# Urinary Tract Infections
## **KIDNEY INFECTIONS**

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# General principles

- **Urinary tract infections** (UTIs)

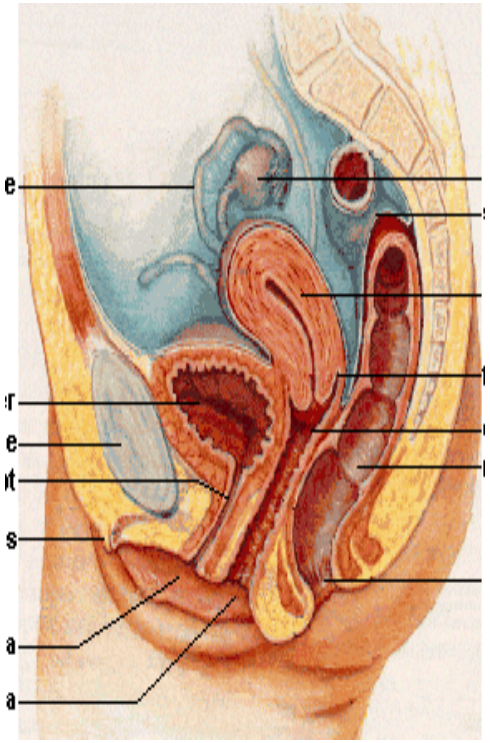
- is inflammatory response of the urothelium to bacterial invasion.
- are common
- affect men and women of all ages,.
- The diagnosis of UTI is based on symptomatology, urinalysis, & urine culture findings.

# Definitions

- **Pyuria**
  - is the presence of white blood cells (WBCs) in the urine in dipstick or **10 WBC/HPF** in sediment of centrifuged urine. occur either due to
  - bacterial infection or
  - **sterile pyuria** absence of bacteriuria carcinoma in situ, TB infection, & stones

- **Bacteriuria**
  - is the presence of bacteria in the urine which is normally free of bacteria. *symptomatic* or *asymptomatic*

# Routes of infection



- Ascending route (commonest)
  - bacteria derived from the large bowel, colonize the perineum, vagina, and distal urethra.
  - They ascend along the urethra to the bladder (risk is increased in ♀ as the urethra is shorter), causing cystitis,
  - & from the bladder they may ascend, via the ureters, to involve the kidneys (pyelonephritis).

# Routes of infection

- Hematogenous route

  Infection of the kidney is uncommon. Occurs in patients with ***Staphylococcus aureus*** **bacteremia & TB**

# Predisposing Factors

1. stasis & obstruction:
   - prostatic enlargement
   - vesico ureteric reflux of urine  VUR
   - neurogenic bladder (spinal cord injury, DM)

2. foreign body:
   - catheter
   - stone

3.Decreased resistance:

- diabetes mellitus
- malignancy
- immunosuppression

4. congenital anomaly

UPJ obstruction,

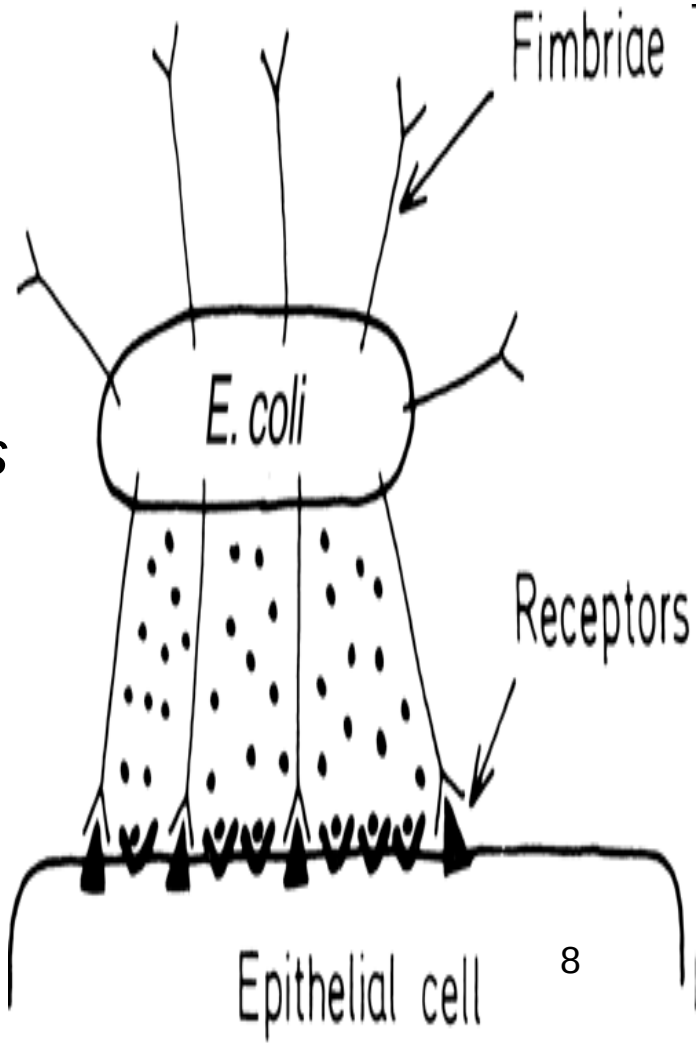
APCKD.

# Urinary pathogens

- **Most UTIs are caused by facultative anaerobes usually originating from the bowel flora.**

" **KEEPS** "

- K *lebsiella*
- E . *Coli* (85%)
- E*nterococci*
- P*roteus mirabilis, pseudomonas*
- S *.saprophyticus , S. Fecalis*



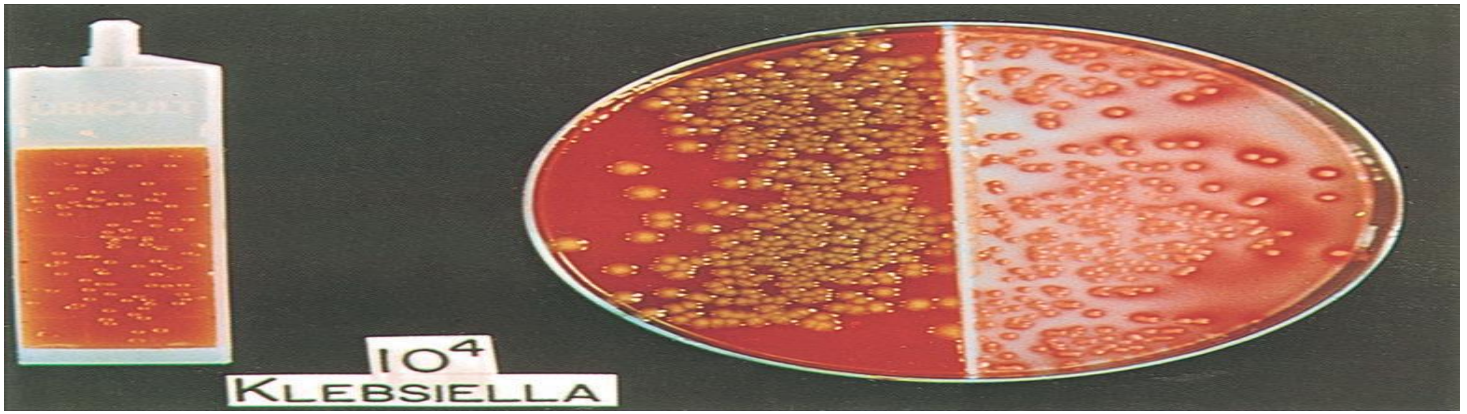
# UTI

- *Isolated UTI*
  - *has an interval of at least 6 months between infections.*
- *Recurrent UTI*
  - *is >2 infections in 6 months, or 3 within 12 months.*
- *Unresolved infection*
  - *is failure of the initial treatment course to eradicate* bacteria from the urine.
    - antimicrobial resistance,
    - patient noncompliance with therapy,
    - insufficient antibiotic dosing

# UTI basic investigation

- Urine dipstick MSU  is used as a first-line screening.
- *GUE:* the observation of WBC, bacteria & RBC
- Urine culture is the gold standard for the diagnosis of UTI.

**Imaging studies are not required in most cases  of UTI**



# *Further investigation*

- **US**:

  calculi & hydronephrosis

  PVR

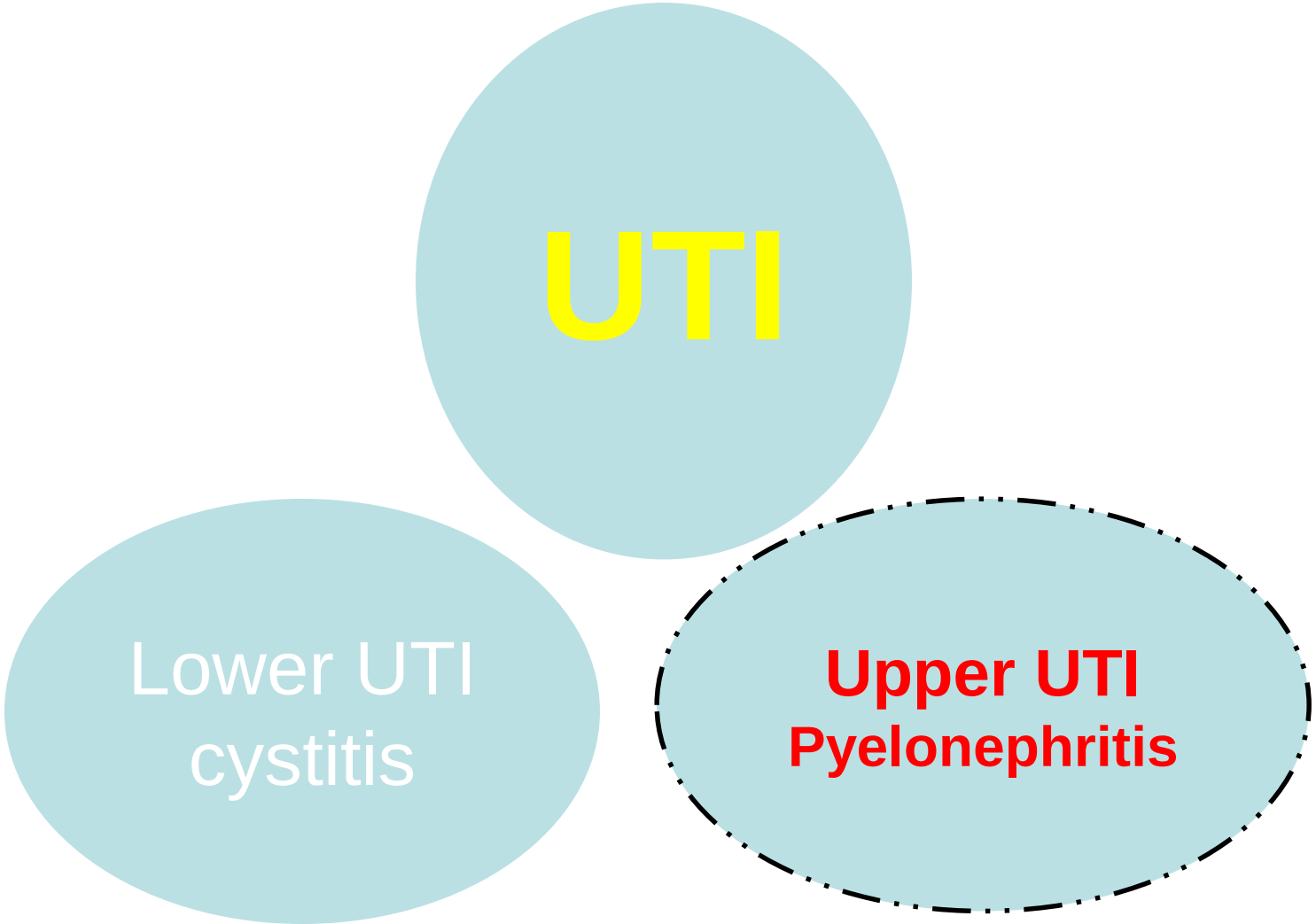
- **VCUG**

  vesicoureteral reflux Dx.

# Further workup

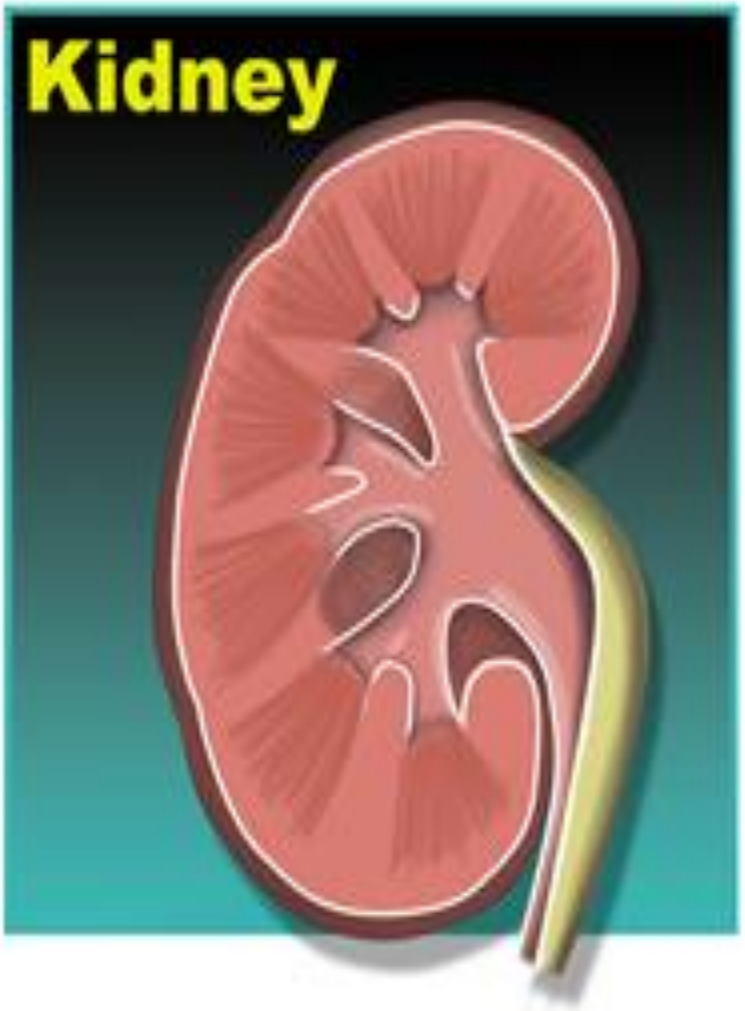
is needed in

- ✓ upper tract infection (**fever, flank pain, malaise,** that suggest acute pyelonephritis, a pyonephrosis, or perinephric abscess
- ✓ **Pregnant patient**
- ✓ **Unusual** infecting organism (e.g., ***Proteus***), suggesting the possibility of an ??
- **Recurrent UTIs**


UTI
Lower UTI
cystitis
Upper UTI
Pyelonephritis

# Acute pyelonephritis

- **pyelonephritis is defined as inflammation of the kidney and renal pelvis**
- A clinical diagnosis is based on the presence of fever, flank pain, and tenderness. It may affect one or both kidneys.



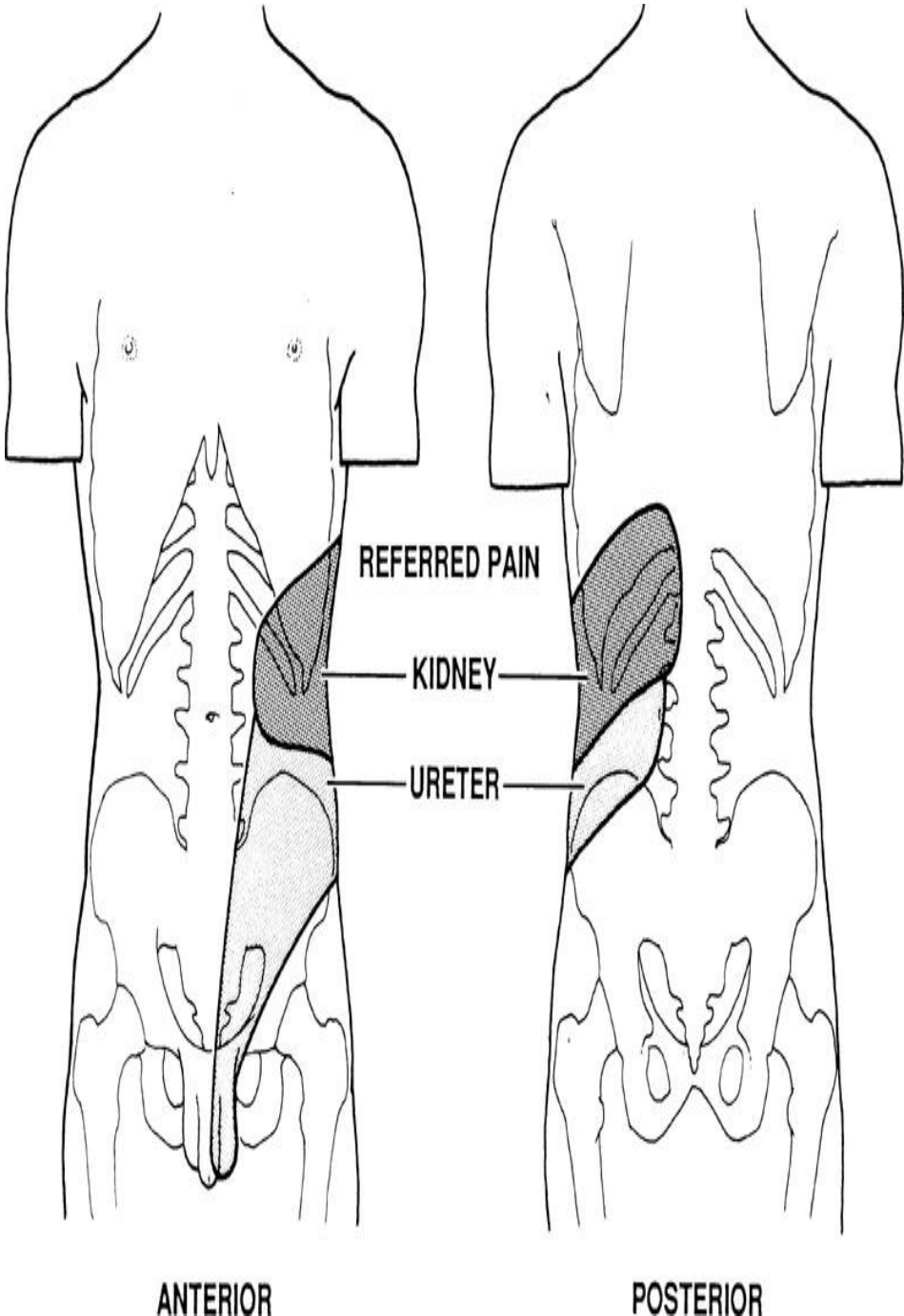
# Symptoms

- ✓ The onset is usually abrupt.
- ✓ fever(38.5 to 40 C),rigor & flank pain
- ✓ symptoms of **cystitis**

  (dysuria, frequency, urgency, suprapubic pain) These are usually suggestive of a lower urinary tract infection that led to the ascending infection, which resulted in the subsequent acute pyelonephritis.
- ✓ Nausea and vomiting are common.

# Physical sign

- **Renal angle tenderness.**



# Investigation

- **GUE:**

  increased pus cells, WBC casts, & RBC.

  Bacteria are often seen.
- **Urine culture & sensitivity test.**
- Blood tests may show a leukocytosis.
- RFT
- U/S & KUB: to see if there is an underlying upper tract abnormality (such a ureteric stone)

# Treatment

- involves the administration of antibiotics according to the clinical presentation and most likely causative organism, before culture sensitivities are available

# Treatment

- patients who have a fever but are not systemically unwell, outpatient oral Rx

**1st choice is Fluoroquinolones**

ciprofloxacin 500 mg PO bid, or

levofloxacin 750 mg PO qd)

**2nd Trimethoprim-sulfamethoxazole**

- If the patient is systemically unwell, admit to hospital and start IV fluids & parenteral antibiotics

# Parenteral antibiotics

We use one of the following:

**1. 3rd generation cephalosporine**

(cefotaxime or ceftriaxone, ceftazidime).

These are active against gram-negative bacteria. also has activity against *Pseudomonas aeruginosa.*

**2. I.V Fluoroquinolones (e.g., ciprofloxacin)**

They exhibit good activity against

*Enterobacteriaceae & P. aeruginosa*

**3.ampicilline & gentamycin**

Parenteral antibiotics for 3 days then switch to oral for total 10-14 d.

# Treatment

However,  if the patient does not respond within 3 days to this regimen of IV antibiotics (confirmed on sensitivities),  a CT urogram is essential.

- The lack of response to treatment suggests the possibility of a **pyonephrosis** (i.e., pus in the kidney, which, like any abscess, will only respond to drainage)

# Pyelonephritis of pregnancy

- usually occurs
  during 3rd trimester
  when hydronephrosis & stasis in the urinary tract are most pronounced .

- Complications:
  abortion or premature birth.
- Rx:
  Pregnant women should be hospitalized and treated initially with parenteral antimicrobial agents 3rd generation cephalosporine

# Urinary infection in childhood

- It is one of the most common bacterial diseases in children;
- is important to recognise because it may damage the growing kidney.
- symptoms are often non-specific but the child

  may pass cloudy or offensive urine.

  Pain or screaming on micturition

  child fails to thrive

  unexplained pyrexia.

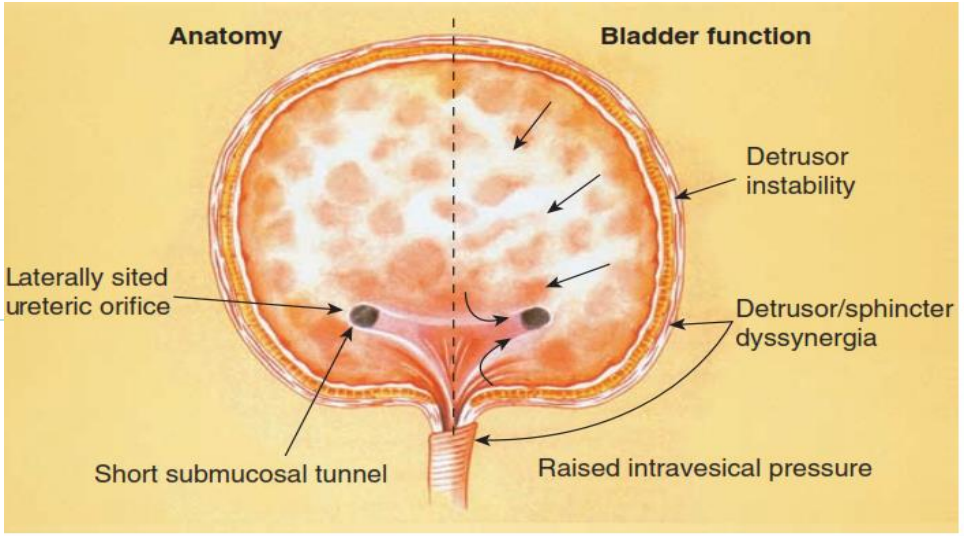
  The older child may complain of loin pain

# VUR

- VUR of urine is detectable in about 35% of children with recurrent UTI

- Up to 50% of children with UTI have an underlying anatomical abnormality (e.g. reflux or obstruction).

# Pathogenesis of VUR




- VUR

  retrograde flow of urine from the bladder into the upper urinary tract.
- The ureter passes obliquely through the bladder wall (1–2 cm), where it is supported by muscular attachments that prevent urine reflux during bladder filling and voiding.

- Reflux occurs when the intramural length of ureter is too short .The degree of reflux is graded I–V.

# Complications VUR

- Recurrent UTI
- reflux nephropathy with hypertension & progressive renal failure.
  - reflux nephropathy is the most common cause of end-stage renal failure in children

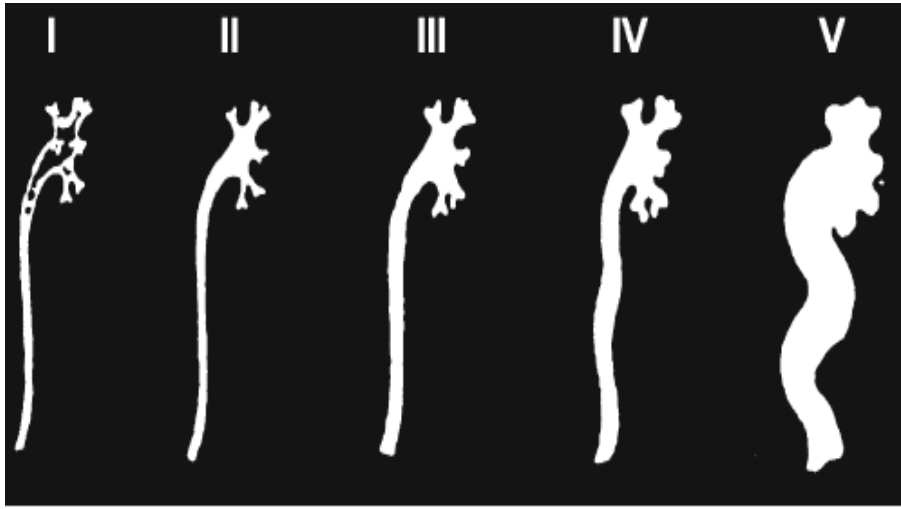
# Dx VUR

**VCUG to diagnose & grade reflux**

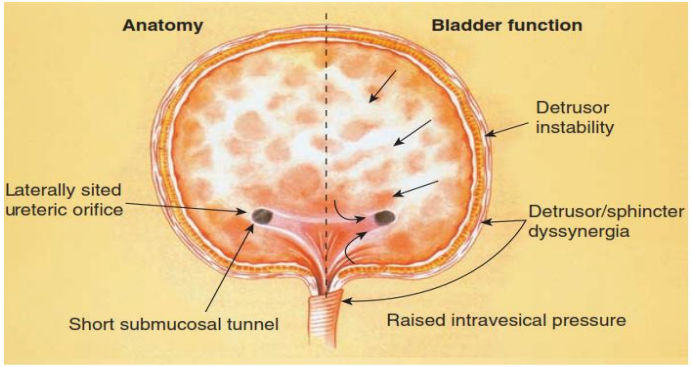
– Urinalysis

Urine culture a pure growth of more than $10^5$ organisms/ml.

– ultrasound scan



# Treatment




- **Medical treatment**

  Continuous antibiotic prophylaxis: e.g trimethoprim 1–2 mg/kg/day, usually as a single night-time dose.

  Endoscopic

- **subureteric injections** (Bulking agent) e.g Deflux
- **Surgery**

  Surgical reimplantation of the ureters is reserved for those in whom conservative measures fail.

# Chronic pyelonephritis

- Refers  to the small, contracted, atrophic kidney that has been produced by bacterial infection,
- It can be a radiological or pathological diagnosis.
- chronic pyelonephritis is the end result of longstanding reflux or obstruction. These processes damage the kidneys, leading to scarring.

# Clinical Presentation

- Most of the changes of chronic pyelonephritis seem to occur in infancy, because the growing kidney is most susceptible to scarring.
- **in adults renal damage is rare in non obstructive UTIs**
- There are no symptoms of chronic pyelonephritis until it produces renal insufficiency, and then the symptoms are similar to chronic renal failure.

# Pyonephrosis

- This is an infected hydronephrosis, the infection being severe enough to cause accumulation of pus with the renal pelvis and calyces of the kidney.
- causes include ureteric obstruction by stone and PUJ obstruction.

# Pyonephrosis

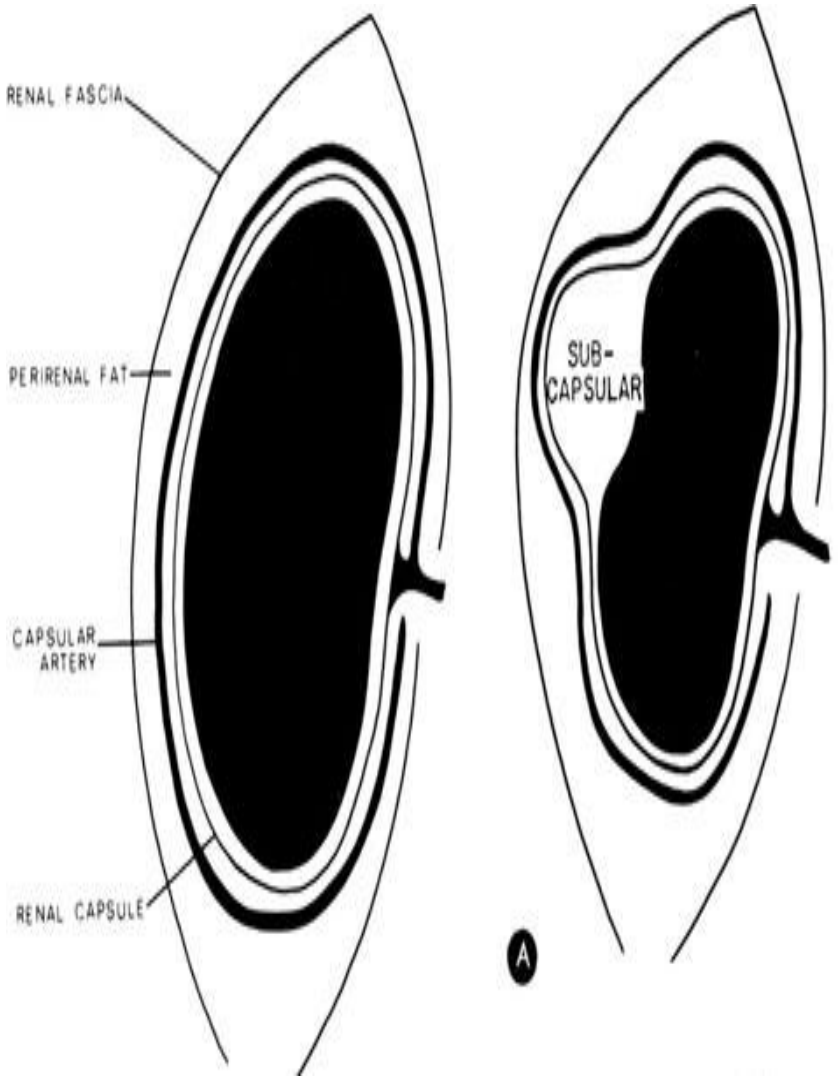
- Clinical presentation: patients very ill ,high fever ,flank pain ,chills ,renal tenderness,  Previous history of urinary calculi, infection or surgery.

- Management  antibiotics and drainage of infected pelvis ( ureteral catheter, nephrostomy)

# perinephric abscess

- develops as a consequence of extension of infection outside the parenchyma of the kidney.

Patients with pyonephrosis, particularly when a calculus is present in the kidney, are susceptible to **perinephric abscess** formation.



# Perinephric abscess

These patients are often **diabetic**, & associated conditions such as an obstructing ureteric calculus.

treatment is surgical drainage

# Renal tuberculosis

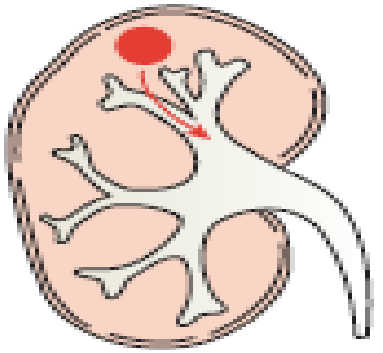
The kidney is among the most common sites for extrapulmonary **tuberculosis**.

Renal tuberculosis (TB)

- is caused by *Mycobacterium tuberculosis*.
- arises from haematogenous spread
  - from a distant focus which is impossible to identify.
- are usually confined to one kidney.
- the latent period between exposure & reactivation of disease is 10- 40 yr

# *Kidney*

Hematogenous spread causes granuloma formation in the renal cortex, associated with caseous necrosis of the renal papillae and deformity of the calyces, leading to release of bacilli into the urine. This is followed by healing fibrosis and calcification, which causes destruction of renal architecture and autonephrectomy.



(b) Cavernous form
It tends to burst

# *Ureters*

- Seeding of the urine may also result in involvement of the bladder and male genital organs
- TB Spread is directly from the kidney and can result in stricture formation.
- *Bladder* Infection is usually secondary to renal infection. Disease progression causes fibrosis and contraction (resulting in a small capacity ‘thimble’ bladder),

- Renal tuberculosis is often associated with tuberculosis of the bladder and typical tuberculous granulomas may be visible in the bladder wall

# Clinical features

- Because of the slow progression and variable course of the disease, there is no classic presentation.
- **Renal symptoms** gross hematuria; dull flank discomfort; and ureteral colic secondary to passage of clots, debris, or calculi.
- Constitutional complaints such as fevers, chills, night sweats, weight loss, and malaise are uncommon.

- It is only when the bladder is involved that the patients become severely symptomatic.
- Frequency is the most common presenting symptom and is often progressive and occurs during the day and at night. Pain, urgency, and dysuria are also common.

# physical examination

- A chronic draining fistula tract from previous **renal** surgery.
- Patients with chronic epididymitis unresponsive to therapy should also be evaluated.

# Investigation

- Urine: At least 3 early morning urines . A typical finding is sterile pyuria (leukocytes, but no growth). Ziehl–Neelsen staining will identify these acid- & alcohol fast bacilli (cultured on Lowenstein–Jensen medium).

pyuria C\S no growth of bacteria ?

# investigations

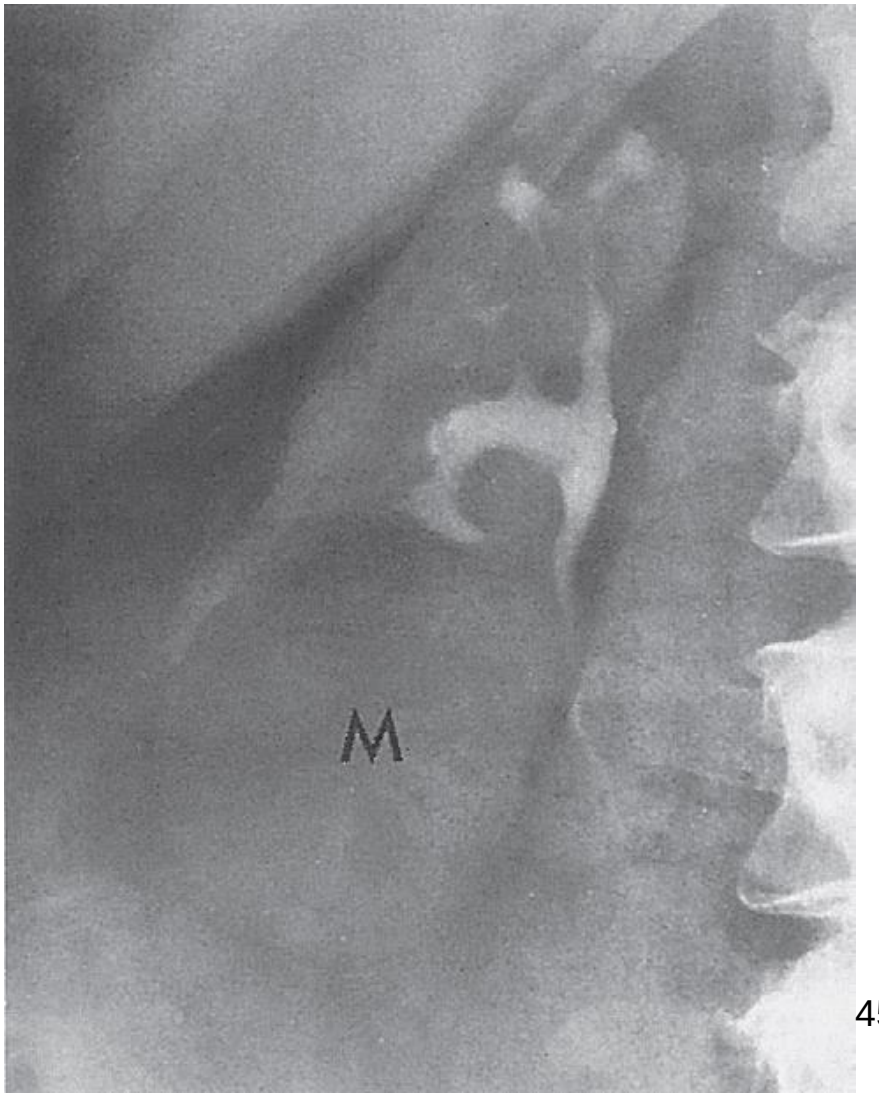
- KUB: Findings include renal calcification (cement kidney)
- IVU: irregular calyces, hydronephrosis caused by stricture of the ureter.
- CXR and sputum
- Tuberculin skin test
- Cystoscopy: bladder studded with granulomas which cluster particularly around the ureteric orifices.

# Treatment

- Medical Rx is with 6 months of isoniazid, rifampicin, and pyrazinamide
- If the kidney has no function it is best to perform a nephroureterectomy .

# Investigation

- **Urinary sediment may show pus cells, proteinuria**.
- IVP: **irregularity of the kidney outlines with blunting and dilation of calyces**



# Management

- **treating infection, if present; and monitoring and preserving renal function.**