

Lec. Name: Urinary calculi.

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### **Aims of the lecture:-**

At the end of the lecture, the students should be able to:

- 1- Identify the main risk factors for urinary calculi formation.
- 2- Recognize those patients with urinary calculi who needs urgent intervention from those who manage conservatively.
- 3- Identify the main options in the management of various types of urinary calculi.

### **Urinary calculi:**

It is the 3<sup>rd</sup> most common urological disease that brought the patient to the urologist preceded only by U.T.I. and prostatic pathology.

Urinary stone diseases are generally more common in males in a ratio of 2:1.

### **Etiology and risk factors:**

In general , the etiology of urinary stones are multifactorial and the main risk factors are:

#### **1. Crystaluria:**

Stone former patients frequently excrete crystals larger than 12 micron.

#### **2.Socioeconomic factors:**

It is more common in affluent industrial countries.

#### **3. Diets:**

High energy-dense diet may increase the incidence of urinary calculi.

High Na. intake and vit.A deficiency also increase the incidence of urinary calculi.

#### **4. Occupation:**

Physicians have higher incidence of urinary stones.

#### **5. Climate:**

Individuals living in a hot climate are more prone to dehydration which increase the incidence of urinary stones.

6. Family hx.: also increase its incidence.

7. Medications: as Indinavir, Trimetrene.

8. Structural and anatomical abnormalities of the urinary tract.

9. Metabolic abnormalities: as hypercystinuria, hyperparathyroidism.

10. Others: as recurrent U.T.I., prolong immobilization.

### **Theories of stone formations:**

For stone formation to occur, urinary crystals and matrix should be intertwined.

1- Nucleation theory:

It states that stones originate from crystals or F.B. immersed in supersaturated urine.

2- Matrix theory:

It postulates that matrix may act as a nidus for crystal aggregation or as a natural glue to adhere small crystals.

3- Crystal inhibitor theory:

It claims that calculi form owing to the absence or low concentration of urinary stone inhibitors.

### **Stone varieties:**

#### **1) Calcium calculi:**

It accounts for 85% of urinary stones. It includes calcium oxalate and calcium phosphate calculi. It is formed due to either:

1. ↑ urinary calcium excretion (Hypercalciuria): which either (absorptive, resorptive or renal induced hypercalciuria).

2. ↑ urinary uric acid excretion (Hyperuricosuria).

3. ↑ urinary oxalate excretion (Hyperoxaluria).

4. ↓ urinary citrate excretion (Hypocitraturia).

#### **2) Uric acid stones:**

It accounts for less than 5% of all urinary calculi.

They are usually formed in male patients with gout, rapid weight loss and those with myeloproliferative diseases.

Those patients usually urinary  $\text{pH} \leq 5.5$

### **3) Struvite stones:**

It composed of magnesium, ammonium and phosphate (MAP).

It frequently found in alkaline urine so it is more common in women with recurrent U.T.I. with urea splitting organisms.

### **4) Cystine stones:**

It usually secondary to inborn error of metabolism.

### **5) Xanthene stones:**

It usually secondary to deficiency of xanthene oxidase enzyme.

### **6) Other rare stones: as Indinavir ,Silicate and Matrix stones.**

## **Clinical presentation:**

The clinical presentation of patient with urinary calculi depend on the site and size of the stones, unilateral or bilateral stone diseases, presence or absence of associated infection and other factors.

**1. Asymptomatic presentation:** some patients with small size renal calculi may be asymptomatic and dx. Accidentally when imaging study performed for other causes.

**2. Pain:** either colicky or dull pain.

The pain of renal and upper ureteric stones usually radiate to the back and testes in males and labia in females.

The pain of midureteric stones radiate to the suprapubic region .

The pain of lower ureteric stones radiate to the tip of penis in males and clitoris in females.

**3. Haematuria.**

**4. Irritative voiding symptoms:** as dysuria, frequency and or urgency.

**5. Obstructive voiding symptoms:** as intermittency, difficulty in urination and or retention of urine.

**6. Non urinary symptoms:** as nausea, vomiting and or abdominal distension.

## **7. Anuria or oliguria with signs and symptoms of renal failure.**

### **Lab. Ix. and dx.:**

After careful medical and surgical hx. And through physical examination then lab. Ix. and imaging studies are used to ensure the dx. and include:

**1. Urinalysis (G.U.E.):** Look for RBC,WBC,Crystals,casts and PH.

**2. Blood ix.:** as P.C.V.,B.urea, S.creatinine.

### **Imaging studies include:**

**1.K.U.B.:** to look for radio opaque shadows. About 90% of renal stones are radio opaque.the most radiolucent stones are uric acid stones, cysteine stones and matrix stones.

**2. I.V.U.:** to look for filling defects and give an idea about the renal function.

**3. Abdominal ultrasound.**

**4. CT-scan :** helical CT-scans are now the imaging modality of choice for patients presenting with acute urinary colic.

While M.R.I. is a poor study for documentation of urinary stones.

**5. Nuclear scintigraphy.**

## **Treatment of urinary stones:**

### **A) Treatment options for renal and ureteral stones:**

#### **1. Conservative treatment:**

It suitable for small size renal and ureteral calculi that are not affecting the renal function and not causing renal parenchymal loss.

Conservative measures include:

1- Encourage fluid intake  $\geq$  than 3L/day.

2- Analgesia (whether NSAID or centrally acting analgesia).

3- Encourage exercise and movement.

4-↓ salts intake.

5- Alkalanization of urine.

#### **\*Indications for intervention:**

1. Failure of conservative treatment with unremitting pain or refractory vomiting or refractory haematuria.
2. Obstructing large size stone that affecting the renal function or renal parenchyma.
3. Impacted ureteral stone (stone in the same site of the ureter  $\geq 2$  monthes).

## **2. Extra corporal shock waves (ESWL):**

It is the treatment of choice for those patients with renal or upper ureteric stones, size(10-25 mm) and those with failed conservative treatment.

There are 2 types of shock waves emitters: supersonic emitters and fine amplitude emitters.

### **\*Contra indications to ESWL:**

1. Pregnancy.
2. Large abdominal aneurysm.
3. Uncorrectable bleeding disorders.

## **3. Per cutaneous nephrolithotomy (PNL):**

It is antegrade instrumentation of the upper urinary tract via percutaneous puncture.

It is indicated for:

1. Big renal stones ( $\geq 25$  mm).
2. Distal obstruction not cause by the stone: as PUJ obstruction.
3. Stone in calyceal diverticulum.
4. Lower pole renal stones where the success of ESWL is low.
5. when there is contra indication for ESWL.

\*Various types of lithotripters can be used for destruction and removal of renal stones as electrohydraulic, ultrasonic or laser probes lithotripters.

## **Procedure of P.C.N.L:-**

1-Under general,epidural or local anesthesia ,cystoscopy should be done first with placement of ureteral catheter and instillation of radiopaque dye to opacify the renal pelvicaliceal system(p.c.s).

2-To do P.C.N.L , the patient should be placed in prone position .

3- Under ultrasonic guide,the puncture site in the skin is few centimeters

inferior and medial to the tip of the 12<sup>th</sup> rib until reach the renal pelvis and guide wire left in place.

4-Dilatation of the tract done with metal or plastic dilators and nephroscopy sheath passed.

5-Destruction of renal stones done with various lithotripters and removal of the fragments through nephroscopy tract.

#### **4. Ureteral stenting and double J stent :**

It is indicated for ureteral stones in the following situations:

1- patients with bilateral ureteric obstruction with increasing blood urea and serum creatinine.

2- patient with obstructing single functioning kidney for temporary relief the obstruction.

3- Following ureteroscopic removal of ureteric stones in some cases.

\*Double J stent act to relief the obstruction and preserve the renal parenchyma and function also dilate the ureter to ↑ the chance of passage of the stone.

#### **5. Ureteroscopy :**

It is mainly used for treatment of ureteric stones especially in the following situations

1- Mid and lower ureteric stones with failure of conservative expectant treatment (where ESWL is contraindicated).

2- Upper ureteric stones with failure of conservative and ESWL treatment.

3- Impacted upper ureteric stones where ESWL is contra indicated.

#### **6. Open surgery :**

It is now rarely indicated ( $\leq 1\%$  of renal calculi).

### **B) Treatment options for bladder calculi:**

#### **1. Endoscopic vesico litholapaxy :**

By cystoscope with use of various types of lithotripters as mechanical, ultrasonic, electrohydraulic or laser lithotripters.

#### **2. Open vesicolithotomy :**

It is mainly used for very large vesical stones and in children where transurethral surgery carry high risk of urethral stricture.

It also indicated where facilities for endoscopic surgery are not present.

### **C) Urethral stones :**

Small stones near the external meatus can be grasped with a grasper.

Large and posterior urethral stones can pushed to the bladder and removed endoscopically.

