

# Renal calculi

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## Definition

Renal stones are small, hard deposits of mineral and acid salts on the inner surfaces of the kidneys. Normally, the substances that make up kidney stones are diluted in the urine. When urine is concentrated, minerals may crystallize, stick together and solidify. The result is a kidney stone. Most kidney stones contain calcium.

## Risk factors

These factors may increase the risk of developing kidney stones:

- ü *Lack of fluids.* Dehydration causes concentration of urinary solutes leading to precipitation.
- ü *Family or personal history.*
- ü *Diet.* A high-protein, high-sodium and low-calcium diet may increase your risk of some types of kidney stones.
- ü *Limited activity.* Due to skeletal decalcification with increasing urinary calcium.
- ü *High blood pressure.* Having high blood pressure doubles the risk of forming kidney stones.
- ü *Gastric bypass surgery, inflammatory bowel disease or chronic diarrhea.* Changes in the digestive process affect the absorption of calcium and increase the levels of stone-forming substances in urine.
- ü *Inadequate urinary drainage and urinary stasis.*
- ü *Decreased urinary citrate:* citrate causes inhibition of calcium phosphate precipitation in urine.
- ü *Renal infection:* struvite stones are common when the urine is infected with urea splitting organisms like proteus, klebsiella pseudomanas or urea splitting staph. Aureus..
- ü *Hyperparathyroidism:* due to hypercalcemia and hypercalciuria( 5% of radio opaque stones)

## Types of renal calculi

- *Calcium oxalate stones:* Radio-opaque, irregular in shape
- *Uric acid & urate stones:* Radiolucent, in children ammonium & sodium stones.
- *Triple Phosphate (Struvite) stones:* Radio opaque, it grows in alkaline urine due to infection with urea splitting organisms. Struvite stones may be large enough to fill most of a kidney's urine collecting space, forming a characteristic stag's-horn shape.

- Calcium phosphate stones: Dense radio-opaque stone associated with hypercalciurea.
- *Cystine stones*: Due to cystinuria, in acidic urine, faint radioopaque, very hard stone.
- *Xanthin stone*: rare.

### Clinical features

- Male; female ratio 4;3 usually between ages of 30 to 50 years.
- Silent stone; even large stag horn stones are silent causing gradual destruction of the renal parenchyma.
- Pain; 75% of urinary stone disease. Fixed renal pain posteriorly in the loin, worse during movement
- Ureteric colic; agonizing pain from the loin to the groin, due to stone lodged in the pelviureteric junction. There is rigidity of lateral abdominal muscles, palpable renal swelling due to hydronephrosis or pyonephrosis.
- Haematuria.
- Pyuria: especially in the presence of obstruction, may lead to septicemia.

### Investigation

- Ø Abdominal X-ray.
- Ø Ultrasound. Safe, painless and noninvasive, but it may miss small stones, especially if they're located in a ureter
- Ø Intravenous pyelography (excretory urogram).
- Ø Computerized tomography (CT) scans. This imaging test has become the standard of care for evaluating acute kidney stones. It's rapidly performed, can identify stones regardless of composition and doesn't require the use of contrast dye

### Treatment of renal stones

- ⊕ Conservative Treatment: calculi smaller than 0.5cm are likely to pass spontaneously unless they are impacted.
- ⊕ Preoperative treatment with antibiotics is necessary if infection is present until the stone is removed.
- ⊕ Open surgery for renal calculi is uncommon, most stones are treated by specialist urologists using minimally invasive techniques, open surgery are still needed when the appropriate expertise is not available or newer methods have failed to clear the stone.

### Modern methods of stone removal

- ✓ Extracorporeal shock wave lithotripsy (ESWL): It uses shock waves to break the stones into tiny pieces that are then passed through the ureter, so ureteric colic is common after ESWL.

Localization of stone either by use X-rays or ultrasound as well as to monitor the status of the stone during treatment.

### Complications of ESWL:

- § Ureteric obstruction after stone fragment impaction.
- § Infection: since many stones contain bacteria which are released after stone fragmentation.
- § Skin and soft tissue hemorrhage: petechial hemorrhage, ecchymosis.
- § Renal hemorrhage: perinephric, subcapsular, intraparenchymal.
- § Chronic renal fibrosis (SWL- induced hypertension).
- § Effects on other tissues
  - Pulmonary injury (hemorrhage).
  - Gastrointestinal structures: minor submucosal bowel hematoma and liver petechiae.
- ✓ Percutaneous nephrolithotomy: When ESWL isn't effective, or the stone is very large, the surgeon may remove the kidney stone using an instrument called a nephroscope.
- ✓ Open surgery for renal calculi:
  - Pyelolithotomy.
  - Nephrolithotomy.
  - Partial nephrectomy.
  - Nephrectomy.
  - In case of bilateral renal stones then the kidney with better function is treated first, except in pyonephrosis and severely painful stone.

## Ureteric stone

### Clinical features:

- ü Ureteric colic: upper ureteric stones have symptoms identical to renal pelvic stone, mid and lower ureteric stones produce referred pain to the groin and external genitalia (with stranguria).
- ü Impaction: frequent attacks of ureteric colic give way to consistent dull pain in the iliac fossa, pain increased by exercise and relieved by rest.
- ü Haematuria.
- ü Abdominal examination: tenderness and rigidity over the course of the ureter.

### Imaging:

- ✚ Abdominal Ultrasonography: will show hydroureteronephrosis
- ✚ -Plain X-ray: most ureteric stones are radio-opaque, inability to see the stone could be due to small stone, or obscured by bowel gas, or shadow of nearby bones.

- ✚ Intravenous urography: during the attack there is little or no excretion of the contrast; late films show dilatation down to the obstruction.
- ✚ Retrograde ureterography: if doubt remains after I.V.U.
- ✚ CT scan of abdomen and pelvis

### Treatment:

- pain; NSAID (diclofenac)
- Medical expulsive therapy.
- Removal of the stone: indications for surgical removal of a ureteric stone:
  - § Repeated attacks of pain without stone movement.
  - § Enlarging stone.
  - § Complete obstruction of the kidney.
  - § Urine is infected.
  - § Stone is too large to pass.
  - § Stone is obstructing a solitary kidney or there is bilateral obstruction.

### Removal of ureteric calculi:

- ü Endoscopic stone removal by dormia basket under vision of ureteroscopy
- ü Ureteric meatotomy: by use of electric diathermy (for stones lodged in the intramural part).
- ü Ureteroscopic stone fragmentation by use of pneumatic or ultrasonic or laser lithotripsy.
- ü Push back: by pushing the stone up into the kidney by ureteric catheter, then ESWL of the renal stone with double J stent insertion.
- ü ESWL: especially for upper ureteric calculi.
- ü Open surgery (ureterolithotomy):
  - Loin incision (upper ureteric stones).
  - Iliac fossa incision (mid ureteric stones).
  - Lower midline incision or Pfannenstiel incision (lower ureteric stone).