IMAGING OF URINARY SYSTEM

FOR 5th Year Medical Students

By

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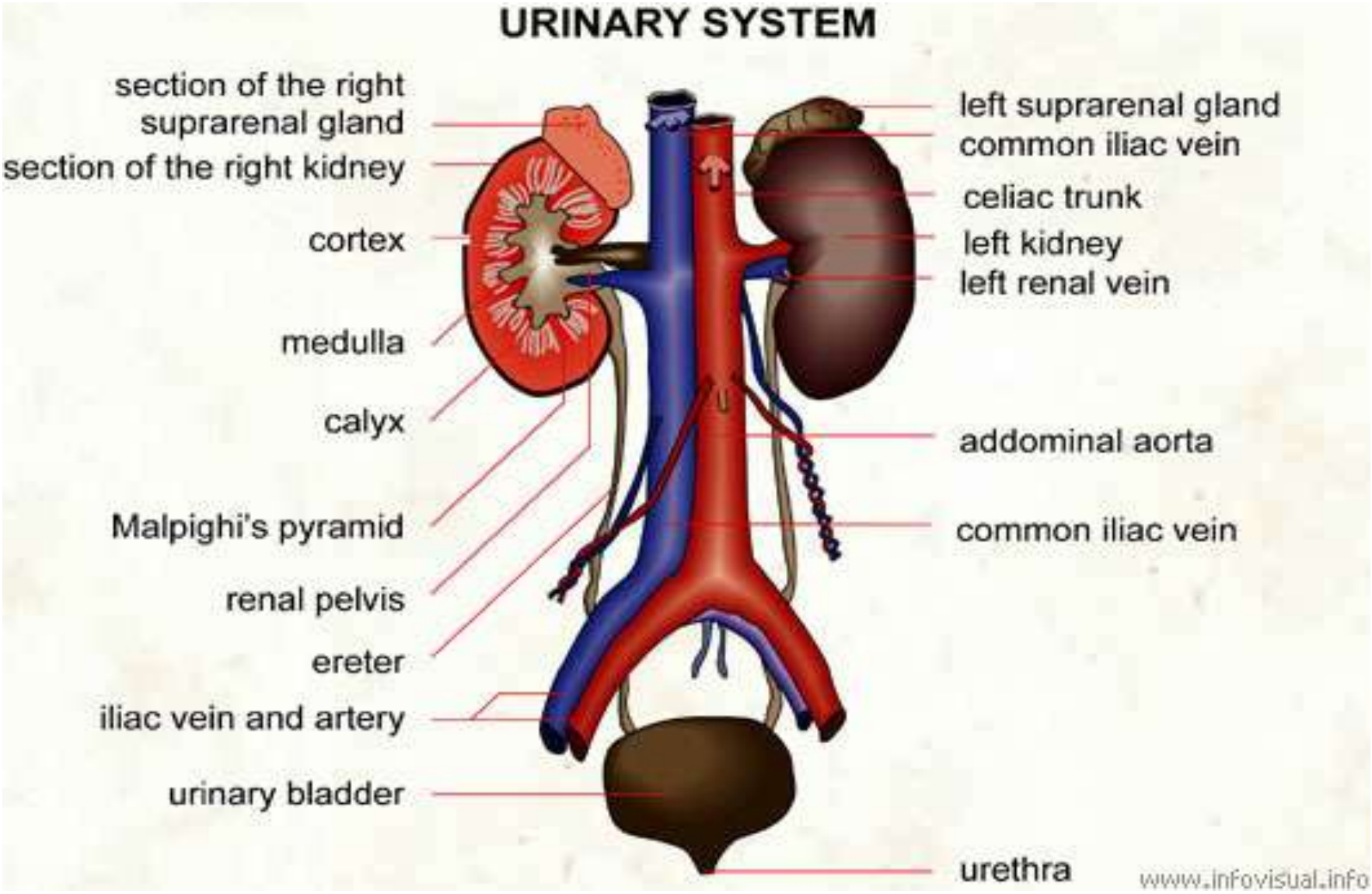
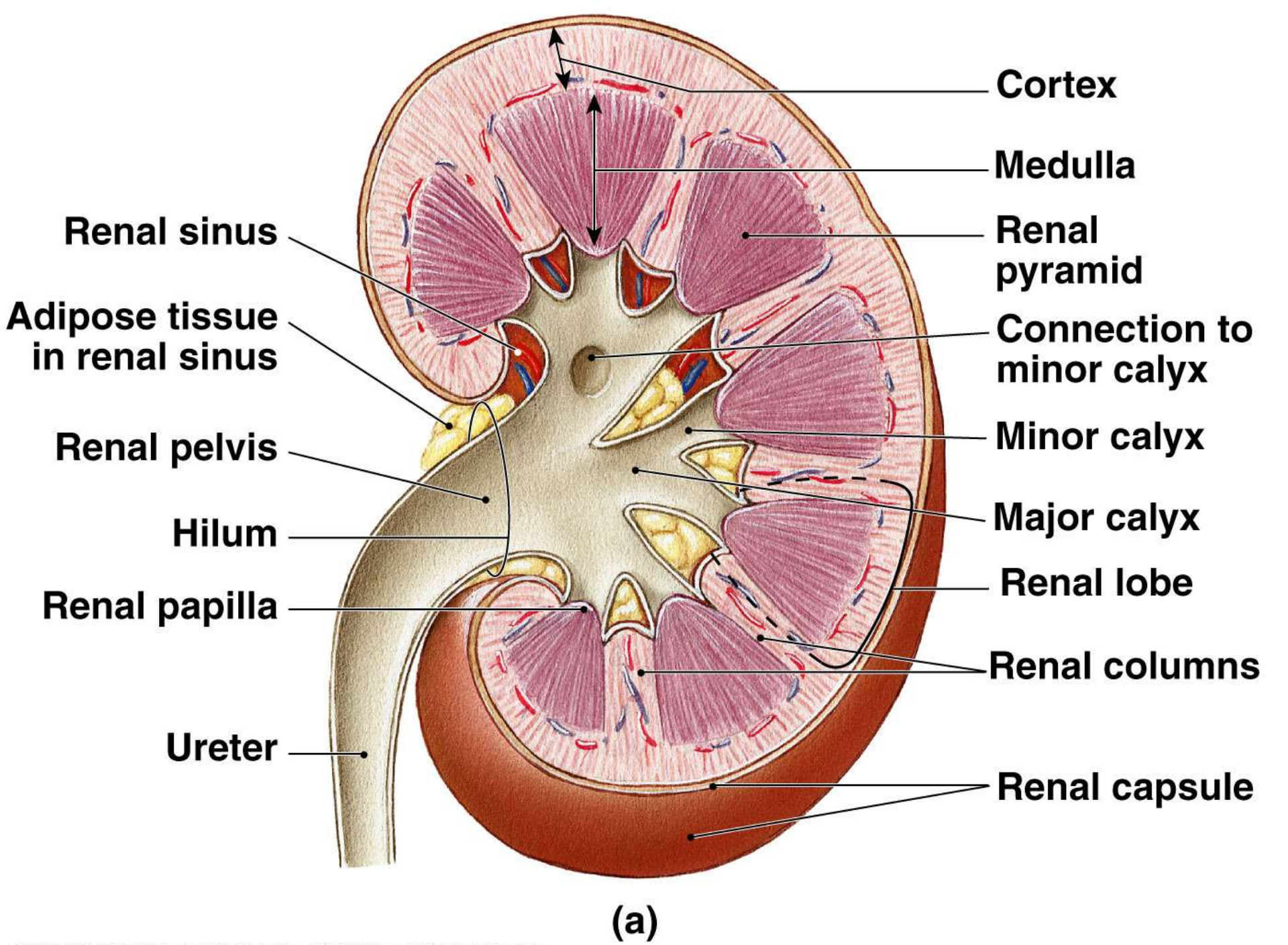
Sohag University

2022

Anatomy of Renal System





(a)

Methods Of Radiological Ex. Of U.T.

1- Ultrasonography "& Doppler "

2- PUT

3- IVU

4- C.T.

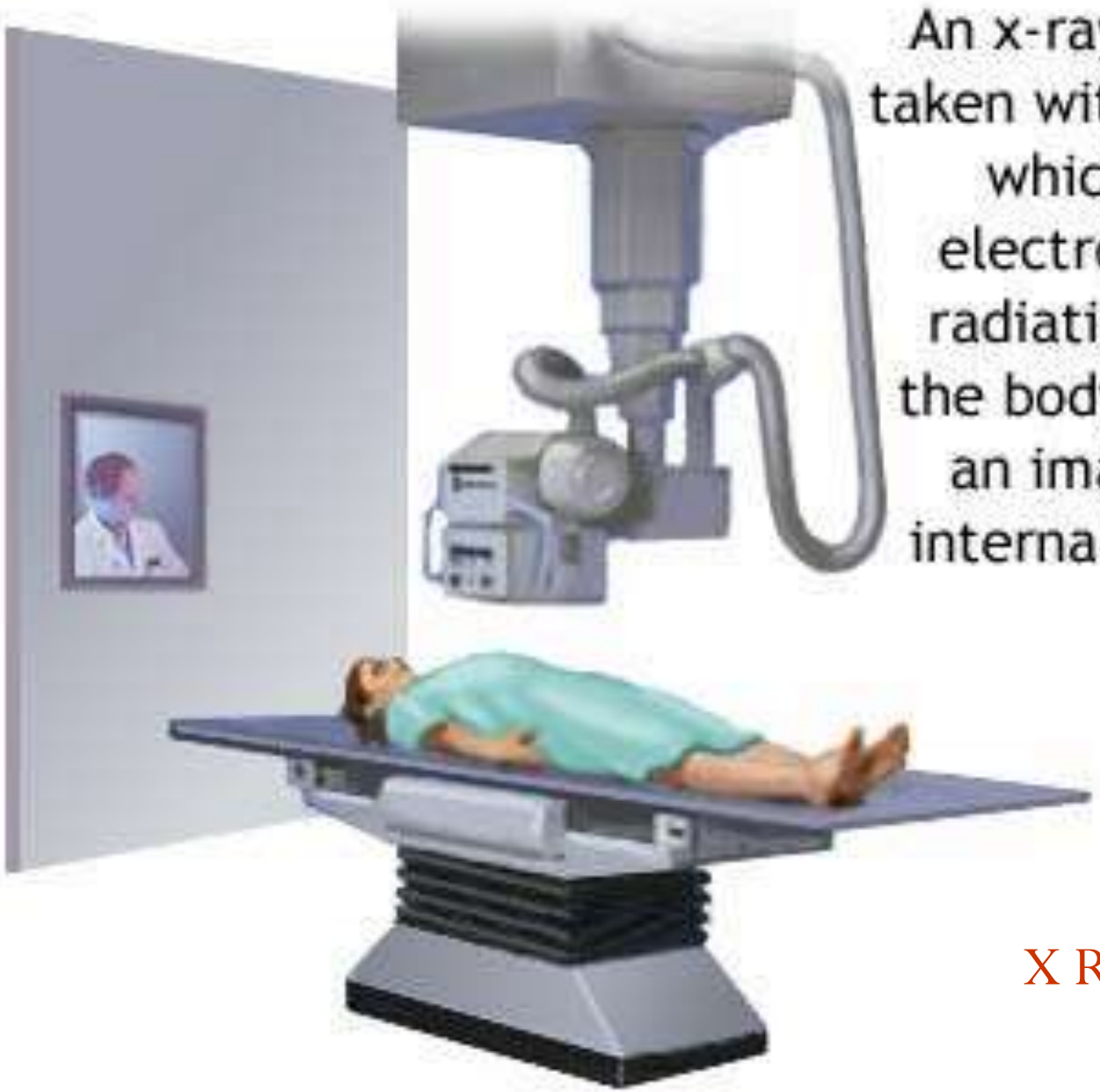
5- M.R.I.

6- RANAL ANGIOGRAPHY

7- Radio-isotope scanning

…… & Others

U.S. & DOPPLER



An x-ray is a photo taken with a machine which passes electromagnetic radiation through the body, capturing an image of the internal structures

X Ray & IVU

A.D.A.M.

C.T.

MRI

- For More Details ……

"Introduction To Imaging Modalities"

Video Lecture

- ***https://www.youtube.com/watch?v=RTaEDka95-E&index=1&list=PLqU6GNJJ8xwkhCDPznBYkvG3_NXZt-B17***

Pathological conditions in UT :

….. At the level of under graduates

- **Congenital** : eg. ectopic , hoarse shoe …..
- **Inflammatory** :
- **Obstructive** : Calculi … non Calcular
- **Traumatic**
- **Malignant** : ….. Cancer U.B.

X – Ray

Many X ray techniques …..But For Undergraduates you're Concerned with **PUT & IVU**

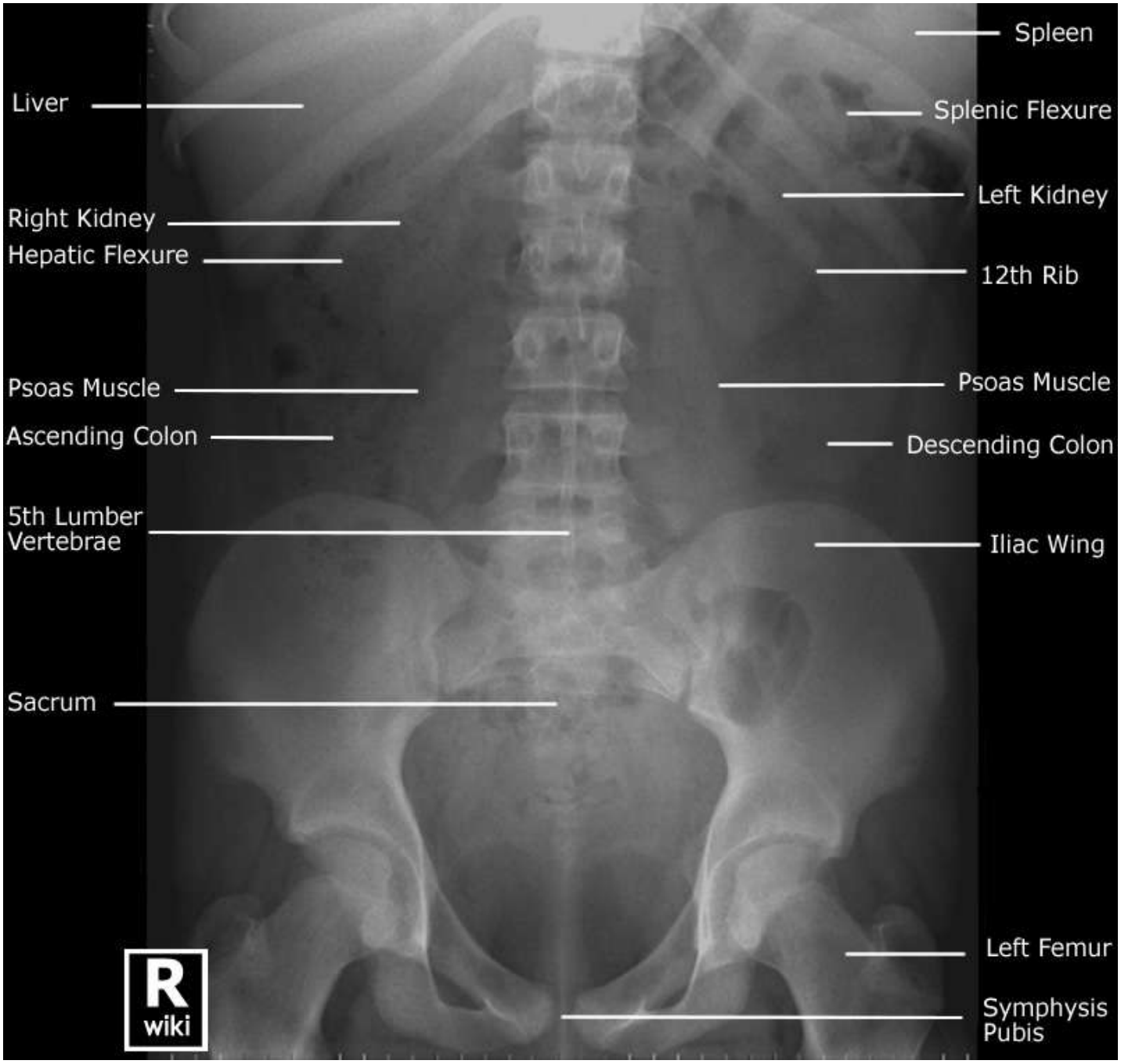
PUT

- **PUT** = **p**lain **U**rinary **T**ract i.e. X ray plain ….<u>with no contrast</u>
- Other Name : **<u>KUB</u>** "Kidney , Ureter & Bladder "
- View : Antro – Posterior
- From Last 2 Ribs → down to below Symphsis Pubis.
- Patient Should be prepared brfore it : Laxative – Fasting

Normal P.U.T.

Values of PUT

- **Confirming good preparation** : …no gaseous Distension… Fecal matter…etc.
- Presence of **Calculi** : which may be masked by contrast
- Viewing any **radiopaque lesions** eg. Calcifications.
- Other Pathological Signs : as
  - air under diaphragm ..GB stones …
- 1st film in any IVU .


Spleen
Liver
Splenic Flexure
Left Kidney
Right Kidney
Hepatic Flexure
12th Rib
Psoas Muscle
Psoas Muscle
Ascending Colon
Descending Colon
5th Lumber Vertebrae
Iliac Wing
Sacrum
Left Femur
Symphysis Pubis
R
wiki

U.T. Stones

- **Radiopaque** or **Radiolucent**
- **Lucent stones** : not visualized by X ray
- PUT → viewing opaque stones , Site , Size , Shape, & Number
- **Site** : From Calyceal, renal pelvis , Ureter , down to UB

  " ***Donot Forget Rt ot Lt*** ☺"
- **Size :** From few mm up to Cm …or Large &Branched , like "***stag Horn Stone***"
- Single , view or Multiple

- Lt Renal Stone

Urinary bladder stones

Stag Horne stone


UB stone

- **Radiolucent stone** is not seen by PUT , but its obstructive effect can be seen by IVU , or By US or CTU


I.V.U.

- **IVU** = Intra Venous Urography
- I.V. Contrast Used "**urografin** - Ultravist "

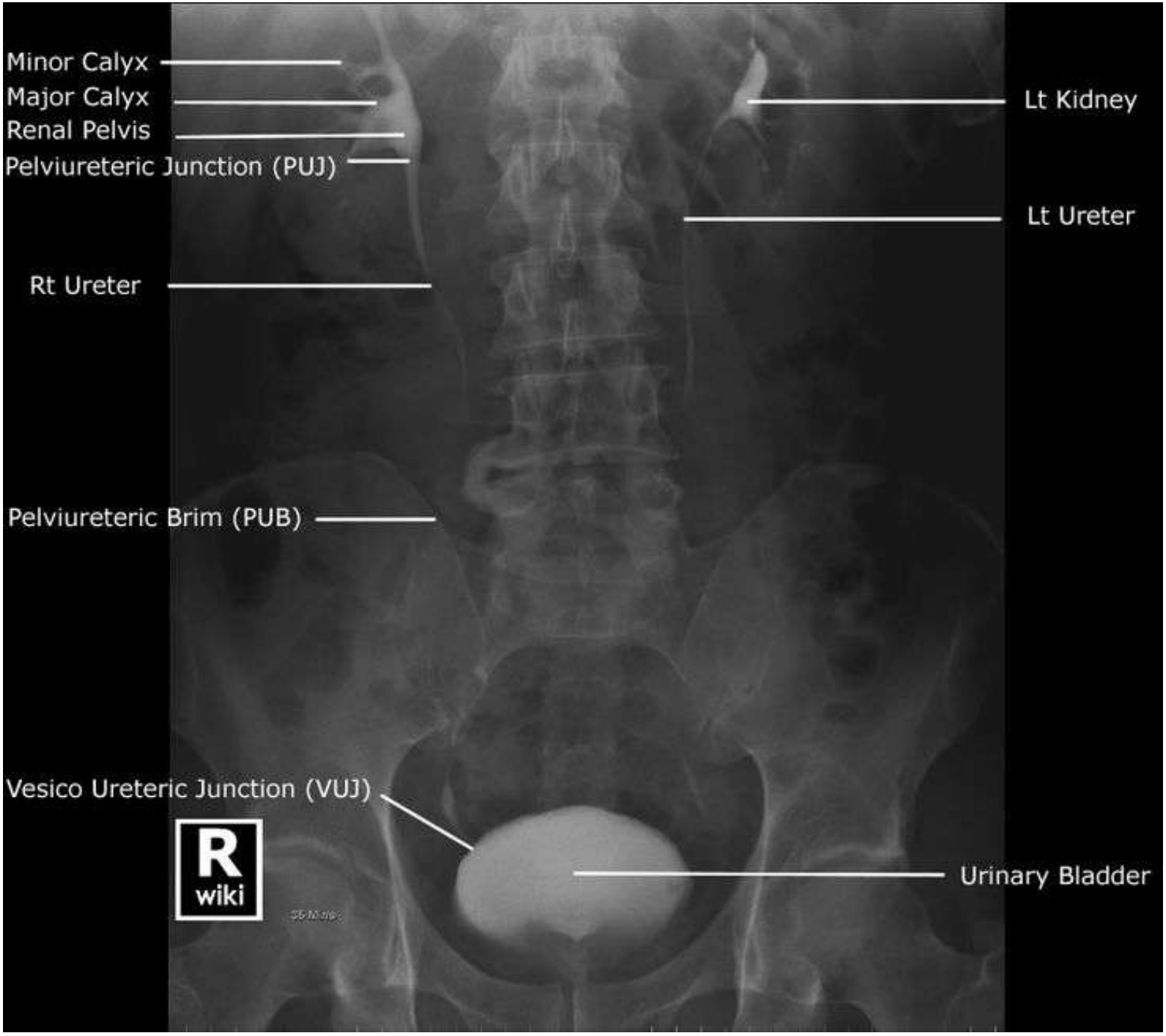
BUT NEVER TO SAY **BARIUM** …. FATAL MISTAKE

- **_Indications** : Genaral Assessment of Urinary system

…… But really now , if CT is available… CTU with contrast

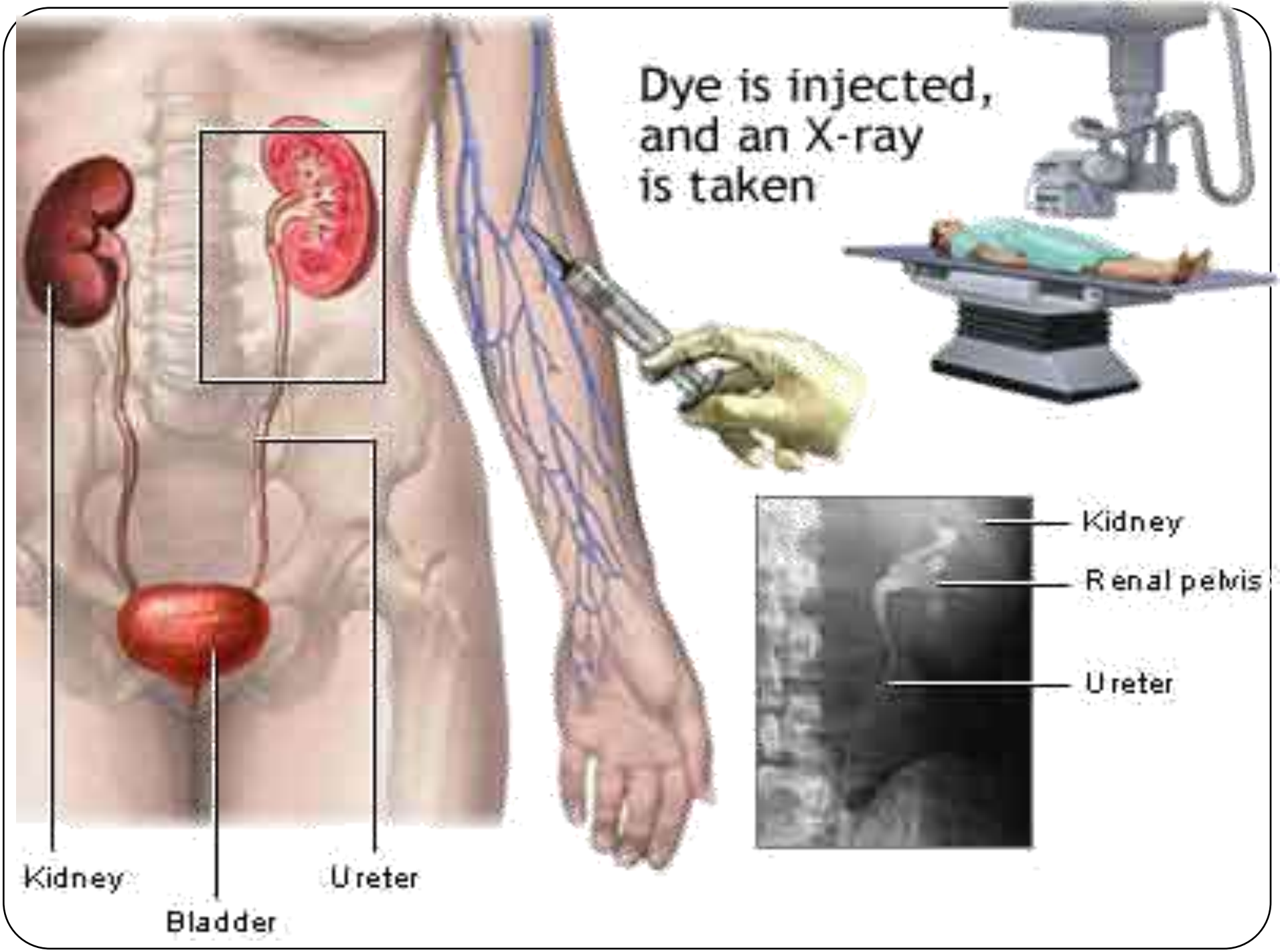
"Enhanced CTU " is of much more value.

- **Contraindications :** Contraindications for Contrast
- Patient is prepared the day before exam : Laxative & fasting
- Serial Films are Taken after IV injection of contrast "1 ml/Kg"
  - 5 minutes - 15 minutes – 25 minutes
  - - Full bladder & after evacuation

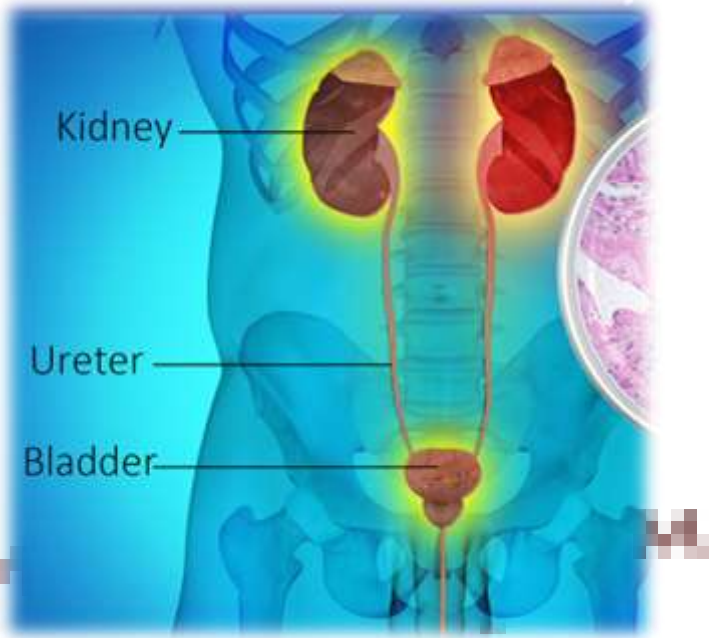

Minor Calyx
Major Calyx
Renal Pelvis
Pelviureteric Junction (PUJ)
Lt Kidney
Lt Ureter
Rt Ureter
Pelviureteric Brim (PUB)
Vesico Ureteric Junction (VUJ)
Urinary Bladder
R
wiki

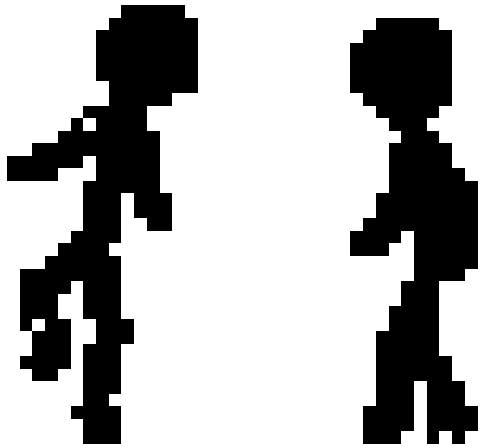

Urografin
Sodium amidotrizoate
Meglumine amidotrizoate
1 ml contains
Sodium amidotrizoate
Meglumine amidotrizoate
370 mg I/ml
Store below 30°C
Protect from light
X-rays
Berlimed S.A.
Spain
BAYER
7.4 g I
20 ml
intra-vascular
MA003RZ
10.2015


Ultravist-300
200 ml
Ultravist-300


Dye is injected, and an X-ray is taken
Kidney
Bladder
Ureter
Kidney
Renal pelvis
Ureter

- ***Indications***
  - Suspected urinary tract *pathology.*
  - Repeated *infections* ? focus, damage,
  - *Heamaturia*.
  - Renal *colic*.
  - *Trauma.*


Kidney
Ureter
Bladder



* Contra Indications

- A- General Contraindications For Contrast
- B- **Pregnancy.**

  _*Absolute very important contraindication*

- C- **Impaired Renal Function** . – Creat. > "1.5 mg/dl"

- ***General* contra indications to water soluble contrast agents:**

1. ***A*llergy to contrast.**
2. ***B*ronchial Asthma or allergic history.**
3. ***C*ardiac Patient : Arrthmya & Heart disease &.**
4. **D**iabetics ttt by metformine (Glucophage).
5. ***H*epatic failure.**
6. ***"H*ormonal" *Thyrotoxicosis*:** as contrast is "Iodine"
7. ***Mylomatosis:*** contrast→ Bence jones protein precipitate in renal tubules.
8. ***Sickle cell anemia*** → precipitate crisis.

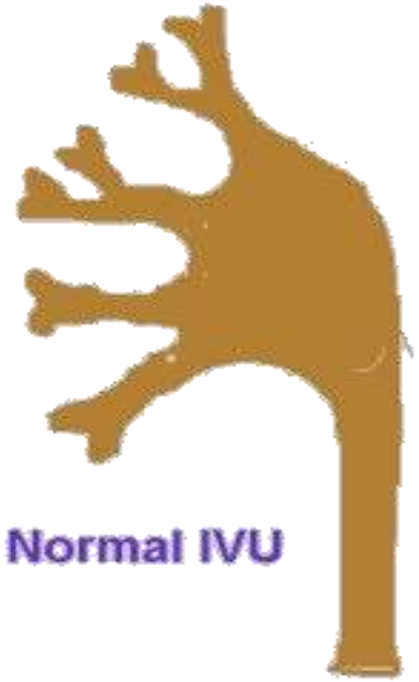
I.V.U.

Most common Finding in IVU

Category	Finding
Congenital	• Absent , Small size •Hoarse shoe Kidneys •Ectopic , Malposition •Duplication : Ureter , Kidney • Uretrocele
Obstructive & Reflux	•Hydronephrosis * PUJ obstruction •Hydroureter
Malignant	* UB Mass → Obstruction
Others	* UB **Diverticulum** * **Filling defects** : Lucent stone , Hematoma , Masses or polyps ……etc. * …… & Many Other finding

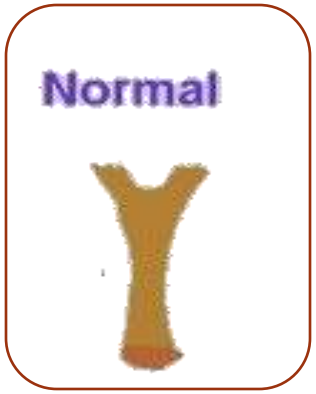
Intra-Venous Urography

Obstructive



Normal IVU

Pelvic Hydronephrosis



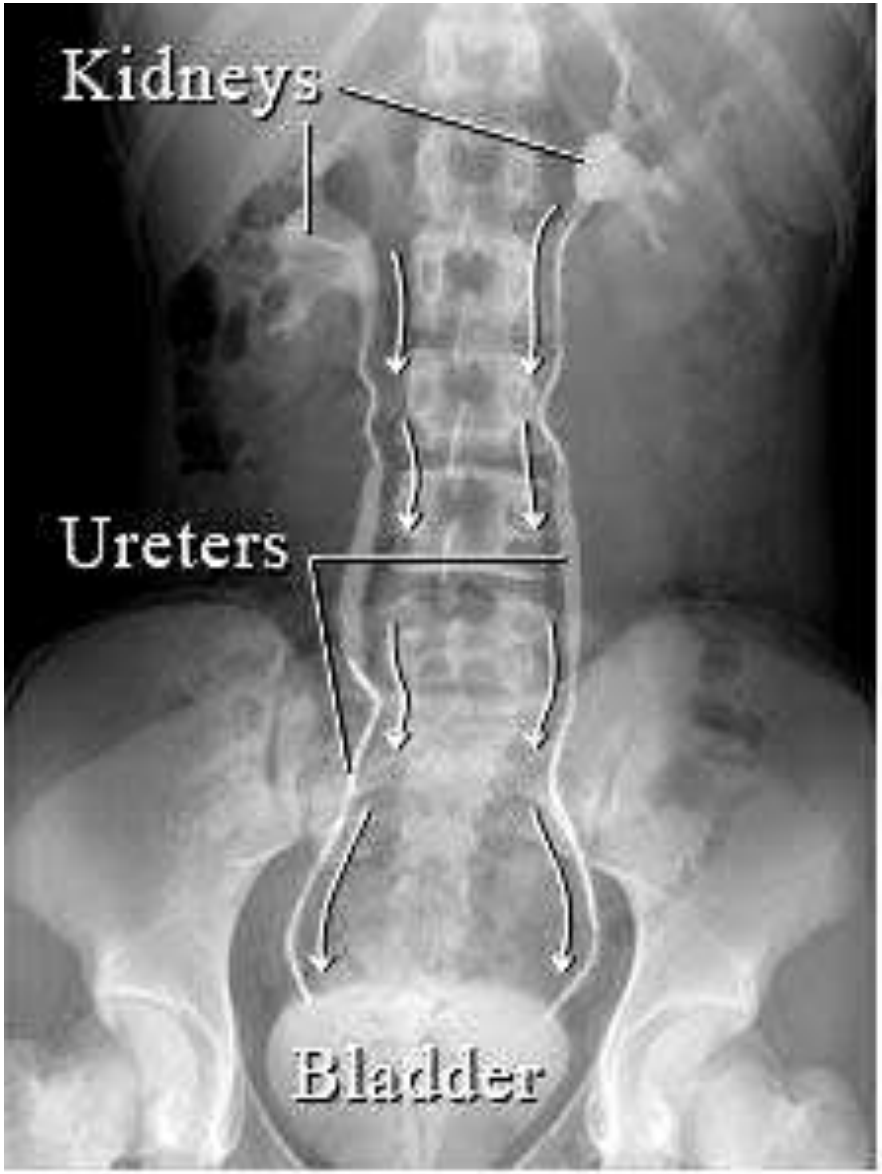


Figure 1

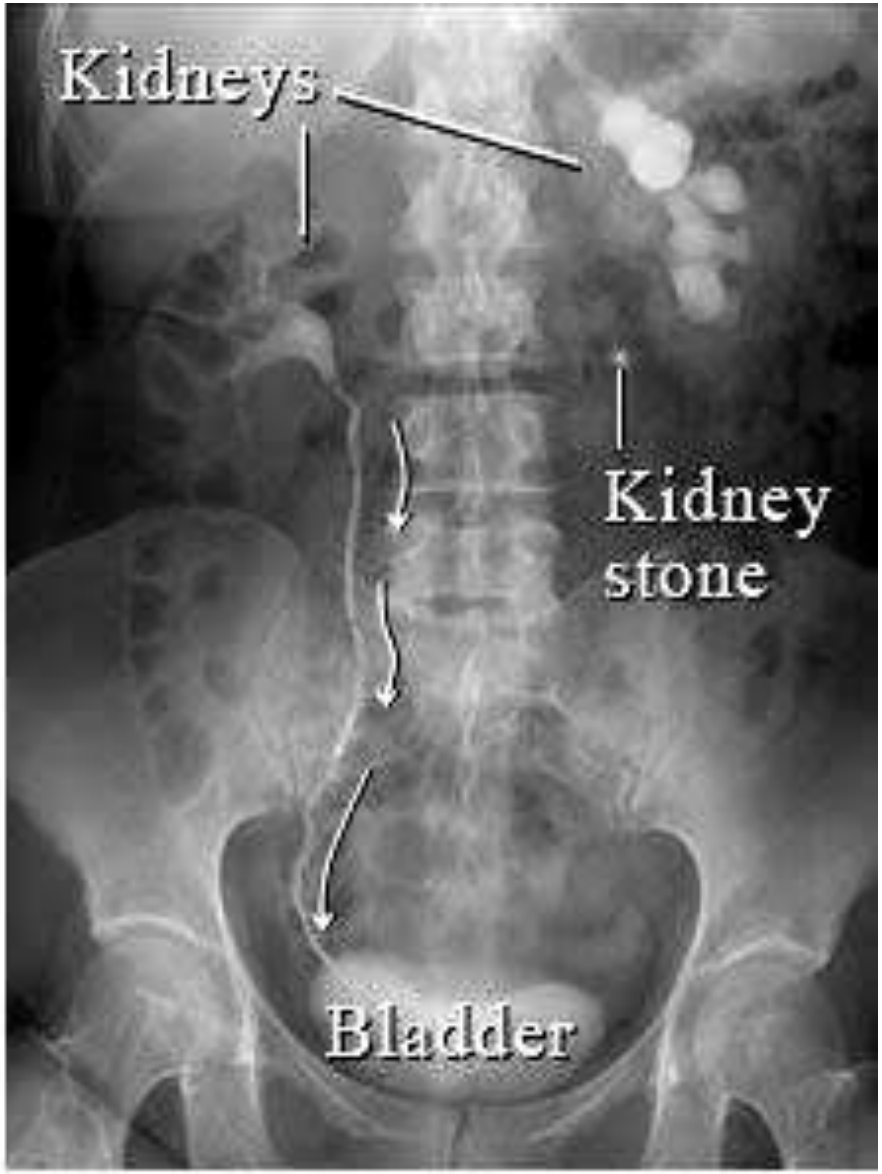
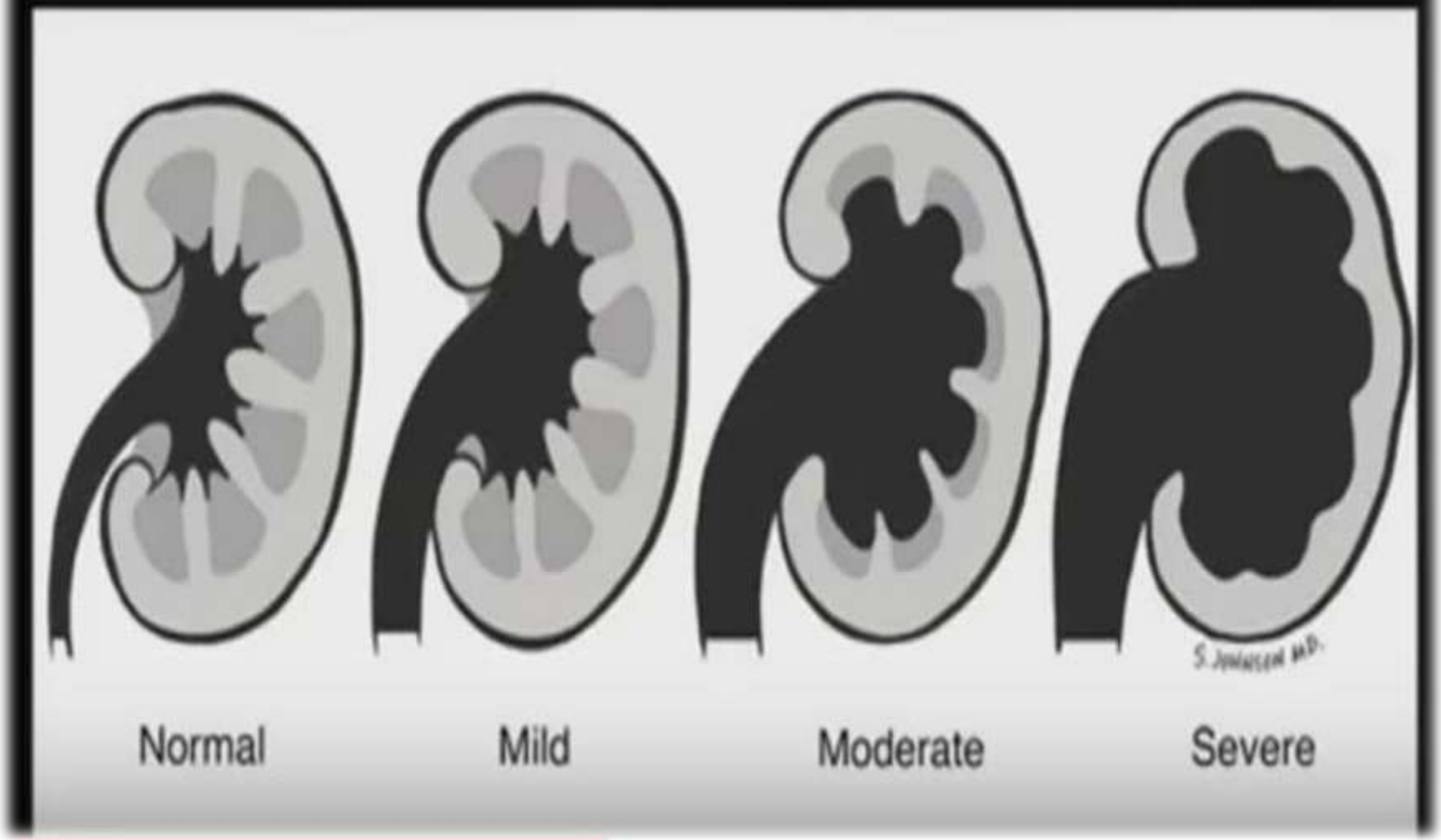


Figure 2

Intra-venous urography “Normal”

Grading Hydronephrosis



Renal obstruction

Normal Ureter is Thread Like , not dialted Like this

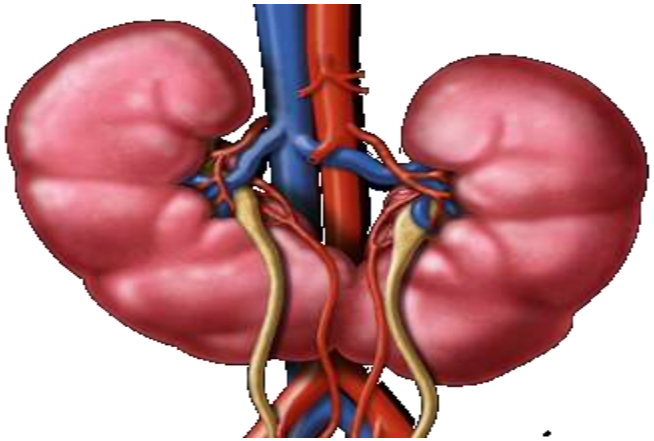
Bilateral hydronephrosis

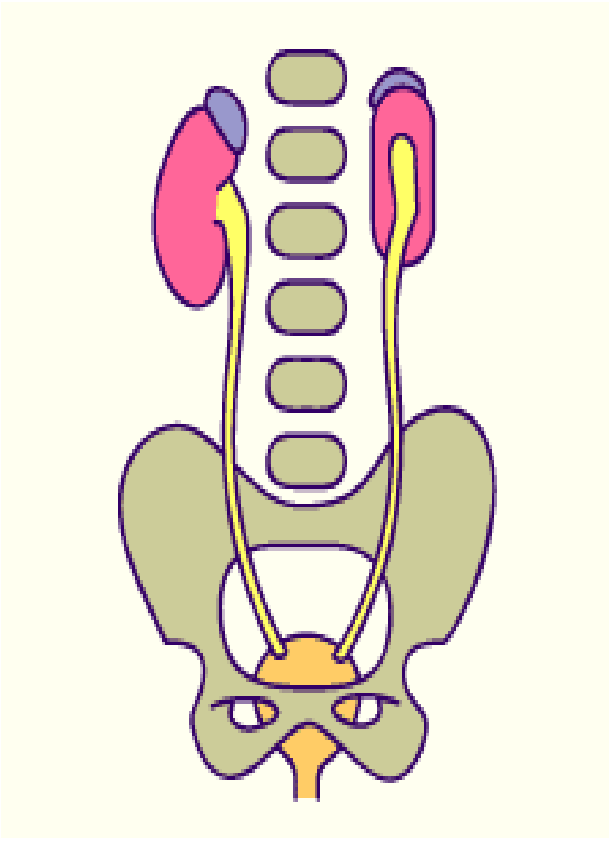
- PUJ obstruction

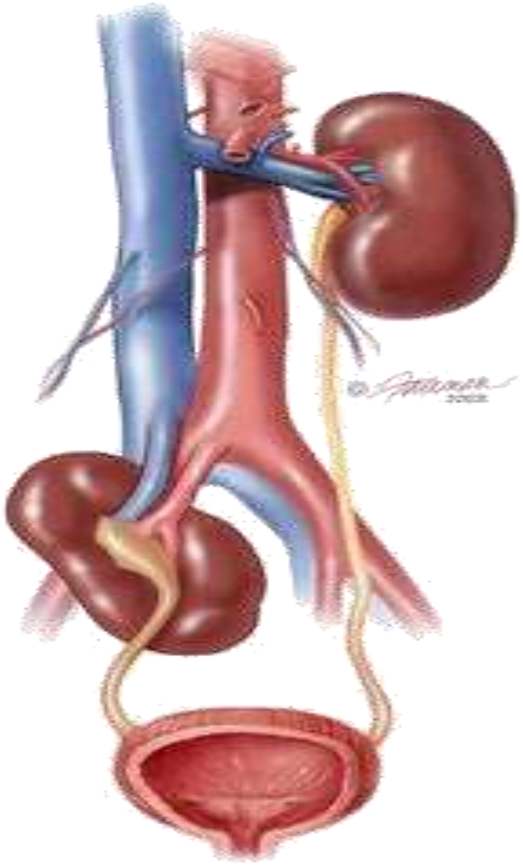
PUJ =

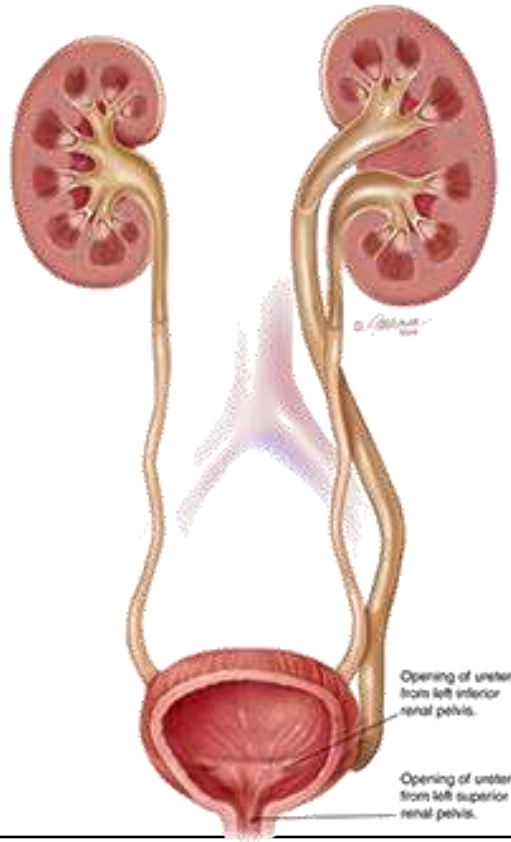
Pelvi Ureteric Junction

Congenital








Opening of ureter from left inferior renal pelvis.
Opening of ureter from left superior renal pelvis.

Horse shoe kidney

Notice The axis of Both kidneys
Upper Poles Normally are closer to each others than lower

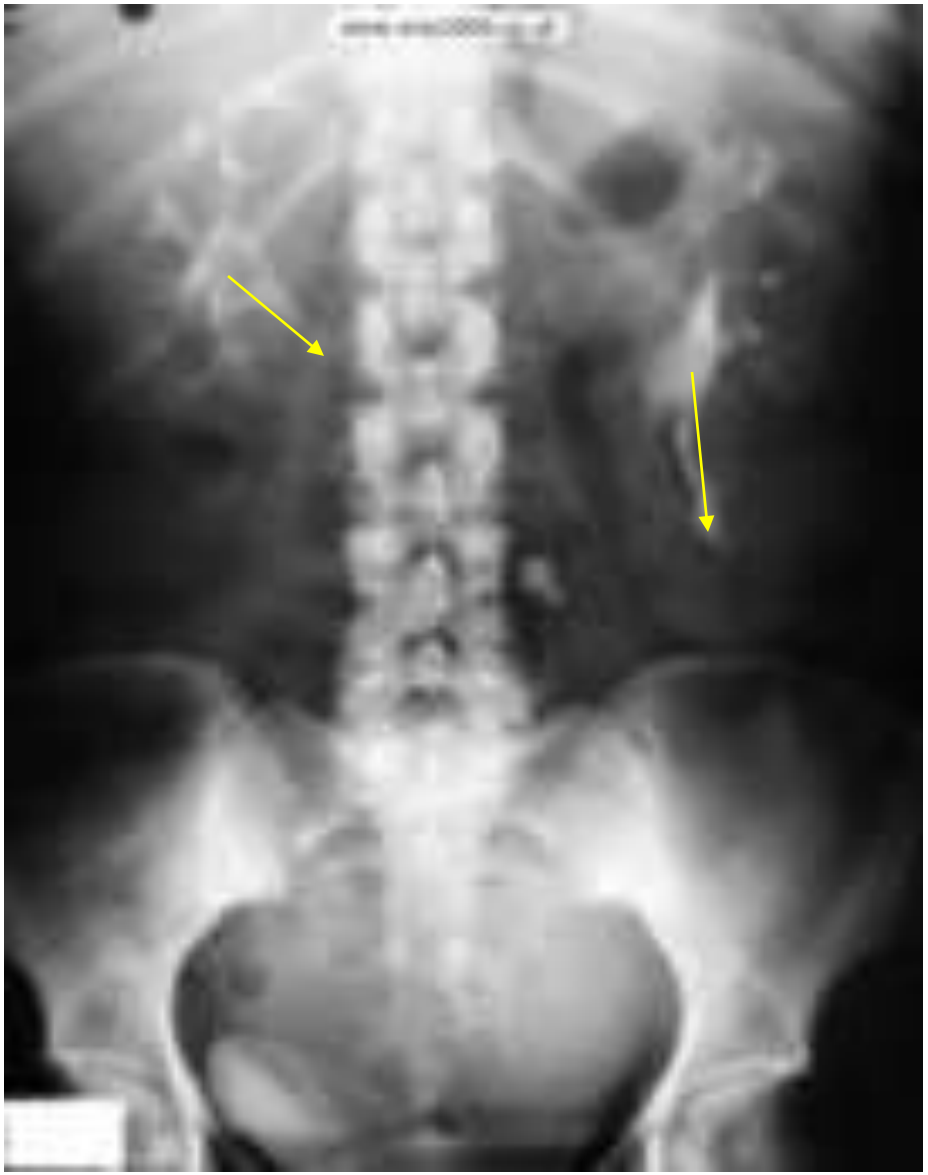
Rt Double Kidney - unilateral

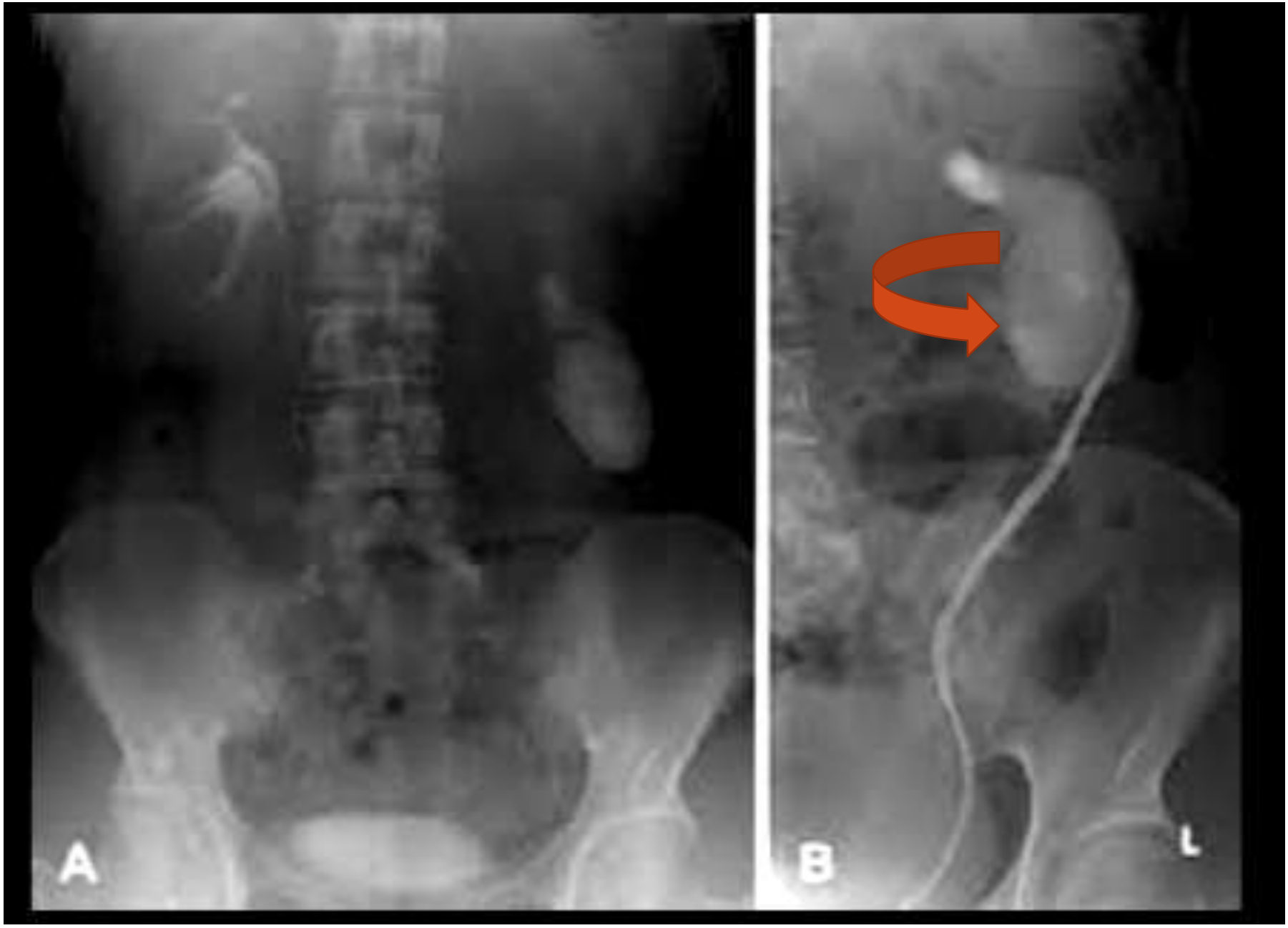
Compare with normal

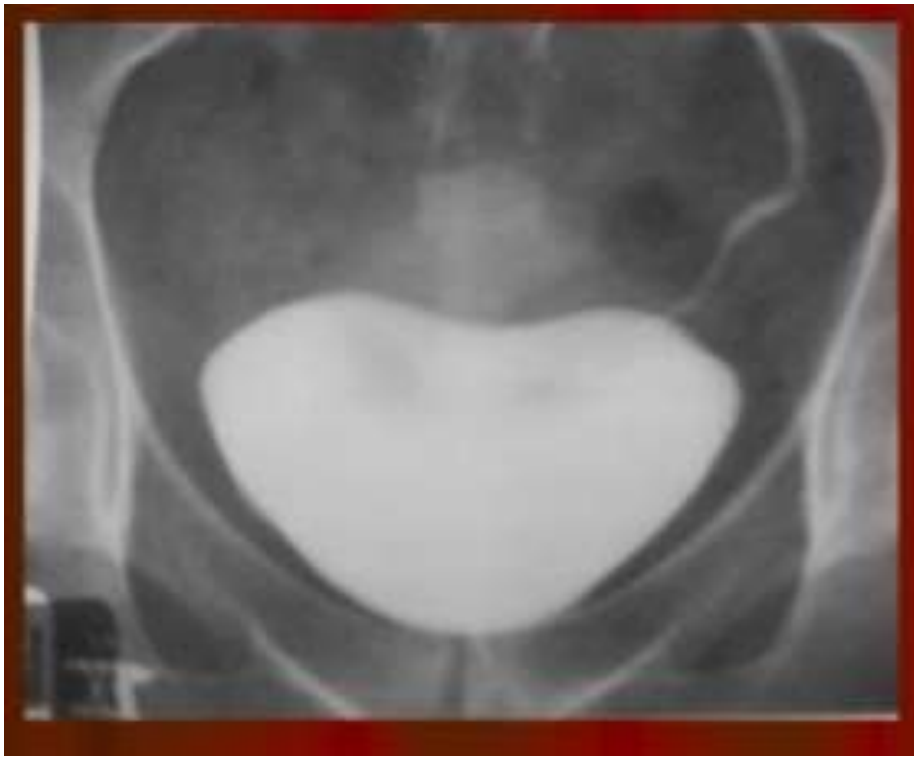
Kidney Malposition

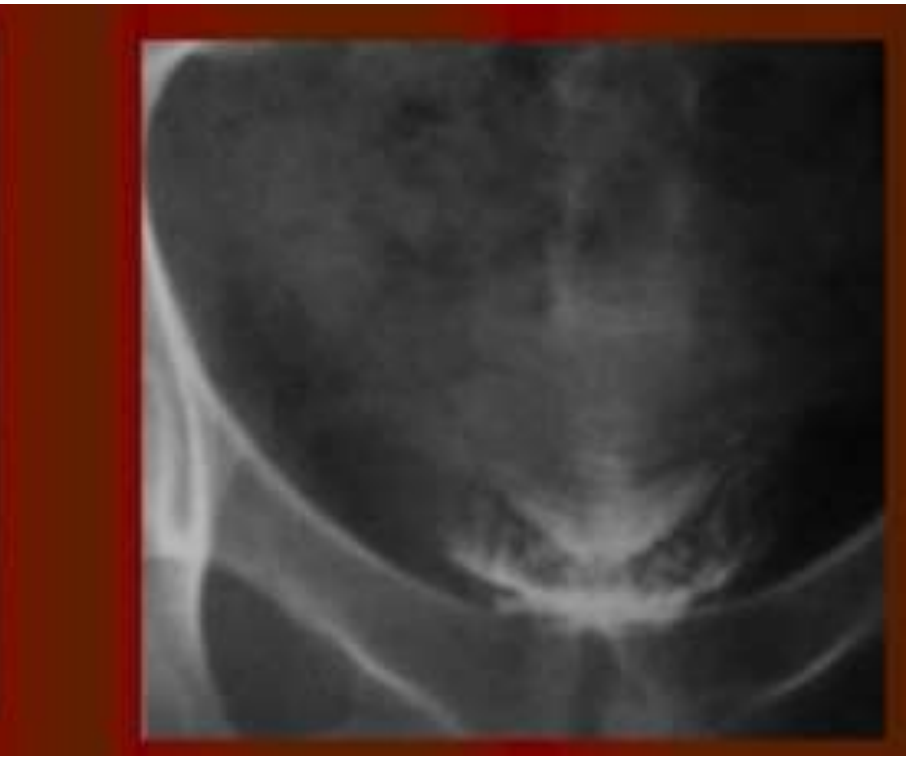
Ectopic kidney

Mal rotated kidney




A
B
L





- **IVU –**

Normal full Bladder

- Average capacity , Smooth outline , No outpouching or Filling deffects.

- **IVU –**

Post evacuation Film

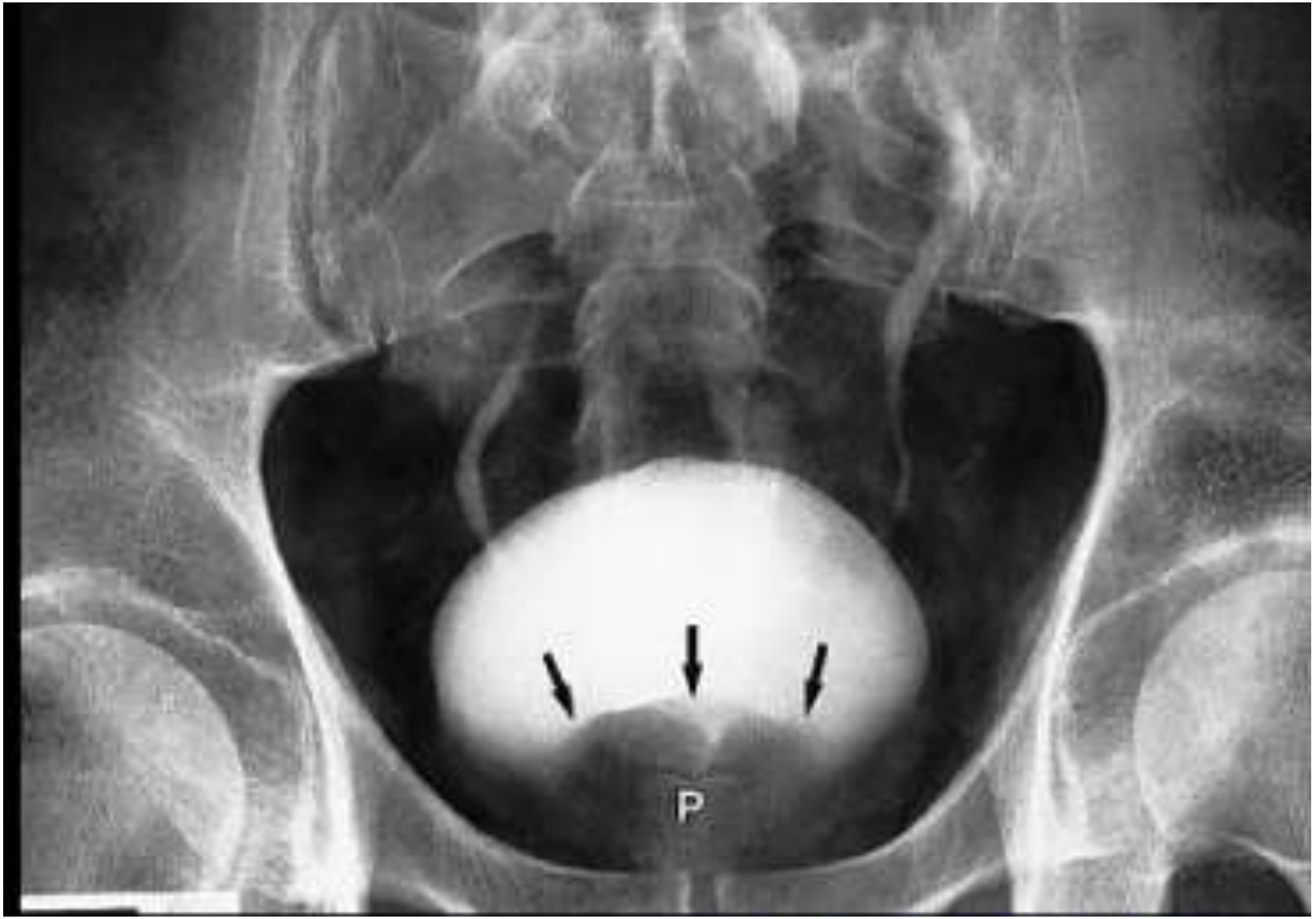
- No significant residual.

Out pouching

→ Urinary Bladder Diverticulum

Filling defect

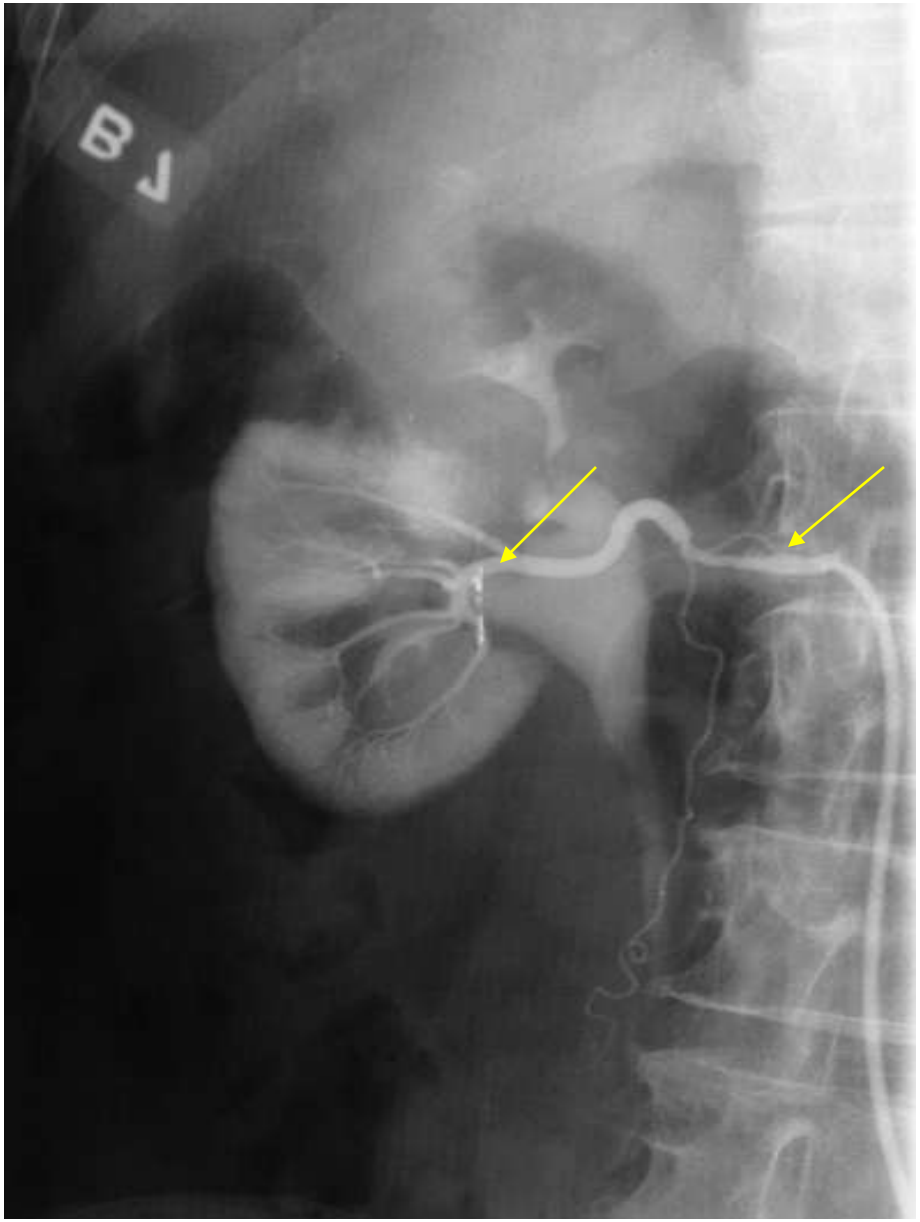
Cancer bladder



- Filling Defect may be an outer impression → a Case of benign prostatic Hyperplasia

Other X ray Techniques

- ***Ascending Cysto – urethrography***
- ***Descending Urography*** "through nephrostomy Tube"
-
- ……. & ***Renal Angiography***



Renal Angiogram

U.S. & Renal System

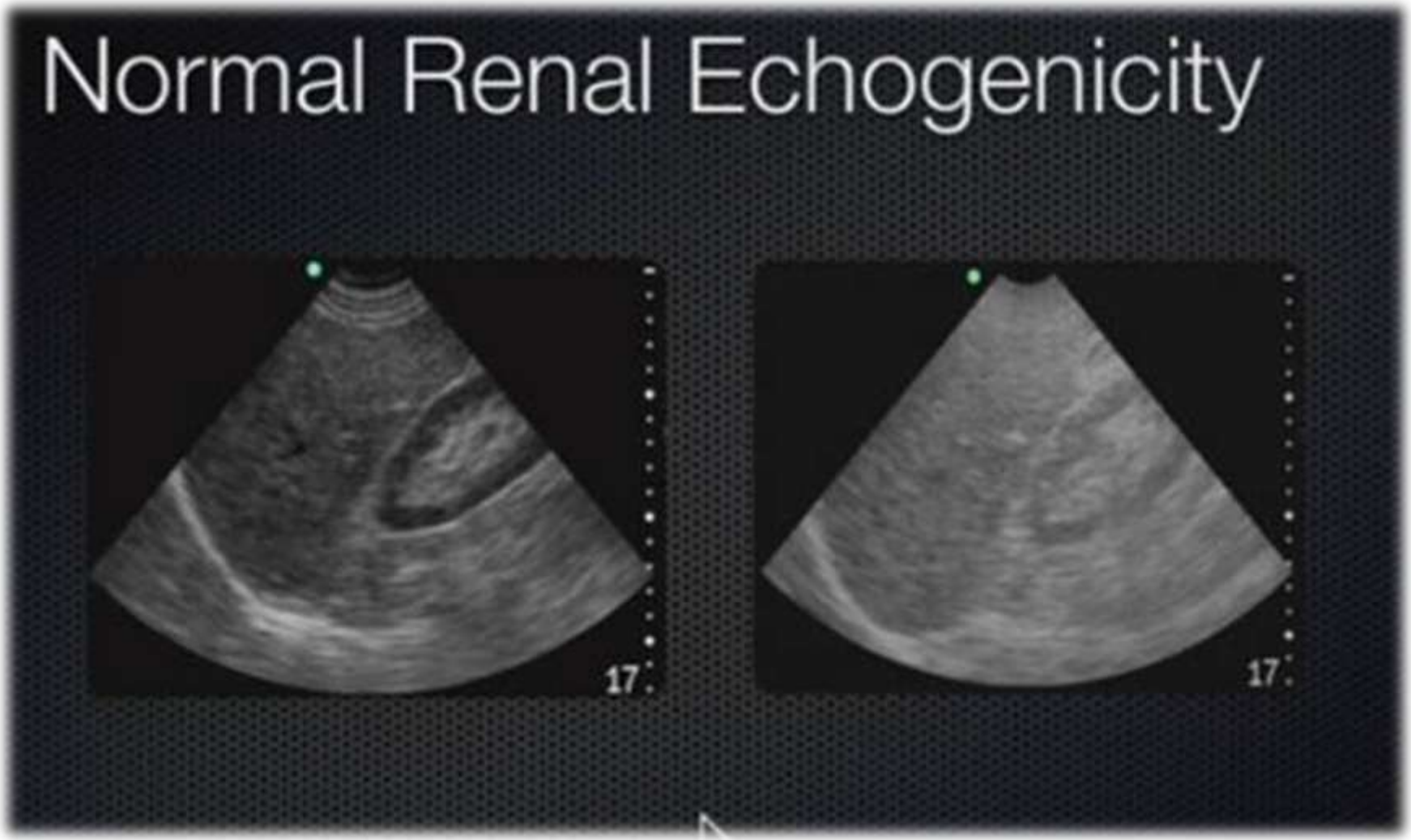
US Advantages:

- Non Invasive.
- Non ionizing. “As X – ray & CT “
- Portable.
- Non expensive.
- Real time images.
- Diagnostic & interventional.

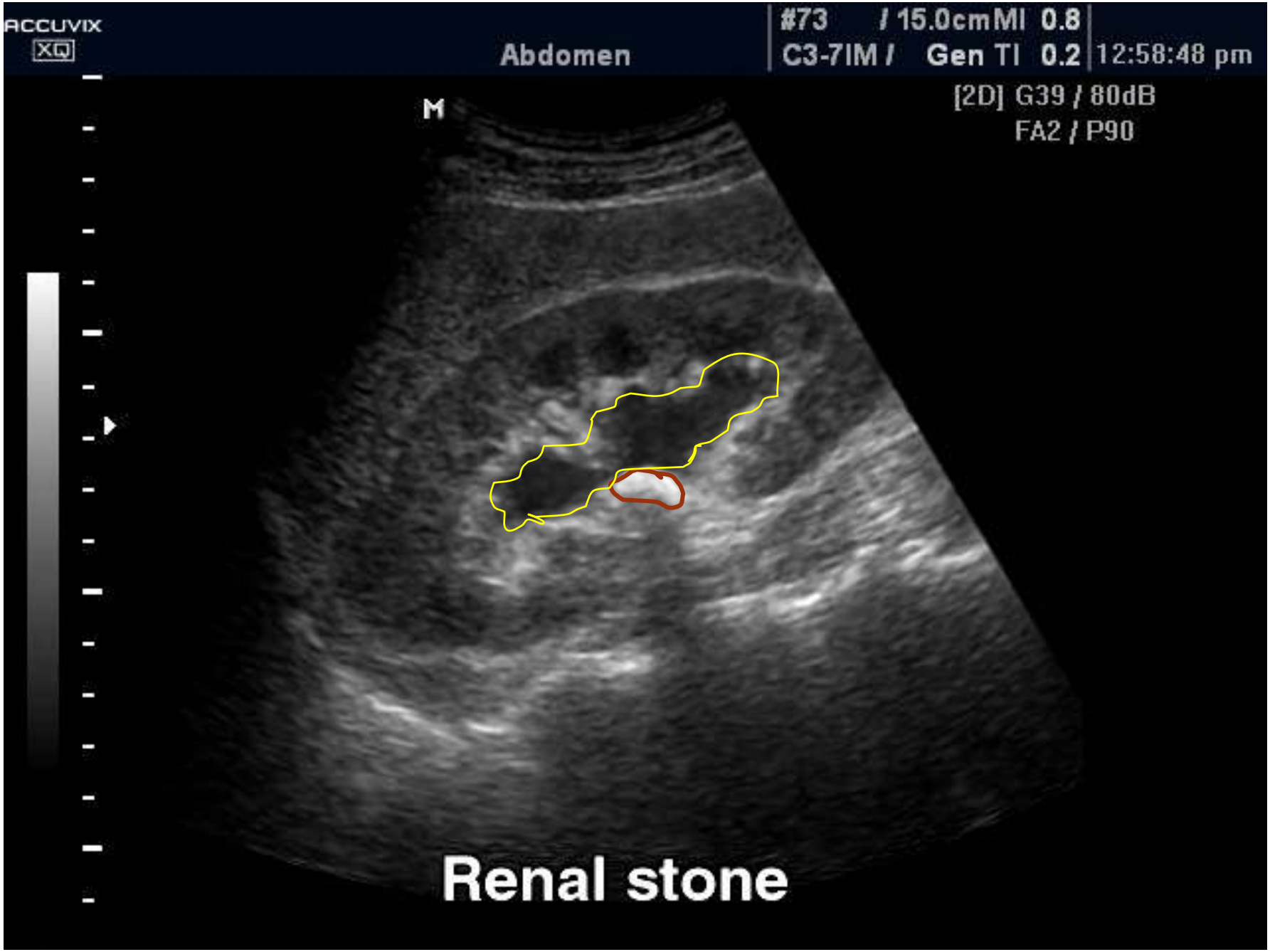
US Obstacles

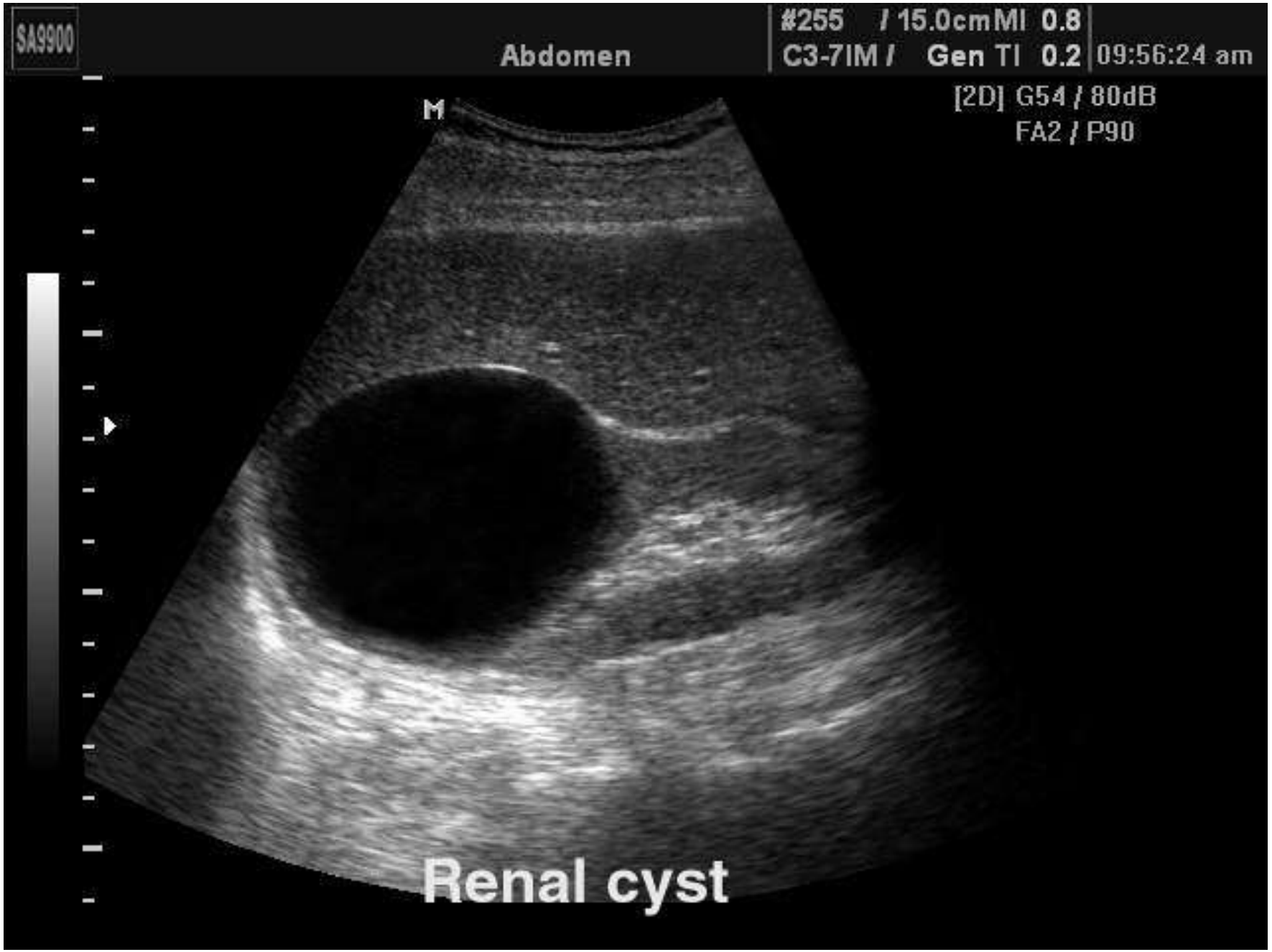
- AIR……(emphysema …..etc)
- Non co-operation…….(children)
- Bandages.
- Bones……..(eg. T.C. US)
- Hair “relatively”

Normal Renal Echogenicity



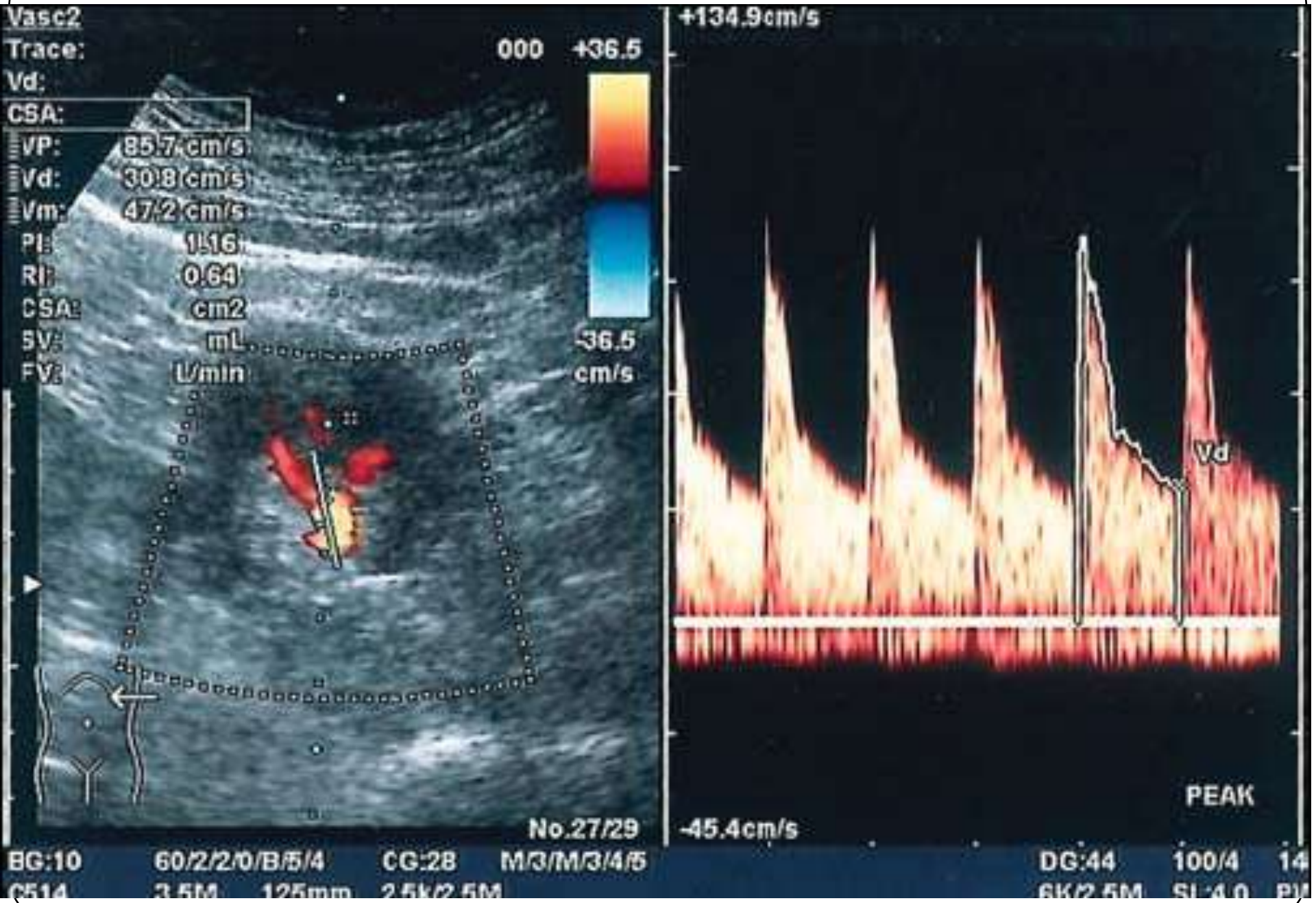

FAST MGH
C6-2
15.0cm
2D
Gen
Gn 60
56
3/3/3
Color
2.0 MHz
Gn 60
3/7/7
Filtr Med
Mild Obstruction
imgflip.com


ACCUVIX
XQ
Abdomen
#73 / 15.0cm MI 0.8
C3-7IM / Gen TI 0.2
12:58:48 pm
[2D] G39 / 80dB
FA2 / P90
M
Renal stone


SA9900
Abdomen
#255 / 15.0cm MI 0.8
C3-7IM / Gen TI 0.2
09:56:24 am
[2D] G54 / 80dB
FA2 / P90
M
Renal cyst


SA9900
Abdomen
#127 / 15.0cm MI 0.8
C3-7IM / Gen TI 0.2
12:57:18 pm
M
[2D] G39 / 80dB
FA2 / P90
M
[2D] G39 / 80dB
FA2 / P90
Renal Stone

Doppler Ex. Of Renal As.

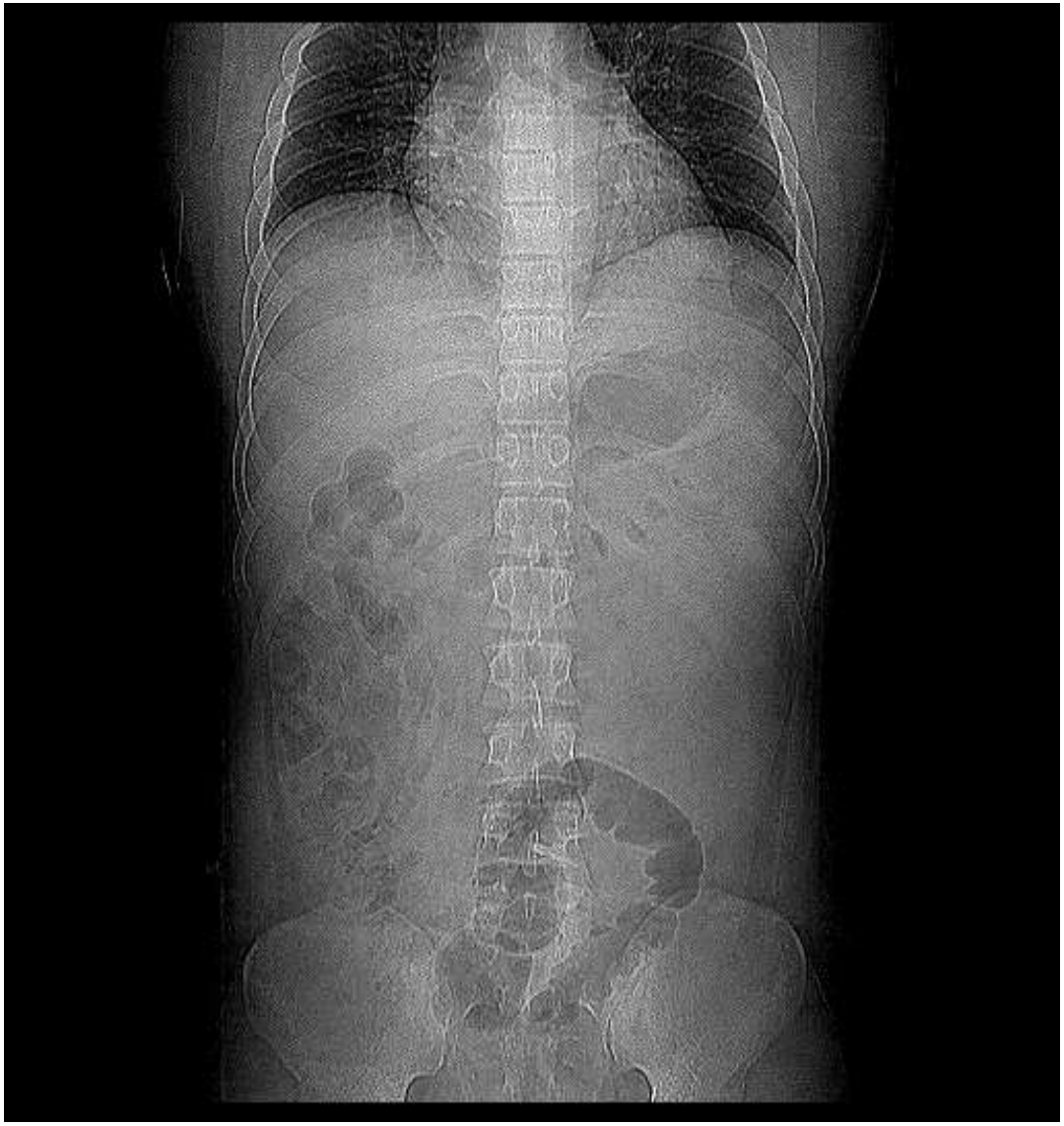

Vasc2
Trace:
Vd:
CSA:
VP: 85.7 cm/s
Vd: 30.8 cm/s
Vm: 47.2 cm/s
PI: 1.16
RI: 0.64
CSA: cm2
SV: mL
FV: L/min
000 +36.5
-36.5
cm/s
No.27/29
+134.9cm/s
Vd
PEAK
-45.4cm/s
BG:10 60/2/2/0/B/5/4 CG:28 M/3/M/3/4/5 DG:44 100/4 14
C514 3.5M 125mm 2.5k/2.5M 6K/2.5M SI:4.0

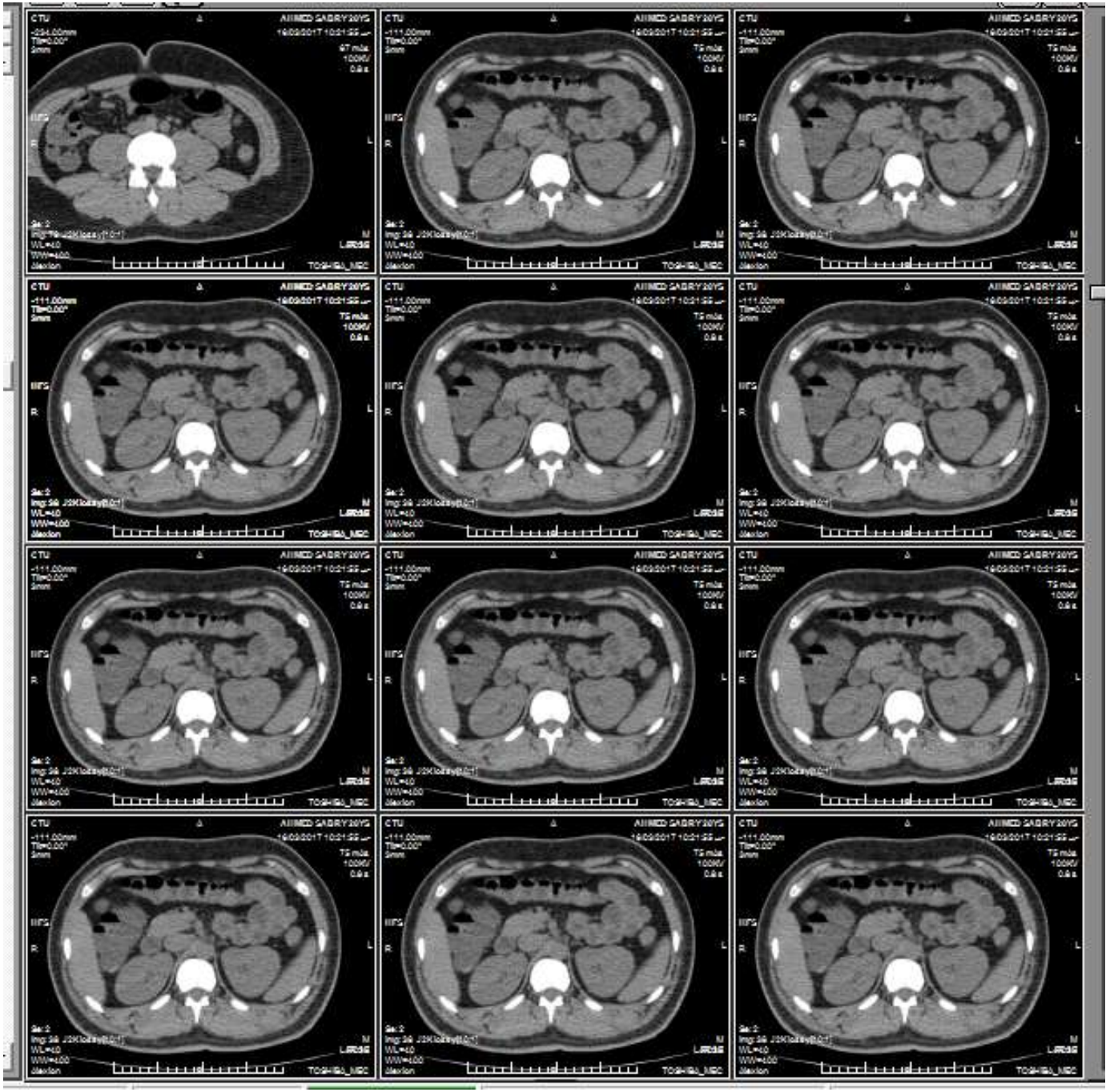
CT Renal System

CTU

- Kidneys are seen in **CT Abdomen** & **CTU**
- CTU is CT scan of Urinary Tract "***with out oral contrast***"
- CTU = computed Tomography Urography
- Pre & Post contrast
- IV contrast "Urografin , Ultravist ……etc"
- More details , 3D reconstruction are available
- More Dose of Radiation "X ray "
-

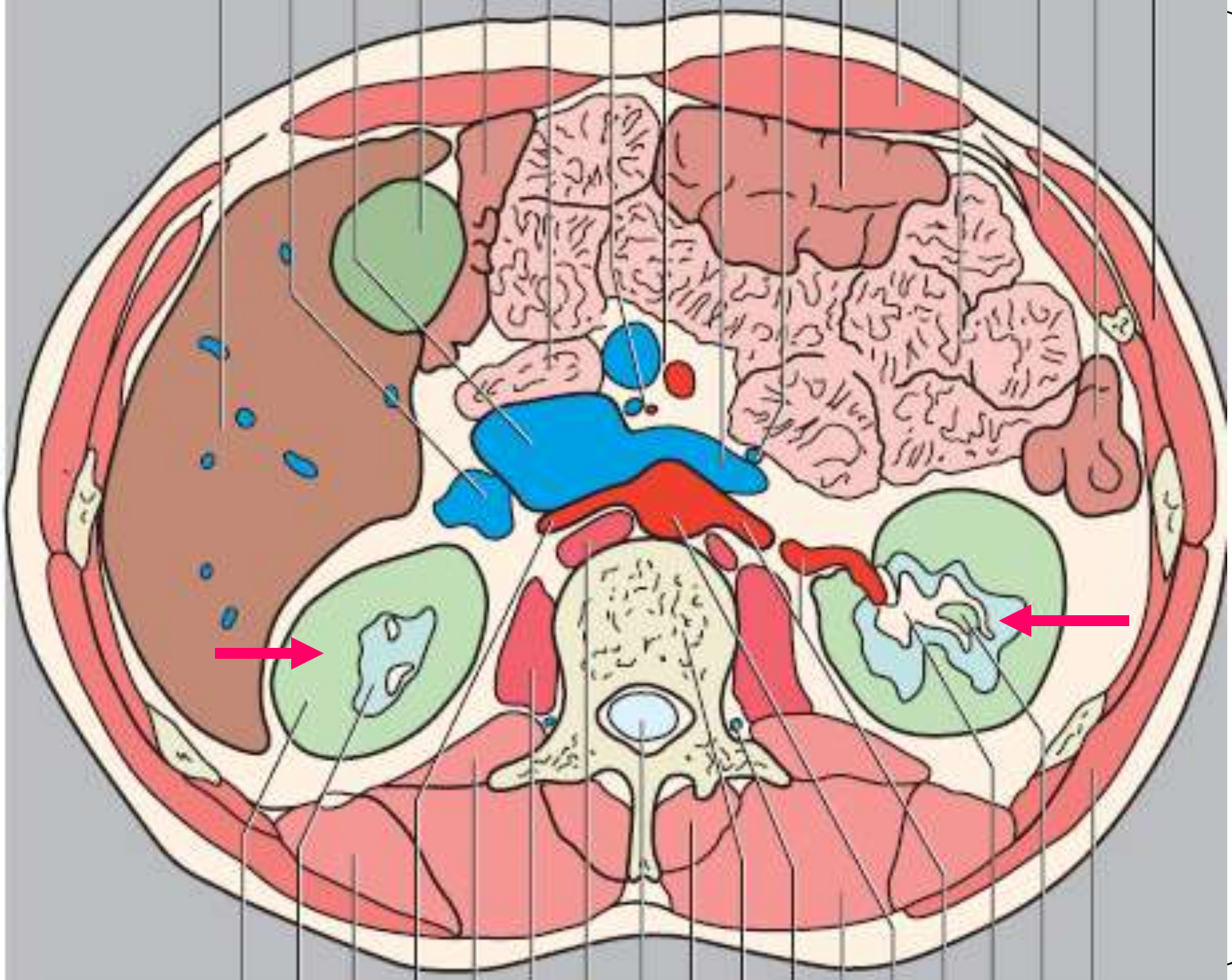
- CT also begin with plain scan = SCOUT

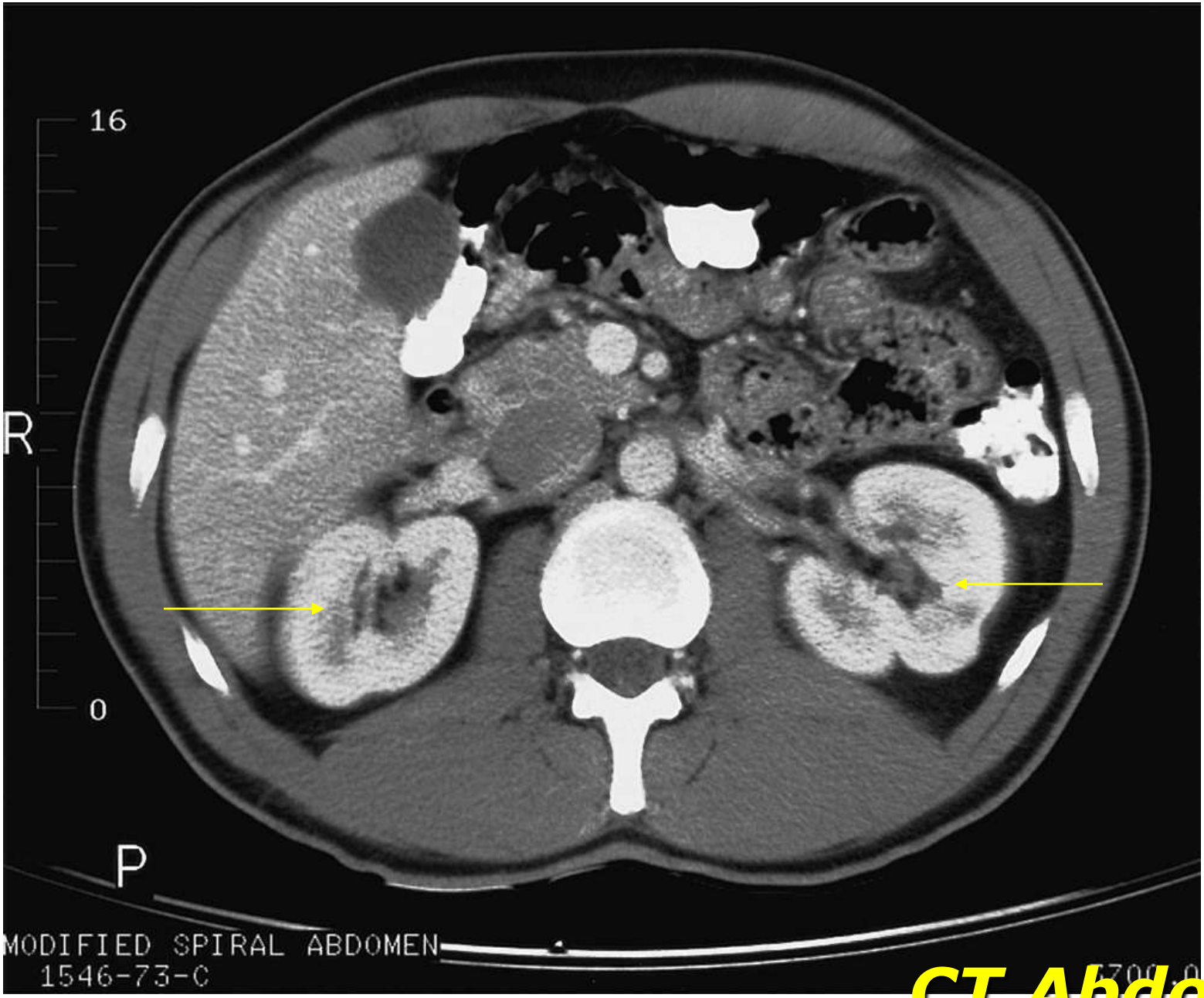




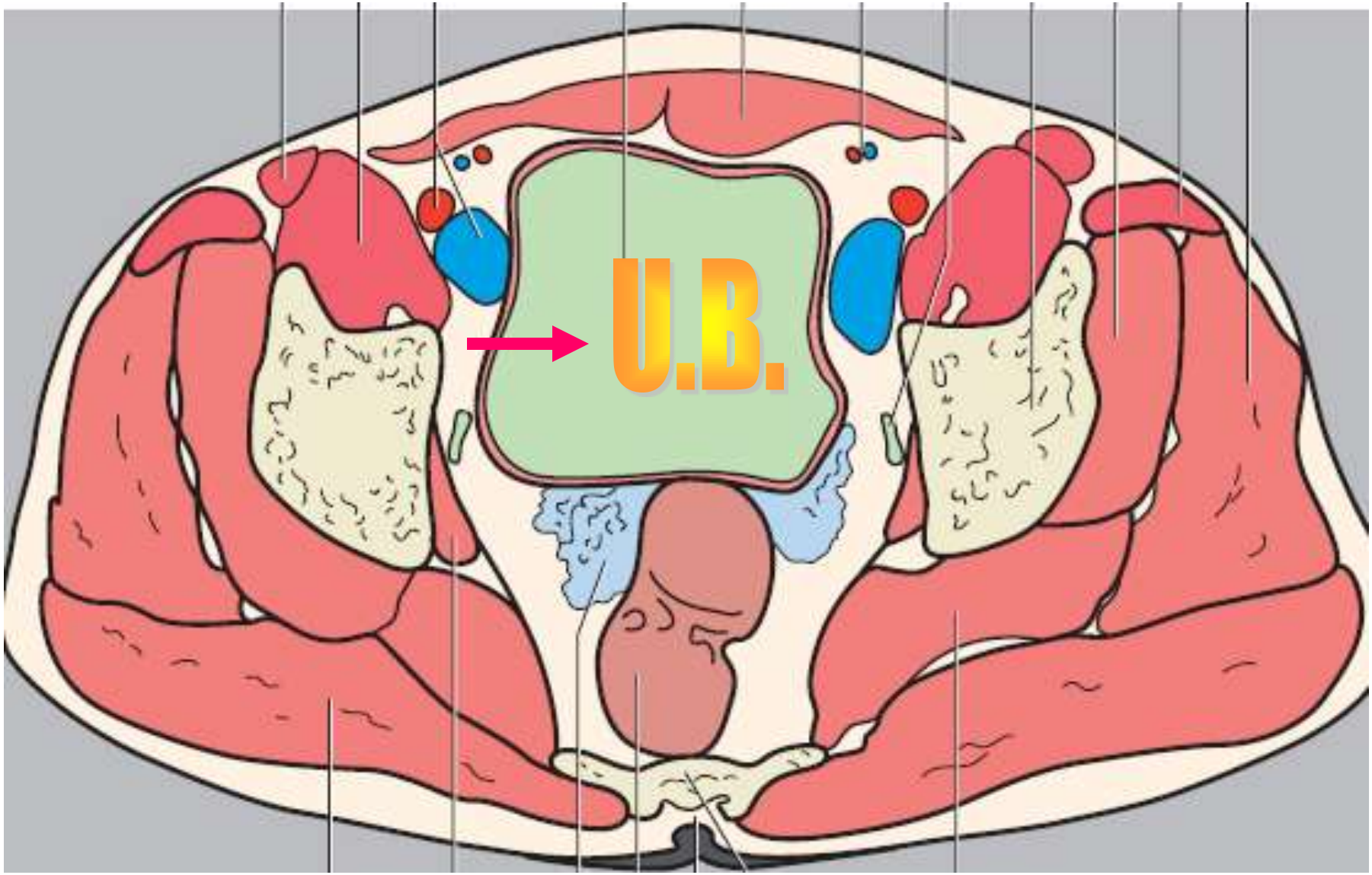
CTU Film

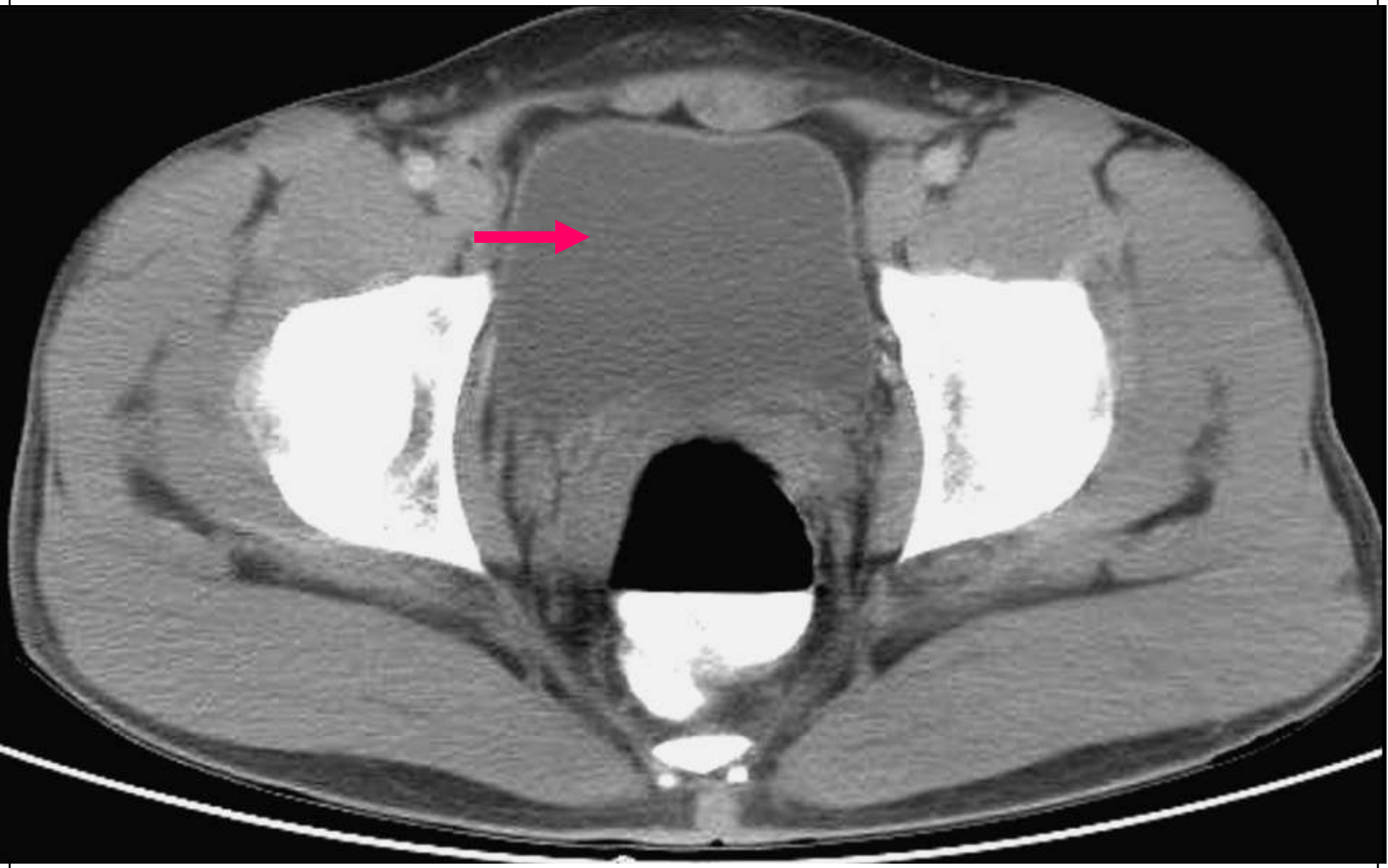

A
R
L
P
MakeAGIF.com

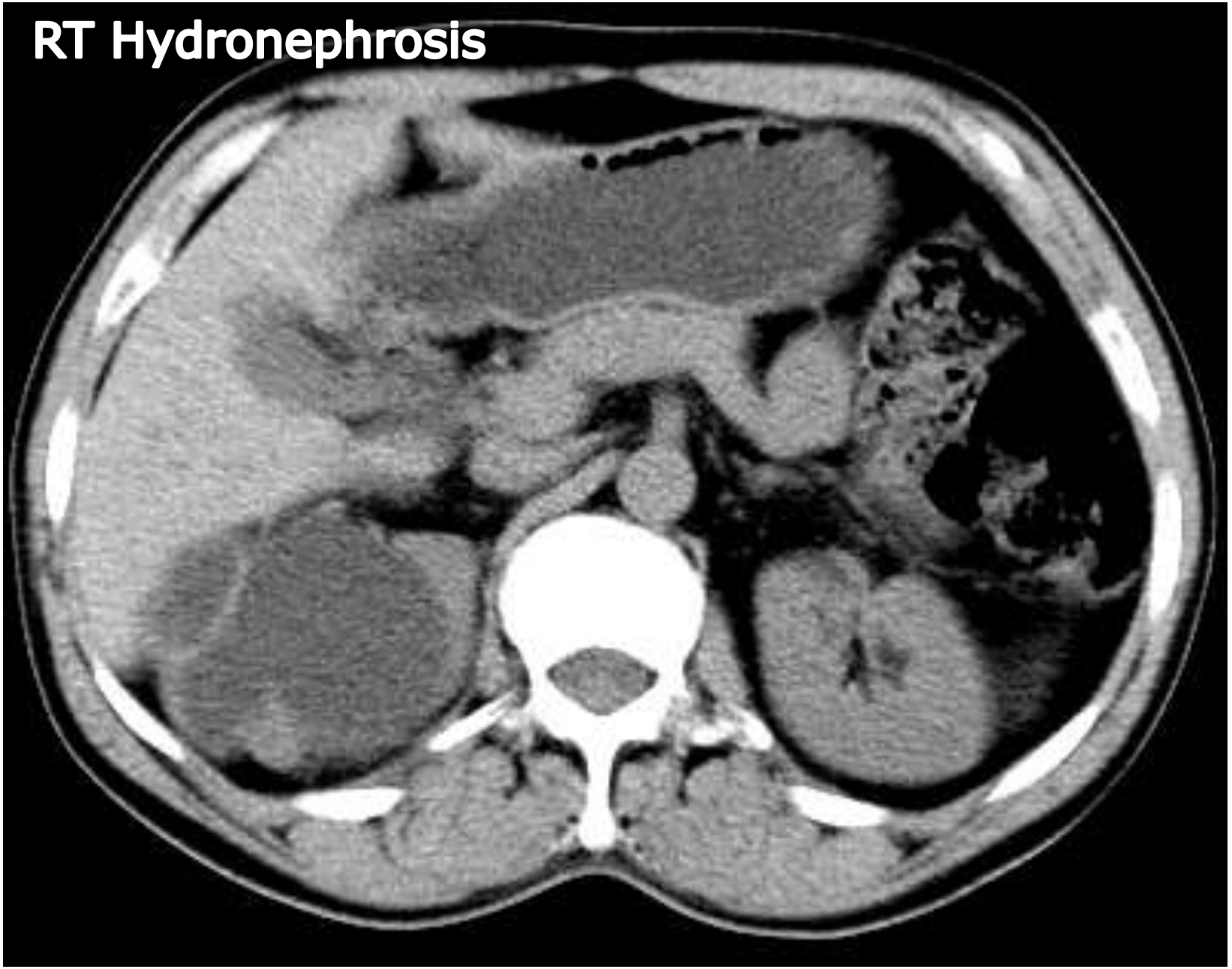


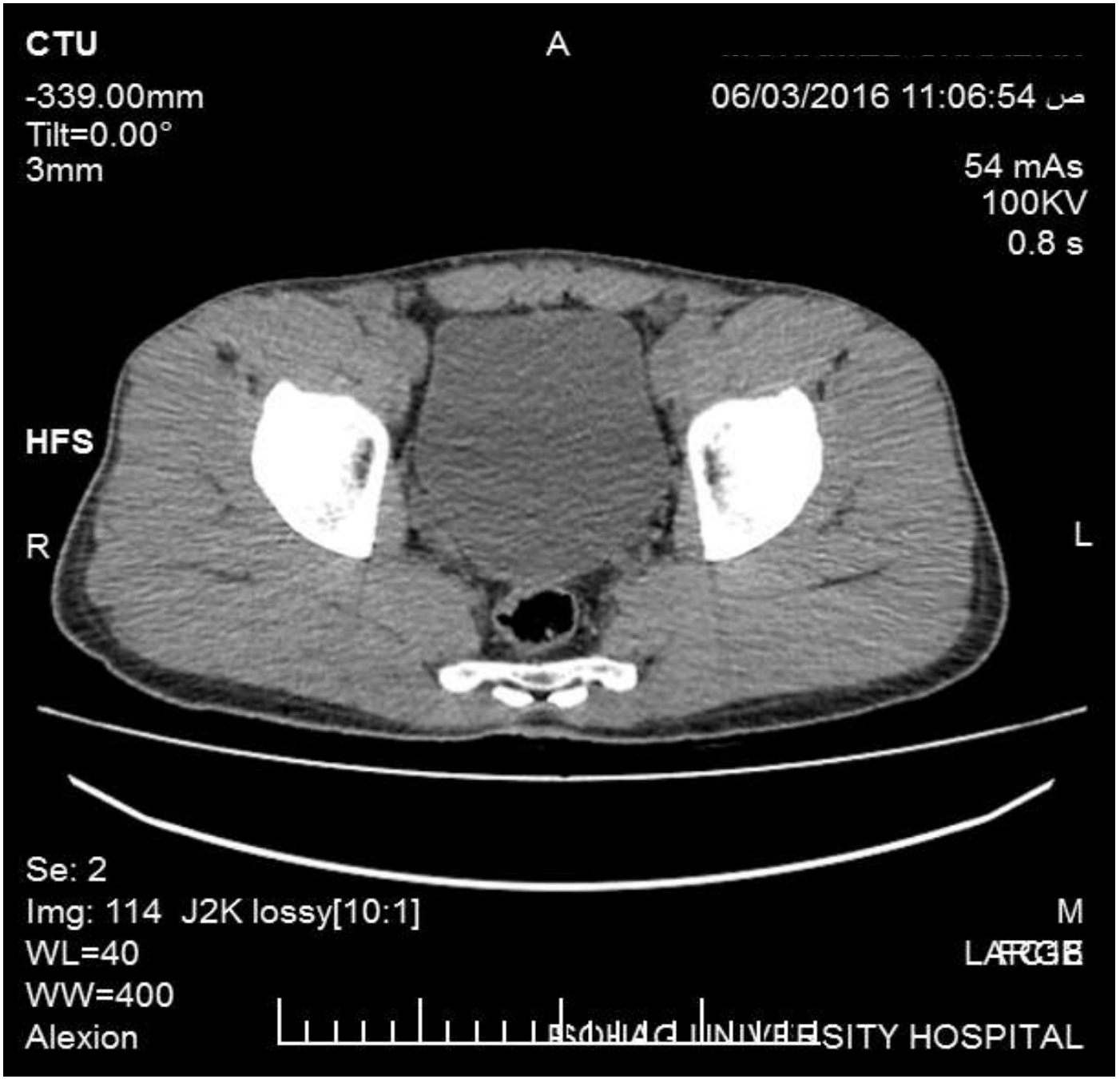


CT Abdomen


U.B.

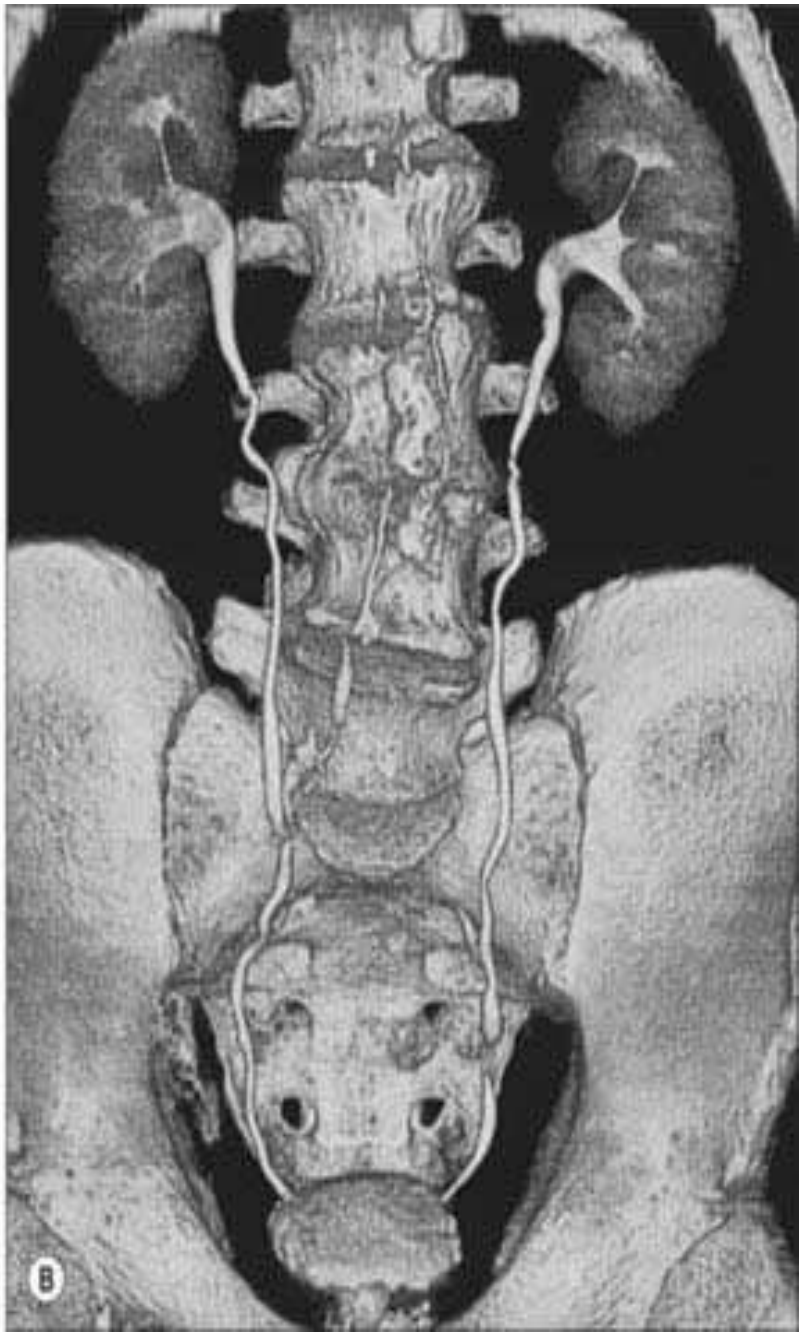


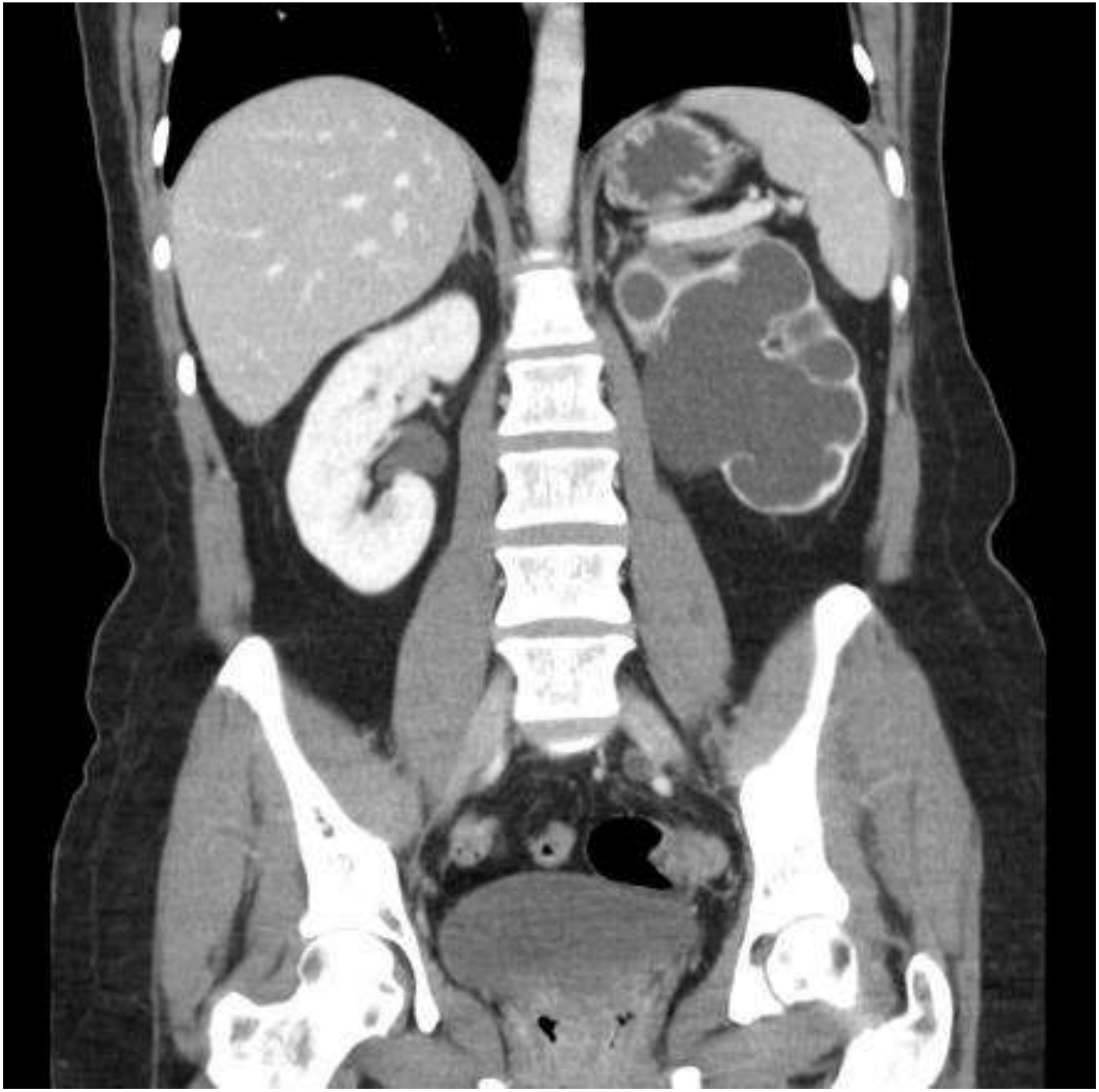

RT Hydronephrosis



- CTU
- non contrast
- Normal Bladder


3
4
1
2
A


B

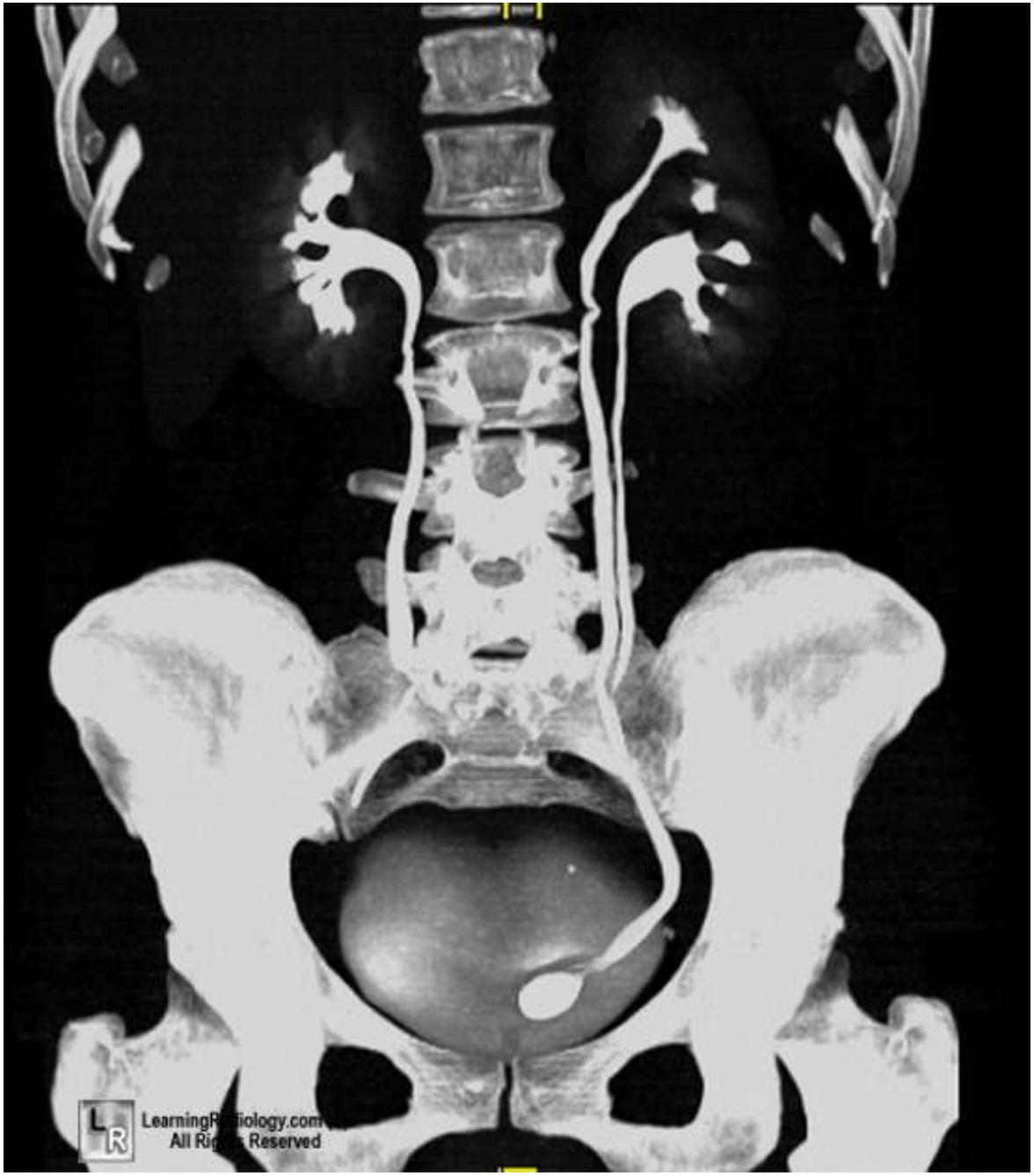


Coronal CTU Reformate image

Lt Sever

Hydronephrosis

- **PUJ**…. Pelvi-ureteric Junction Obstruction

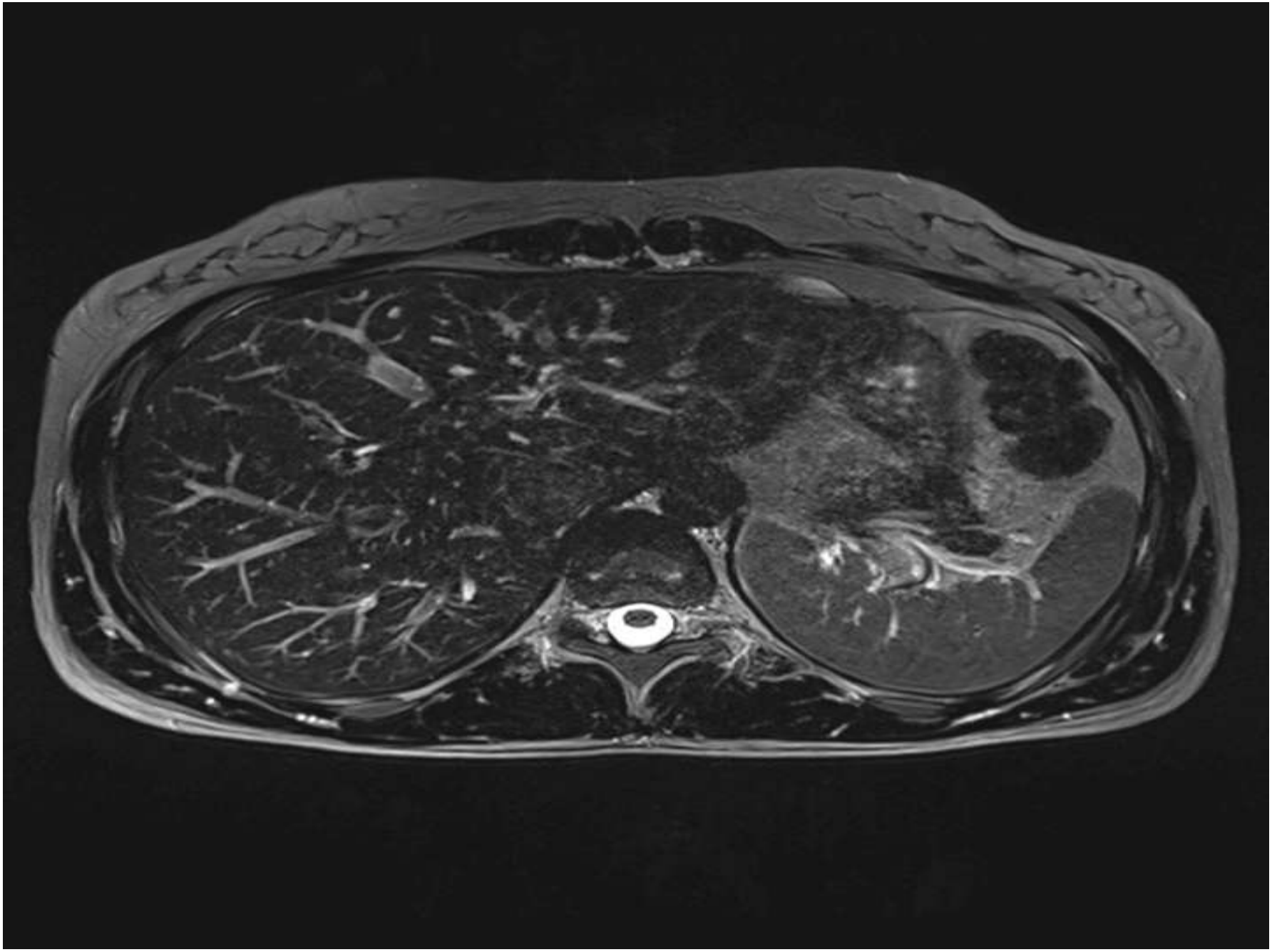


- Lt Double Kidney , Ureter & Lt **Uretrocele**
- 3D Reformate Image

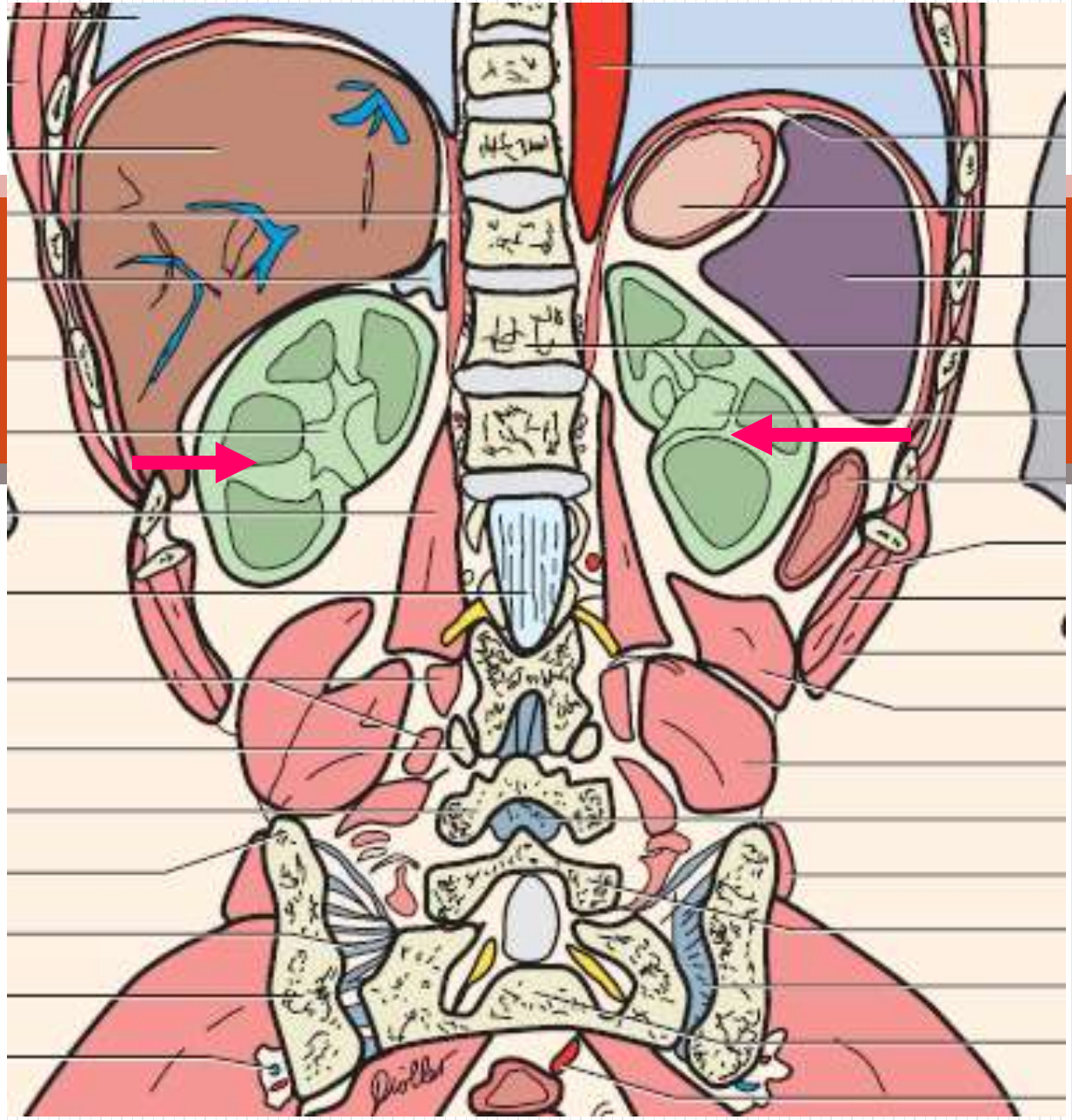
MRI & Renal System

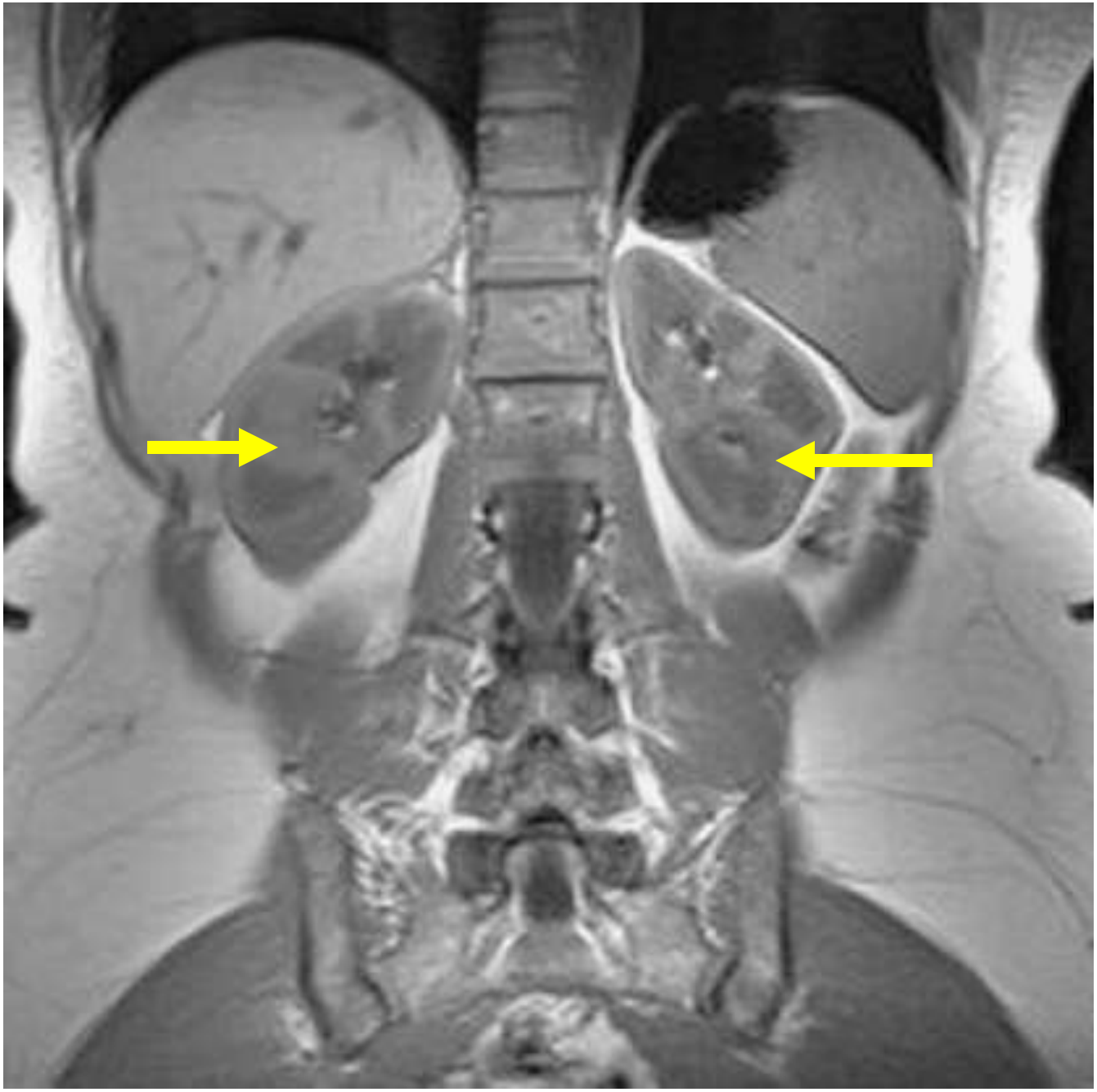
MRU

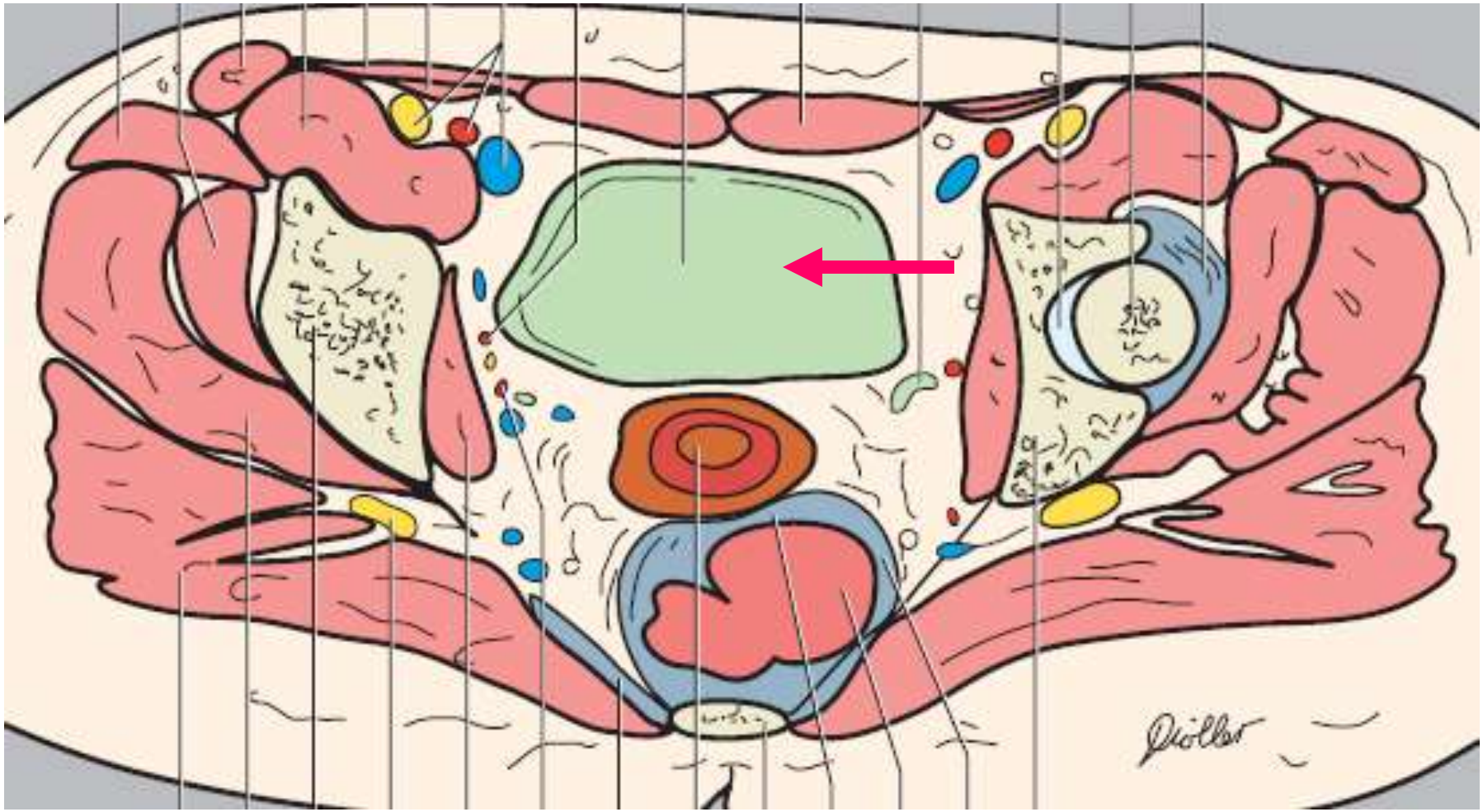
- **Muliplanner** “Axial , Sagital , Coronal & Obliques
- * Multisequnces T1 , T2 , STIR, ……. Etc.
- Good Tissue Differentiation

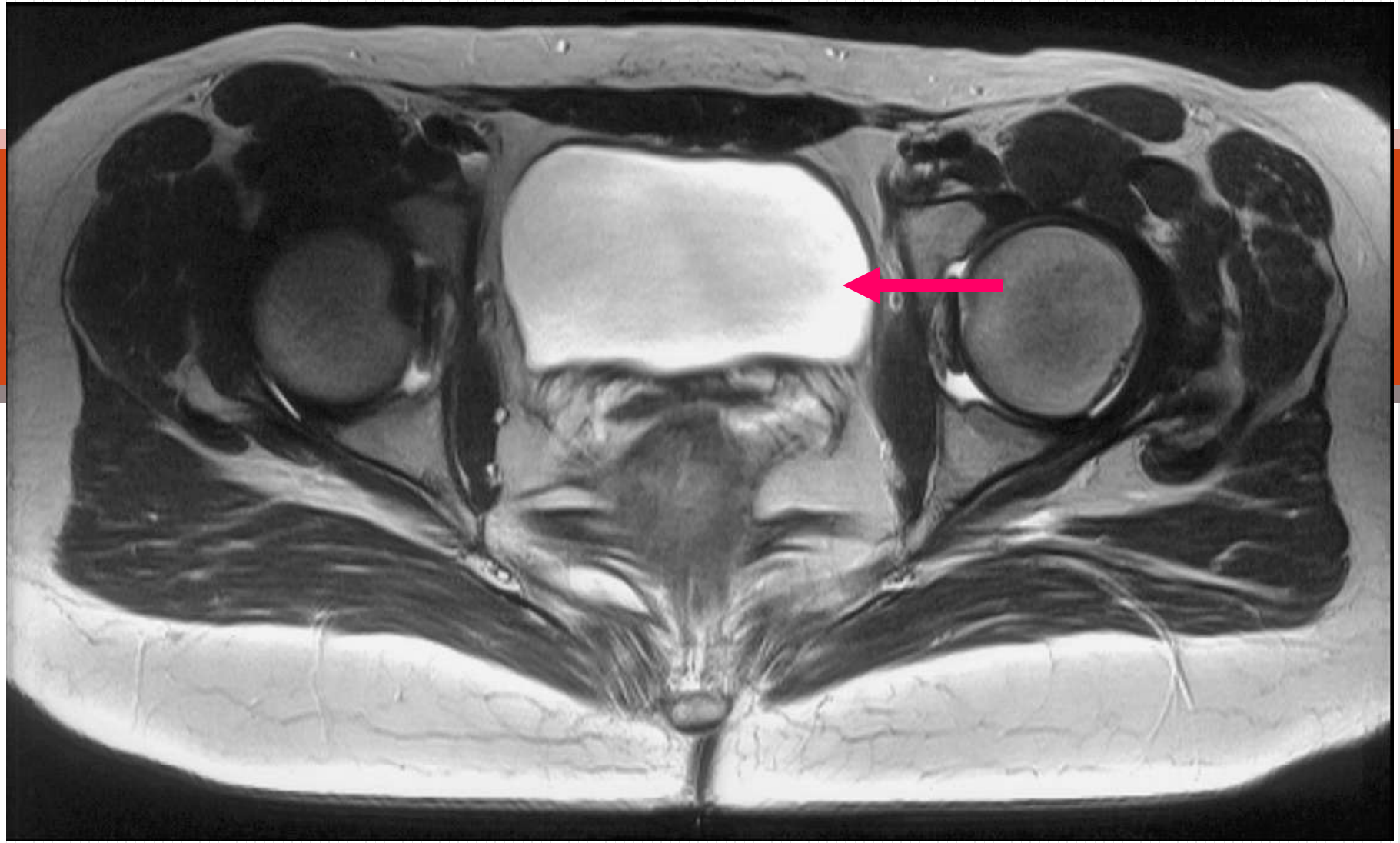


Coronal Plain



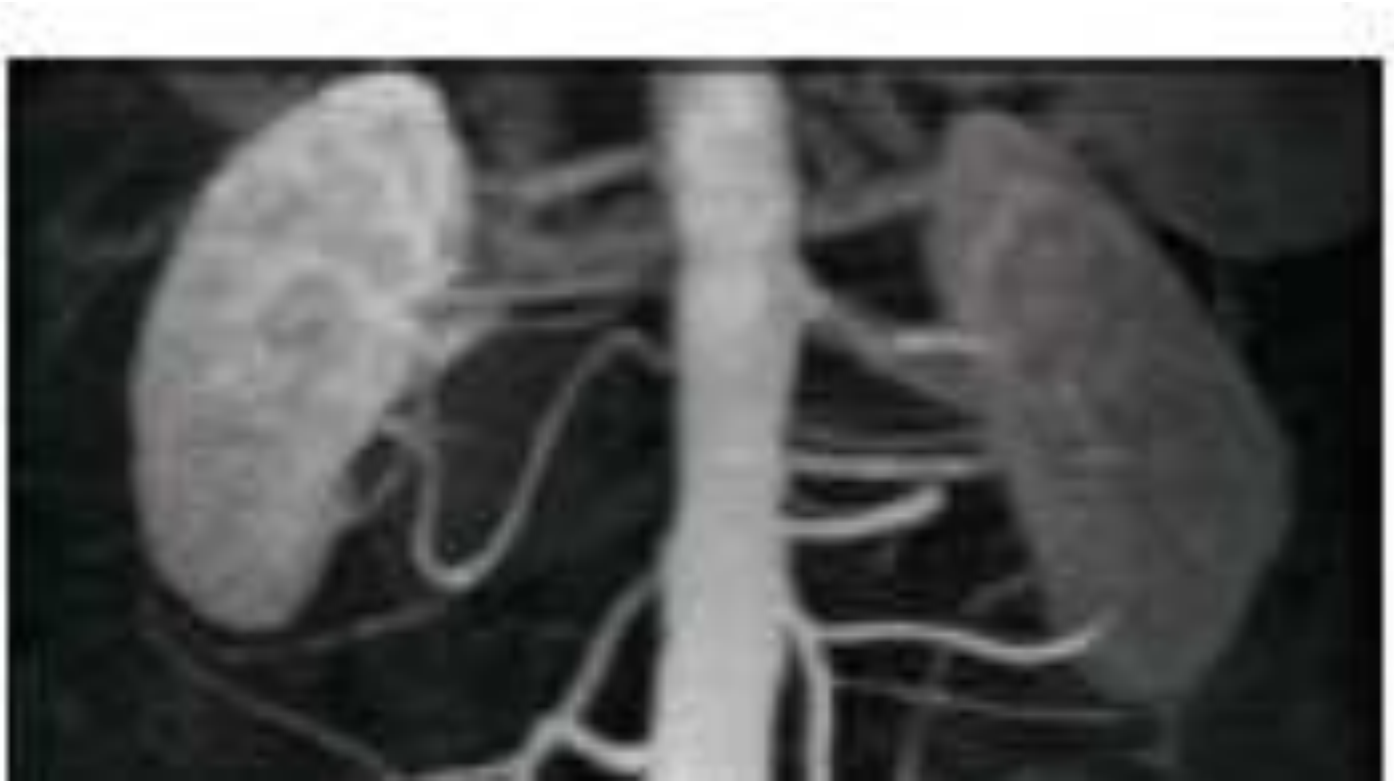






U.B. In MRI…. T2WI

MRA Of Renal As.



Magnetic resonance angiogram using an intravenous bolus of gadolinium contrast showing normal renal arteries

- ***Imaging Modalities are advancing***

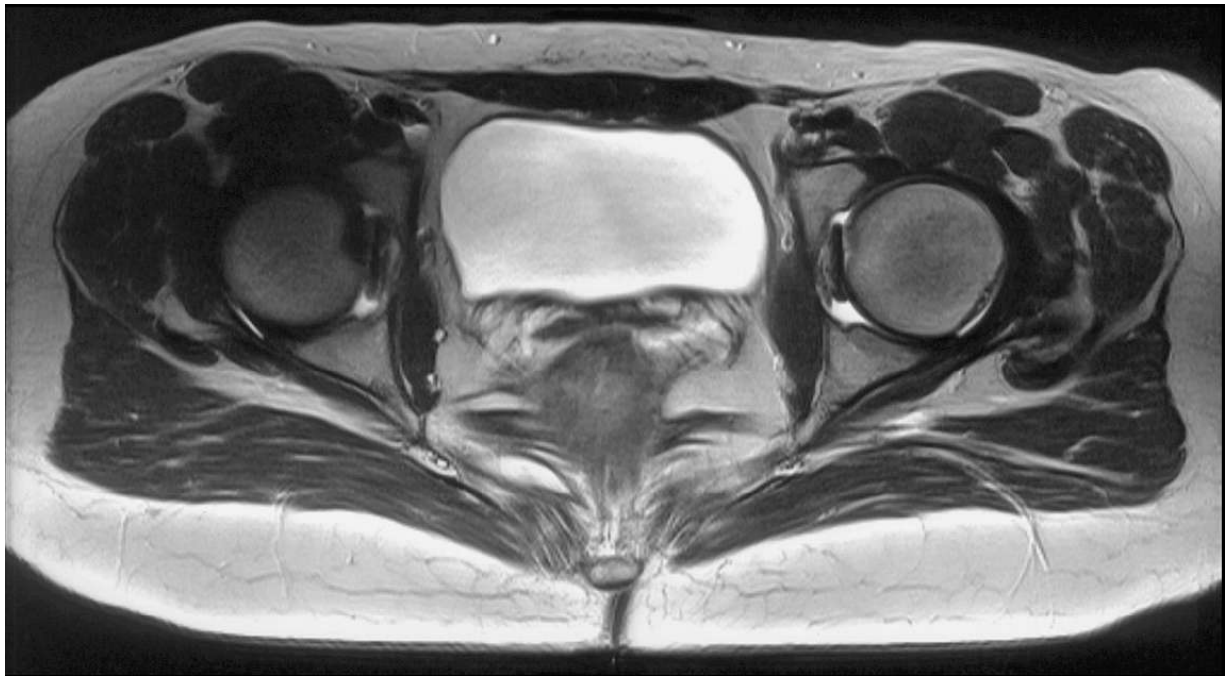
day by day…… But that is the basal that every

Undergraduate should know

QUIZ


www.xray2000.co.uk

Is there backpressure ? Where ?



C.T. Or M.R.I ?

Sources & Further reading :

- *My YouTube channel :*

https://www.youtube.com/c/DrAhmadMokhtarA_M_ABODAHAB/

- *Staff members web site :*

https://staffsites.sohag-univ.edu.eg/ahmed_abodahab

- *PDF File of the lecture :*

https://staffsites.sohag-univ.edu.eg/stuff/supplements/6008

- *Renal Imaging revision - Video Lecture :*

https://www.youtube.com/watch?v=7i9WdKvchlI&list=PLqU6GNJJ8xwkhCDPznBYkvG3_NXZt-B17&index=8

THANK YOU

with my best wishes

Dr. A.M. Abodahab

Jan 2022