Radiology of Urinary System Disorders

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Categories:

- Renal Colic
- Infections
- Urosepsis
- Masses
- Renal Failure
- Trauma

Renal Colic

- Caused by renal calculi

- Most urinary calculi are calcified

- *Classic presentation*: (sudden onset of severe flank pain radiating inferiorly and anteriorly +/- nausea and vomiting)

- *Diagnosis often made clinically*

Imaging: to confirm and evaluate calculi

Renal Colic

- Questions to ask:
  - Are urinary stones present?
    - If so, what is the level and size?
  - Is obstructions present?
    - If so, what is the level and severity
  - Is urgent intervention required?
    - Factors include: urosepsis, solitary kidney, severe pain

Treatment: percutaneous nephrostomy or ureteric stent

Renal Calculi

KUB: to assess total stone burden, size, shape, location

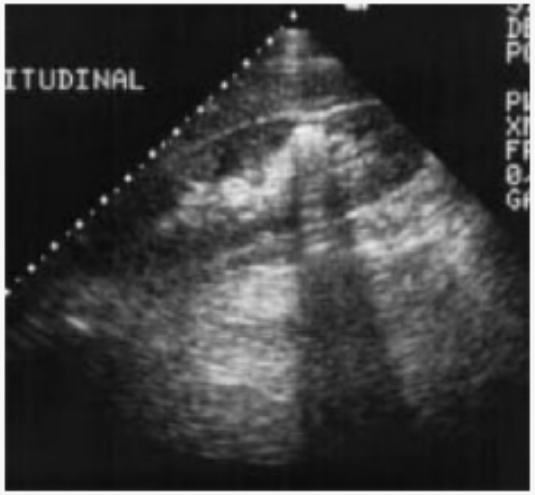
Often: US or CT is required in conjunction

Microscopic Hematuria
Bladder Calculi

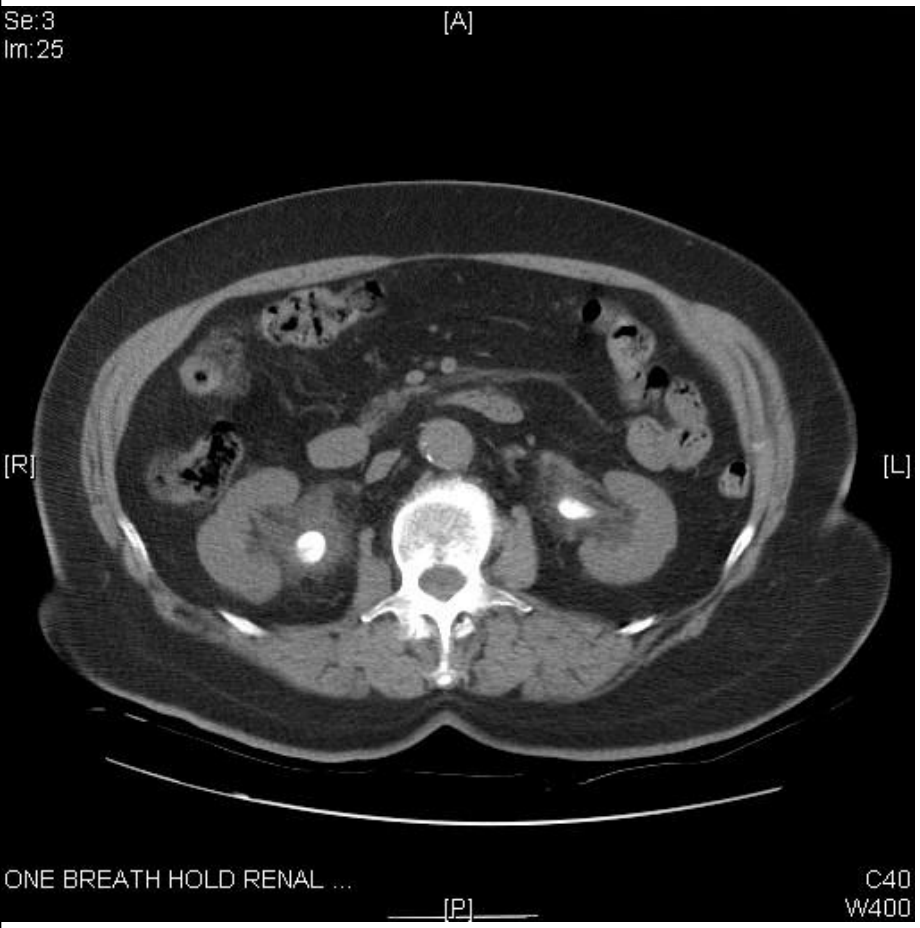
Renal Colic

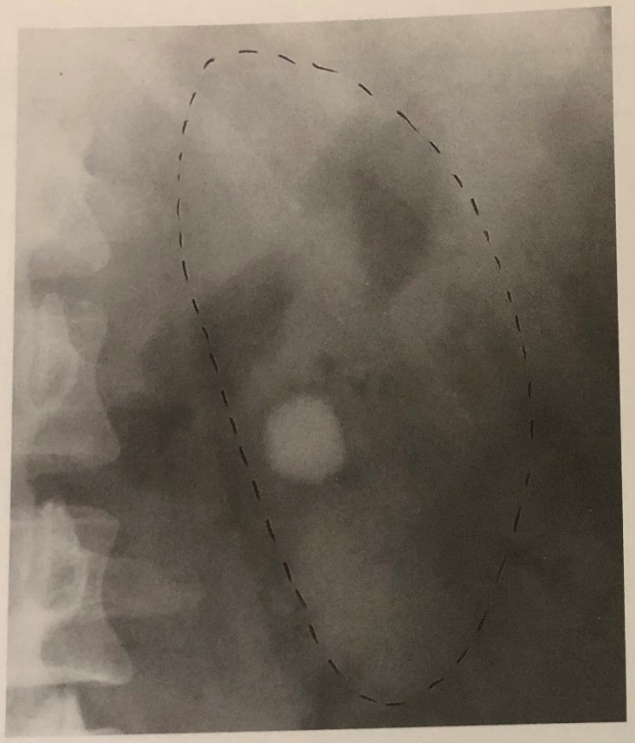
Radiolucent uric acid stones

Renal Calculus - US

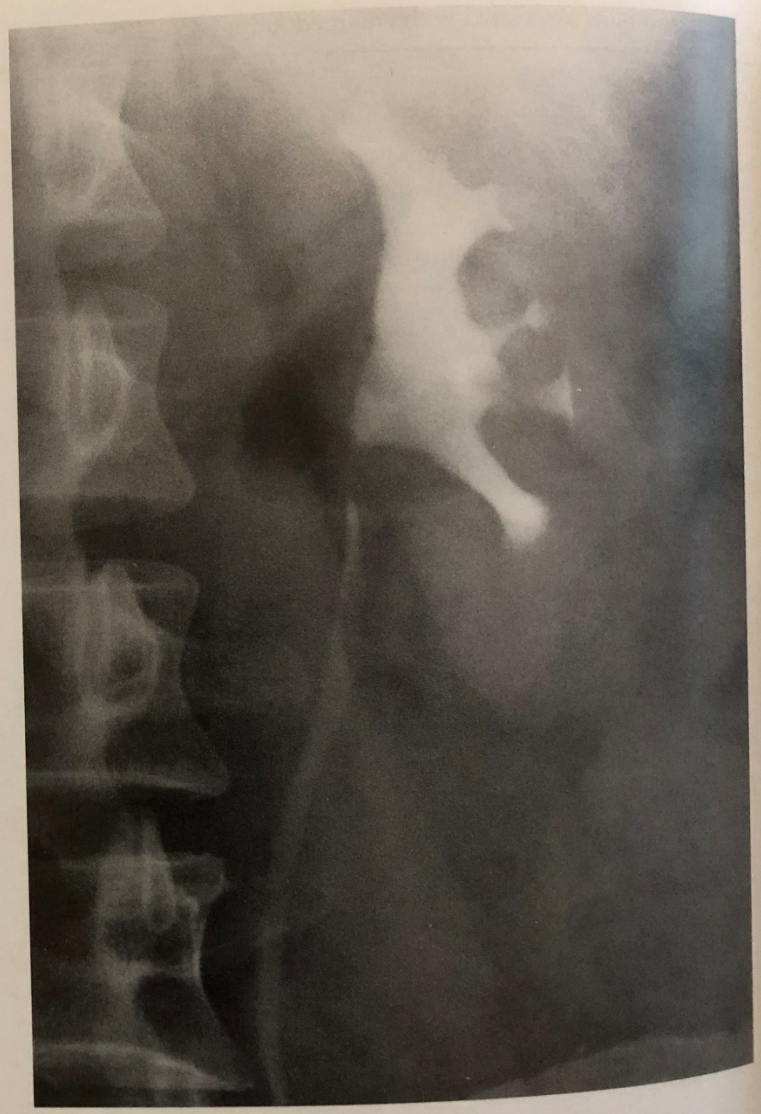


Renal Calculus– CT Scan





(a)



(b)

Fig. 8.3 (a) A rounded calcification is seen overlying the left kidney in the anteroposterior plain film. (b) Post contrast film in the same patient. As the contrast medium and the calculus have the same radiographic density, the calculus is hidden by the contrast medium.

Box 8.2 Causes of dilated calices

Due to obstruction, with dilatation down to a specific point of hold-up

Within the lumen
- Calculus
- Blood clot
- Sloughed papilla

Within the wall of the collecting system
- Intrinsic pelviureteric junction obstruction
- Transitional cell tumour
- Infective stricture (e.g. tuberculosis or schistosomiasis)

Extrinsic compression
- Retroperitoneal fibrosis
- Pelvic tumour, e.g. cervical, ovarian or rectal carcinoma
- Aberrant renal artery or retrocaval ureter

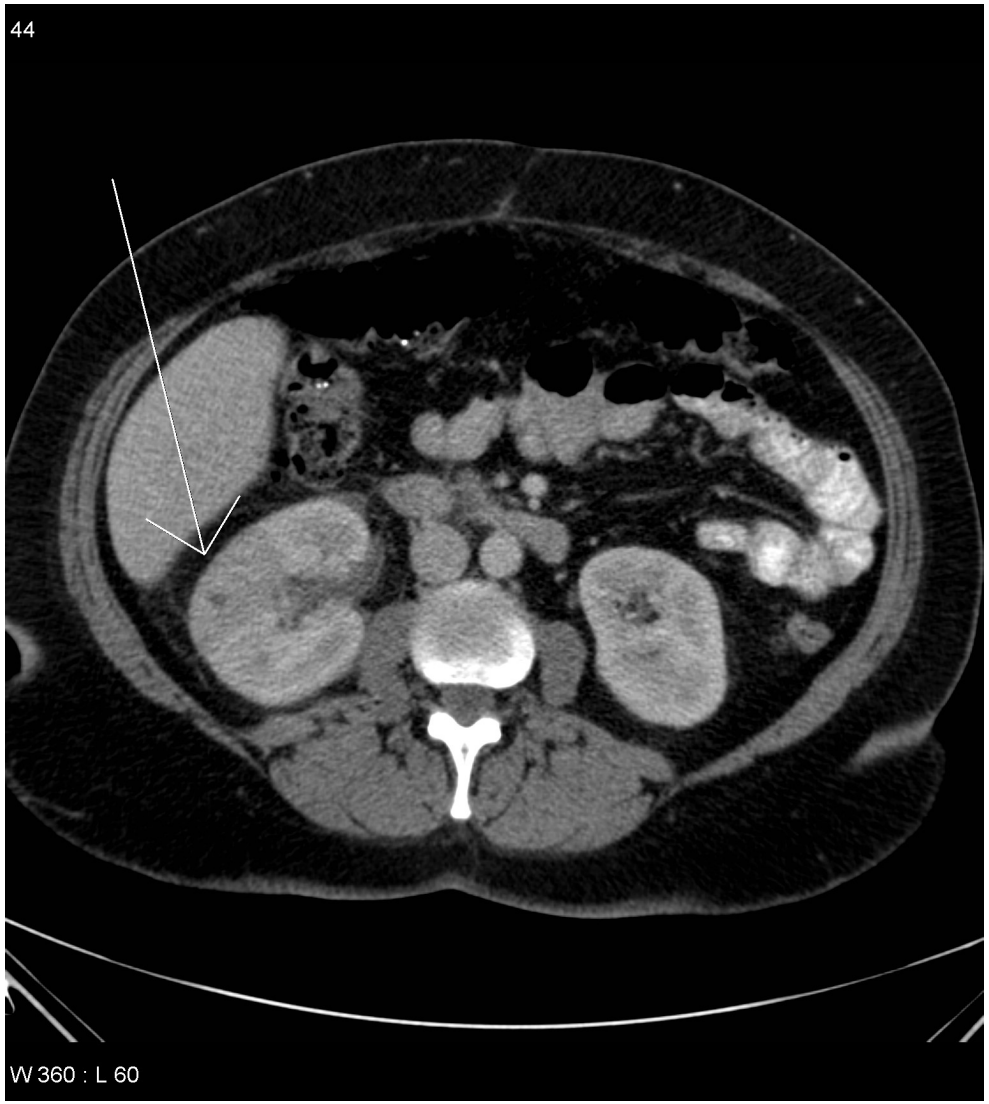
Due to papillary atrophy or destruction
- Reflux nephropathy
- Papillary necrosis
- Tuberculosis

Acute Pyelonephritis

- Life threatening infection & medical emergency
- Through lower urinary tract
- Early diagnosis and management has significant impact on patient outcome
- Presentation: (Fever, loin pain, nausea/vomiting)
- Diagnosed mainly clinically

Predisposing Factors:

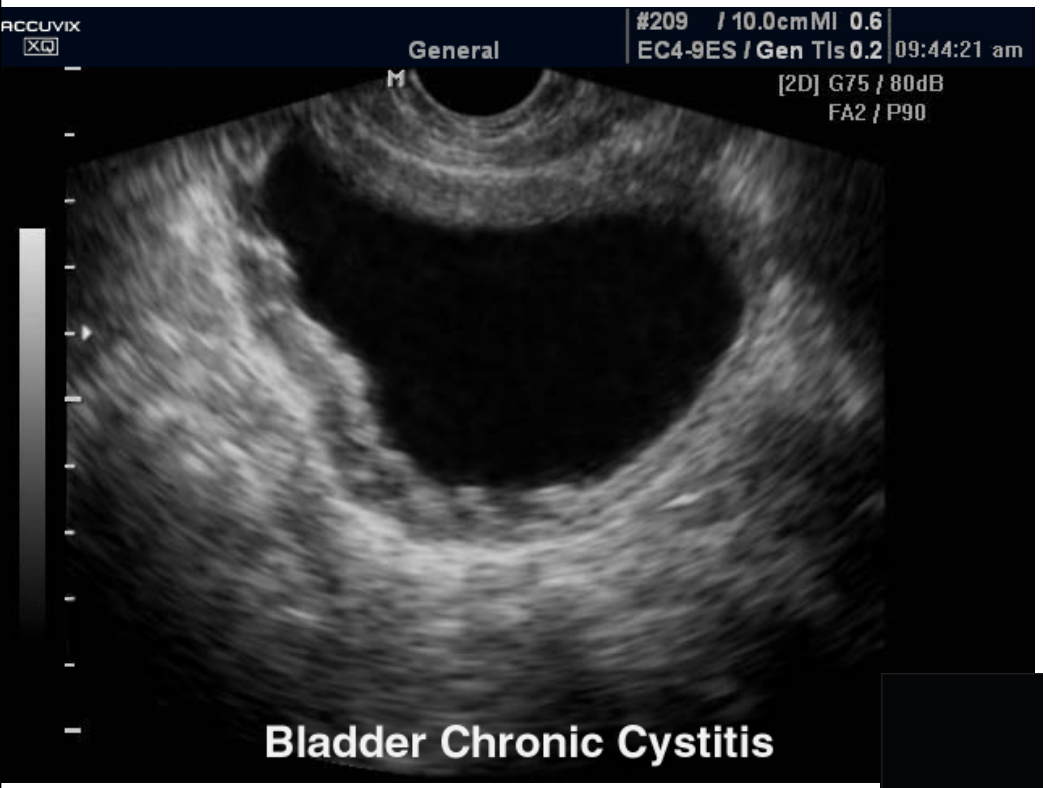
- Stones
- Obstruction
- Reflux
- DM



Pyelonephritis: Wedge shaped hypoperfused lesion

Cystitis

- Presentation: (Fever, suprapubic pain, frequent urination)
- As upper UTI, more common in females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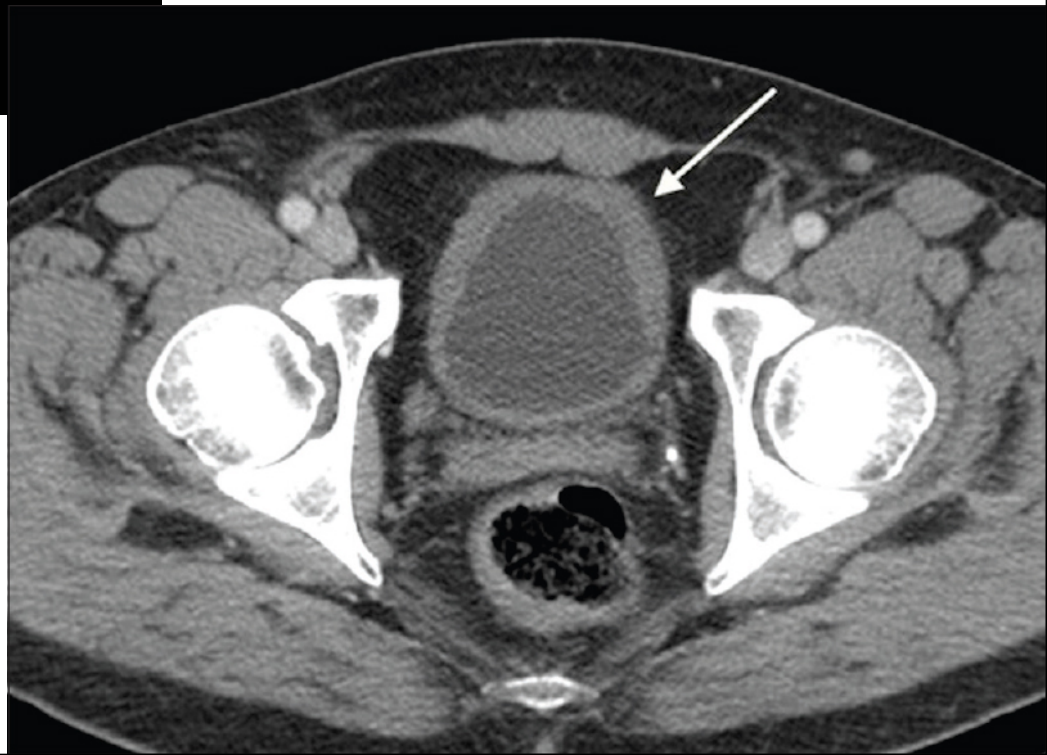
Bladder Chronic Cystitis



Urosepsis

- Establish a clinical diagnosis: pyelonephritis, cystitis, prostatitis
- Urosepsis and an obstructed ureter is a **urologic emergency!**
- Renal US performed to rule out:
  - Renal obstruction
  - Renal or perirenal abscess

Urosepsis

Left pyonephrosis

Right UPJ stone causing hydronephrosis

Renal Masses

- Most solitary renal masses are either: malignant tumor or simple cyst

- In adult, a malignant tumor is almost certain to be a renal cell carcinoma (RCC) whereas in young children it is usually Wilm's tumor

- Other causes of renal mass include: renal abscess, benign tumor (Oncocytoma, angiomyolipoma), metastasis

Multiple renal masses include:

- Multiple simple cysts
- Polycystic disease
- Malignant lymphoma
- Metastases
- Inflammatory masses

Approach to Renal Masses

- Most renal masses are simple cysts
- Use US to characterize the mass
  - simple cyst : STOP
  - solid mass or atypical cyst: CT
- US and CT characterize > 90% of masses > 1.5 cm
- Biopsy is rarely warranted

Renal Cysts

- US will determine if the lesion is cystic or solid

- 2 Types of Renal Cysts:
1) Simple: spherical, echo-free fluid collection within a thin surrounding wall and will show good sound wave transmission
2) Complicated: will show the presence of echos within the cyst, will have a thick wall, and/or show calcification in the wall

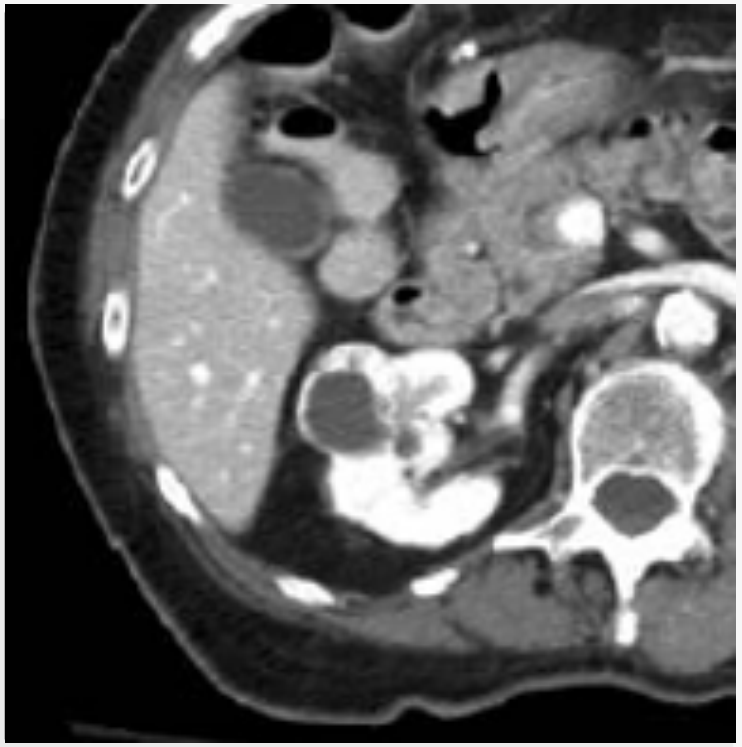
Renal Mass

Left renal mass on IVP

Simple cyst on ultrasound

Renal Carcinoma

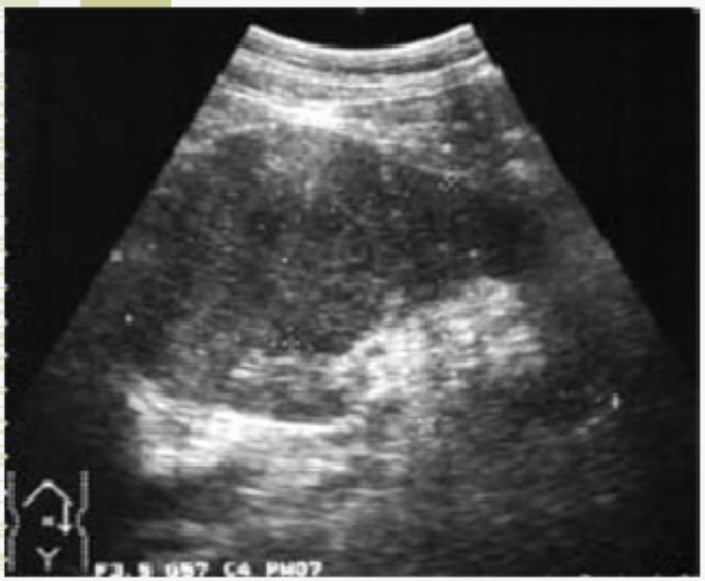
- if US indicates that the mass is solid, CT with IV contrast can characterize the tumour in greater detail – delineate extent, show the degree of vascularity, presence/absence of necrotic centre, presence/absence of local invasion of adjacent structures

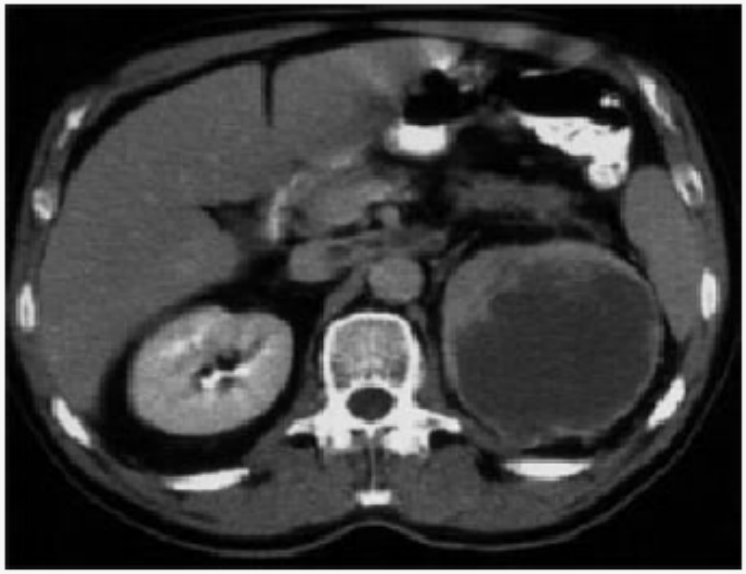


Renal Mass

Distortion of left pelicalyceal system in IVP

Renal Mass



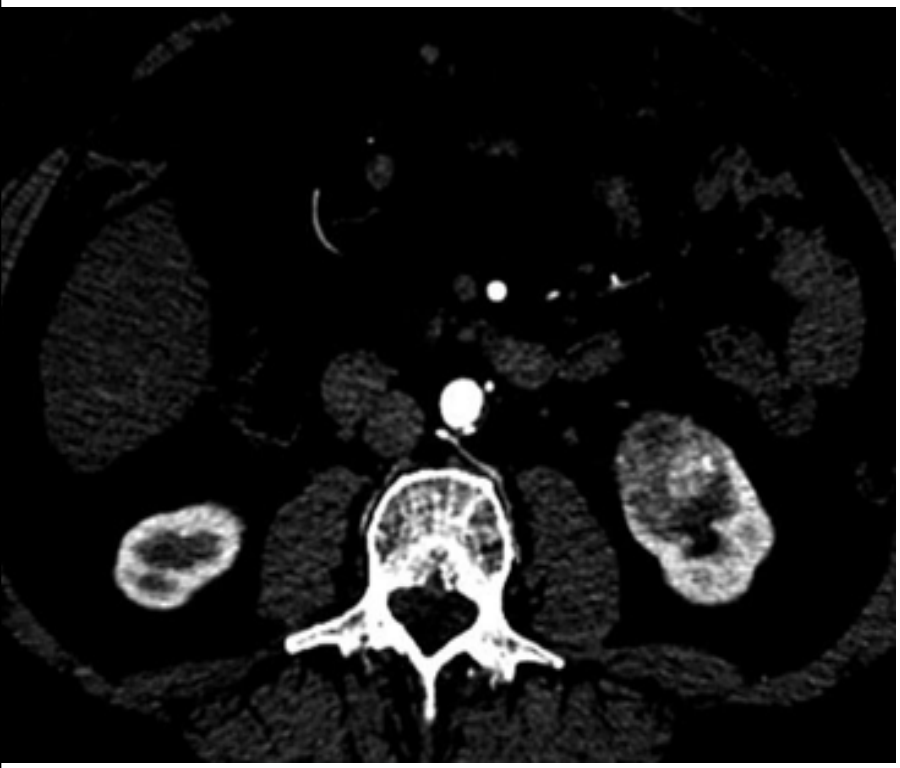


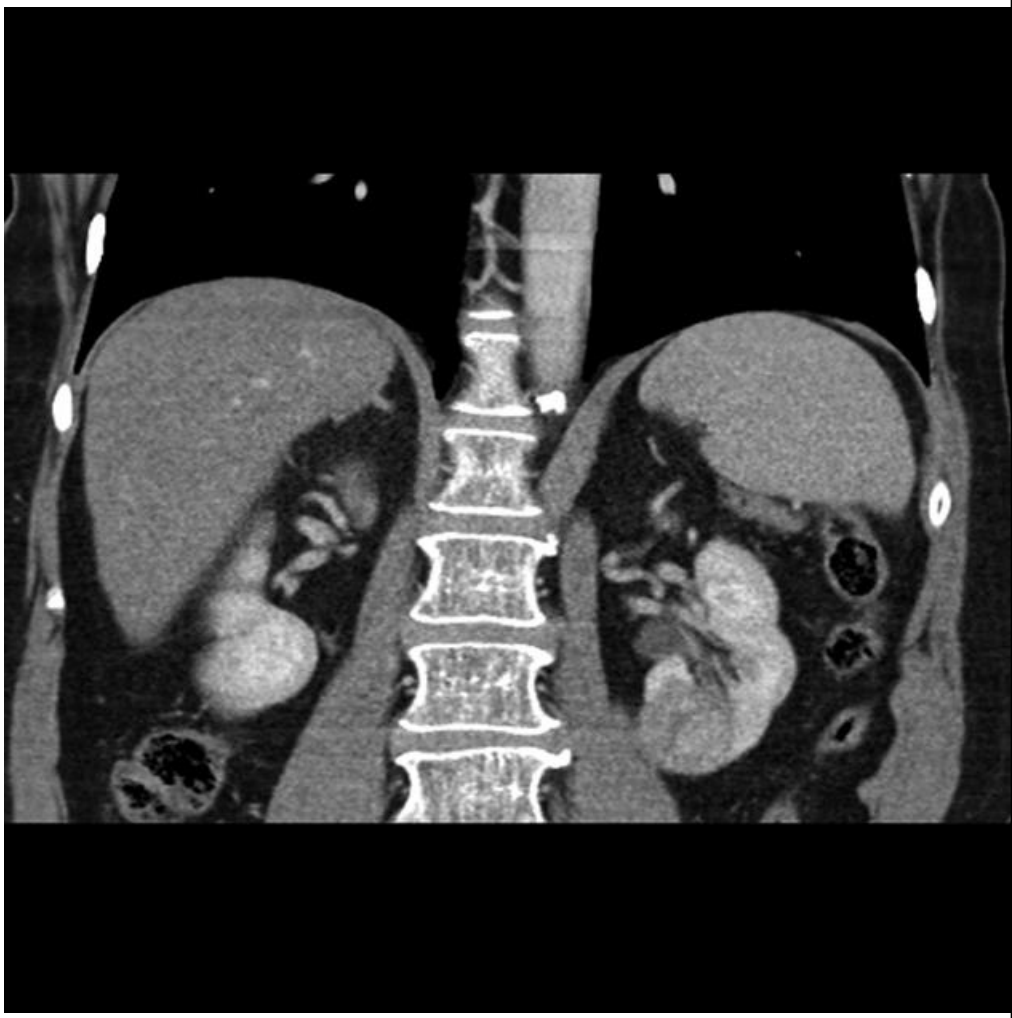
Solid left renal mass in a patient with micro hematuria

Renal Mass
Renal Adenocarcinoma

- 90% of all renal malignancies
- 15-30% metastatic at diagnosis
- Hematogenous and lymphatic spread
- 10% have venous invasion (renal vein or IVC)
- Treatment:
  - Radical nephrectomy
  - Partial nephrectomy

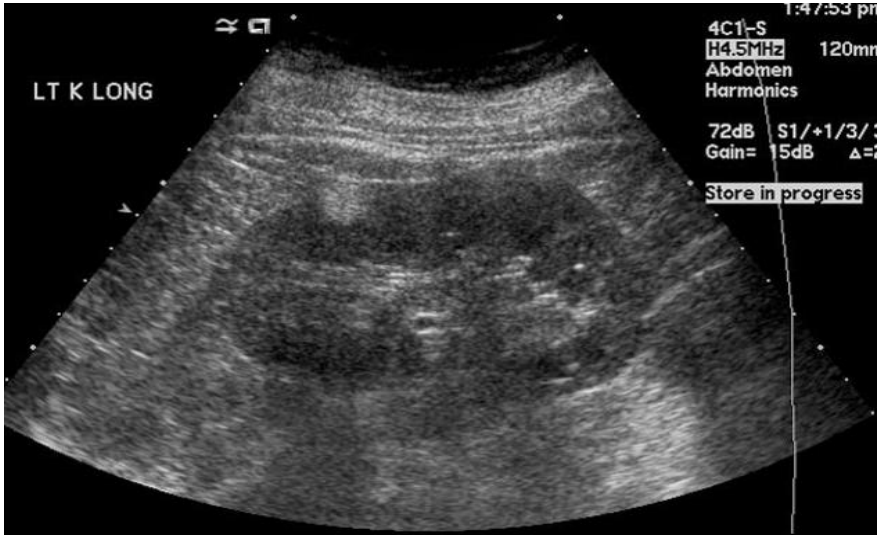
70 y/o female presented with painless hematuria





Renal Mass
Renal Angiomyolipoma

- Benign harmartomatous tumour comprised of fat, smooth muscle and vessels
- Usually asymptomatic
- Occasionally present with hemorrhage when large or multiple
- Fat detected in 96% by CT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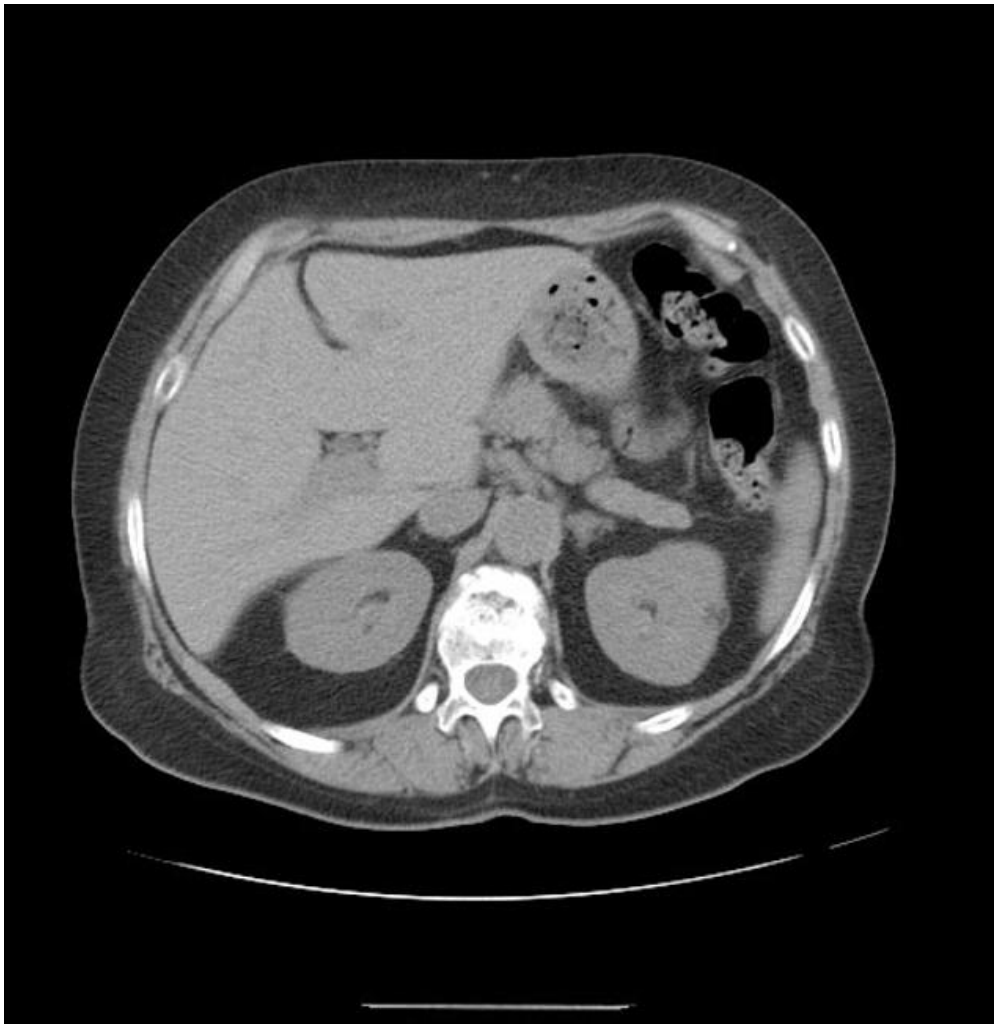
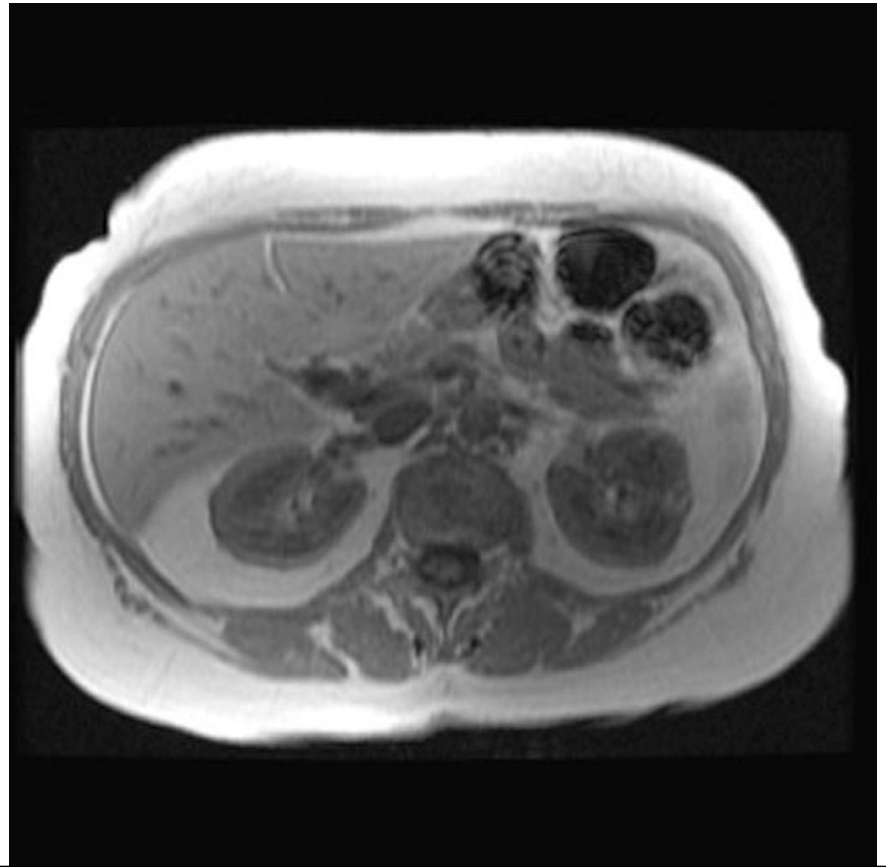


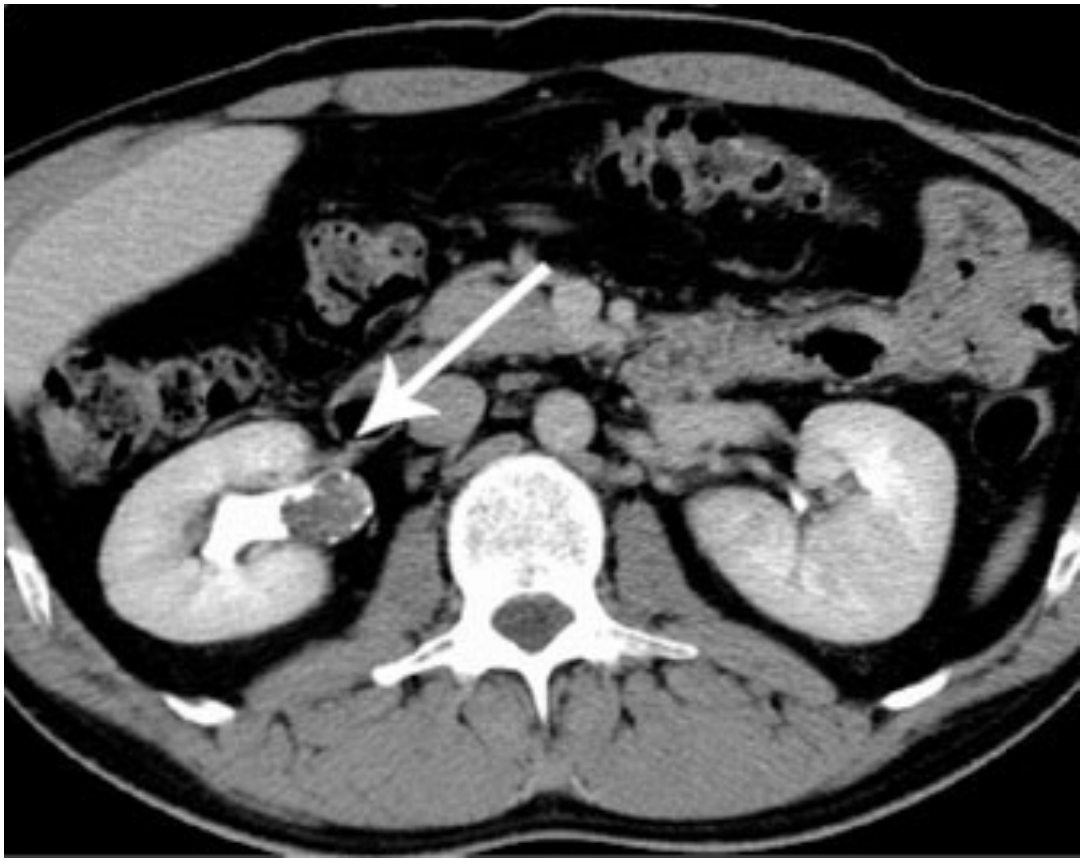


Transitional Cell Carcinoma

- Most common malignancy of ureter and bladder
- <10% of renal malignancies
- Typically present with gross hematuria
- CT for staging and surgical planning
- Treatment: radical nephrectomy

Transitional Cell Carcinoma

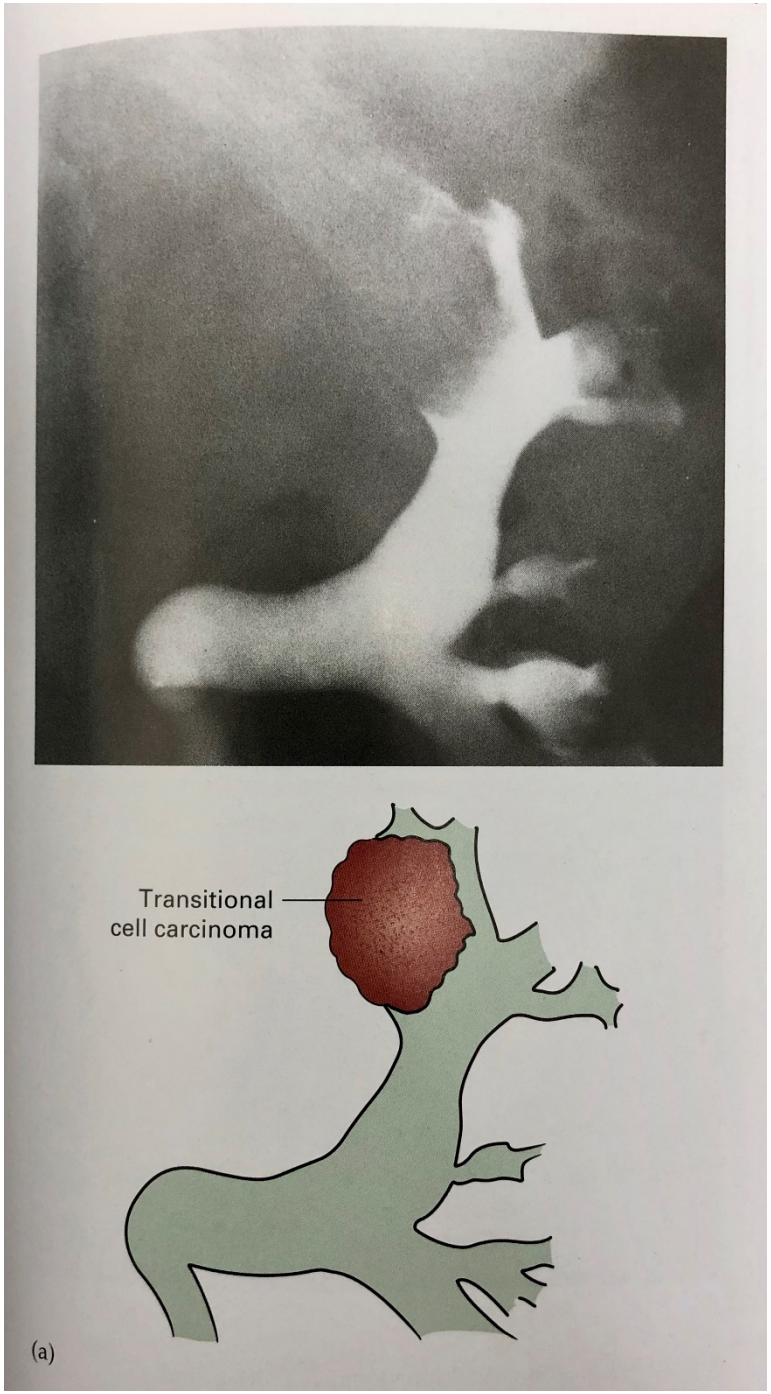
IVP and retrograde pyelogram TCC proximal left ureter



Large TCC of Rt renal pelvis

Transitional Cell Carcinoma

Small TCC of bladder in patient with hematuria


Transitional
cell carcinoma
(a)

Acute and Chronic Renal Failure

- Clinical catergories
  - Prerenal (dehydration, shock, cardiac failure)
  - Renal (parenchyma, diabetes, GN, drugs, renovascular)
  - Postrenal (obstruction)
- IV contrast **contraindicated** if creatinine > 200 mmol/d
- Use ultrasound to assess:
  - Renal size
  - Parenchymal thickness
- Ultrasound guided renal biopsy to establish diagnosis

Acute and Chronic Renal Failure

Hydronephrosis post-renal

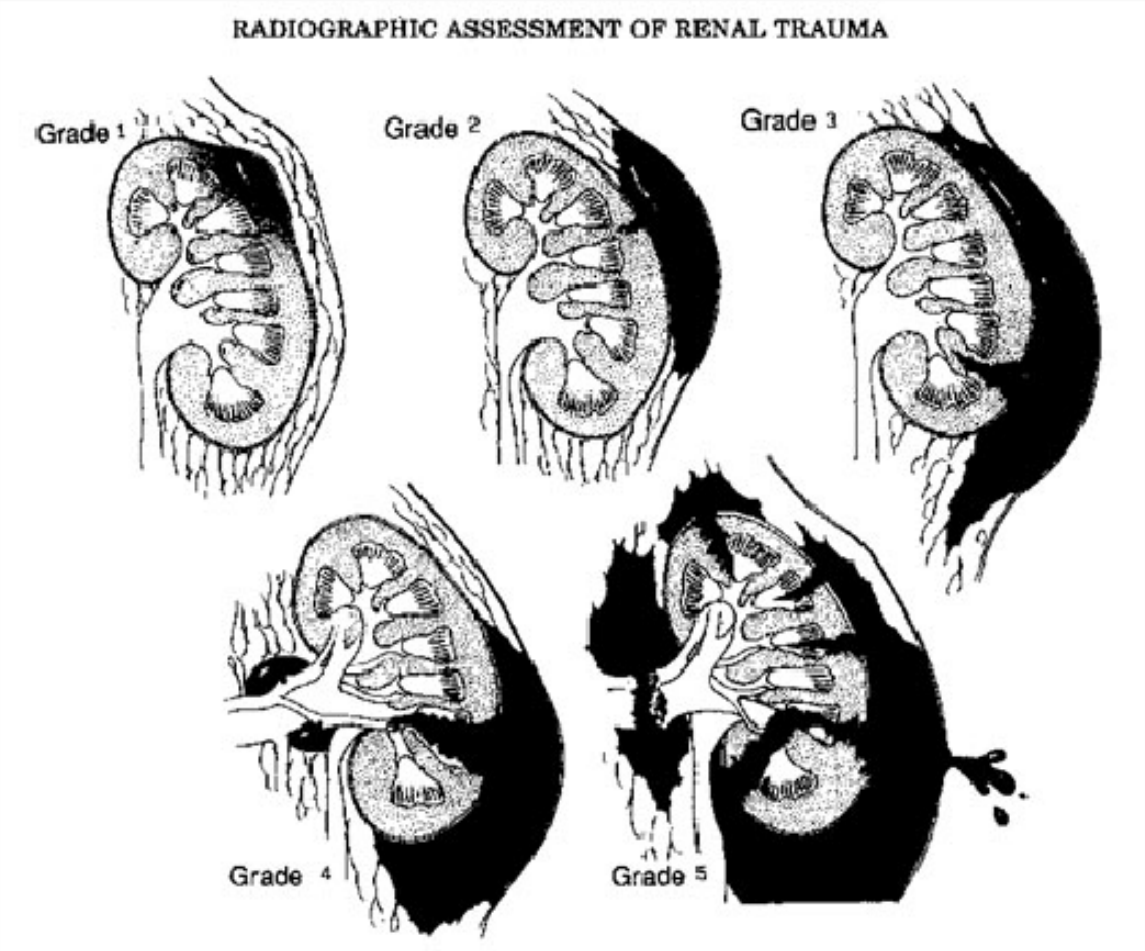
Atropic, echogenic kidney

Medical renal disease

GU Trauma
Penetrating trauma (gunshot, stab)

- Unstable
  - Surgery or angiography
- Stable
  - CT

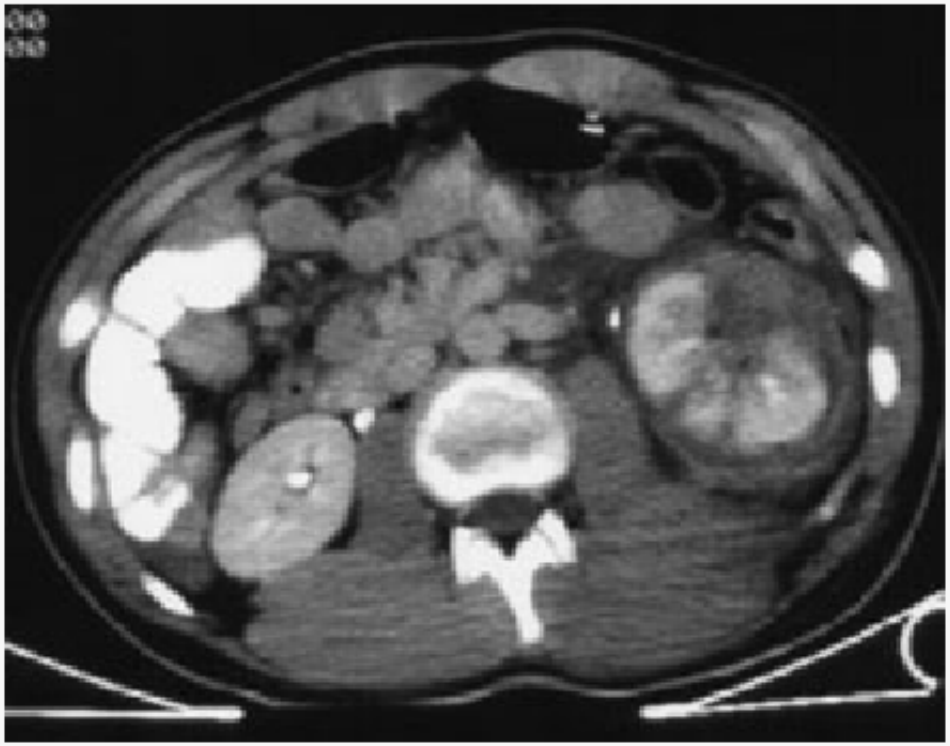
GU Trauma


RADIOGRAPHIC ASSESSMENT OF RENAL TRAUMA
Grade 1
Grade 2
Grade 3
Grade 4
Grade 5

Grade 1-2 injury

Grade 3 injury

GU Trauma



Grade 4 injury: deep lacerations with perirenal hemorrhage

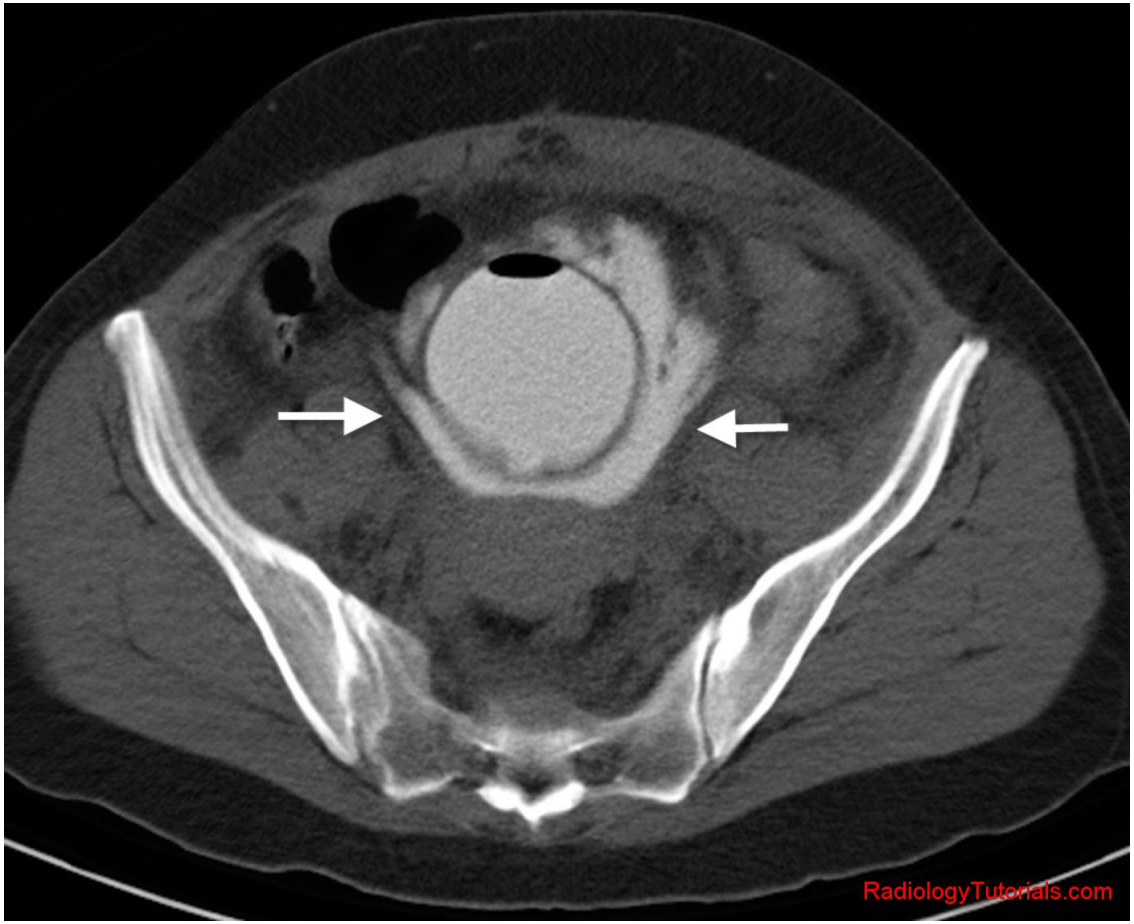
GU Trauma

Grade 5 injury: thrombosed renal artery

GU Trauma

Extraperitoneal bladder rupture

Intraperitoneal bladder rupture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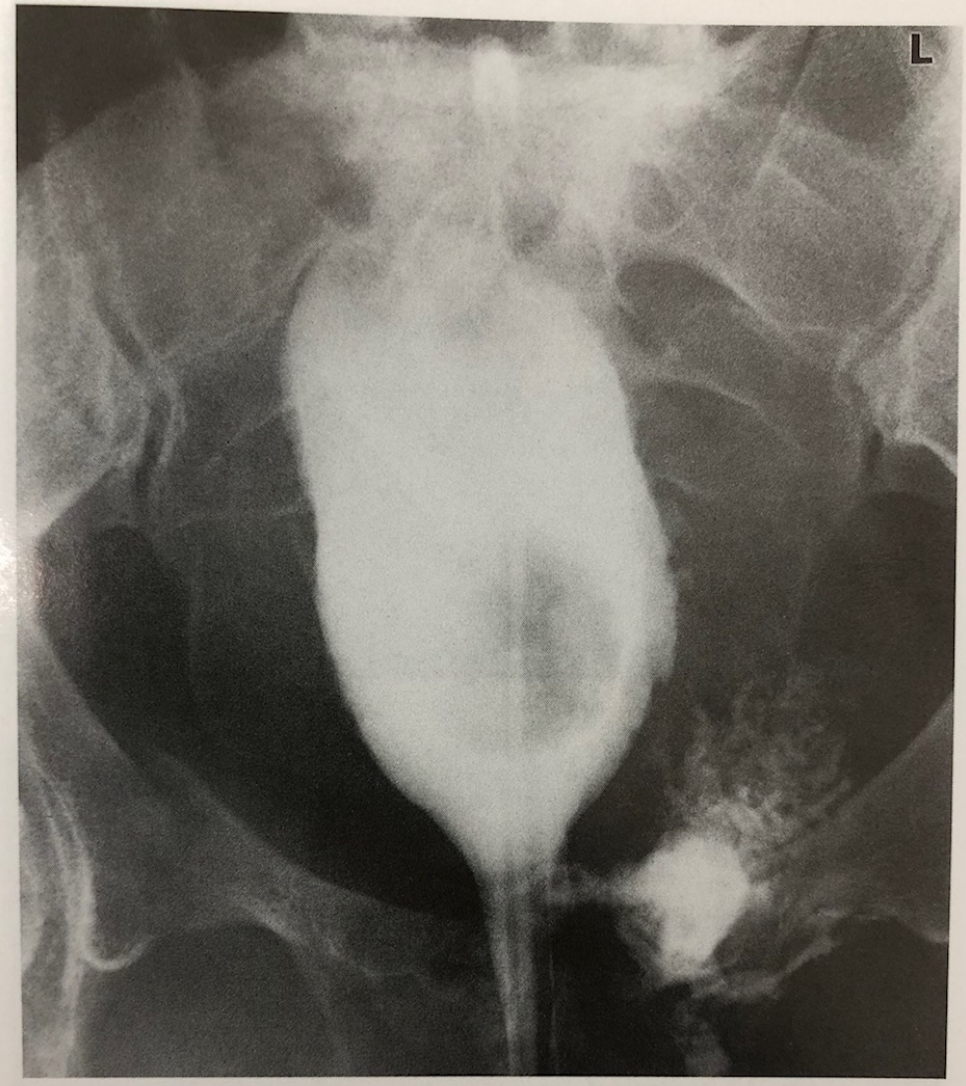
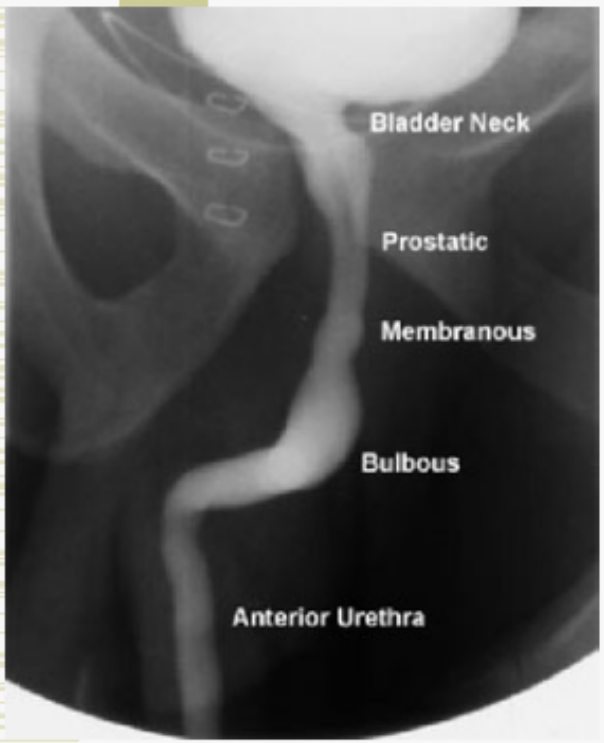


Fig. 8.56 Rupture of the base of the bladder. Cystogram showing extravasation of contrast into the extraperitoneal space on the left, and deformity of the bladder due to surrounding haematoma and urine. [redacted]

GU Trauma



Normal retrograde urethrogram

Traumatic rupture of bulbous urethra


Thank you