

Imaging of renal system (3rd lecture: urinary tract disorders)

DR. Marwa Majid Aladhab

MBCChB, FIBMS (clinical radiology)

Objectives

- Imaging in transitional cell carcinoma
- Imaging of renal trauma
- Imaging of bladder tumors
- Imaging of bladder diverticula
- Imaging in bladder outlet obstruction
- Imaging in prostatism

Transitional cell carcinoma (TCC)

- is the most common primary malignancy of the collecting system and may be found along its entire length, from the renal pelvis to the bladder.

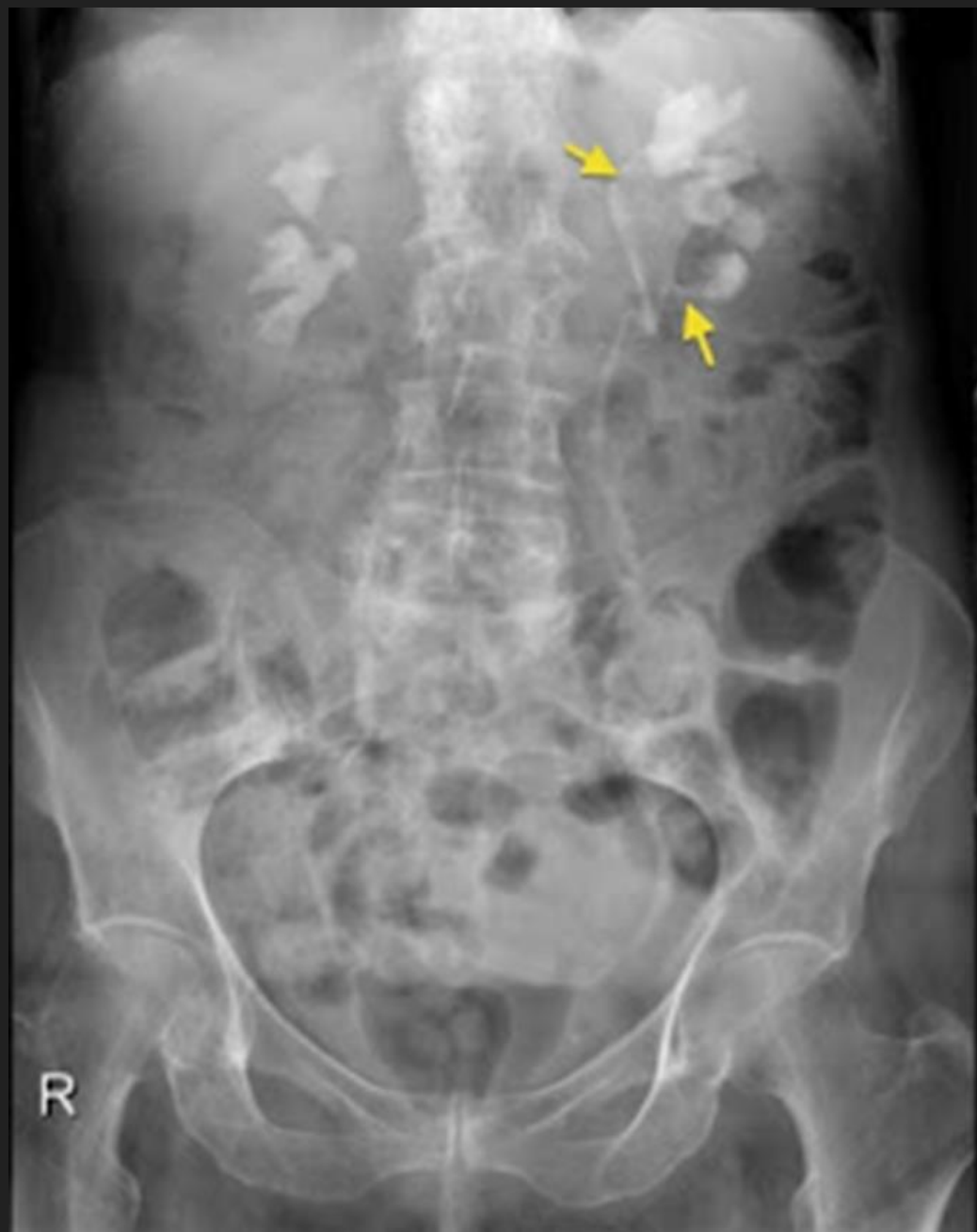
General role of imaging:

- Help in the diagnosis of symptomatic patient
- incidental discovery of the tumor (asymptomatic patient)
- Staging (local, distant, nodal status)
- Look for other synchronized focus of tumor if present
- Assessment of complications (e.g. obstructive uropathy)

Findings on CT urography, conventional urography (IVU) and direct pyelography

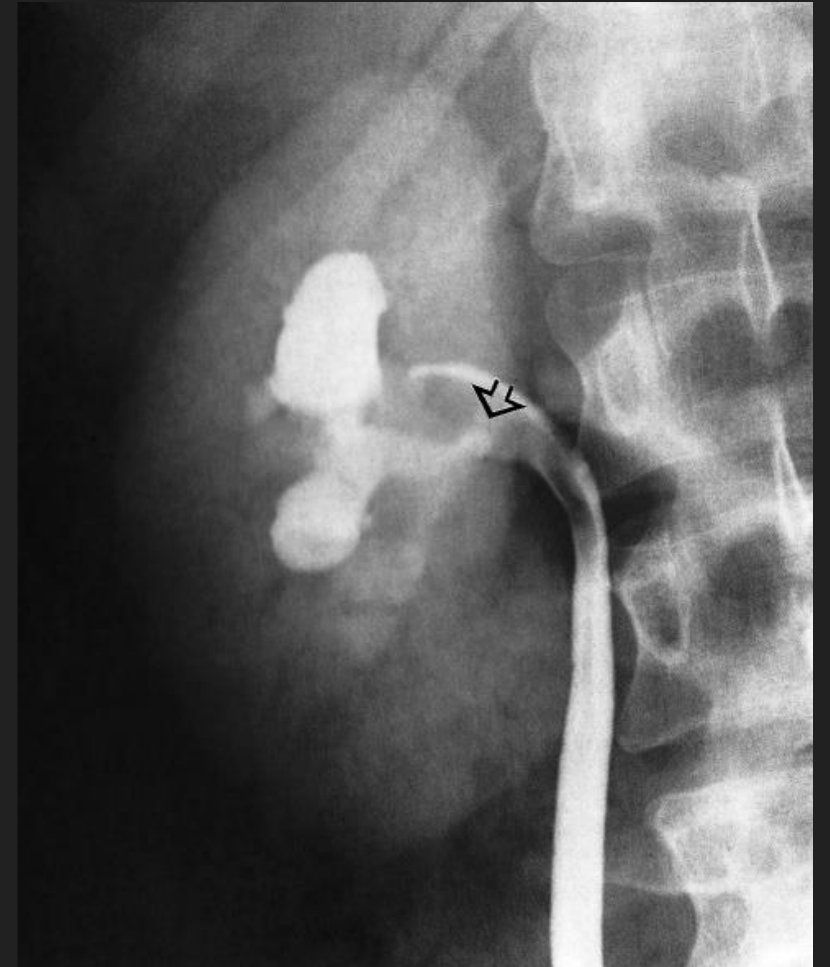
(i.e. opacification of collecting system by contrast medium)

- Irregular mass projecting into the pelvicalyceal system (filling defect within the renal pelvis or ureter)
- It may be sessile or polypoidal
- Distortion/obliteration/amputation of calyces
- Obstructive lesion lead to hydronephrosis and/or non-functioning kidney (depending on site and size)
- A calyx may be distended by a tumor within it (known as an oncocalyx) or prevented from filling with contrast (known as a phantom calyx)



Common differential diagnosis for filling defect in the collecting system

- Calculi (non opaque)
- Blood clot
- Other malignant tumor like metastases, RCC invading the collecting system

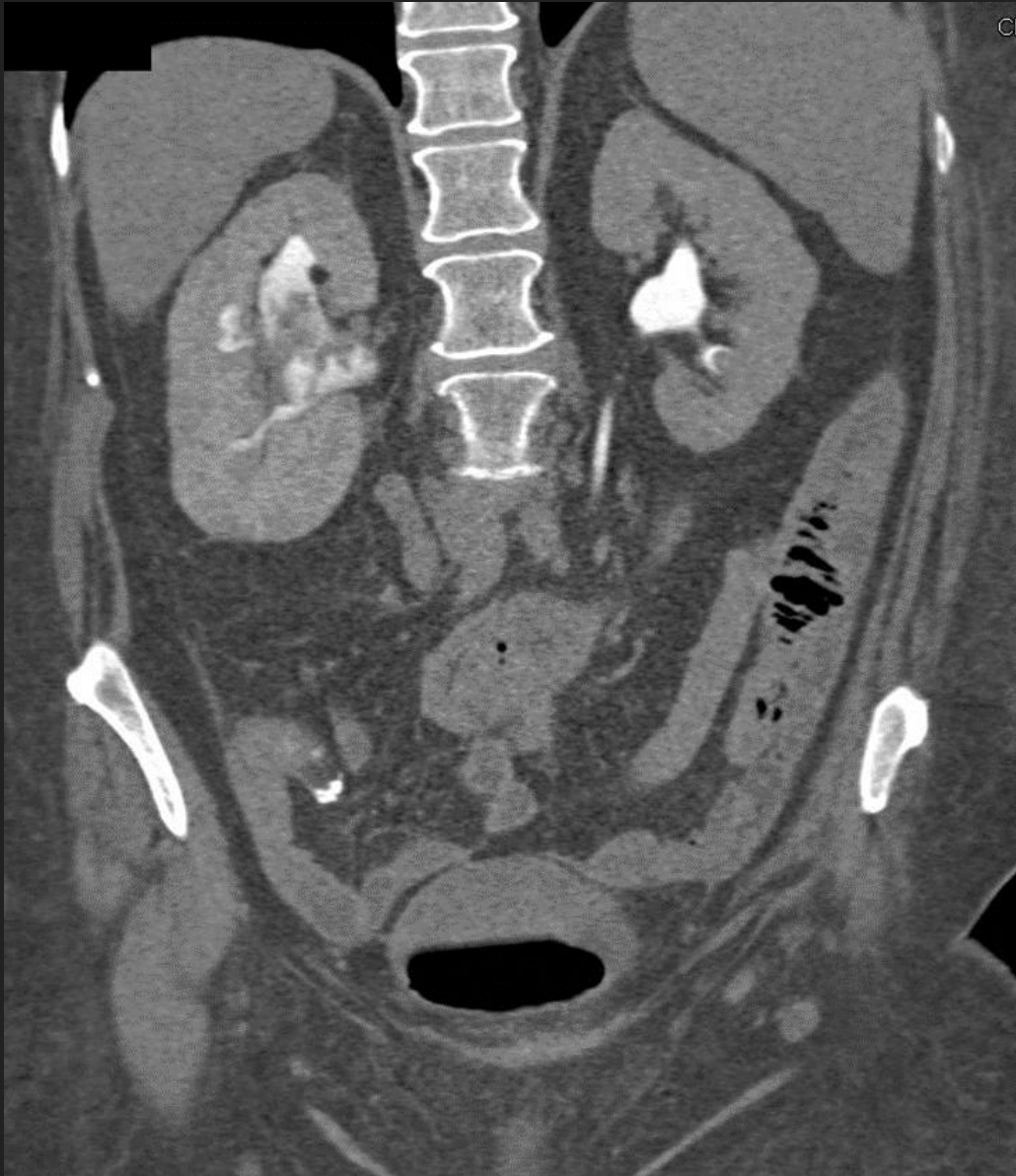


CT urography in ureteric TCC

- Demonstrate thickening of the wall of the ureter at the site of a urothelial tumor
- The ureter is often obstructed at the level of TCC



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Ultrasound

- Transitional cell carcinomas (TCC) appear as solid, albeit hypoechoic masses located within the renal pelvis or a dilated calyx although it can be difficult to see because it blends with adjacent sinus fat.
- Demonstration of associated hydronephrosis
- Help to differentiate between radiolucent stone and tumor.

Renal trauma

○ Mechanism:

- Blunt trauma, particularly road traffic accidents and contact sports (the mechanisms of injury in $> \frac{3}{4}$ of patients)
- Penetrating injury.

○ Presentation: Loin pain and haematuria are the major presenting features

○ Imaging: Contrast enhanced CT scan is the preferred investigation

Role of CT scan in renal trauma

- Demonstrate the presence or absence of perfusion to the injured kidney.
- Ensure that the opposite kidney is normal.
- Show the extent of renal parenchymal damage.
- Demonstrate injuries to other organs, a feature of great importance in penetrating injury, where other organs are frequently lacerated.

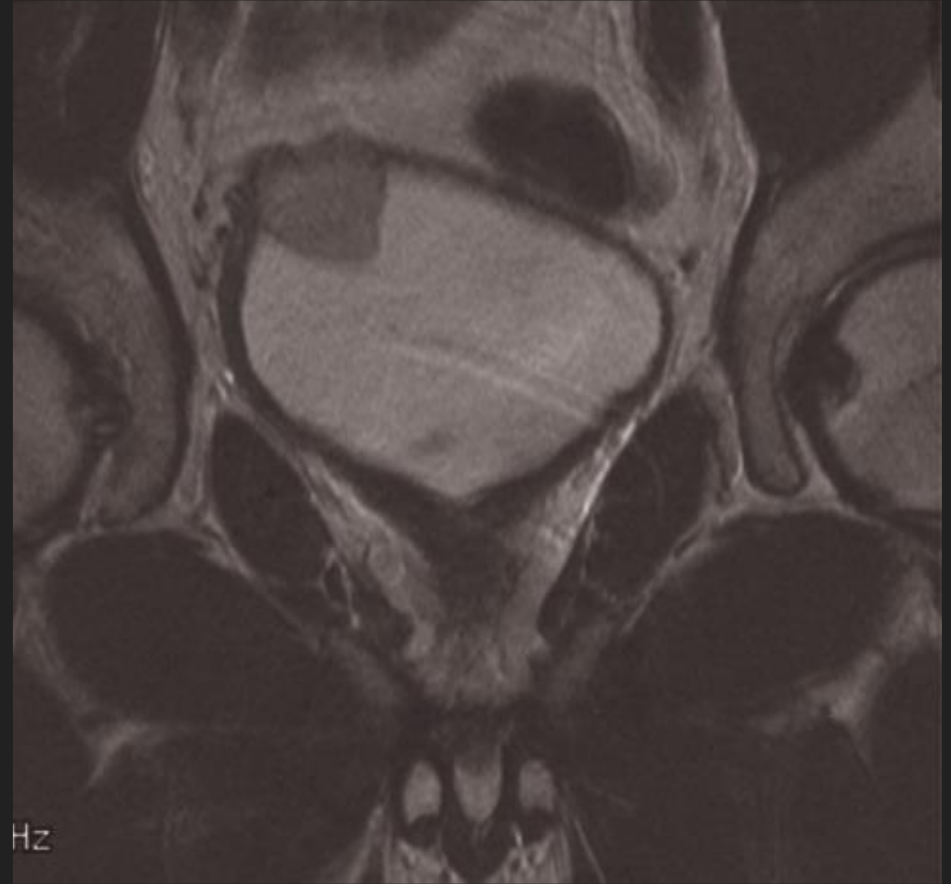


Bladder tumors

- It is the most frequent site for neoplasms in the urinary tract
- Almost all are transitional cell carcinomas
- Shape:
 - delicate fronded papillary lesions
 - sessile irregular masses
 - flat, plaque like growths that infiltrate widely

Imaging of bladder tumor

- **US**: they are seen as soft tissue masses protruding into the fluid-filled bladder or as localized bladder wall thickening.
 - **IVU**: if the mass is large enough, it seen as a filling defect in the bladder, rarely there is visible calcification on the surface of the tumor.
 - **CT and MRI**: they are seen as a soft tissue mass projecting from the wall or a focal thickening of the bladder wall
- * As the diagnosis is best established by cystoscopy and biopsy, the roles of CT and MRI are to stage the tumor (MRI for local spread, CT scan for nodal status and distant spread)



Bladder diverticula

- Usually the consequence of chronic obstruction to bladder outflow or may be congenital
- **Complications**: Because of urinary stasis, diverticula predispose to infection and stone formation and tumors may arise within them.
- **Imaging**: Most diverticula fill at urography and cystography. They are readily demonstrated at ultrasound, CT and MRI.
- When large, diverticula may deform the adjacent bladder or ureter



Bladder outlet obstruction

Causes:

- Benign prostatic hyperplasia.
- Prostatic neoplasia
- Bladder neck stenosis and urethral strictures and occasionally calculi

Imaging appearance

- Diffusely thickened trabeculated bladder wall
- Formation of bladder diverticula
- Increase post voiding residual urine volume
- Dilatation of upper tract.

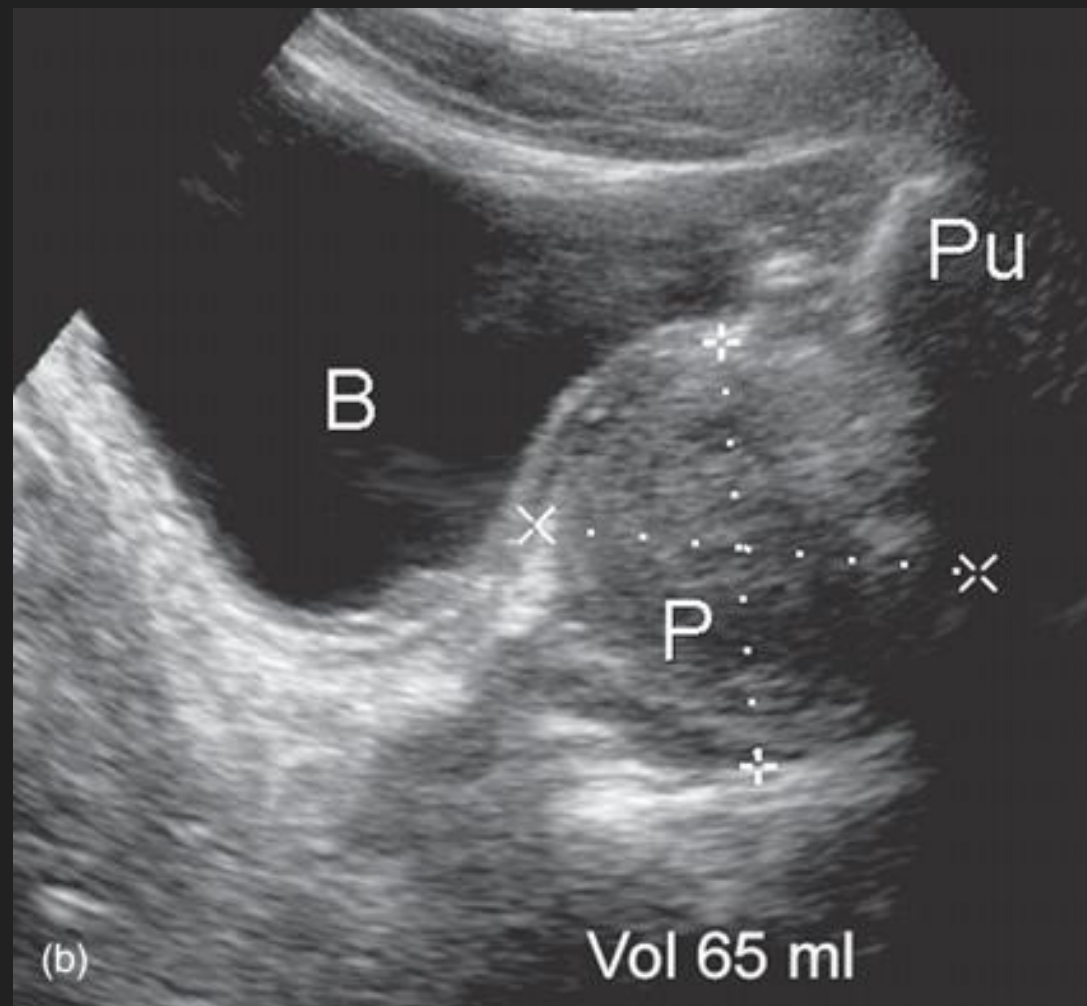
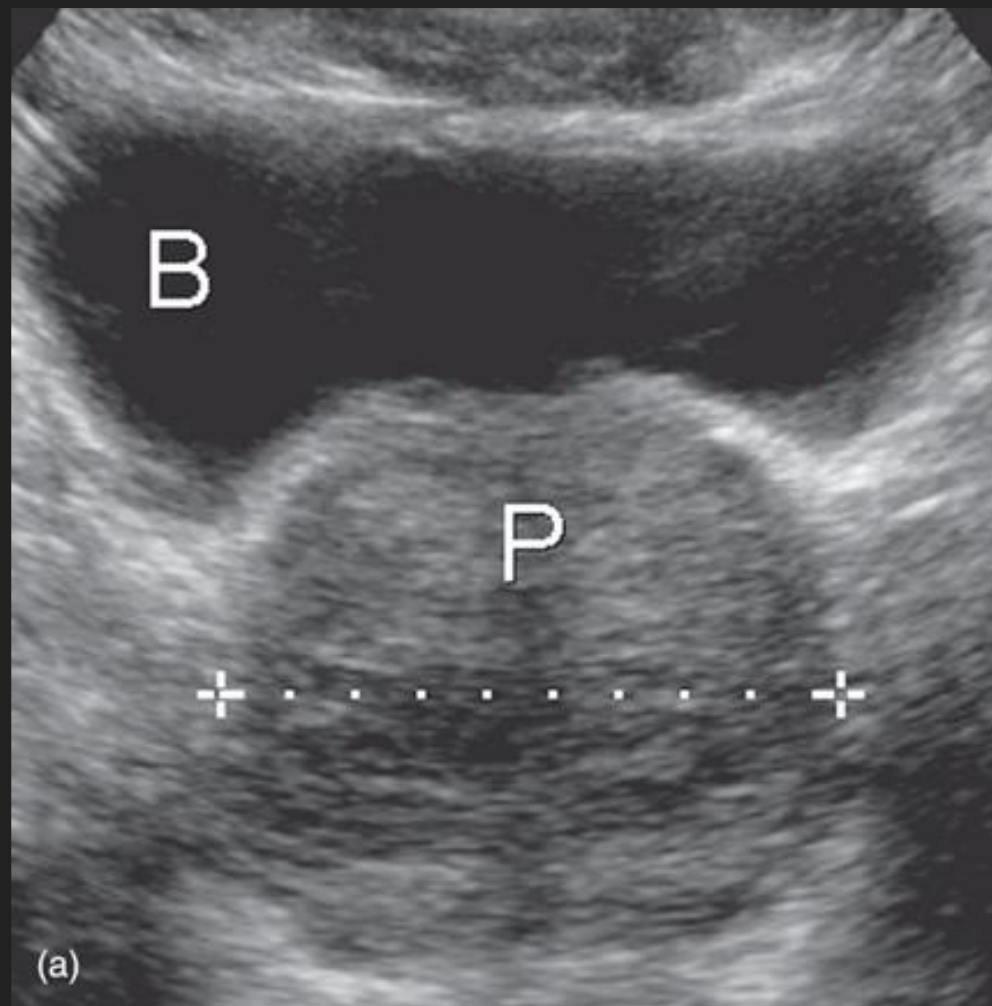
Imaging in prostatism

- Prostatism refers to obstructive voiding symptoms due to prostatic enlargement
- Prostatic enlargement is very common in elderly men. It is usually due to benign hypertrophy but may be due to carcinoma.
- US: primary imaging investigation

Ultrasound

includes assessment of prostate, bladder and upper urinary tracts.

- **Prostate** : volume and any detectable focal mass (better if by trans-rectal US)
- **Bladder** : is assessed for morphological changes indicating bladder obstruction including bladder wall thickening and trabeculation, bladder wall diverticulum and bladder calculi. Bladder volume is measured pre- and post-micturition.
- **Kidneys** are examined for hydronephrosis, asymptomatic congenital anomalies and tumors, and renal calculi



Diagnosis of adenocarcinoma of the prostate

- If either digital rectal exam or PSA are abnormal, prostate biopsy is performed. This is done under trans-rectal ultrasound (TRUS) guidance
- MRI is used to assist in detection of prostate cancer. MRI is the imaging investigation of choice for local staging of prostate carcinoma.
- CT scan: distal staging
- Bone scintigraphy: detection of skeletal metastases.

Summary

- Acute renal colic
- Painless hematuria
- Renal mass
- Prostatism
- Staging of adenocarcinoma of prostate.

Clinical presentation	Investigation of choice	Comment
Painless haematuria	CT urography and cystoscopy	US for further definition in selected cases
Renal mass	US CT	MRI in some centres Biopsy in selected cases
Prostatism	US	
Staging of adenocarcinoma of prostate	CT abdomen and pelvis Bone scintigraphy MRI prostate	

Thank you