Evaluation of the renal mass: The common and the commonly missed
Learning Objectives

1. Discuss the utility of conventional imaging modalities for renal mass evaluation
2. Identify the CT features characteristic of renal cell carcinoma
3. What else can present as a renal mass or renal pseudo-tumour?
Multiphase renal CT

Non-contrast + nephrogenic + corticomedullary + excretory

- Nephrogenic and non-contrast phases are used for detection of abnormal contrast enhancement
- Corticomedullary phase can evaluate vascular anatomy, which is essential for surgical planning and subsequent intraoperative control of renal hilar bleeding
- Excretory phase helps define collecting system anatomy and can help to exclude urothelial cancer (aka TCC = transitional cell carcinoma), which is managed differently compared to RCC

Multiphase renal CT is the urologist’s initial imaging of choice for renal mass characterisation, local staging and surgical planning
Renal ultrasound

- **Pros:** wide availability, low cost, no ionising radiation, no nephrotoxic intravenous contrast agents
- Useful for assessing if lesion is cystic
- Not as sensitive or specific as CT or MRI
- **Hypertrophied column of Bertin** = renal cortical tissue extending between renal pyramids; this may be mistaken as solid renal mass extending into the renal sinus

Quality of ultrasound images are limited by operator experience, patient body habitus and interposition of bowel gas
MRI kidneys

- When CT finding indeterminate, evaluate further with MRI
  - e.g. equivocal lesion enhancement or for detection of small amounts of macroscopic fat
- Consider MRI instead of CT in children, pregnancy and patients for whom iodine contrast is contraindicated
- Can assess for renal vein and IVC tumour thrombus
  - Contrast enhancement differentiates tumour thrombus vs bland thrombus (clot only, free of neoplastic cells)

T2 differences on MRI may suggest likely histology:
- ccRCC = T2 hyperintense
- papillary RCC = T2 hypointense
Renal cell carcinoma (RCC) accounts for 90% of renal cancers.

Most commonly an incidental finding on abdominal imaging for other reasons.

However, 20-30% present with advanced metastatic disease.

20-30% develop post-operative recurrence or metastatic disease.
Papillary renal cell carcinoma may demonstrate minimal or no enhancement on CT, and can be mistaken for hyperdense renal cysts. Papillary renal cell carcinoma is the second most common subtype of RCC (13-20%). Small lesions often appear homogenous, less vascularised compared to clear cell RCC. Usually hypoechoic on ultrasound, MRI: hypointense on T2-weighted images. Spontaneous renal haemorrhage.
Upper tract urothelial cancer

- Usually centered at the renal pelvis with filling defect on delayed phase CT (or cystoscopic retrograde pyelogram)
- Tendency to have preserved renal shape (vs RCC with distorted renal outline)

Locally advanced tumours require nephroureterectomy and investigation/ongoing surveillance for bladder urothelial cancer (compared to radical nephrectomy only for RCC)
Definitive treatment of xanthogranulomatous pyelonephritis is nephrectomy.

Papillary renal cell carcinoma

Upper tract urothelial cancer

Xanthogranulomatous pyelonephritis

Renal lymphoma

Angiomyolipoma

Spontaneous renal haemorrhage

Xanthogranulomatous pyelonephritis

Rare form of chronic pyelonephritis

Enlarged kidney with characteristic bear paw appearance due to destruction of renal parenchyma

Renal calculi formation, often staghorn

Definitive treatment of xanthogranulomatous pyelonephritis is nephrectomy.
Renal lymphoma

Characterise on CT, with typical findings including:
- Multiple bilateral hypodense or infiltrative renal masses, with associated enlarged retroperitoneal lymph nodes
- Invasion from retroperitoneal nodal mass

If diagnostic uncertainty, consider 18F-FDG PET-CT: lymphoma shows intense uptake; also useful for assessing response to treatment and detecting recurrence
Angiomyolipoma

Macroscopic fat is strongly suggestive of AML, although not pathognomonic.

Multiple angiomyolipomas are common in patients with tuberous sclerosis, a rare genetic disease causing multiorgan involvement with benign tumours.

Risk of life-threatening retroperitoneal haemorrhage increases with lesion size (>4cm).
Spontaneous renal haemorrhage may be secondary to underlying benign and malignant tumours, including angiomyolipoma and renal cell carcinoma.

History is important in perinephric/retroperitoneal haemorrhage.

?trauma vs spontaneous bleed - if spontaneous, investigate for underlying lesion.

CT angiography may identify an actively bleeding vessel suitable for intervention.

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Multiphase renal CT is the initial imaging of choice for renal mass characterisation, local staging and surgical planning.

Papillary RCC may be minimally or nonenhancing on CT and can be mistaken for hyperdense renal cysts - MRI can further characterise.

Spontaneous renal haemorrhage may be secondary to underlying benign and malignant tumours, including angiomyolipoma and renal cell carcinoma - interval imaging is indicated.

Take-home points:

1. Multiphase renal CT is the initial imaging of choice for renal mass characterisation, local staging and surgical planning.

2. Spontaneous renal haemorrhage may be secondary to underlying benign and malignant tumours, including angiomyolipoma and renal cell carcinoma - interval imaging is indicated.

3. Papillary RCC may be minimally or nonenhancing on CT and can be mistaken for hyperdense renal cysts - MRI can further characterise.
References


Related Radiopaedia resources:
- CT renal mass (protocol)
- Renal cell carcinoma
- Renal pseudotumours