Renal Calculi Interventions

Renal calculi are solid concretions, or stones, that form within the kidneys from crystallized minerals and salts in the urine. Adequate hydration is essential, maintaining ?2 L urine/day and avoiding dehydration-promoting beverages. Pain control uses NSAIDs first-line and opioids if needed. Tamsulosin relaxes ureteral smooth muscle to aid stone passage, especially distal stones <10 mm. Thiazides reduce urinary calcium to prevent calcium stones, while potassium citrate alkalinizes urine, increases citrate, and prevents uric acid, cystine, and calcium stones. Antibiotics treat infections and may include acetohydroxamic acid for urease inhibition. Lithotripsy fragments stones for passage, sometimes with a stent, and surgical removal is reserved for large, obstructing, or infected stones. CT-KUB is the gold standard; ultrasound is preferred in pregnancy. A low-sodium diet reduces calcium excretion, and avoiding high protein prevents uric acid stones. Stones <4 mm may pass spontaneously, though it may take weeks.



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Interventions

Increase Fluid Intake
Up-arrow Fluid Intake
Adequate hydration is essential for preventing recurrent kidney stones. Patients should drink enough fluids to maintain a urine output of ?2 L/day (about 3 L intake). Hydration dilutes urinary solutes and reduces supersaturation of stone-forming salts.

Pain Control
Pain Controler
Pain management is a priority in nephrolithiasis. NSAIDs (e.g., ketorolac) are first-line for renal colic due to prostaglandin-mediated ureteral spasm. Opioids are used if pain remains uncontrolled or NSAIDs are contraindicated.

Tamsulosin
Tanning-lotion
An alpha 1 adrenergic antagonist that relaxes ureteral smooth muscle, facilitating stone passage, particularly for distal ureteral stones <10 mm.

Thiazide Diuretics
Tarzan Die-Rocket
Reduce urinary calcium excretion by increasing calcium reabsorption in the distal convoluted tubule, thereby preventing calcium-containing stone formation (e.g., calcium oxalate or calcium phosphate stones).

Antibiotics
ABX-guy
Indicated when infection accompanies renal calculi (infected or struvite stones). Antibiotics treat urinary tract infections and prevent further stone formation caused by urease-producing bacteria (e.g., Proteus). Acetohydroxamic acid may be added to inhibit bacterial urease activity.

Potassium Citrate
Banana Citrus
Potassium citrate is used to prevent recurrent kidney stones by alkalinizing the urine and increasing urinary citrate levels. It helps dissolve and prevent the formation of uric acid and cystine stones and reduces calcium stone formation by binding urinary calcium.

Lithotripsy
Lizard-tripsy
A noninvasive procedure (e.g., extracorporeal shock-wave lithotripsy) that fragments stones into smaller pieces for passage. Hematuria is common post-procedure, and a ureteral stent may be placed to prevent obstruction by stone fragments.

Surgical Stone Removal
Surgeon Removing Stone with Scalpel
Indicated for large stones, obstruction, or infection that is not manageable conservatively. Procedures include nephrolithotomy, ureterolithotomy, or cystolithotomy. Monitor closely for hemorrhage due to renal vascularity.

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Considerations

CT-KUB is a Gold Standard

Cat Scanner

Non-contrast spiral CT of the kidneys, ureters, and bladder (CT-KUB) is the gold standard diagnostic test for nephrolithiasis. It rapidly detects all stone types and complications without contrast. Stone composition guides specific therapy (e.g., thiazides for calcium stones, allopurinol or potassium citrate for uric acid stones).

Ultrasound for Pregnant Patients

Ultrasound-machine and Pregnant Patient

Ultrasound is the preferred imaging modality for diagnosing kidney stones in pregnant patients because it avoids ionizing radiation. It can detect hydronephrosis and larger renal or ureteral calculi, making it a safe and effective alternative to CT.

Low Sodium Diet

Low Salt-shaker and Nutritional-plate

High sodium intake increases urinary calcium excretion because sodium and calcium reabsorption are linked in the proximal tubule. When more sodium is excreted, calcium “follows,” increasing calciuria. Elevated urinary calcium promotes supersaturation of calcium salts, leading to kidney stone formation. A low-sodium diet reduces urinary calcium excretion, decreasing the risk of calcium stone formation.

Avoid High Protein Diet

Avoid-sign High Mr. Protein

Excess animal protein increases uric acid production and lowers urine pH, predisposing to stone formation.

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