Urinary Calculi

Epidemiology

- 50% of patients present between the ages of 30 and 50 years
- But the disease can affect anyone at any age
- Slight male preponderance
- A lifetime risk

❑2-5% - Asia

❑8-15% - West

❑20% - Saudi Arabia

Aetiology

- Vitamin A deficiency
- Dehydration
- Reduced urinary citrate- during menstruation
- Infections – Staphylococcus ,E.coli
- Stasis
- Prolonged immobilization
- Hyperparathyroidism
- Familial cystinuria
- Hypervitaminosis D

Stone formation

Caused by two basic phenomena

- Supersaturation of the urine by stone-forming constituents, including calcium, oxalate, and uric acid

- Crystals or foreign bodies can act as nidi, upon which ions from the supersaturated urine form microscopic crystalline structures

Compositions of stones

- Majority of renal calculi contain calcium
- Uric acid calculi
- Crystals of uric acid
- less frequent stone

Cystine

Ammonium acid

Urate Xanthine

Dihydroxyadenine

Types of calculi

Calcium oxalate
Irregular
75% of stones
Sharp – cause haematuria

Uric acid or urate calculi
5% of calculi
Hard, smooth, multiple

Calcium phosphate
15% of stones
Often combine with ammonium and magnesium phosphate
Struvite or triple phosphate or staghorn calculi
Associate with *E.coli* infection in alkali urine

Clinical features

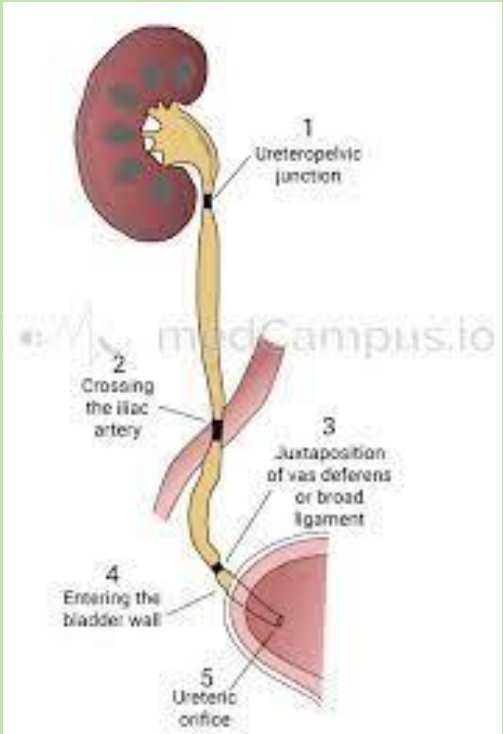
- Asymptomatic stones
- Ureteric colic pain
- Visible haematuria (rarely)
- Dipstick haematuria (frequent)
- Nausea
- Vomiting
- Dysuria
- Urinary urgency

Diagnosis

- Non-contrast CT scan – For diagnosis
- Plain x-ray

1. Assess if the stone(s) are radio-opaque
2. Follow-up of a patient who is expected to pass a stone spontaneously

- There are 5 recognised narrowings in the ureter which may present obstacles to a stone's passage through to the bladder and these are the PUJ



Normal anatomical narrowings (1-5) of the ureter

Management

- There are 2 settings

1. Emergency setting – In obstructed infected system (urological emergency)

2. Elective setting

Emergency setting

- Non-steroidal anti-inflammatory - diclofenac (for pain relief)
- Observed for further episodes of pain
- Monitor temperature, pulse, blood pressure and white blood count (for signs of developing infection)
- Monitor estimated glomerular filtration rate (eGFR) (for signs of a decline in renal function)

Urgent treatment options for pain

- In situ extracorporeal shockwave lithotripsy (ESWL).
- Cystoscopy and insertion of a ureteric stent as a temporizing procedure
- Primary ureteroscopic stone retrieval
- Lasertripsy

In a patient who is septic secondary to an obstructing urinary tract calculus, the options are

- Insertion of a percutaneous nephrostomy (PCN) under local anaesthetic
- Cystoscopy and insertion of a ureteric stent

Elective setting

- Most stones <5 mm will pass spontaneously

- **Medical expulsive therapy**

Ureteral stones >5 mm and ≤10 mm in diameter,

1. Tamsulosin - Alpha blockers
2. Nifedipine - Calcium channel blockers
3. Tadalafil - phosphodiesterase type 5 inhibitor
4. Silodosin - selective alpha-1A receptor blocker

- Elective intervensions

For stones >0.5cm , not moving or solitary kidney

- Management depend on the site of the stones

Middle 1/3 of ureter

1. URS+IPL
2. Surgery

Upper 1/3 of ureter

1. ESWL
2. PCNL
3. URS+IPL
4. Surgery

Lower 1/3 of ureter

1. URS+IPL
2. Domia basket extraction
3. Surgery

Extracorporeal shockwave lithotripsy (ESWL)

- Non-invasive method
- Commonest method of treating urinary tract stones nowadays
- Shockwaves outside the body which are focuse on the stones
- Generating shockwaves - spark gap, electromagnetic, piezoelectric and microexpulsive
- Stones can be localize - fluoroscopy or USS
- Approximately 1.5 cm in size are suitable

Complications

- Infection
- Haematuria
- Parenchymal haemorrhage
- Perirenal haematoma
- Steinstrasse (‘street of stones’) - Stone fragments collecting in the distal ureter

Contraindications to ESWL

- Obese patients
- Pregnant patients
- Patients taking oral anticoagulants

Ureteroscopy

- Rendered the entire urinary tract accessible to endoscopic examination and manipulation

<u>Types</u>

- Rigid
- Semi-rigid
- Flexible

- Directly visualize ureteric calculi

- Stones are retrieved by - wire retrieval baskets (if <6 mm and in the distal ureter

or

-Lithotripsy employing different energy sources

- Stones can also be fragmented using mechanical disintegration using the lithoclast

<u>Complications</u>

Ureteric perforation

Extravasation of urine

Avulsion of the ureter

Ureteric stricture

Percutaneous nephrolithotomy(PCNL)

- Used to treat larger stones in the renal pelvis or calyces or proximal ureter
- Tract is established into the renal collecting system using ultrasound or fluoroscopic guidance
- Series of dilators
- Placement of a working sheath into the collecting system
- Stone is visualised and fragmented
- Nephrostomy tube is left in the kidney for 24/48hrs

PCNL is indicated for:

- Larger stones
- An obstruction - PUJ obstruction, calyceal diverticula , ureteric obstruction
- Obese patients - ESWL is contraindicated
- Lower calyceal stones - Less likely to pass after ESWL
- Stone composition - Struvite stones (associated infection)
- Very hard composition - Difficult to fragment using ESWL

Complications

- Injury to the spleen, pleura and colon
- Haemorrhage from the renal parenchyma ,major renal vessels
- Sepsis
- Extravasation due to rupture of the collecting system
- Retained stone fragments
- Open surgery to the kidney is sometimes more complicated after PCNL

Complictions of ureteric stones

- Obstruction
- Hydronephrosis
- Infection
- Impaction
- Ureteric stricture