Objectives:

- **Definition and causes**
- **Types**
- **Clinical presentation**
- **Investigations**
- **Management**

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References :Step up to Medicine, Master the boards ،435 Teams

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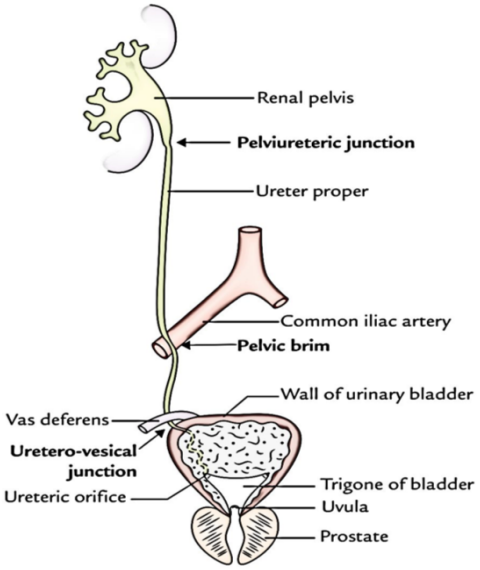
Renal stones (nephrolithiasis)

❖ Definition:

- **Nephrolithiasis:** is development of stones in urinary tract.
- **Prevalence of 2% to 3%**
- **Lifetime risk: Male 20% , Female: 5-10%**
- **Recurrence rate 50% at 10 years**



Site of obstruction:

1- ureterovesicular junction : most common site of impaction
2- calyx of the kidney
3- ureteropelvic junction
4- intersection of the ureter and the iliac vessels (near the pelvic brim)

❖ Risk factors:

Intrinsic Factors	Extrinsic factors
1- **Genetics**: eg. (cystine) . 2- **gender**: males 3 times more than females. 3- **age** : 20s - 40s young people .	1- low fluid intake: most common and preventable risk factor. 2- conditions known to precipitate stones formation: - **gout :** ↑ uric acid . - **crohn disease :** ↑ oxalate absorption. - **hyperparathyroidism**: ↑ Ca . 3- **medications**: eg. loop diuretics, antacid, acetazolamide, chemotherapeutic drugs that cause cell breakdown (uric acid stones). 4- **UTI** : especially with urease producing bacteria . 5- **dietary factors** : low Ca intake : lead to increase oxalate because Ca binds to oxalate in the bowel so when Ca ingestion is low , there is increased oxalate absorption in the gut because there is no Ca to bind it in the gut.

❖ Types of renal stones :

Calcium stones **Most common form**	- account for 80% to 85% of urinary stones - composed of calcium oxalate or calcium phosphate (less common) or both - secondary to : **1- Hypercalciuria:** ↑ intestinal absorption of Ca, ↓ renal reabsorption of Ca, ↑ renal excretion of Ca, ↑ bone reabsorption of Ca , primary hyperparathyroidism, malignancy, vit.D excess 2- **Hyperoxaluria**: severe steatorrhea (such as disease of liver and gallbladder due to inability to secrete bile or pancreatic disease due to inability to secrete pancreatic juice) lead to ↑ absorption of oxalate, crohn disease. - **Radiopaque** .
Uric acid stones **Second most common**	- account for 10% of urinary stones . - a persistently acidic urine pH < 5.5 promotes uric acid stones formation :by increasing excretion of urinary titratable acids (phosphates) and decreased urinary citrate excretion, which will contributes to precipitation and crystallization of uric acid (Mechanisms are not yet fully understood) - these are associated with hyperuricemia secondary to gout or chemotherapeutic treatment leukemias and lymphomas which lead to cell breakdown that cause release of purines which lead to hyperuricemia. - **Radiolucent**.
Struvite stones **(Staghorn stones)** **(magnesium, ammonium, phosphate)**	- account for 5% to 10% of urinary stones . - occur in patient with recurrent UTIs due to urease- producing organism (Proteus, Klebsiella, Serratia, Enterobacter spp) - they are facilitated by alkaline urine: urea-splitting bacteria convert urea to ammonia, thus producing the alkaline urine. - remove them surgical . **- Radiopaque .**
Cystine stones	- Hereditary : cystinuria(autosomal recessive). - account for 1% of urinary stones . - manage surgical removal and alkalinizing the urine . **- Radiolucent .**

❖ Clinical presentation:

- ❖ Renal or ureteric colic. (patient tends to move continuously)
- ❖ Frequency, dysuria.
- ❖ Hematuria (in over 90% of cases) .
- ❖ GI symptoms: N/V, ileus or diarrhea.
- ❖ Restless:
  - ➢ ↑ HR, ↑ BP
  - ➢ Fever (If UTI)
  - ➢ Tender costovertebral angle.

❖ Investigations:

1- laboratory:

A- urinalysis: pH,RBCs,WBCs, Bacteria, Crystals. Hematuria + pyuria indicate a stone with concomitant infection

B- urine culture: obtain if infection suspected.

C- 24 hour urine collect: to assess Cr, Ca, uric acid , oxalate, and citrate level

D- serum chemistry : obtain BUN and Cr level (evaluation of renal function) , calcium , uric acid and phosphate levels

2- imaging :

A- plain radiography of the kidneys, ureter and bladder (KUB):

- Initial imaging test for detecting stones.
- Useful in detecting an ileus.
- Cystine and uric acid are not usually visible on plain films.

B- CT scan (spiral CT) without contrast:

- Gold standard for diagnosis. Most sensitive test for detecting stones.
- All stones, even radiolucent such as cystine and uric acid are visible on CT scan.

C- Intravenous Pyelogram (IVP): rarely used now

- Most useful test for defining degree and extent of urinary tract obstruction
- This is usually not necessary for diagnosis of renal stones.
- IVP may be appropriate for deciding whether patient needs procedural therapy

D- renal ultrasound:

- **Used for pregnant** (because CT is contraindicated in pregnancy)
- Helps in detecting hydronephrosis or hydroureter.
- False -negative result are common in early obstruction.
- Also , there is a low yield in visualizing the stone.

❖ Management :

1- Conservative:

A- analgesia: IV morphine , **parenteral NSAIDs (Ketorolac) is the most effective analgesic**

B- vigorous fluid hydration.

C- antimetics.

D- antibiotics: if UTI is present

- Stones (<5 mm) >90% undergo spontaneous passage.
- Stones 5 - 7 mm get nifedipine and tamsulosin to help them pass

2- indications for hospital admission:

A- pain not controlled with oral medications.
B- anuria (usually in patient with one kidney)
C- renal colic + UTI and/ or fever .
D- large stone > 1 cm that is unlikely to pass spontaneously.

3- surgery:

What are the indications for intervention?

- **Urinary tract obstruction**
- **Persistent infection**
- **Impaired renal function**

Extracorporeal shock wave lithotripsy (SWL)	- **Most common method** - It breaks the stones apart; once the stone is fragmented the stone can pass spontaneously. - Best for stones that are >5 mm to <2 cm in diameter
Percutaneous nephrolithotripsy (PNL)	- If SWL fails - **Best for stones > 2 cm in diameter.** - **Done with staghorn stones**
Uretroscopy laser	- If SWL fails - With large stones
Open surgery	- Rare

4- prevention of recurrences

A- dietary measures:

- High fluid intake (keep urine at 2 L/day)
- Limit animal protein intake in patient with hyperuricosuria (uric acid stones)

B- pharmacologic measures:

- **Hydrochlorothiazide** : remove calcium from the urine and have been found to lower recurrence rates especially in patient with hypercalciuria
- **Allopurinol** : is effective in preventing recurrence in patient with high uric acid in the urine