2025

KARNATAKA RADIOLOGY EDUCATION PROGRAM

CASE 2

- 57 year old male, K/C/O DM and HTN.
- Presented with complaints of low back pain and bilateral lower limb swelling x 1 month .
- Patient initially went to outside hospital and diagnosed with bilateral lower limb DVT and resolving AKI.
- Outside MRI cervical and lumbar spine with thoracic spine screening done and it showed

➢ Multilevel vertebral body lesions.

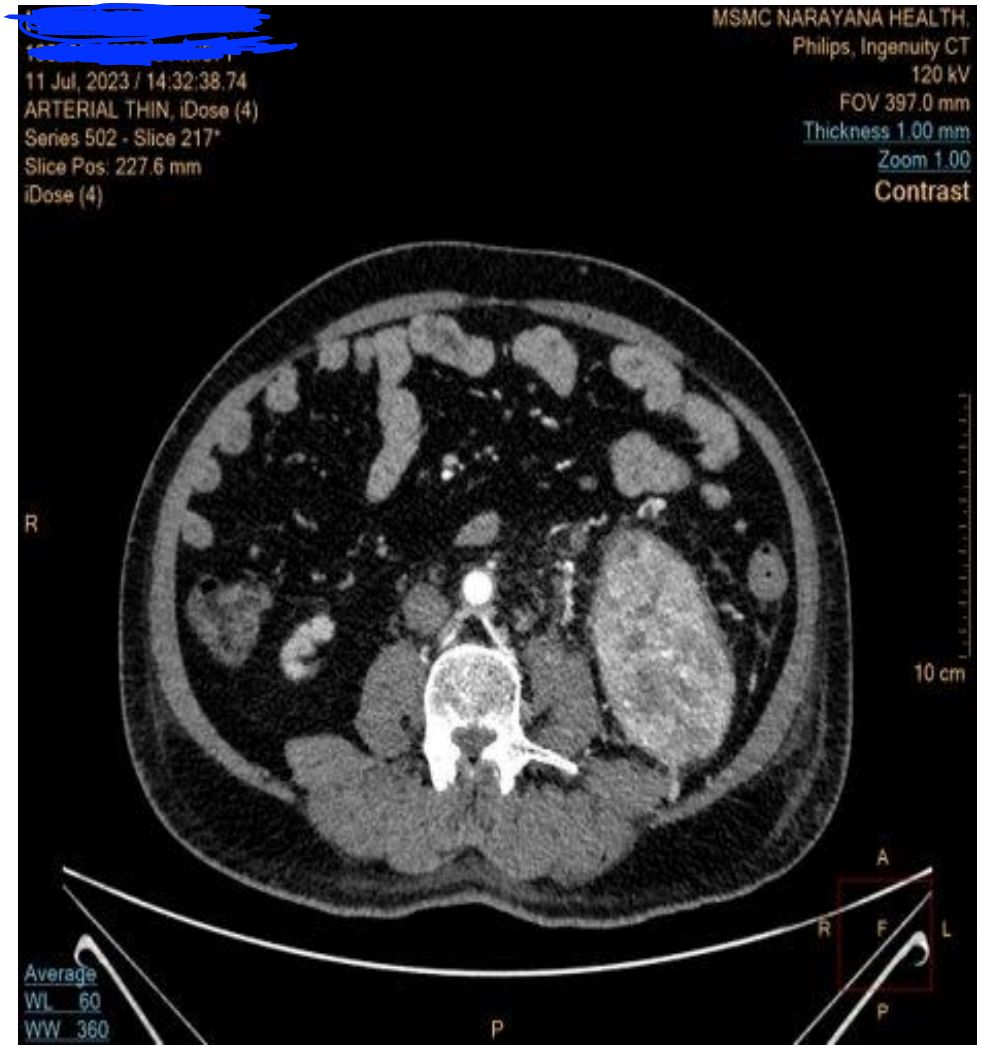
➢ Ancilliary findings showed thrombus in the visualised left renal vein and IVC.

- Hb 10.8 and creatinine 1.4 (eGFR 52).
- ECHO showed normal EF and no right heart strain.

- In view of thrombus in left renal vein and IVC ,CECT abdomen was advised.

FINDINGS:

- Heterogenously enhancing soft tissue density lesion arising from mid and lower poles of the left kidney with extension into the left renal vein and renal IVC.
- Multiple perinephric, preaortic and left paraortic lymph nodes.
- Osteolytic metastasis in the L2 and L4 vertebral body.
- Left adrenal gland metastasis.
- Acute deep vein thrombosis from the infrarenal IVC, bilateral common iliac veins, external iliac veins, internal iliac veins up to the visualized common bilateral femoral veins.
- **D.D:**
- RCC
- Sarcomas
- Lymphoma
- Metastasis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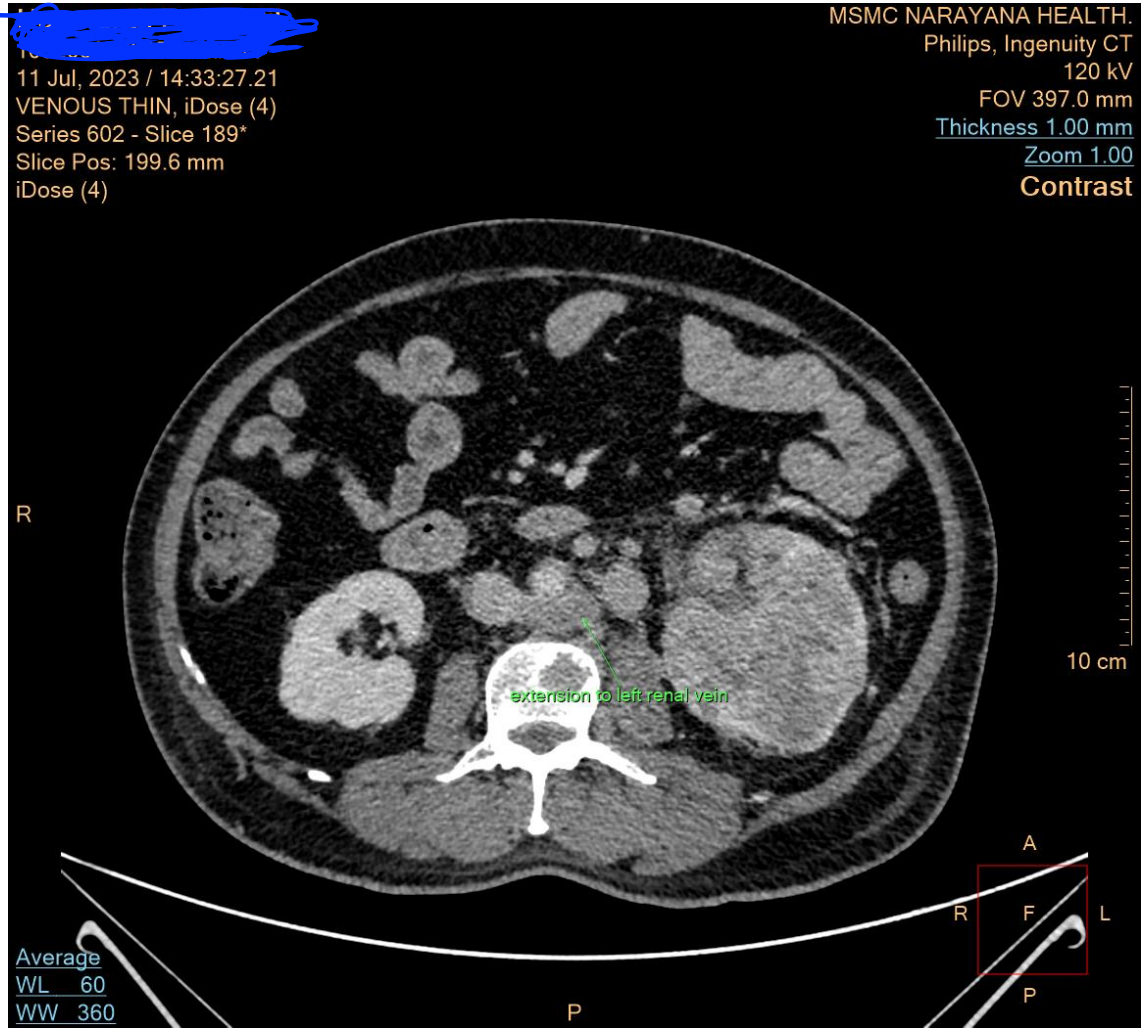
Contrast
R
10 cm
A
R
F
L
P
P
Average
WL 60
WW 360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Philips, Ingenuity CT
120 kV
FOV 397.0 mm
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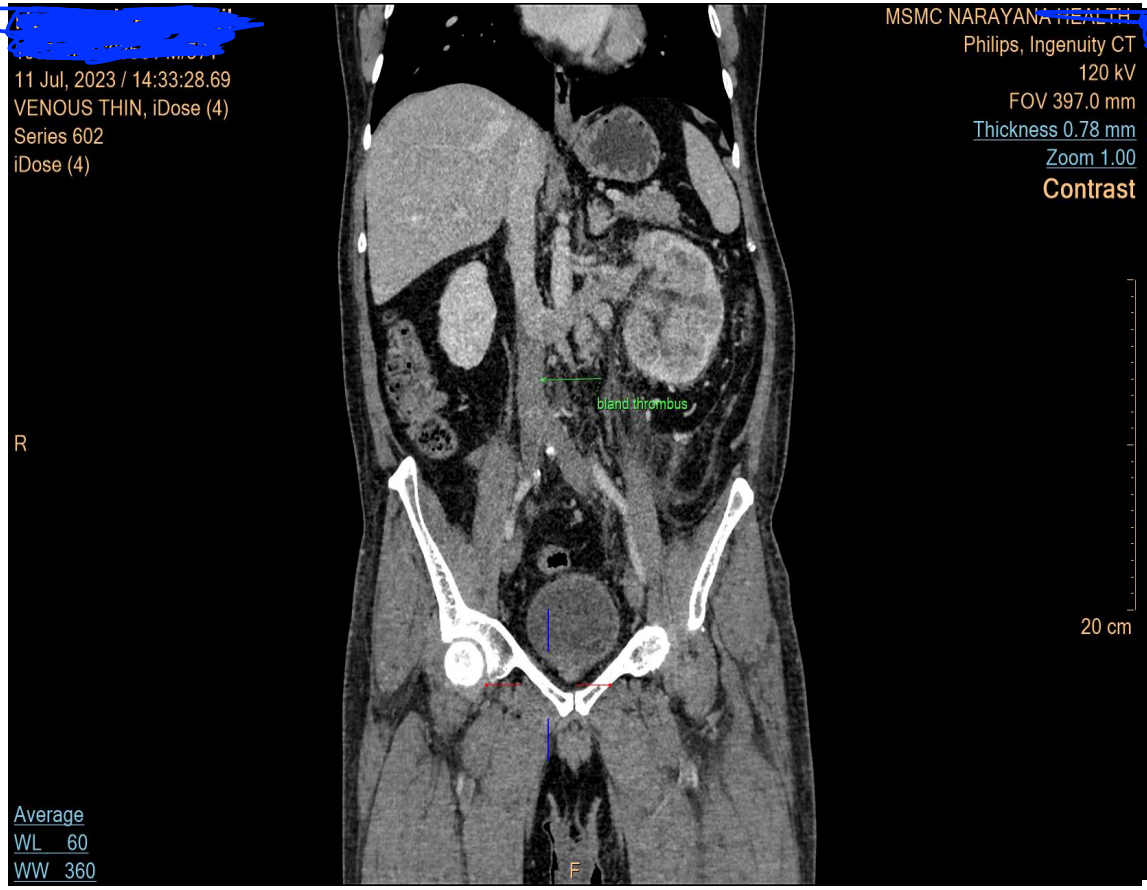
Contrast
R
extension to left renal vein
10 cm
A
R
F
L
P
P
Average
WL 60
WW 360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VENOUS THIN, iDose (4)
Series 602
iDose (4)
MSMC NARAYANA HEALTH
Philips, Ingenuity CT
120 kV
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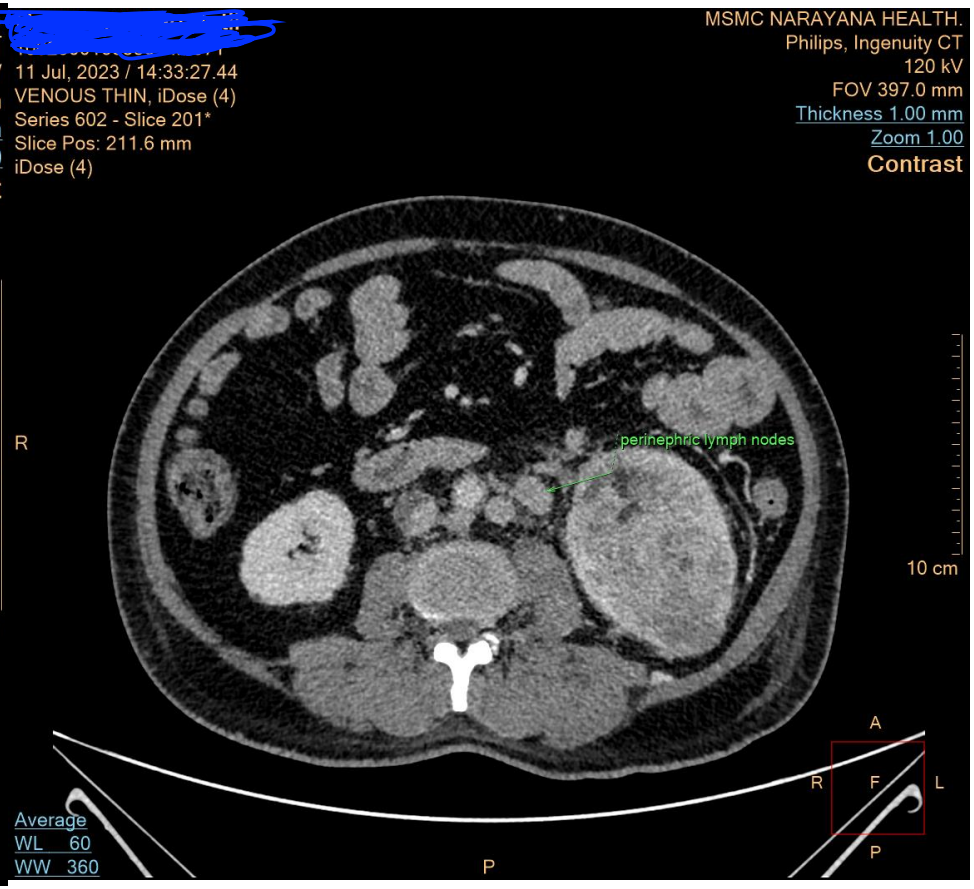
Thickness 0.78 mm
Zoom 1.00
Contrast
bland thrombus
R
20 cm
Average
WL 60
WW 360
F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iDose (4)
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Philips, Ingenuity CT
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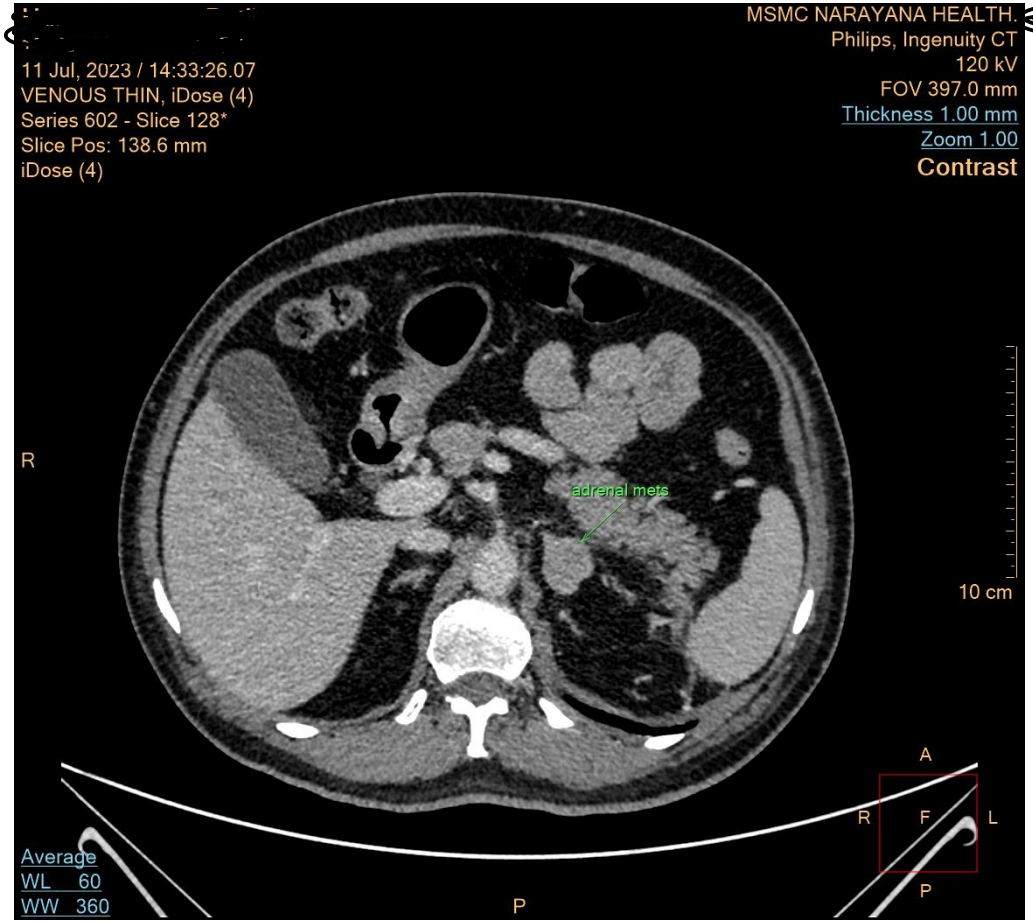
FOV 397.0 mm
Thickness 1.00 mm
Zoom 1.00
Contrast
perinephric lymph nodes
R
10 cm
A
R
F
L
P
Average
WL 60
WW 360
P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Philips, Ingenuity CT
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Thickness 1.00 mm
Zoom 1.00
Contrast
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VENOUS THIN, iDose (4)
Series 602 - Slice 128*
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iDose (4)
adrenal mets
R
10 cm
A
R
F
L
P
Average
WL 60
WW 360
P

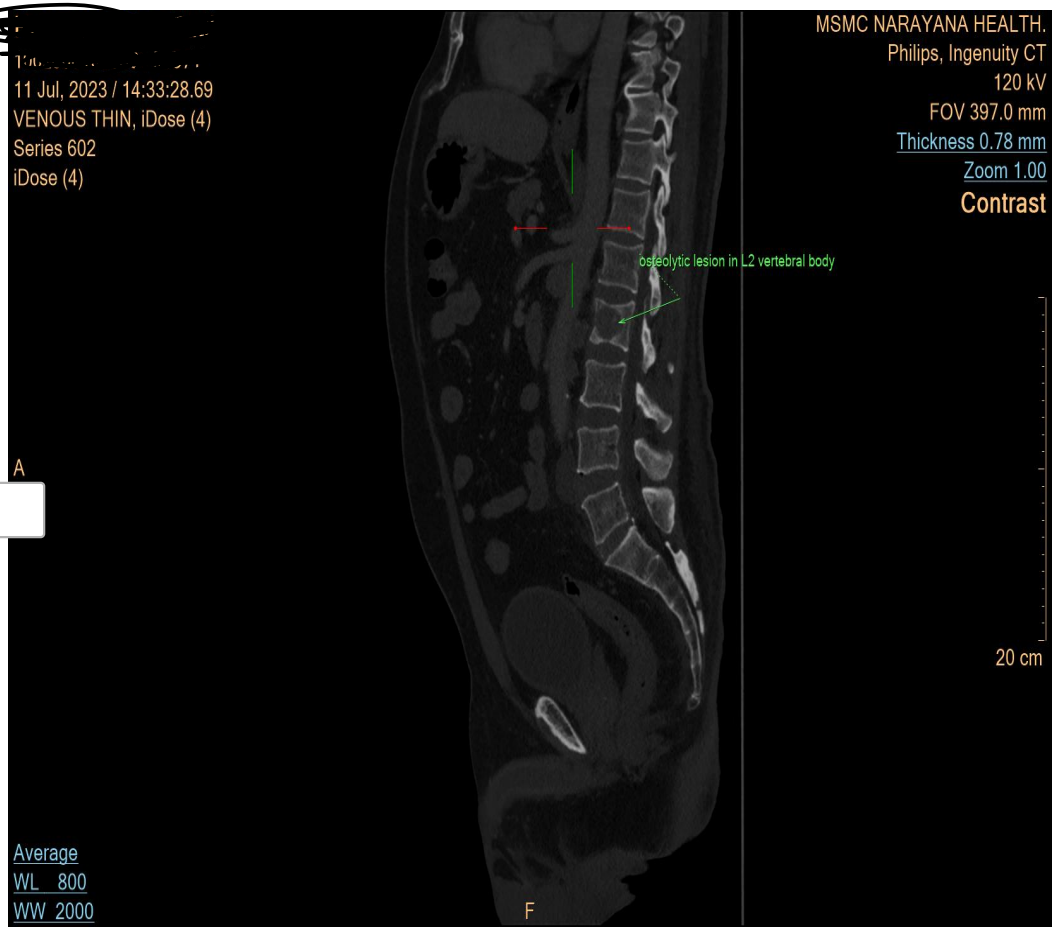

MSMC NARAYANA HEALTH.
Philips, Ingenuity CT
120 kV
FOV 397.0 mm
Thickness 0.78 mm
Zoom 1.00
Contrast
11 Jul, 2023 / 14:33:28.69
VENOUS THIN, iDose (4)
Series 602
iDose (4)
osteolytic lesion in L2 vertebral body
A
20 cm
Average
WL 800
WW 2000
F

Table 2: AJCC TNM Staging System

Category	Definition
Tumor	
Tx	Primary tumor cannot be assessed
T0	No evidence of primary tumor
T1	Primary tumor is ≤7 cm in greatest dimension and confined within the renal capsule
T1a	Primary tumor is ≤4 cm in greatest dimension and confined within the renal capsule
T1b	Primary tumor is >4 but ≤7 cm in greatest dimension and confined within the renal capsule
T2	Primary tumor is >7 cm in greatest dimension and confined within the renal capsule
T2a	Primary tumor is >7 cm but ≤10 cm in greatest dimension and confined within the renal capsule
T2b	Primary tumor is >10 cm in greatest dimension and confined within the renal capsule
T3	Primary tumor extends into major veins or perinephric tissues but not into the ipsilateral adrenal gland and not beyond the perirenal (Gerota) fascia
T3a	Primary tumor extends into the renal vein, renal sinus fat, and renal capsule but not beyond the perirenal (Gerota) fascia
T3b	Primary tumor invades the IVC below the diaphragm
T3c	Primary tumor invades the IVC above the diaphragm
T4	Primary tumor invades beyond the perirenal (Gerota) fascia or invades the ipsilateral adrenal gland
Lymph nodes	
Nx	Lymph nodes cannot be assessed
N0	No regional (retroperitoneal) lymph node metastasis
N1	Regional (retroperitoneal) lymph node metastasis
Distant metastasis	
M0	No distant metastasis
M1	Distant lymph node or other metastasis, including noncontinuous adrenal involvement

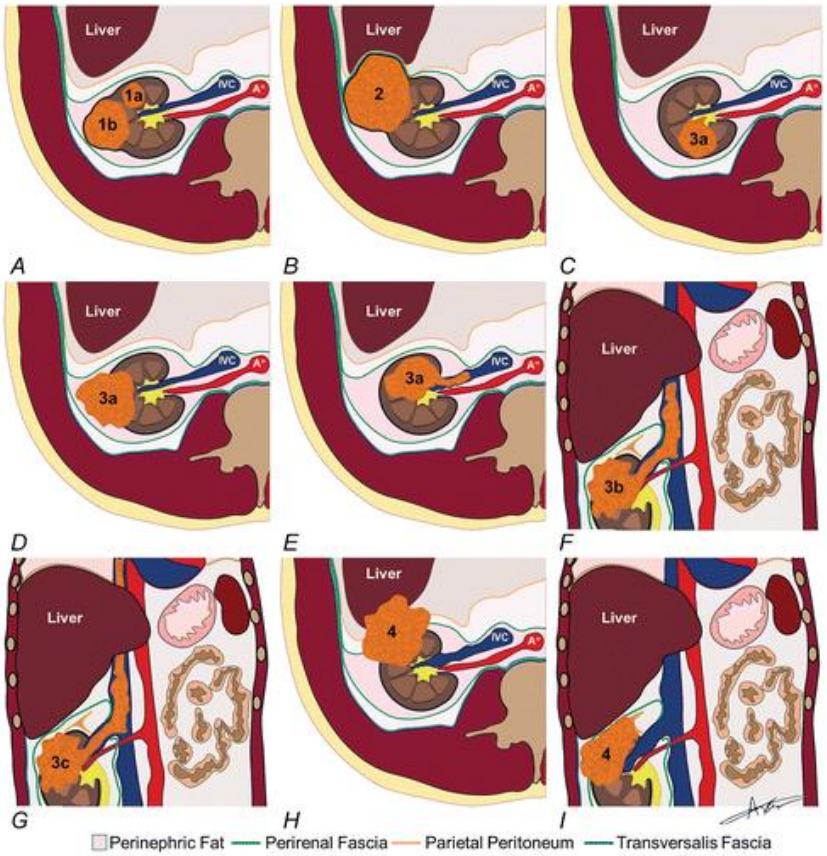


Figure 1. Illustrations depict the AJCC TNM staging system for renal cell carcinoma (RCC) (orange areas). *Ao* = aorta, *IVC* = inferior vena cava. T1a (≤4 cm) and T1b (>4 but ≤7 cm) tumors, *A,* and T2 (>7 cm) tumors, *B,* are confined within the renal capsule. T3a tumors are defined by invasion of the renal sinus fat, *C,* invasion through the renal capsule into perirenal fat but not beyond perirenal (Gerota) fascia, *D,* or invasion of the renal vein, *E.* T3b tumors invade the vena cava below the diaphragm, *F.* T3c tumors invade the vena cava above the diaphragm, *G,* or the wall of the vena cava (not shown). T4 tumors invade beyond the perirenal (Gerota) fascia, *H,* or invade the ipsilateral adrenal gland, *I.*

Table 3: Stage Groups for the AJCC TNM Staging System

Stage	Tumor	Node	Metastasis
Stage 1	T1a or T1b	N0	M0
Stage 2	T2a or T2b	N2	M0
Stage 3	T1a–3c	N1	M0
	T3a–3c	Nx or N0	M0
Stage 4	T4	Any N	M0
	Any T	Any N	M1

Source.—Reference 15.

- **IMAGING OF RENAL TUMOUR:**
- X-ray, IVU
- USG
- CT,MRI
- Incidental inclusions in other regional studies

IVU:

- Filling defect in nephrogram phase
- calcification
- calyceal distortion , cut-off
- Filling defects and contour alteration
- Dilatation due to distal mass obstruction/compression

- **USG**:
- Distinguish cysts from solid tumours
- Reveals the septations better
- Limitations:

➢42 % tumours are isoechoic

➢Visualising retroperitoneum and perinephric tissues

- **CT(Multiphasic)**:

➢100 – 150 ml IV contrast

➢Arterial /cortico-medullary phase

➢Nephrogenic phase

➢Delayed / Excretory phase

1.**CORTICOMEDULLARY PHASE(25-70 SEC):**

Early enhancing tumours and arterial vascular anatomy

2.**NEPHROGRAPHIC PHASE(80-180 SEC):**

- Renal parenchyma enhances homogenously ,best for discrimination b/w normal renal medulla and less enhancing masses.
- Tumour washout
- Best for density measurement:
- Post-contrast-Precontrast HU

➢<10 HU-No enhancement

➢10-20 HU-Indeterminate

➢>20 HU -Enhancement

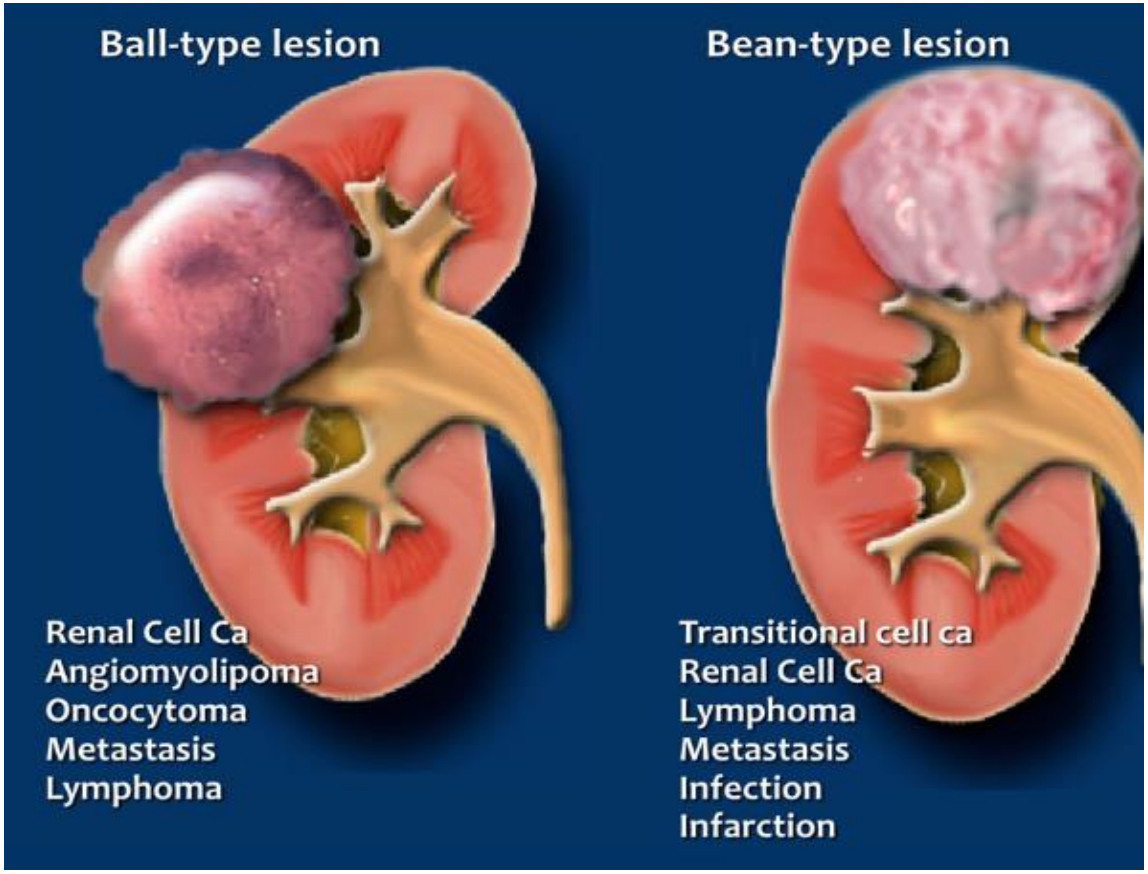
3.EXCRETORY PHASE(~180 sec)

➢Relationship of a centrally located mass with the collecting system

Figure 3a. Evaluation of perirenal fat invasion at renal CT in a 62-year-old woman. Axial **(a)** and coronal **(b)** images obtained during the corticomedullary phase show a right-sided greater than 50% exophytic 4.5-cm clear cell RCC (categorized as T3a at surgical pathologic analysis). The tumor (*) has irregular margins, and there is thickening of the perirenal fascia (arrow). Imaging findings associated with perirenal fat invasion include thickened perirenal fascia, perinephric fat stranding, and visualization of ill-defined margins between tumor tissue and the perinephric fat.

Figure 5a. Tumor invasion into adjacent organs in a 57-year-old man. Axial **(a)** and coronal **(b)** renal CT images obtained during the corticomedullary phase show a right-sided clear cell RCC that invades the renal vein and subdiaphragmatic inferior vena cava, invades through the perirenal (Gerota) fascia into the liver, and invades (obliterates) the ipsilateral adrenal gland (categorized as T4 at imaging). The invasion of both the liver and the ipsilateral adrenal gland can be used to stage this tumor as T4.

- RENAL TUMOURS:

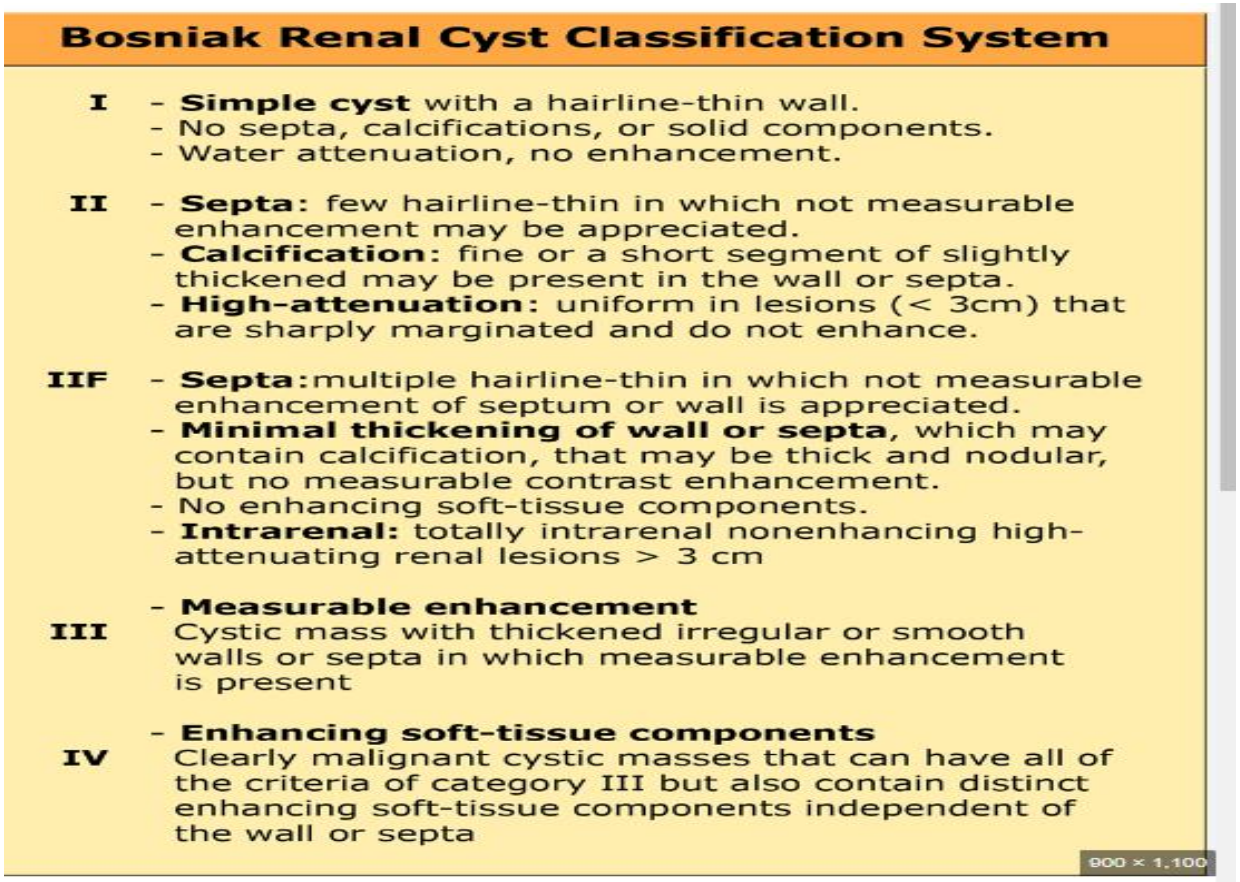


- **Ball or Bean**

➢ *Ball-type* lesions are the most common and present as expansile masses, deforming the renal contour.
Renal cell carcinomas and oncocytomas are typical ball-type lesions.

➢ Bean-type lesions do not deform the renal contour and the bean-shape of the kidney is preserved.
Bean-type lesions are more difficult to detect and usually not visible on unenhanced CT images.

- BOSNIAK CLASSIFICATION:



- CT in RCC –What to look for?

➢Tumour characteristics

➢Contrast enhancement pattern

➢Renal vein anatomic variants

➢Renal vein thrombosis-bland vs tumour

➢Perinephric tumour extension

➢LN metastasis

➢Bony lesions

➢Lung secondaries

- Histologic subtypes:

➢Clear cell carcinoma(80%)-PCT

➢Papillary-straight tubule

➢Chromophobe-Cortical CD

➢Collecting duct-Medullary CD

TUMOUR CHARACTERISTICS:

- **Clear cell RCC**

➢ enhances brightly and heterogenously

➢ Increase of > 80 HU in the cortico-medullary phase differentiates clear cell RCC from non-clear cell tumours.

- **Papillary tumours:**

➢ More homogenous and less hypervascular

- **Chromophobe tumours:**

➢ Peripheral pattern of enhancement and less vascular

- **Medullary tumours:**

➢ Aggressive tumour in young pt with sickle cell disease or trait.

➢ Located centrally in kidney and show variable contrast enhancement.

- **MODES OF SPREAD:**

➢DIRECT-via breach in the capsule

➢Venous phase-Antegrade spread via renal veins to IVC ,rt heart and lungs.

➢Arterial spread

➢LN

Differential diagnosis:

Benign-

➢oncocytoma

➢Hemangioma

➢Angiomyolipoma

➢Tb granuloma(Calcified)

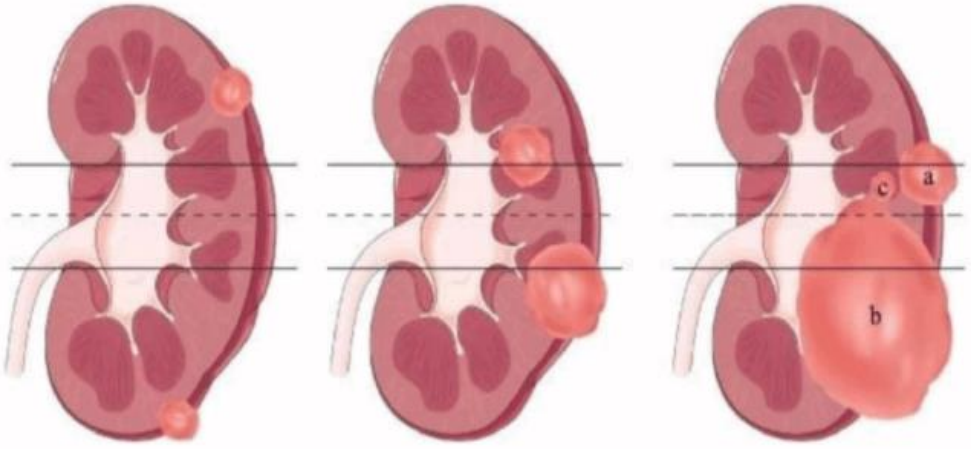
MALIGNANT:

- **Parenchymal**
- Lymphoma
- Sarcoma
- Adult wilms tumour
- Secondaries
- **Non –parenchymal**
- Transitional cell carcinoma
- Squamous cell carcinoma

- **TREATMENT OPTIONS**

- Nephron sparing surgery
- Radical nephrectomy-Higher risk RENAL score patients and Locally advanced T4 disease
- Aggressive surgical approach with en bloc resection of involved adjacent organs.
- Renal RFA-Treatment for surgically unfit patients with small masses(size upto 3 cm).

	1pt	2pts	3 pts
(R)adius (maximal diameter in cm)	≤4	>4 but < 7	≥ 7
(E)xophytic/endophytic properties	≥ 50%	<50%	Entirely endophytic
(N)earness of the tumor to the collecting system or sinus (mm)	≥7	>4 but <7	≤4
(A)nterior/Posterior	No points given. Mass assigned a descriptor of a, p, or x		
(L)ocation relative to the polar lines* * suffix "h" assigned if the tumor touches the main renal artery or vein	Entirely above the upper or below the lower polar line	Lesion crosses polar line	>50% of mass is across polar line (a) or mass crosses the axial renal midline (b) or mass is entirely between the polar lines (c)



RENAL NEPHROMETRY SCORE

Tumor complexity	*Scores based on NS sum*
Low	4–6
Intermediate	7–9
High	10–12