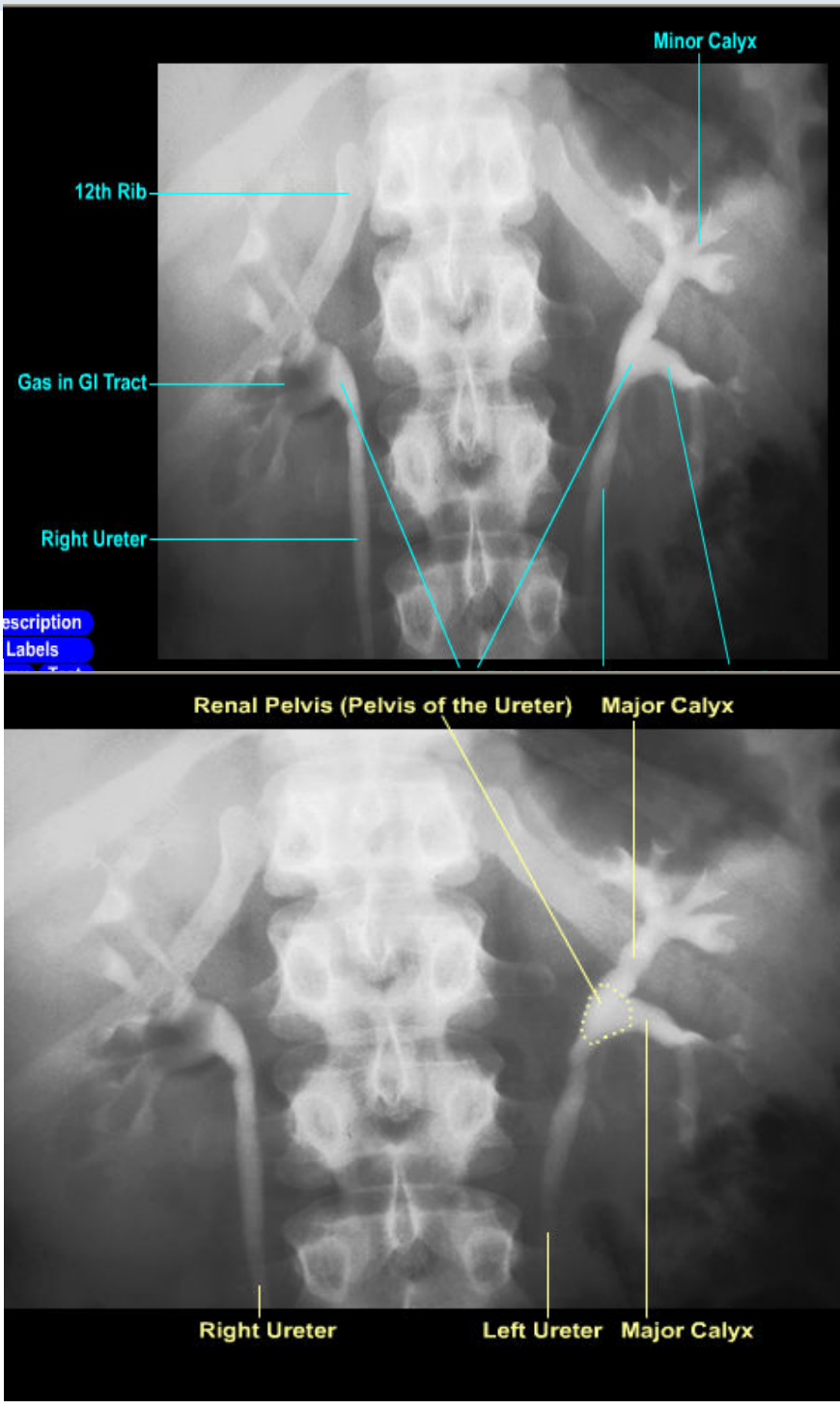
**In the kidney approx. 3 major calyces and 5-10 minor calyces.....so every major calyx has approx. 2 minor calyces .**

**Note**

**(IVU) = (IVP):-**
**Giving contrast that's only eliminated by the kidneys**
**NON ionic iodine**
**prep.:-avoid bowl gases--giving laxatives and bowl softness**
**- make sure there's no allergy to the contrast**
**- No renal failure--because the contrast will accumulate in the body**
**- pt is not pregnant (it's ionizing radiation) .**

# ☒ IVU

الصور بس المهمة .. الكلام غير مهم



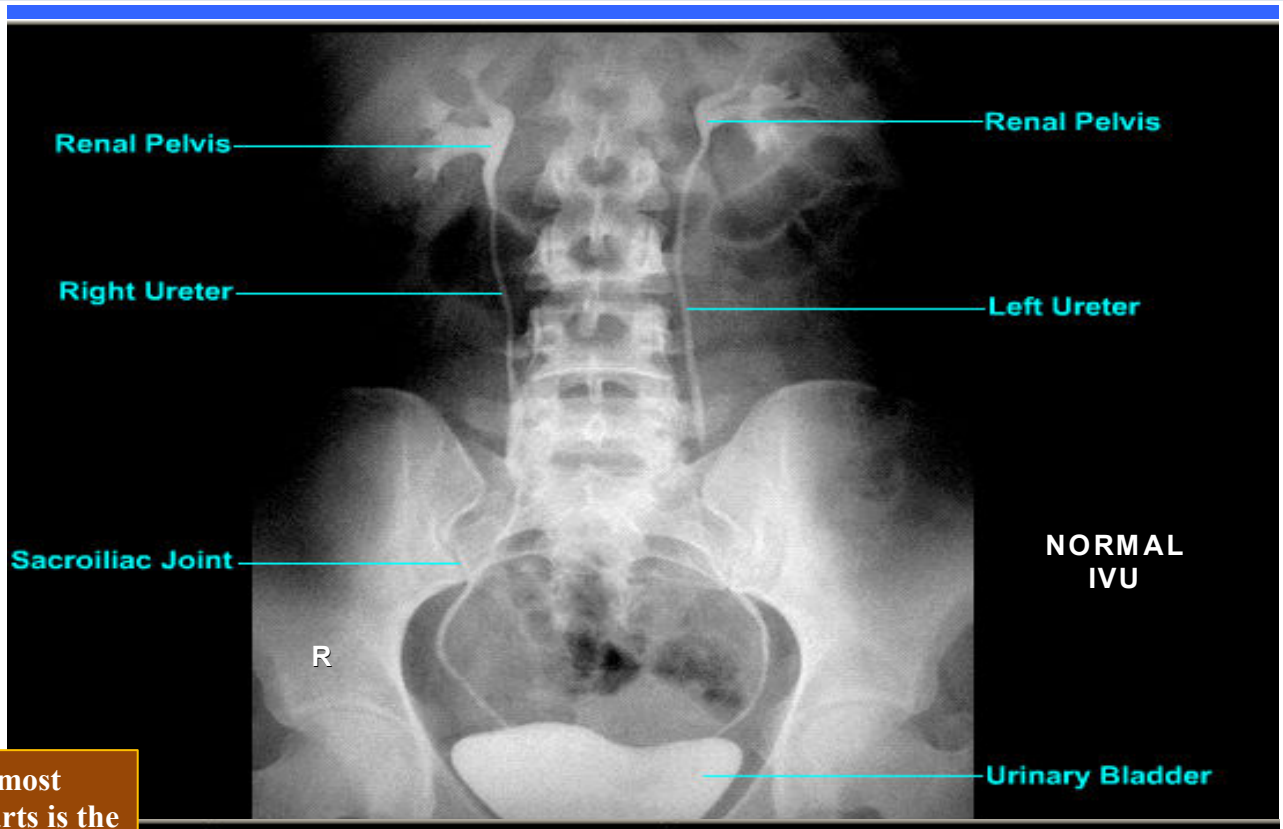

*The renal hilum opens up into the renal sinus, a space in which the renal pelvis, calices, vessels, and nerves lie surrounded by fat. The renal pelvis is the superior end of the ureter, formed from two to three major calices.

* Each major calyx is formed from two or three minor calices, into which protrude a renal papilla, the apex of pyramid-shaped clusters of collecting ducts that form the renal medulla. Surrounding the medulla is the renal cortex, the excretory system of the kidney that contains the Bowman's capsule , the excretory system of the kidney that contains the Bowman's capsule, the proximal and distal convoluted tubules, the loop of Henle, and supporting parenchymal tissue and vasculature.

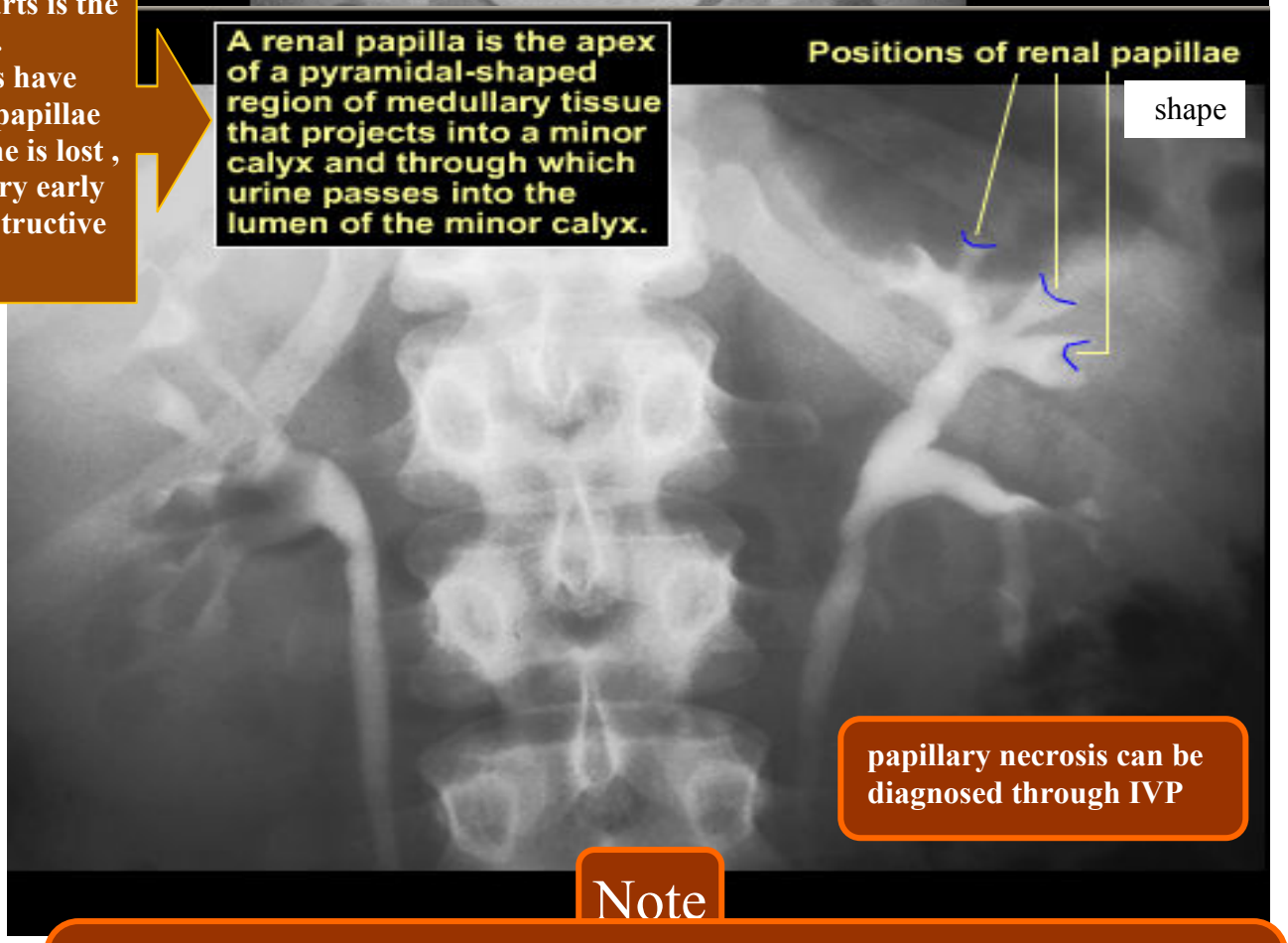
* Each minor calyx with its associated pyramid and cortex comprises one lobule of the kidney, these lobules having formed from distinct embryologic structures (mesonephros) that coalesce during renal development.

SO In the kidney approx. 3 major calyces and 5-10 minor calyces.....so every major calyx has approx. 2 minor calyces .

# * IVU



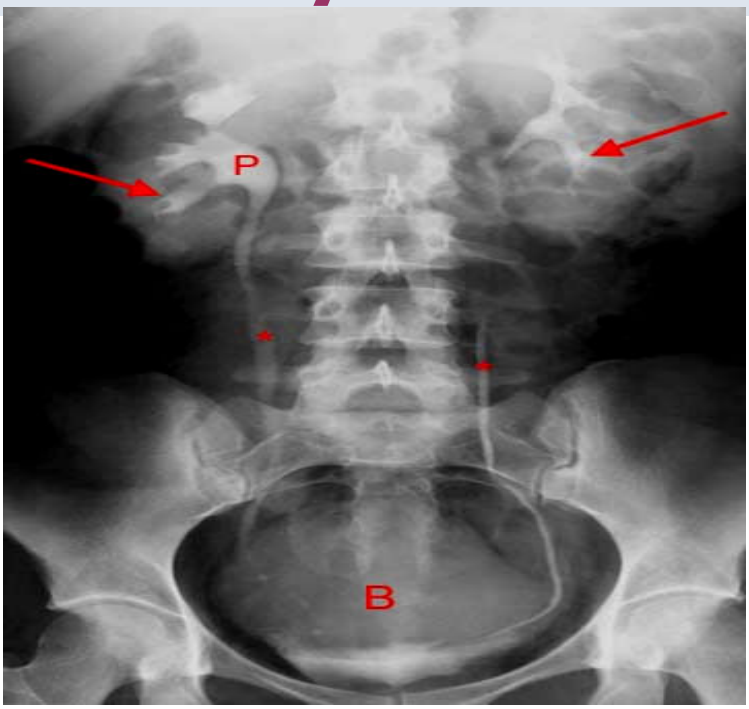

* One of the most important parts is the renal pelvis ..
Renal calyces have cups (كوبي)= papillae
When this line is lost , it means a very early degree of obstructive uropathy




Note

cupping appearance is the picture of the renal calyces with an inward edge that's crescentric in shape and it's normal and if it's absent--> pathology
when it's absent it may give a picture of balloning or filling without a crasentric shape to show the cupping

# * Anatomy of Kidney & Ureter




Retroperitoneal against posterior abdominal wall at level of T12-L3 vertebrae, **the right kidney slightly lower than the left** (MCQ) due to displacement by the right lobe of liver. The right kidney is posterior to the liver, duodenum and ascending colon; the left kidney is related to the spleen, stomach, pancreas, jejunum, and descending colon .

There are many variations of the renal vasculature—the following is the most common configuration. The renal arteries branch from the abdominal aorta between L1 and L2, the right renal artery passing posterior to the IVC. *There may be more than one renal artery (on one or both sides) in 20-30% of the time* . **The renal veins lie anterior to the arteries; the longer left renal vein passes anterior to the aorta before draining into the inferior vena cava**(MCQ) This anatomy makes the left kidney more desireable for transplant giving the surgeon some extra vessel to work with for creating the vascular anastomoses in the recipient. Common variants include retroaortic and circumaortic left renal veins.

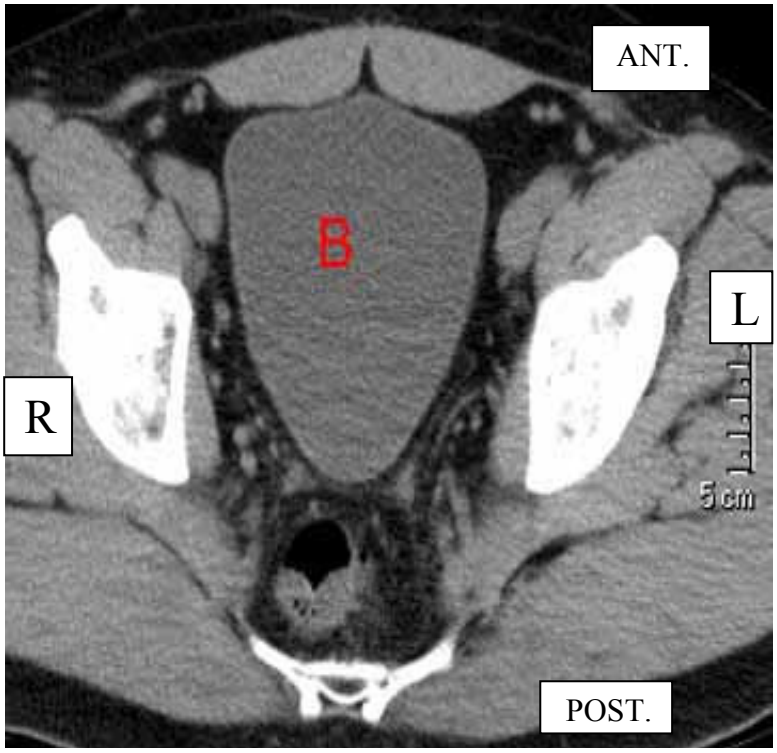
Superior and inferior poles, anterior and posterior surfaces, medial and lateral margins. The renal hilum, located at the medial margin, is a cleft that provides access for the vasculature and an exit for the ureters. A tough, fibrous capsule surrounds the kidney.

The Ureters exit medially from the kidney at the renal hilum posterior to the renal vessels , then course inferomedially along the psoas major muscle and transverse processes of the lumbar vertebrae.

They cross the external iliac artery just distal to the bifurcation of the common iliac, then course along the lateral wall of the pelvis to empty into the posterior aspect of the urinary bladder at the bladder trigone Blood is supplied by the ureteral branches of renal and testicular or ovarian arteries, and abdominal aorta. Renal and testicular or ovarian veins supply venous drainage

# * ANATOMY OF BLADDER & URETHRA

- When empty, the bladder lies on the pelvic floor surrounded by extraperiotoneal fatty tissue, posterior to the pubic bones. As it fills, it ascends in the extraperitoneal fatty tissue and enters the greater pelvis, reaching as high as the level of the umbilicus when full. In males, it is situated anterior to the rectum and superior to the prostate gland. In females, it is anterior to the vagina and anteroinferior to the uterus.
- The anterior portion of the bladder, the apex, is connected to the medial umbilical ligament (vestigal urachus). The superior surface is covered with peritoneum. There are two inferolateral surfaces, a base, and a neck.
- The body of the bladder extends from the apex to the posterior end, the fundus. The ureters enter the bladder through the internal ureteric orifices at the posterolateral angles of the trigone, which is located at the posterior base of the bladder and extends inferiorly to its anteroinferior angle at the neck of the bladder and the internal urethral orifice.




**Note**

**Right kidney is lower than the left one but normally no more than 2.5 Cm,,if more→ pathology e.g. loss of peri renal fat on rapid weight loss .**

**Some pt has more than one renal artery"up to 20-30% of people have this anomaly .**

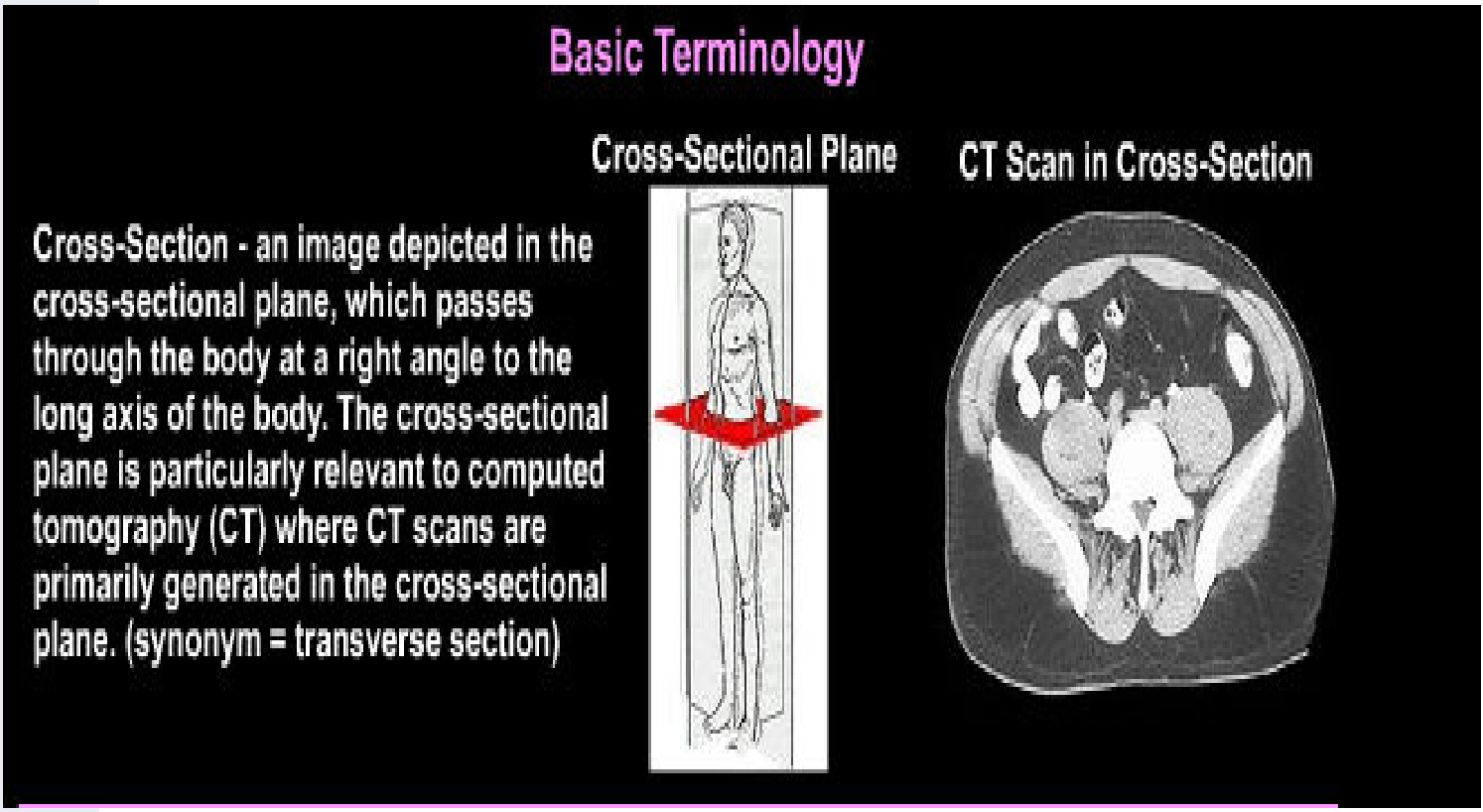
**It's important to know the situatuion of the renal arteries esp. in the donor in case of renal transplant so we can harvest the kidney with the single artery .**

**Note**

**Pathologies that can be found in the ureter radiologically:**

**1- obstructed 2- displaced**

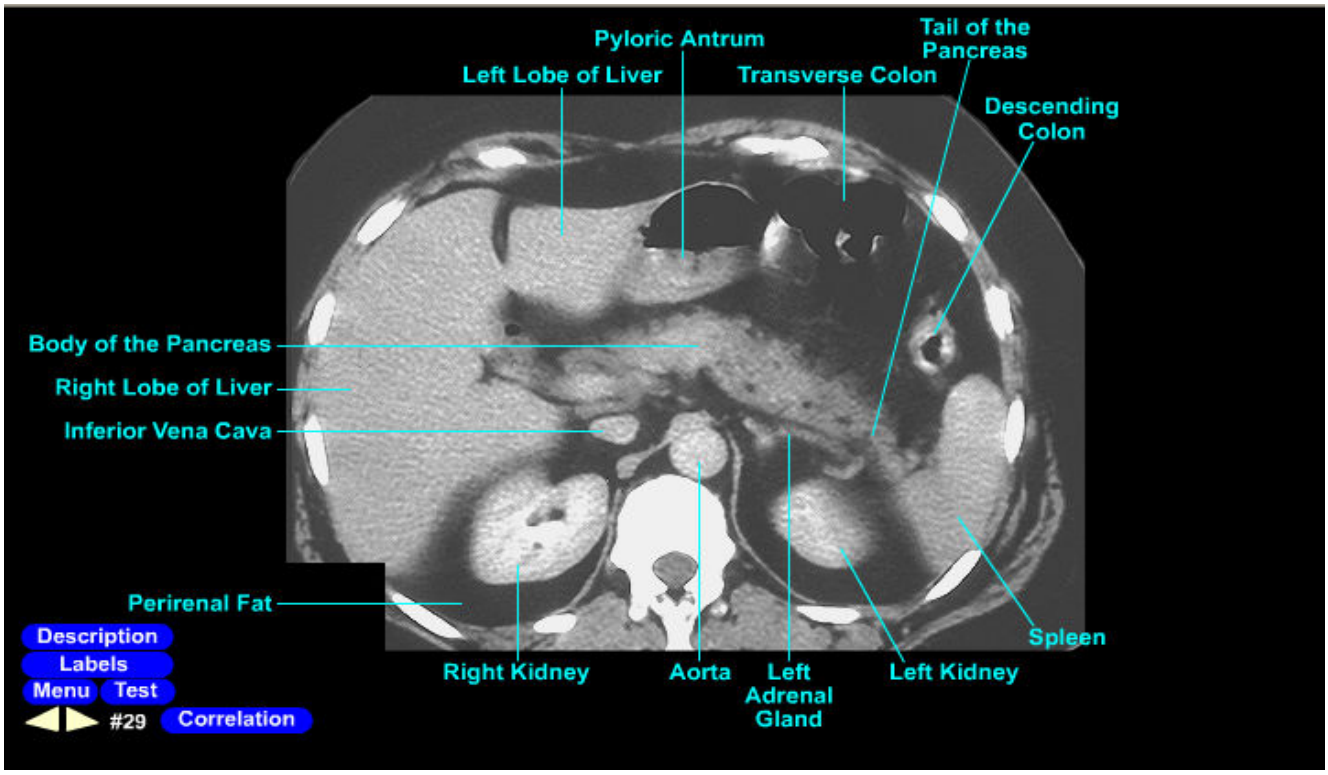
**3- invasion**

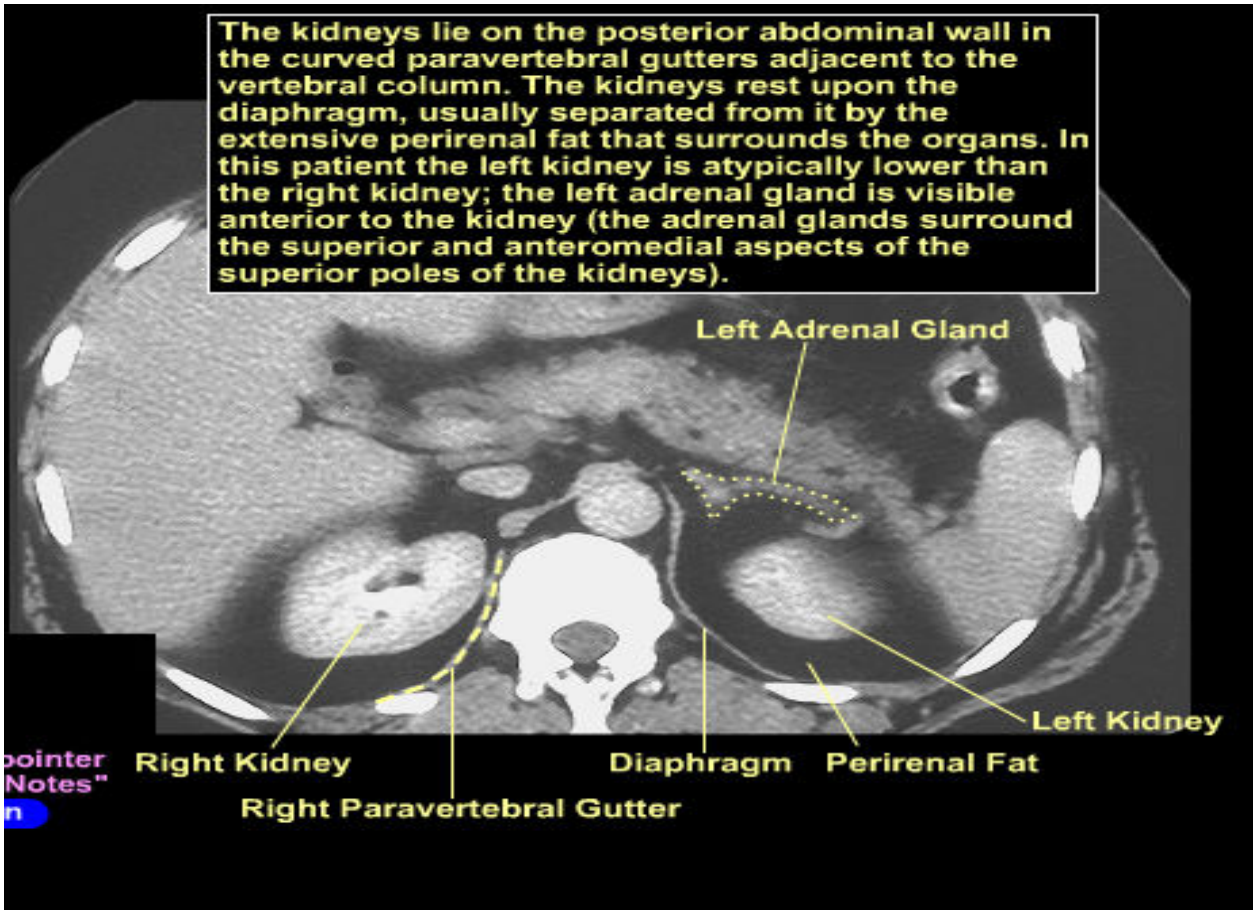



**Remember** the best car in ksu is :
1-bogati .. Faster than airplane
2- Lamborghini .. bcuz I have it :P
3- Avalon..in condition that the driver have big muscle and wear D&G sunglass ☺

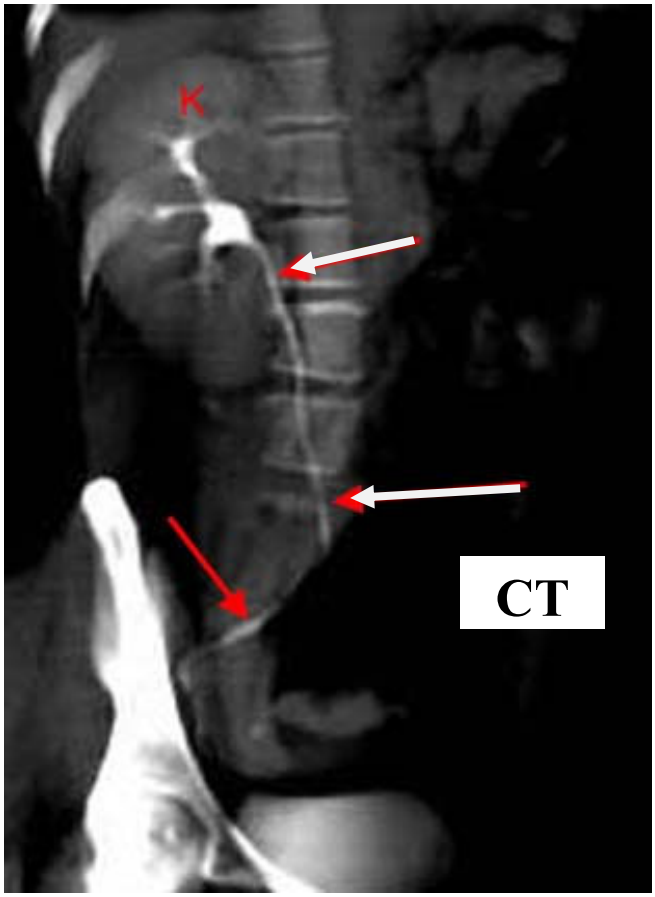
برضو فيه شيء مهم

1- in plain film we use the term upper pole and lower pole , medial aspect ( which has pelvis ) and lateral aspect .
2- But in CT we use : posterior , anterior , lateral and medial , but NOT inferior and superior .

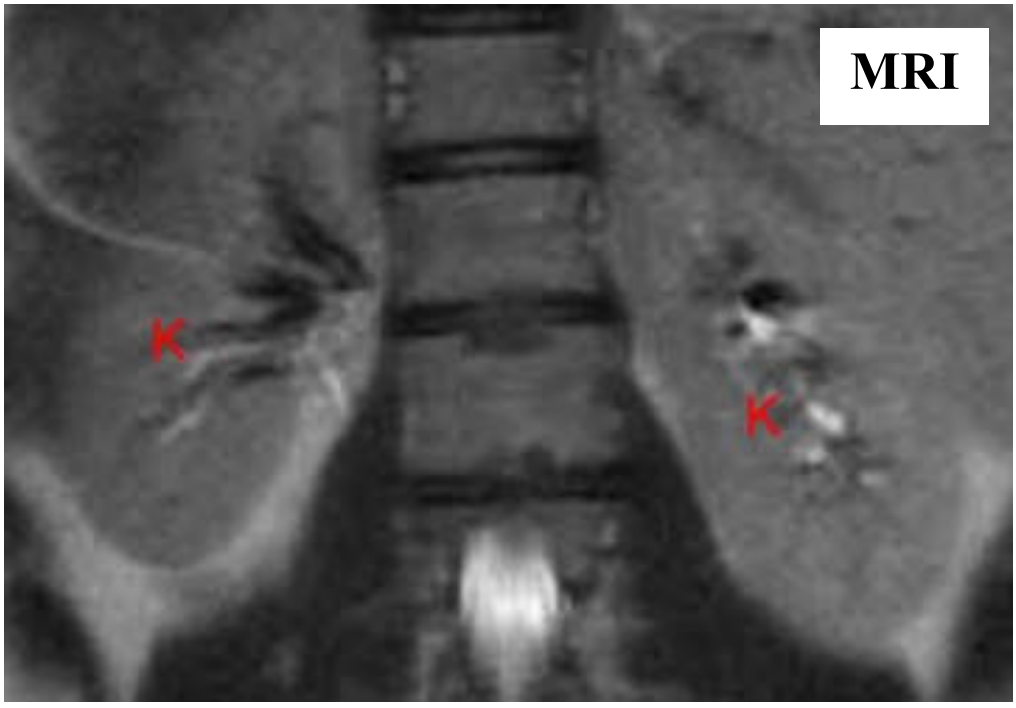

Pyloric Antrum
Tail of the Pancreas
Left Lobe of Liver
Transverse Colon
Descending Colon
Body of the Pancreas
Right Lobe of Liver
Inferior Vena Cava
Perirenal Fat
Description
Labels
Menu
Test
#29
Correlation
Right Kidney
Aorta
Left Adrenal Gland
Left Kidney
Spleen


The kidneys lie on the posterior abdominal wall in the curved paravertebral gutters adjacent to the vertebral column. The kidneys rest upon the diaphragm, usually separated from it by the extensive perirenal fat that surrounds the organs. In this patient the left kidney is atypically lower than the right kidney; the left adrenal gland is visible anterior to the kidney (the adrenal glands surround the superior and anteromedial aspects of the superior poles of the kidneys).
Left Adrenal Gland
Left Kidney
Right Kidney
Diaphragm
Perirenal Fat
Right Paravertebral Gutter

# * CT IVP



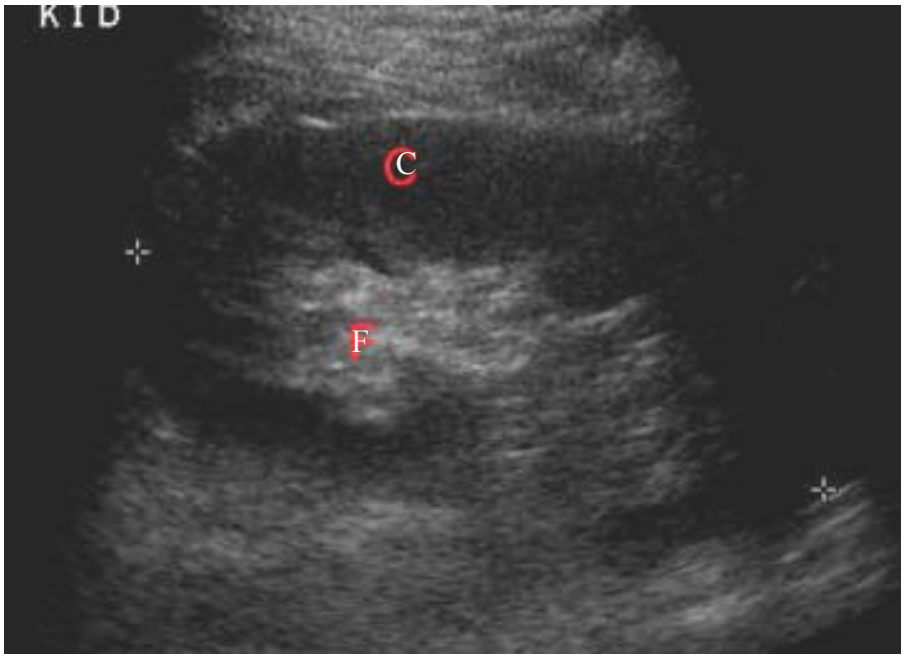

3D reconstructed image from CT scan of the abdomen and pelvis known as CT IVP. This exam is quickly replacing the conventional IV Urogram. This 3D reconstruction is performed through the right kidney (K) and follows the normal ureter (arrows) all the way to the ureter's insertion into the bladder




T2 weighted images through the kidneys (K) in the coronal plane

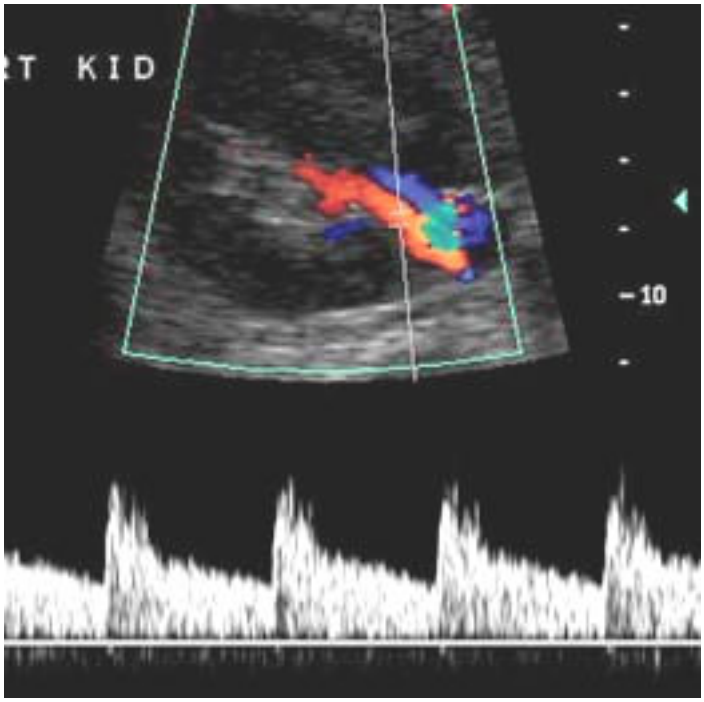
# * RENAL ULTRASOUND

Sagittal view of normal left kidney showing normal cortex (C) and echogenic (bright) renal sinus fat (F)




# * Color Doppler Renal Ultrasound

View of normal right renal artery (red) and vein (blue) with spectral analysis (bottom of image) showing normal low resisitence wave form in the artery .

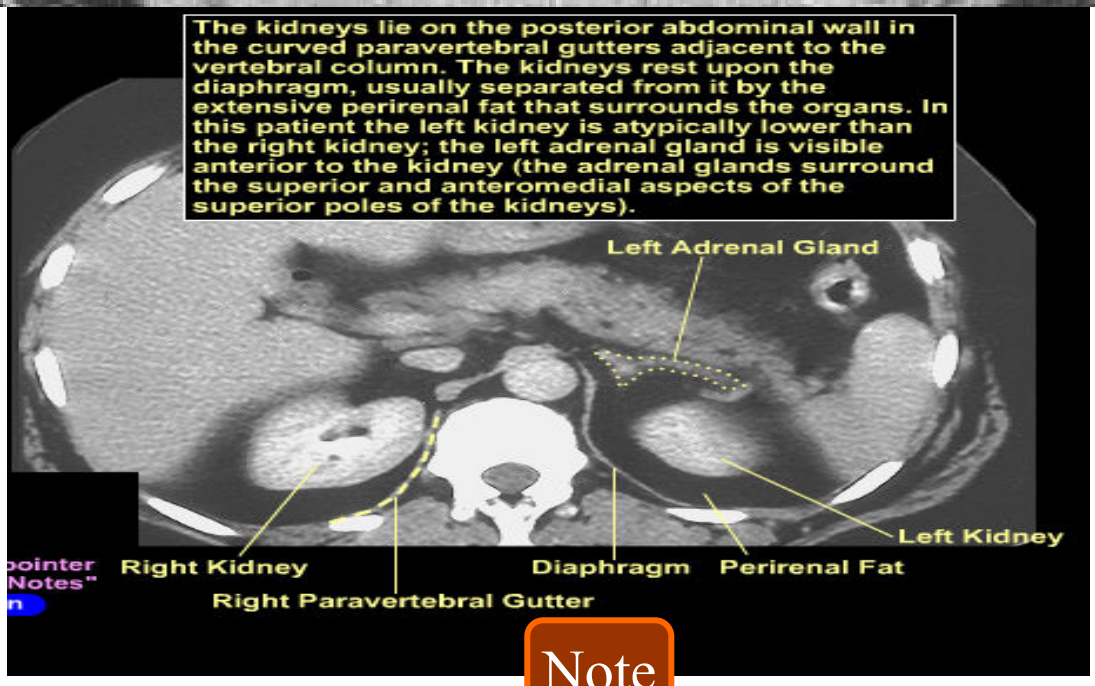



**Note**

**renal artery stenosis can be diagnosed by doppler US also we use it in renal transplantation**

# * CT of ADRENAL GLAND

Unenhanced CT scan through the level of the adrenal glands shows normal appearing bilateral adrenal glands in the suprarenal fossa. The glands take on te appearance of an upside down "V" or "Y" often (arrows) .



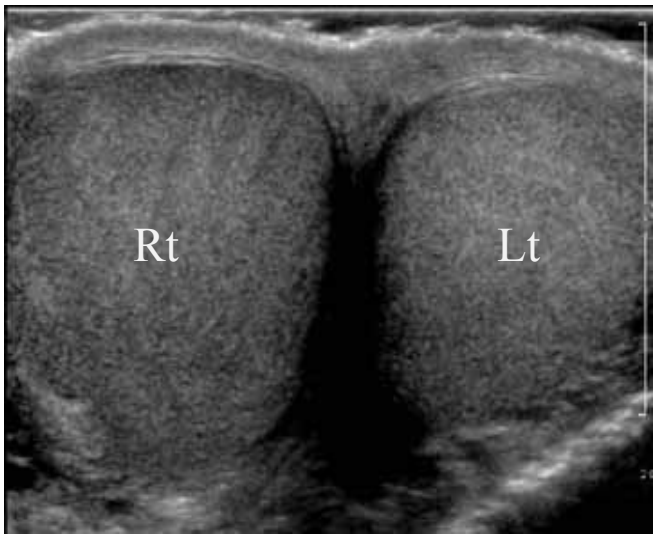

**Note**

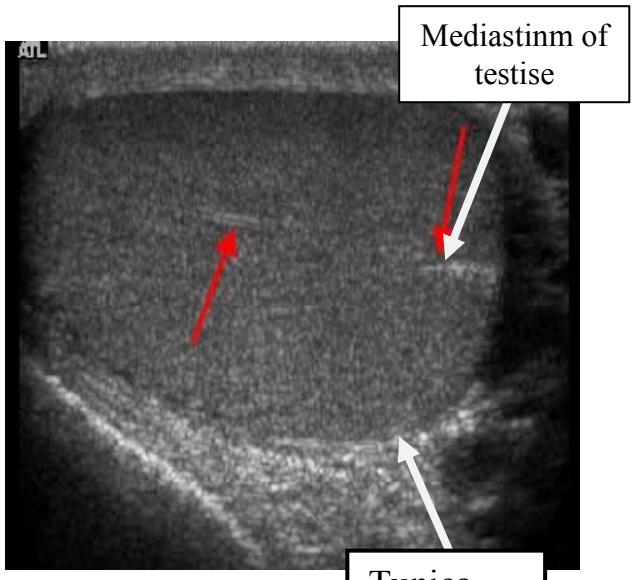
**The adrenal gland is triangular in shape which located anteriorly in the left side and slightly superior in the right side . Left gland is "Y" shape and right one is "D" Shape. Each one has one body and two limbs. you need making sure that we don't have any swelling either in limbs or body .**

# * Testicles

The Testis measures 3.5-4 c in length and 2-3 cm in width and is covered by the fibrinous tunica albuginea. The spermatic cord enters the testis along the posterosuperior margin, known as the mediastinum testes. The testis is divided into lobules arrayed radially around the mediastinum testes; each lobule being composed of branching seminiferous tubules.

- The epididymis is 6-7 cm in lenth, 7-8 mm diameter at the globus major (head of epididymis at mediastinum testis) and 1-2 mm at the tail where it continues as the vas deferens. The vas deferens courses through the spermatic cord and exits via the deep inguinal ring. At the base of the prostate, it joins the seminal vesicle to form the ejaculatory duct.
- 20-30 ducts form the prostate gland, draining into the prostatic urethra at the verumontanum, located between the internal and external urethral sphincters. 3 zones of ductular drainage subdivide the prostate: the peripheral zone, the central zone, and the transitional zone.



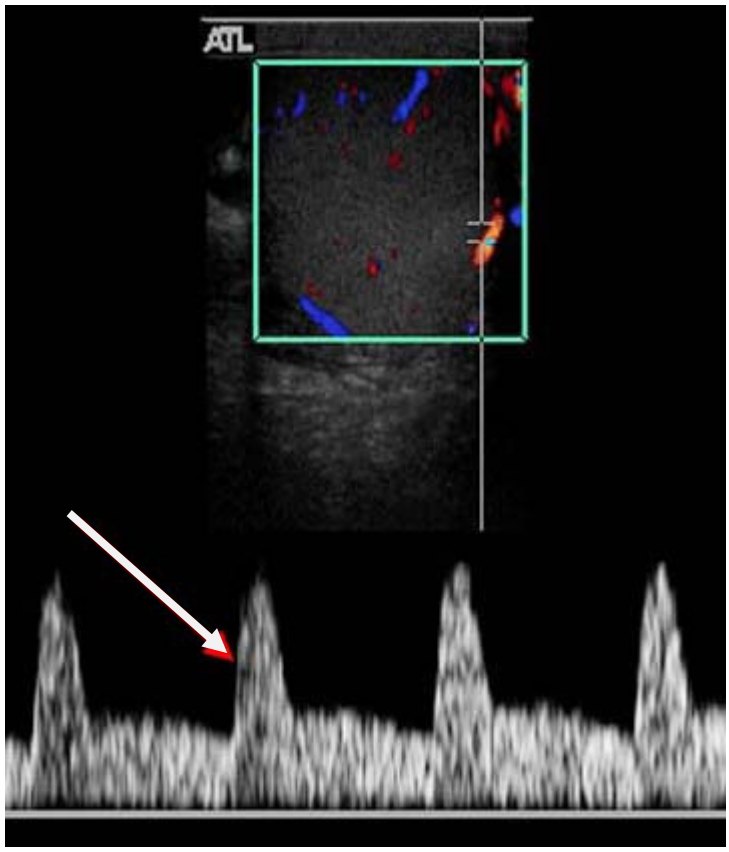

**Male Pelvis**

يا حلوين .. المقصود هنا الحواف يعني مثل الكبسول

**Note**

**Testicles are better assessed by US because it has no ionizing radiation**
**In US of testicles we must see: shape, echo pattern and homogeneity.**

# *Duplex ultrasound of testis




In this patient with suspected torsion, normal color flow (red and blue represents flow) and spectral analysis (arrows) show both venous and arterial flow thereby excluding torsion .

It is done with all my wish 2 have good live y3iny good marks

Abdualziz Al-saad

rad Gp

☺