GUT Imaging 1

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Genitourinary Imaging

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Scope

Methods of imaging
- Urinary system
- Male/ female genital system

- Indications
- Advantages
- Disadvantages
- Imaging pathology

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Urinary System

1. **Methods of imaging:**

2. Plain films - KUB
3. Ultrasound
4. Intravenous urogram (pyelogram) - (IVU, IVP; excretion urography)
5. Micturating cystogram or cystourethrogram (MCUG)
6. Cystogram
7. Urethrogram (ascending urethrogram)
8. Retrograde pyelogram
9. Antegrade pyelogram
10. Radionuclide studies:
11. Computed tomography (CT)
12. Magnetic Resonance Imaging (MRI)
13. Angiography

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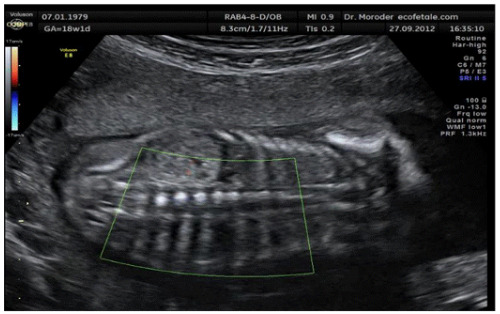
1. ULTRASOUND

- investigation of choice in children
- In adults, depending on indication Ultrasound or IVU/CT pyelogram maybe considered.



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Indications of ultrasound

1. Assess the kidneys in suspected renal pathology; location, size, echotexture, masses, cysts, hydronephrosis, calcifications
2. Vascularity of the kidney, renal masses or suspected vascular lesions
3. Resistive index of renal arteries in suspected renal artery stenosis
4. Ultrasound guided procedures e.g. Percutaneous kidney biopsies, drainage catheter placement
5. Assess renal transplants; size, structure, vascularity, fluid collections
6. Obstructive uropathy; level of obstruction and sometimes the cause of the obstruction
7. Bladder outline, bladder volume, residual volume
8. Assess the surrounding structures in the retroperitoneum/extraperitoneum for fluid

collections, masses

9. Ultrasonic lithotripsy

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Advantages: ultrasound

1. it is cheap and readily available
2. it is safe – no danger of contrast reactions, can still assess kidneys in renal failure
3. no radiation
4. Can be used in point-of-care or emergency settings

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Ultrasound; Disadvantages

1. the ureters cannot be seen unless dilated.
2. calyceal detail cannot be seen which is necessary for assessment of chronic pyelonephritis, papillary necrosis and tuberculosis
3. Uro-endothelial (transitional cell) tumours of the renal pelvis/calyces are not visualised until large.

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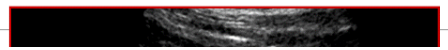
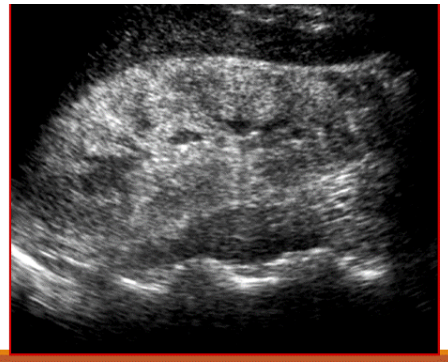
Ultrasound appearances of the kidneys





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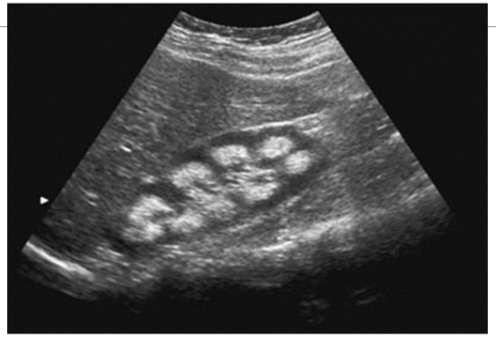
nephrolithiasis



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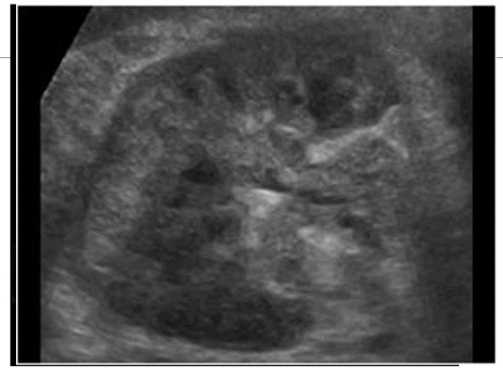

Renal cell cancer

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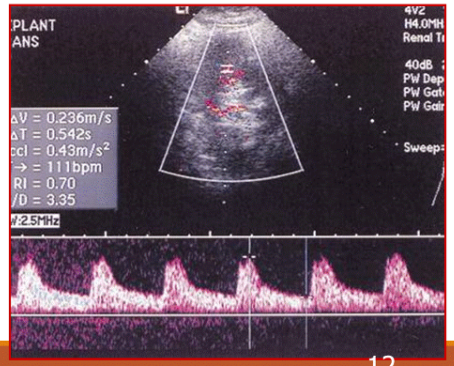
TRANSPLANTED KIDNEY

Ultrasound Doppler

- Assess evenness of perfusion
- Detect abnormalities of flow pattern



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2. PLAIN FILMS - KUB

1. **Calcifications- 85-90% of renal stones calcify.**
   - Stag horn calculus ; large calculus occupying much of the pelvi-calyceal system.
   - Nephrocalcinosis - multiple calcifications in the parenchyma.

2. **Displacement of bowel loops in abdominal mass**

3. **Spinal metastases in prostatic cancer, spinal anomalies in a child with urinary problems**

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Urinary stones

▶Renal parenchymal stones-

- medullary sponge kidney
- hyperparathyroidism
-renal tubular acidosis

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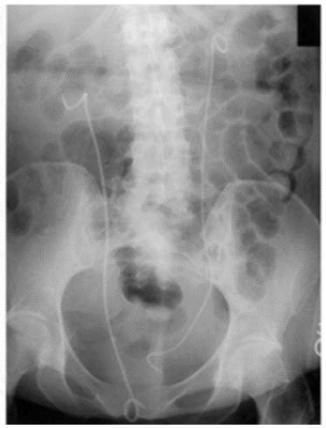
KUB



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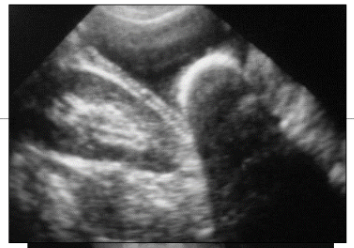
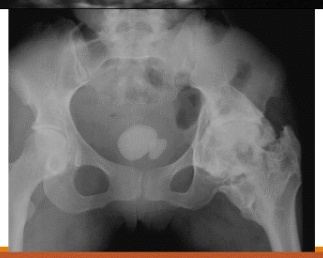
Bladder

Wall calcifications in Schistosomiasis



Calculus - may be small, large, laminated or just calcified around periphery



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2. GAS IN THE URINARY TRACT

Gas in the bladder lumen may be seen in

vesico-intestinal fistula

Cystitis due anaerobic infection in diabetics

A round dark shadow is produced by the bulb of an indwelling catheter.

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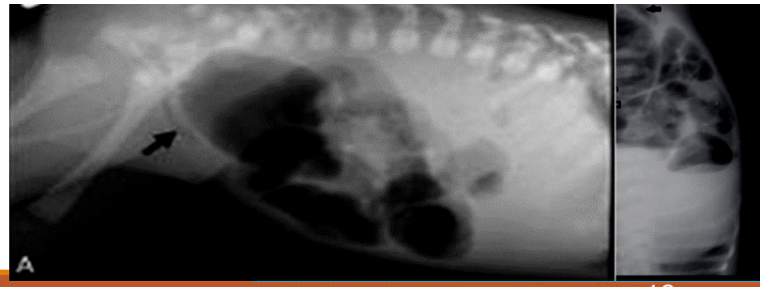
Invertograms Vs prone cross-table laterals



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3. INTRAVENOUS PYELOGRAM (IVP)

1. **Intravenous Urogram** is indicated in suspected urinary tract pathology when ultrasound has failed to make a diagnosis.
2. Is NOT sensitive in hypertension
3. Iodinated water-soluble contrast medium is given intravenously and series of films taken

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Indications for IVU

1. Haematuria
2. dilated ureter on ultrasound
3. inconclusive ultrasound scan

Less common indications:

1. to show the position of ureters for planning surgery or X-ray therapy
2. in suspected calyceal deformity in tuberculosis, papillary necrosis and chronic pyelonephritis
3. Trauma – if ultrasound is inconclusive and CT not available

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Contra-indications: IVU

Intravenous pyelography is not indicated in:

1. Advanced renal failure – use ultrasound
2. Prostatism
3. Polycystic renal disease – better seen on ultrasound
4. Vague abdominal pain
5. Acute urinary tract infection
6. Renal artery stenosis
7. Previous reaction to iodinated contrast

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Relative contraindications: IVU

Intravenous pyelography should be performed with caution in:

1. diabetic patients
2. very small children
3. myelomatosis
4. patients with sickle cell disease

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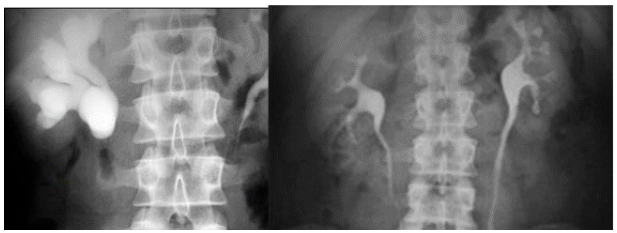

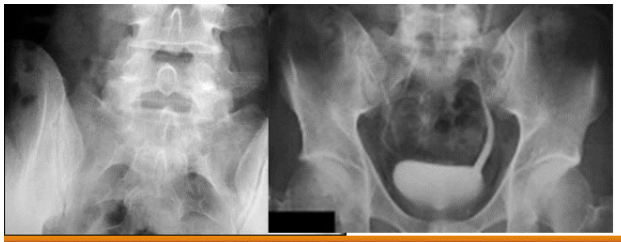

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67y M with hematuria

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4. MICTURATING CYSTOGRAPHY

MCU - study of bladder emptying after water soluble contrast has been inserted into the bladder, usually by catheter.

Its main use is to show:

Ureteric reflux

Abnormality of the posterior urethra – urethral valves or stricture.

Vesico-vaginal fistula (usually just a cystogram is adequate)

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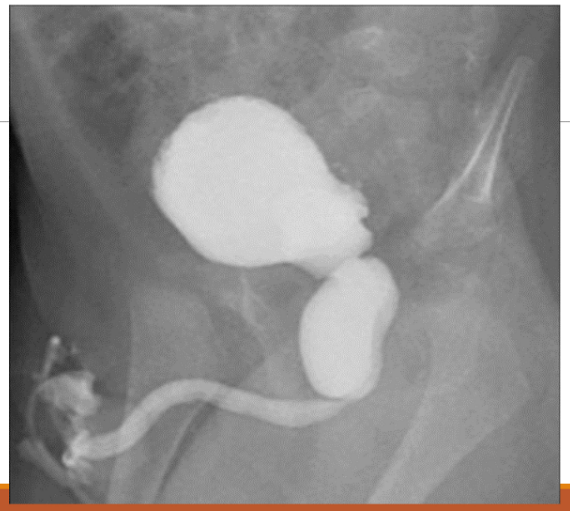

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I II III IV V

Vesico-ureteric reflux into an ectopic ureter

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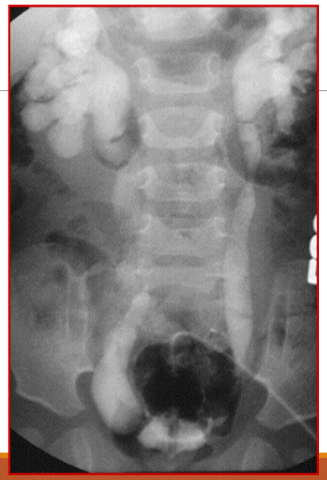
VUR grades 3 & 5



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5. ASCENDING URETHROGRAPHY

This is only performed in males. Indications are:

1. urethral stricture
2. trauma
3. congenital abnormalities
4. fistulae or false passages due to previous catheterisation/ instrumentation.

It is contraindicated in:

- acute urinary infection

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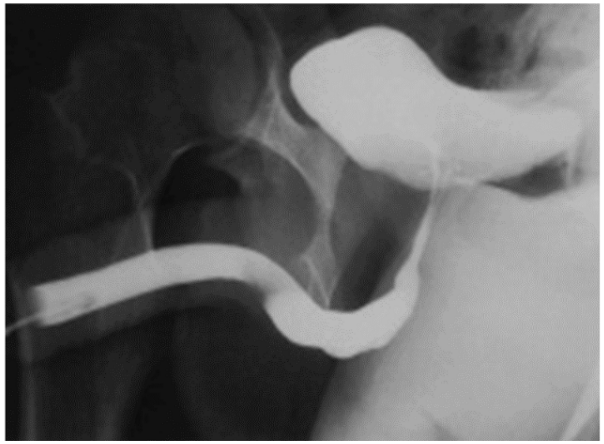

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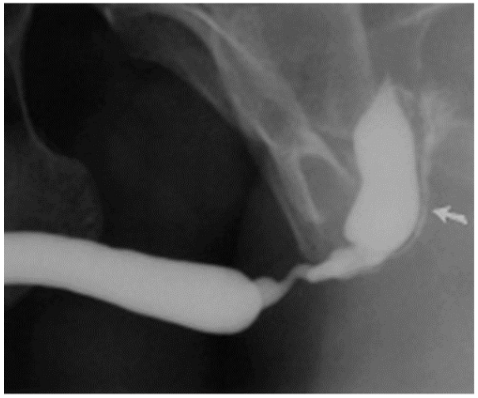

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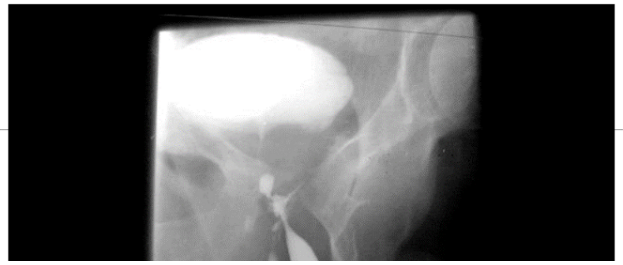

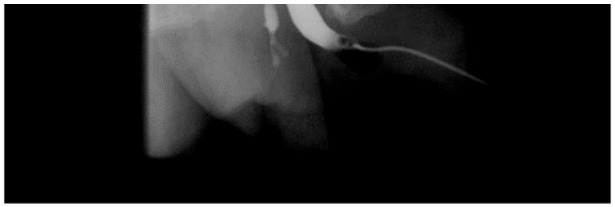

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6. RETROGRADE PYELOGRAM

Its use has reduced with the advent of computed tomography and ultrasound

Main indication:-

- Demonstrate detail of the pelvi-calyceal system or ureter that has not been adequately seen in IVU especially in suspected Transitional cell tumor
- It is contra-indicated in acute urinary infection.

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Ureteric intra-luminal lesion obstructing the ureter and causing proximal dilatation.

Complications include:

damage to the ureter or perforation

infection

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7. ANTEGRADE PYELOGRAM

Used to demonstrate the pelvicalceal system and ureter in obstructive uropathy

May be combined with percutaneous nephrostomy in order to relieve obstruction as a temporary measure.

Contraindication- acute infection.

- Contrast is injected through a fine needle introduced percutaneously into the pelvi-calyceal system under ultrasound or fluoroscopic guidance.

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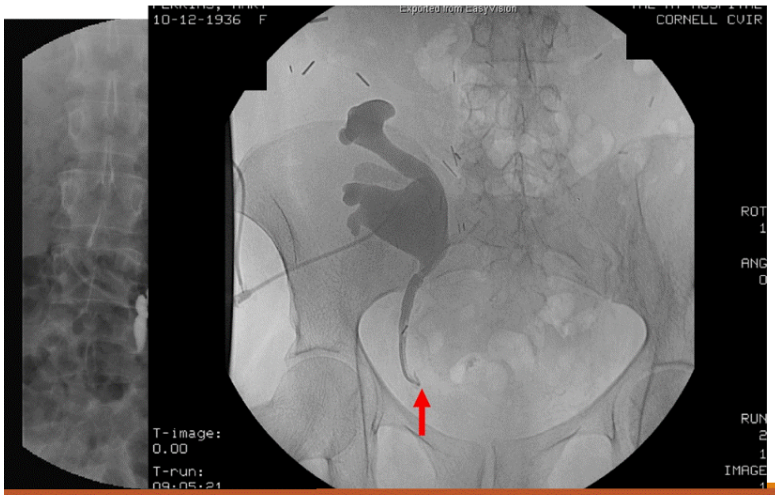

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8. RADIONUCLIDE STUDIES

1. Static scan:

Radiopharmaceutical attaches to normal functioning renal tissue.

Demonstrates the size , outline and amount of normal renal parenchyma

(Dimercaptosuccinate - 99mTc).

1. Indication- renal parenchymal disease

2. Dynamic scan:

Measures the excretion the radiopharmaceutical by the kidneys primarily by GFR and its clearance down the ureters

Functional study (99mTc-DTPA).

1. Indications- hypertension, renal tubular acidosis, renal transplant

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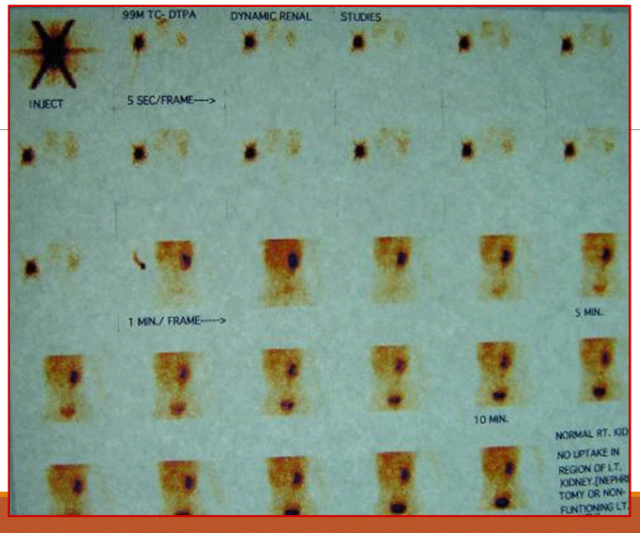

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9. COMPUTED TOMOGRAPHY.

Used in the assessment of

1. renal masses
2. Urinary tract obstruction
3. retroperitoneal disease
4. renal and bladder neoplasms; staging
5. Trauma; CT is the imaging method of choice in **renal trauma**.

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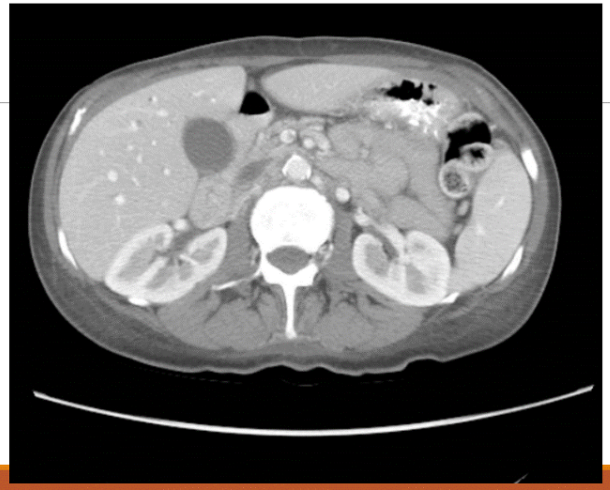

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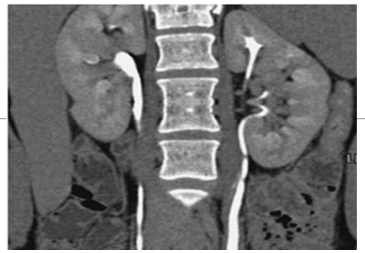
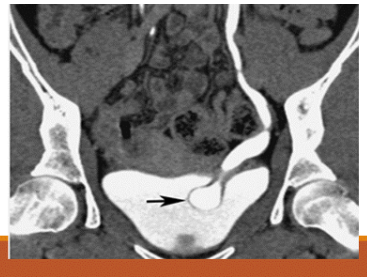


CT urography



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9. ANGIOGRAPHY

Ultrasound, and especially Doppler studies, CT have reduced the need for diagnostic renal angiography.

Main indications:

1. prior to interventional techniques e.g. angioplasty
2. to diagnose renal artery stenosis
3. vascular lesions e.g. arterio-venous fistula, angioma, aneurysm
4. anatomical detail prior to renal transplant or suspected vascular occlusion following surgery

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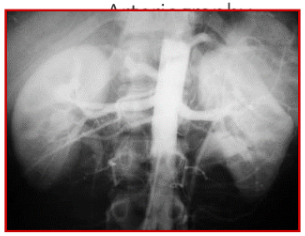
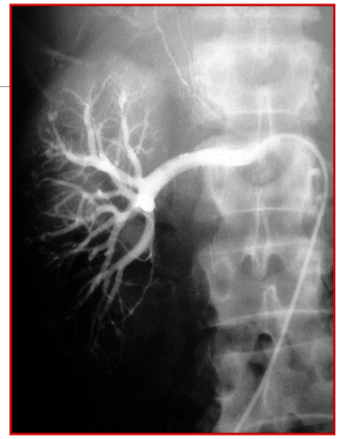
Angiography

Flush Aortography vs. Selective renal





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10. MRI SCANNING

1. Main indication-
   1. staging renal, bladder and prostatic tumours.

2. MR angiography can show renal vein involvement in renal cell carcinoma.

3. MR urography to demonstrate the urinary system

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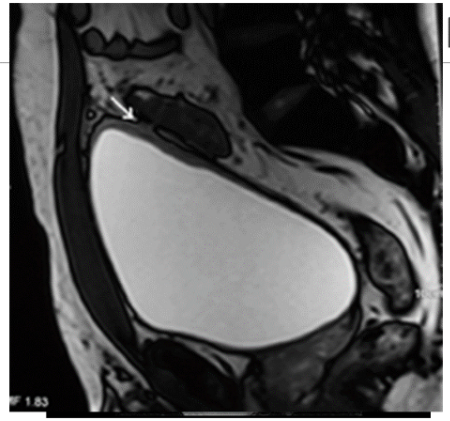
MRI



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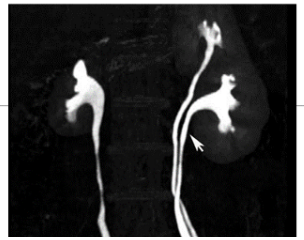

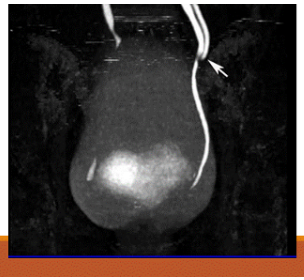

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MRA- to assess vascular anatomy

Transplant kidney

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