

Nephrolithiasis Stone Types (Part 1/2)

Patients with nephrolithiasis can have one of several types of stones, or calculi. Calcium oxalate stones are the most common, and are associated with inflammatory bowel disease, ethylene glycol ingestion, and hypervitaminosis C. The stone is characterized by a "dumbbell", bipyramidal, or octahedral-shaped appearance in microscopic urine and is radiopaque in imaging studies. Uric acid stones can be seen in gout or tumor lysis syndrome. The stone is characterized by a rhomboidal, rosette, or needle-shaped appearance in microscopic urine and is radiolucent in imaging studies. It is associated with decreased urine pH.



PLAY PICMONIC

Calcium Oxalate

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Calcium-cow Oxalate-ox

Calcium oxalate is the most common type of kidney stone, representing 75% of cases. These are most commonly associated with hyperoxaluria, which occurs due to increased oxalate absorption by the gut or high oxalate intake (e.g., nuts and spinach). It can also result from hypercalciuria, hypercystinuria, hypocitraturia, and hypomagnesuria.

Inflammatory Bowel Disease

Bowel-bowl in Flames

Inflammatory bowel disease (IBD) and other fat malabsorption disorders will increase the binding of free fatty acids to calcium in the gut lumen. The decrease of calcium in the gut lumen due to its binding to free fatty acid prevents calcium from binding with oxalate. This will increase oxalate in the gut, which will then be absorbed.

Ethylene Glycol

Antifreeze

Ethylene glycol is a solvent used in some products, such as antifreeze and fabric cleaners. Intoxication can lead to calcium oxalate deposition due to its metabolite, oxalic acid.

Vitamin C

Viking Orange

Vitamin C is metabolized in the body to oxalate. The excess consumption of vitamin C can lead to hyperoxaluria and increase the risk of calcium oxalate stone formation.

"Dumbbell", Bipyramidal, or Octahedral-shaped

Dumbbell with Bipyramidal shaped

Calcium oxalate stones have a characteristic "dumbbell," bipyramidal, or octahedral-shaped appearance under urine microscopy.

Radiopaque

Shining-radio

Calcium oxalate stones are classically radiopaque on imaging due to the presence of non-attenuating calcium metal.

Uric Acid

Uric Acid

Unicorn and Acidic-lemon

Uric acid is formed endogenously from purine degradation. High purine intake or high endogenous production due to purine turnover can result in a high uric acid content in urine. These factors and low urine pH will contribute to uric acid stone formation. These represent 10% of kidney stones.

Gout

Gout-goat

Gout is characterized by the precipitation of monosodium urate crystals in joints due to hyperuricemia. It is most commonly seen in the metatarsophalangeal joint. This hyperuricemia and low pH urine in patients can be a risk factor for uric acid stone formation.

Tumor Lysis Syndrome

Tumor-guy Laser

Tumor lysis syndrome (TLS) is a spontaneous reaction described as rapid cellular lysis of tumor cells due to chemotherapy, radiotherapy, or immunotherapy. This lysis can lead to hyperuricemia as uric acid spills out into the blood and can occur 48-72 hours after treatment. Uric acid can precipitate in the renal tubules causing stone formation.

Rhomboidal, Rosette, or Needle-shaped

Rhomboid-shaped Stone

Uric acid stones have a characteristic of a rhomboidal, rosette, or needle-shaped appearance on microscopy.

Radiolucent

Radio-lucent

Uric acid stones are typically radiolucent on radiographs.

Decreased Urine pH

Down-arrow Urinal and pH-scale

Decreased urine pH (acidic) promotes uric acid and cystine stone formation. On the other hand, increased urine pH (alkaline) promotes calcium and phosphate-containing stones.