

### Uro-radiologic studies:

#### ➤ The basic types:

1. Plain (conventional) abdominal films (KUB means kidney, ureter, bladder)
2. Urography.
3. Cystourethrograms.
4. Urethrograms.

#### ➤ SONOGRAPHY

#### ➤ Cross-sectional imaging systems.

#### ➤ Isotope Scanning (Nuclear Renography).

### Contrast media

- Radiographic contrast media used in uroradiography are water-soluble iodinated compounds that are radiopaque.
- Similar compounds are used for basic radiographic techniques and CT.
- In general, intravenous administration for CT or IVU is performed with 1-2 cc/ kg.
- These agents are water-soluble, low-osmolality, nonionic organic iodine-containing compounds. significantly improve patient tolerance and decrease the incidence of adverse reactions.

### Adverse reactions of radiographic contrast media

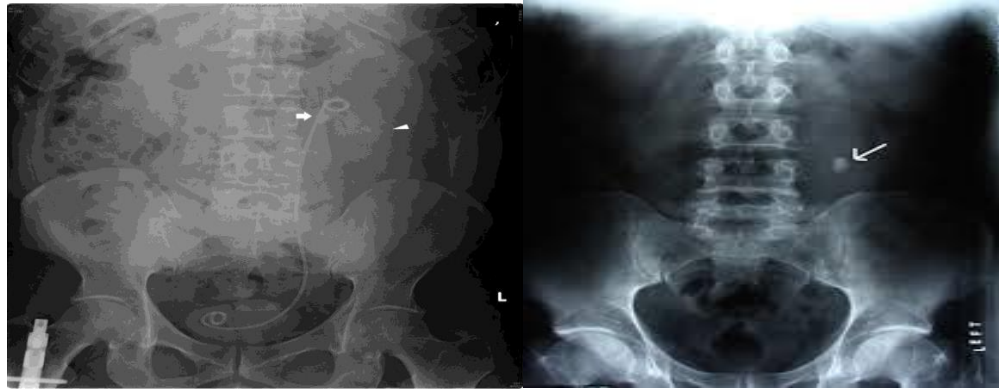
- ⇒ All procedures using intravascular contrast media carry a small but definite risk of adverse reactions.
  - ⇒ The overall incidence of adverse reactions is about 5%.
  - ⇒ The risks and benefits of contrast use should be carefully evaluated for each patient before the procedure is initiated.
1. Most reactions are minor, for example, nausea, vomiting, hives, rash, or flushing, and usually require only reassurance.

2. Cardiopulmonary and anaphylactoid reactions can occur with little warning and can be life threatening or fatal, was 0.9 deaths/100,000 injections. Treatment of adverse reactions involves the use of antihistamines, epinephrine, vascular volume expanders, bronchodilators, and other cardiopulmonary drugs as well as ancillary procedures indicated by the nature and severity of the reaction.
3. Nephrotoxicity caused by intravascular contrast agents is another concern. The pathogenesis of contrast nephropathy (CN) likely involves medullary ischemia due to contrast induced vasoconstriction and direct tubular injury.
  - Patients at higher risk of Nephrotoxicity are those with:
    1. Preexisting renal insufficiency
    2. Diabetes.
    3. Dehydration.
    4. Patients who receive higher volumes of contrast material.
  - Alternative procedures can be selected in high-risk patients.
  - If contrast use is deemed necessary in a high-risk individual, CN can be minimized through attention to :
    1. Proper hydration.
    2. Discontinuation of drugs that may exacerbate toxic effects.
    3. Adequate hydration in the 24 hours prior to scanning.
    4. Reduction of contrast volume.
    5. Possibly administration of oral N-acetylcysteine.

#### 1. Plain film of the abdomen:

- A plain film of the abdomen, frequently called a KUB film, is the simplest uro-radiological examination.
- It is generally the preliminary radiograph in extended radiologic examinations, such as intravenous urography, and is usually taken with the patient supine.
- It may demonstrate
  - ⇒ osseous abnormalities, abnormal calcifications like stone , or large soft-tissue masses.

- ⇒ Kidney outlines usually can be seen on the plain film, so that their size, number, shape, and position can be assessed.
- ⇒ Foreign body.
- ⇒ Constipation (fecal impaction).
- ⇒ Postoperative: location of double J stent.



Lt upper ureteric stone, Renal stone  
Lt DJ stent

2. **Urography:** collecting structures of the kidneys, ureters, and bladder can be demonstrated radiologically with contrast media by the following methods:

⇒ **Intravenous Urography**

- The IVU, also known as excretory urography (EU), or intravenous pyelography (IVP), can demonstrate a wide variety of urinary tract lesions, is simple to perform, and is well tolerated by most patients.
- CT, Sonography, MRI replaced urography in majority of cases.

3. **Cystography, voiding cystourethrography:**

- Direct instillation of contrast media into the urinary bladder (cystography) allows a more focused examination of the bladder.
- Contrast is usually instilled via a transurethral catheter, but when necessary can be administered via percutaneous suprapubic bladder puncture
- Cystography and cystourethrography are important radiologic techniques for
  1. detecting vesicoureteral reflux

2. CT cystography (CT of the pelvis after the instillation of dilute contrast medium into the bladder) has been shown useful in the evaluation of traumatic bladder rupture.



MCU showing small capacity bladder  
with gross right reflux

Normal voiding cystourethrogram.  
No VUR noted.  
Normal contour of the bladder

#### 4. Urethrography:

- The urethra can be imaged radiographically by retrograde injection of radiopaque fluid.
  1. posterior urethral valves.
  2. Urethral stricture.
  3. Urethral tumor or diverticula

#### Advantages and Disadvantages of the basic types:

1. Radiography produces anatomic images of almost any body part.
2. Costs are moderate compared with cross-sectional imaging systems.
3. Space requirements are modest.
4. Portable equipment is available for use in hospital wards, operating rooms, and intensive care units.
5. Many specialists trained with this radiography.

### **The major disadvantage of the basic types:**

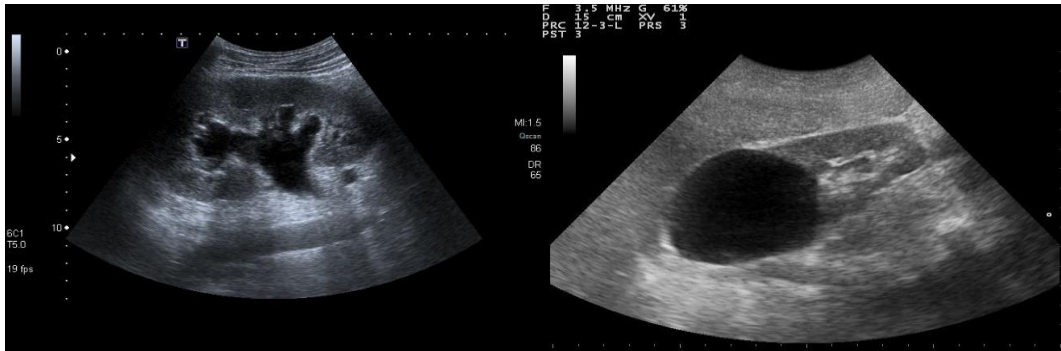
1. Use of ionizing radiation
2. Relatively poor soft-tissue contrast.
3. The evaluation of the urinary tract almost always requires opacification by iodine contrast media.

## **SONOGRAPHY**

✓ Ultrasound is commonly used for the evaluation of the kidney, urinary bladder, prostate, testis, and penis.

### **• Renal Ultrasound is useful for assessing:**

1. Renal size and growth. It is also helpful in triaging patients with renal failure. For example, small echogenic kidneys suggest renal parenchymal (medical) disease, whereas a dilated pelvocaliceal system indicates an obstructive, and potentially reversible, cause of renal failure.
2. Detection and characterization of renal masses. Ultrasound provides an effective method of distinguishing benign cortical cysts from potentially malignant solid renal lesions. Since the most common renal lesion is a simple cortical cyst, ultrasound is a cost-effective method to confirm this diagnosis.
3. Doppler sonography is useful for the evaluation of renal vessels, vascularity of renal masses, and complications following renal transplant.
4. The initial procedure for the evaluation of the patient with acute flank pain and suspected urolithiasis especially in children and pregnant women.
5. Guidance of aspiration, biopsy or intervention
6. For the evaluation of hematuria, recent studies indicate that CT (or CTU) is the preferred modality. A balance between optimizing imaging quality and minimizing radiation exposure is advocated.
7. Follow-up of previously identified pathology.



**Renal USS Show Hydronephrosis**

**Renal cyst**

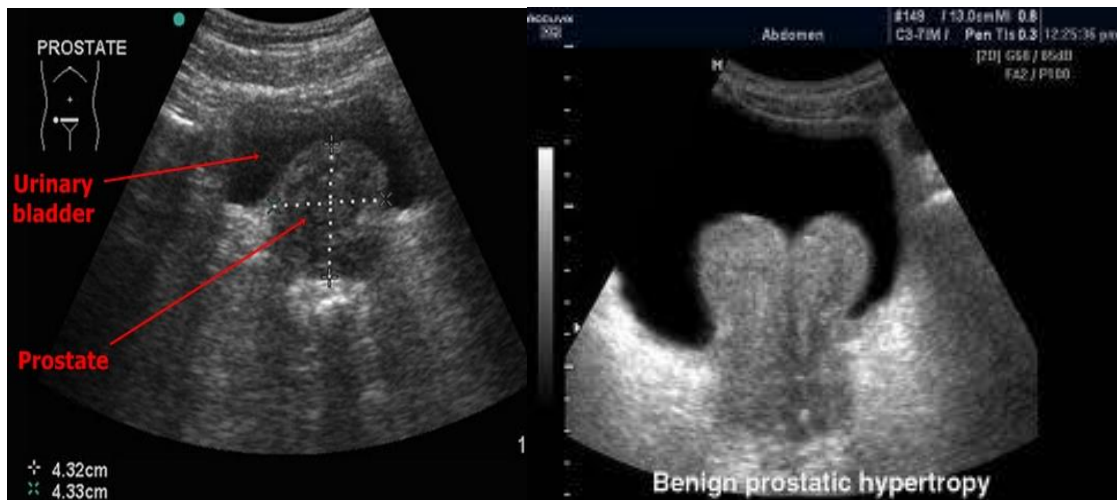


**Renal stone**

• **Applications of bladder sonography include**

1. Assessment of bladder volume (Pre and post micturition volumes).
  2. Bladder wall thickness (normal = 4-6mm).
  3. Detection of bladder Stone.
  4. Trabeculation
  5. Diverticulum
  6. Detection of bladder Masses (polyps, carcinoma).
  7. foreign body.
  8. Measurement of prostatic size.
- ⇒ The suprapubic transabdominal approach is most commonly used.

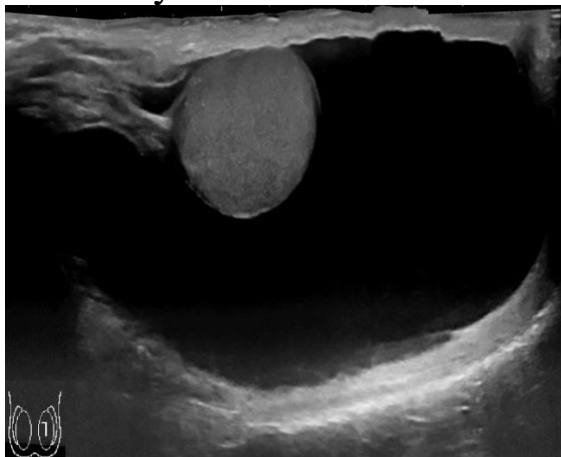




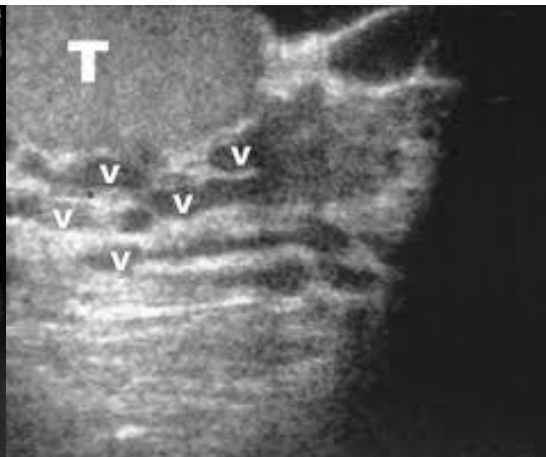
Bladder mass

### Ultrasound examination of the testis and scrotum:

1. Evaluate acute conditions of the scrotum to exclude or diagnosis acute testicular torsion.
2. Epididymitis not responding to antibiotics within 2 weeks.
3. Color Doppler sonography provides diagnosis of varicocele.
4. Any testicular mass.



scrotal U/S: Hydrocele



varicocele

- **Advantages of Ultrasound:**

1. Ease of use.
2. high patient tolerance.
3. Noninvasiveness.
4. lack of ionizing radiation.
5. low relative cost.
6. wide availability.

- **Disadvantages of Ultrasound:**

1. Tissue non specificity.
2. limited field of view.
3. Dependence on the operator's skill and the patient's habitus.

## COMPUTED TOMOGRAPHY SCANNING

### Clinical Applications

1. Renal CT is most commonly used in the evaluation of:

1. Acute flank pain.
2. Hematuria.
3. Renal infection (search for abscess).
4. Trauma
5. Staging of renal neoplasm.

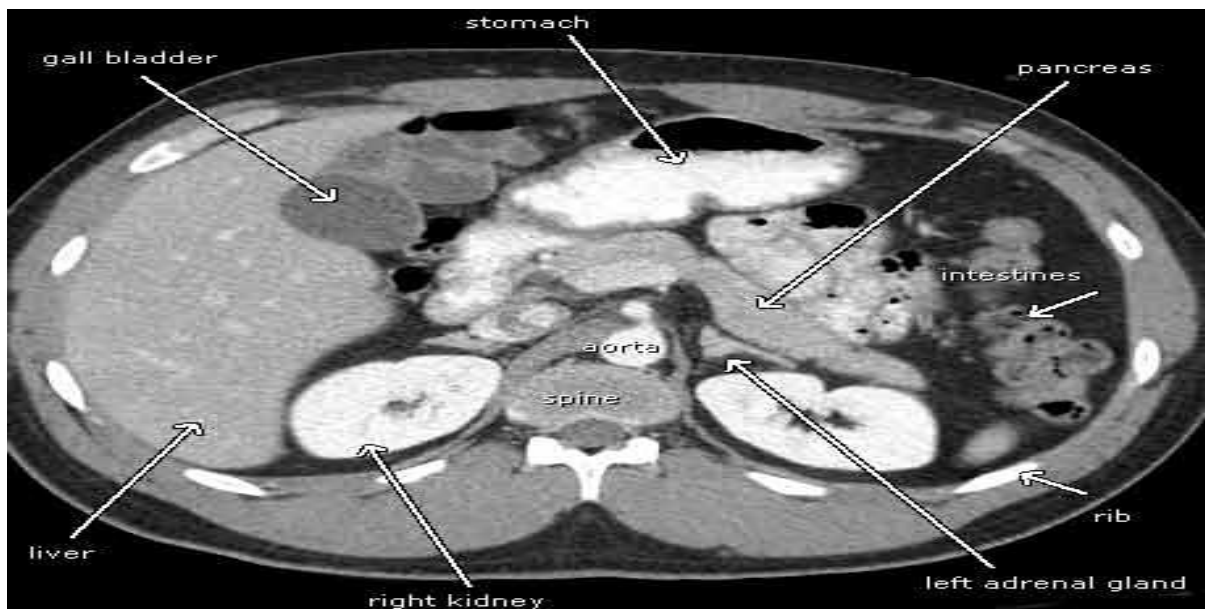
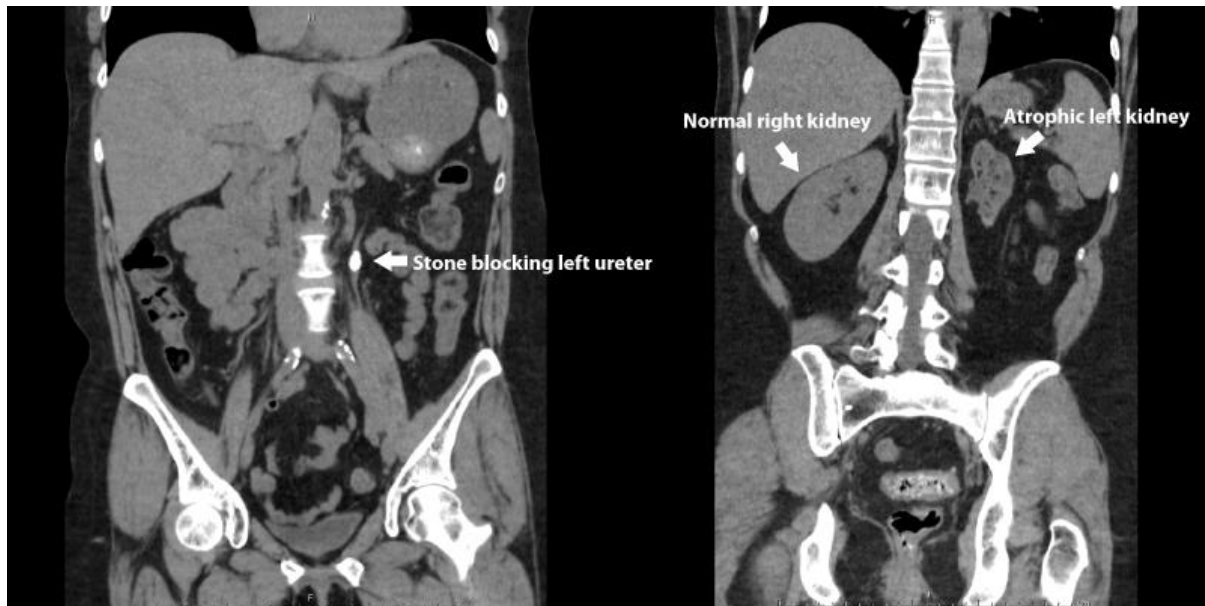
- CT evaluation of renal anatomy and pathology generally requires intravenous injection of iodinated contrast media.
- pre- and postcontrast scans are required to determine whether a mass is solid or cystic.
- Although CT can detect ureteral tumors, the current role of CT in the evaluation of the ureters is predominantly for tumor staging and evaluation of the cause and level of obstruction.

2. Helical CT without intravenous contrast is the preferred imaging modality for patients with renal colic or suspected urolithiasis , Helical CT also has the potential for identifying other causes of flank pain such as appendicitis and diverticulitis.

3. In the evaluation of the urinary bladder, CT is used primarily in staging bladder tumors and in diagnosing bladder rupture following trauma. Performing CT after filling the bladder with dilute contrast medium (CT cystography) improves the sensitivity of this modality for detecting tumors and bladder rupture.



4. For prostate diseases, CT is used for detection of lymphadenopathy, gross extraprostatic tumor extension, and to delineate prostatic abscesses.
5. CT is used for staging of testicular tumors, and in the search for nodal or distant metastasis.
6. Intravenous contrast-enhanced CT shows high sensitivity and specificity in characterizing adrenal lesions.



## Advantages and Disadvantages

- **Advantages of CT** include:

1. A wide field of view.
2. The ability to detect subtle differences in the x-ray attenuation properties of various tissues.
3. Good spatial resolution.
4. Anatomical cross-sectional images.
5. relative operator independence.

- **Disadvantages of CT** include:

1. It is relatively expensive.
2. It exposes the patient to a relatively high radiation dose (and thus should not be performed on pregnant women).
3. May need Contrast material.

## MAGNETIC RESONANCE IMAGING

### Clinical Applications

- **Kidney:** Applications for MR in renal imaging include:
  1. Demonstration of congenital anomalies.
  2. Diagnosis of renal vein thrombosis.
  3. Diagnosis and staging of renal cell carcinoma.
  4. Evaluating renal transplant vessels.
  5. Renal artery stenosis.
- Compared to iodinated contrast media, gadolinium has superior renal tolerance in patients with preexisting renal failure.
- Cases of nephrogenic system fibrosis (NSF) have been reported in patients with renal failure who have received gadolinium. patients on dialysis or with estimated glomerular filtration rates of  $\leq 30$  mL/min are at higher risk for developing NSF after gadolinium administration.
- **Bladder tumors stage.**
- **Prostate gland:** MRI is principally used to stage patients with prostate cancer
- **MRI of the testis** is appropriate when other imaging studies are inconclusive.
- **Adrenal masses:** commonly used.

## Advantages and Disadvantages

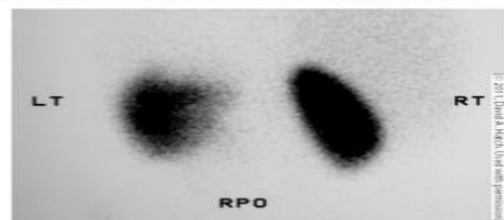
- **Advantages of MRI** include
  1. Excellent soft-tissue contrast.
  2. imaging without exposure to ionizing radiation.
  3. less operator dependence (as compared to ultrasound).
  4. MRI can image blood vessels and the urinary tract without contrast material.
- **Absolute contraindications to MRI** include the presence of
  1. Intracranial aneurysm clips, unless the referring physician is certain that the clip is made of a nonferromagnetic material (such as titanium).
  2. intra-orbital metal fragments.
  3. any electrically, mechanically activated implants (including cardiac pacemakers, neurostimulators, cochlear implants).
- **Relative contraindications** such as pregnancy should always be viewed in the light of risk versus benefit of the examination.

## Isotope Scanning (Nuclear Renography)

- The glomerular agent Tc 99m diethylenetriaminepentaacetic acid (DTPA) and the tubular agent Tc 99m MAG3 are most commonly used in the evaluation of obstruction.
- DMSA, a cortical agent, has been shown to be superior to tubular selective agents DTPA or MAG3 predict function and renal scar.

### DMSA Cortical Scan

- ▶ Her right kidney is smooth and reniform (bean-shaped).
- ▶ The left kidney is irregular. It looks as if someone took a bite out of the upper pole. The lower pole is irregular too.



- Besides renal scarring from chronic infection, what could give this appearance (photopenic areas)?

## COMPARISON OF IMAGING METHODS

- As new imaging methods have been developed, changes have occurred in patterns of use for each type of imaging. For example, CT scanning have resulted in a substantial decrease in the use of IVU.

THANK YOU  
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