Kidney Stones

Medical Management

Minimally invasive Treatment – PCNL , miniPCNL , RIRS

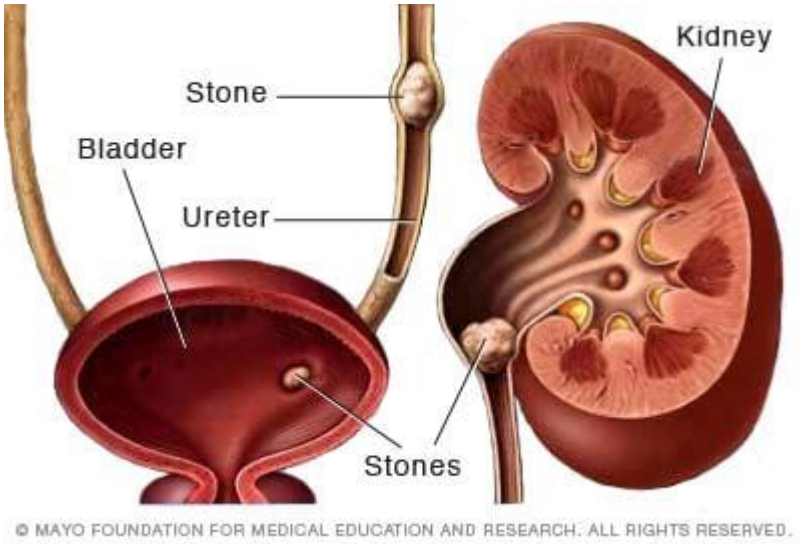
Kidney stones (also called renal calculi, nephrolithiasis or urolithiasis) are hard deposits made of minerals and salts that form inside your kidneys.

Diet, excess body weight, some medical conditions, and certain supplements and medications are among the many causes of kidney stones. Kidney stones can affect any part of your urinary tract — from your kidneys to your bladder. Often, stones form when the urine becomes concentrated, allowing minerals to crystallize and stick together.

Passing kidney stones can be quite painful, but the stones usually cause no permanent damage if they're recognized in a timely fashion. Depending on your situation, you may need nothing more than to take pain medication and drink lots of water to pass a kidney stone. In other instances — for example, if stones become lodged in the urinary tract, are associated with a urinary infection or cause complications — surgery may be needed.

We may recommend preventive treatment to reduce your risk of recurrent kidney stones if you're at increased risk of developing them again.

Symptoms



A kidney stone usually will not cause symptoms until it moves around within the kidney or passes into one of the ureters. The ureters are the tubes that connect the kidneys and bladder.

If a kidney stone becomes lodged in the ureters, it may block the flow of urine and cause the kidney to swell and the ureter to spasm, which can be very painful. At that point, you may experience these symptoms:

- Severe, sharp pain in the side and back, below the ribs
- Pain that radiates to the lower abdomen and groin
- Pain that comes in waves and fluctuates in intensity
- Pain or burning sensation while urinating

Other signs and symptoms may include:

- Pink, red or brown urine
- Cloudy or foul-smelling urine
- A persistent need to urinate, urinating more often than usual or urinating in small amounts
- Nausea and vomiting
- Fever and chills if an infection is present

Pain caused by a kidney stone may change — for instance, shifting to a different location or increasing in intensity — as the stone moves through your urinary tract.

Causes

Kidney stones often have no definite, single cause, although several factors may increase your risk.

Kidney stones form when your urine contains more crystal-forming substances — such as calcium, oxalate and uric acid — than the fluid in your urine can dilute. At the same time, your urine may lack substances that prevent crystals from sticking together, creating an ideal environment for kidney stones to form.

Types of kidney stones

Knowing the type of kidney stone you have helps determine its cause, and may give clues on how to reduce your risk of getting more kidney stones. If possible, try to save your kidney stone if you pass one so that you can bring it to your doctor for analysis.

Types of kidney stones include:

- **Calcium stones.** Most kidney stones are calcium stones, usually in the form of calcium oxalate. Oxalate is a substance made daily by your liver or absorbed from your diet. Certain fruits and vegetables, as well as nuts and chocolate, have high oxalate content.

  Dietary factors, high doses of vitamin D, intestinal bypass surgery and several metabolic disorders can increase the concentration of calcium or oxalate in urine.

  Calcium stones may also occur in the form of calcium phosphate. This type of stone is more common in metabolic conditions, such as renal tubular acidosis. It may also be associated with certain medications used to treat migraines or seizures, such as topiramate .

- **Struvite stones.** Struvite stones form in response to a urinary tract infection. These stones can grow quickly and become quite large, sometimes with few symptoms or little warning.
- **Uric acid stones.** Uric acid stones can form in people who lose too much fluid because of chronic diarrhea or malabsorption, those who eat

a high-protein diet, and those with diabetes or metabolic syndrome. Certain genetic factors also may increase your risk of uric acid stones.

- **Cystine stones.** These stones form in people with a hereditary disorder called cystinuria that causes the kidneys to excrete too much of a specific amino acid.

Risk factors

Factors that increase your risk of developing kidney stones include:

- **Family or personal history.** If someone in your family has had kidney stones, you're more likely to develop stones, too. If you've already had one or more kidney stones, you're at increased risk of developing another.
- **Dehydration.** Not drinking enough water each day can increase your risk of kidney stones. People who live in warm, dry climates and those who sweat a lot may be at higher risk than others.
- **Certain diets.** Eating a diet that's high in protein, sodium (salt) and sugar may increase your risk of some types of kidney stones. This is especially true with a high-sodium diet. Too much salt in your diet increases the amount of calcium your kidneys must filter and significantly increases your risk of kidney stones.
- **Obesity.** High body mass index (BMI), large waist size and weight gain have been linked to an increased risk of kidney stones.
- **Digestive diseases and surgery.** Gastric bypass surgery, inflammatory bowel disease or chronic diarrhea can cause changes in the digestive process that affect your absorption of calcium and water, increasing the amounts of stone-forming substances in your urine.
- **Other medical conditions** such as renal tubular acidosis, cystinuria, hyperparathyroidism and repeated urinary tract infections also can increase your risk of kidney stones.
- **Certain supplements and medications,** such as vitamin C, dietary supplements, laxatives (when used excessively), calcium-based antacids, and certain medications used to treat migraines or depression, can increase your risk of kidney stones.

Diagnosis

If your doctor suspects that you have a kidney stone, you may have diagnostic tests and procedures, such as:

- **Blood testing.** Blood tests may reveal too much calcium or uric acid in your blood. Blood test results help monitor the health of your kidneys and may lead your doctor to check for other medical conditions.
- **Urine testing.** The 24-hour urine collection test may show that you're excreting too many stone-forming minerals or too few stone-preventing substances. For this test, your doctor may request that you perform two urine collections over two consecutive days.
- **Imaging.** Imaging tests may show kidney stones in your urinary tract. High-speed or dual energy computerized tomography (CT) may reveal even tiny stones. Simple abdominal X-rays are used less frequently because this kind of imaging test can miss small kidney stones.

  Ultrasound, a noninvasive test that is quick and easy to perform, is another imaging option to diagnose kidney stones.
- **Analysis of passed stones.** You may be asked to urinate through a strainer to catch stones that you pass. Lab analysis will reveal the makeup of your kidney stones. Your doctor uses this information to determine what's causing your kidney stones and to form a plan to prevent more kidney stones.

Treatment

Treatment for kidney stones varies, depending on the type of stone and the cause.

Small stones with minimal symptoms

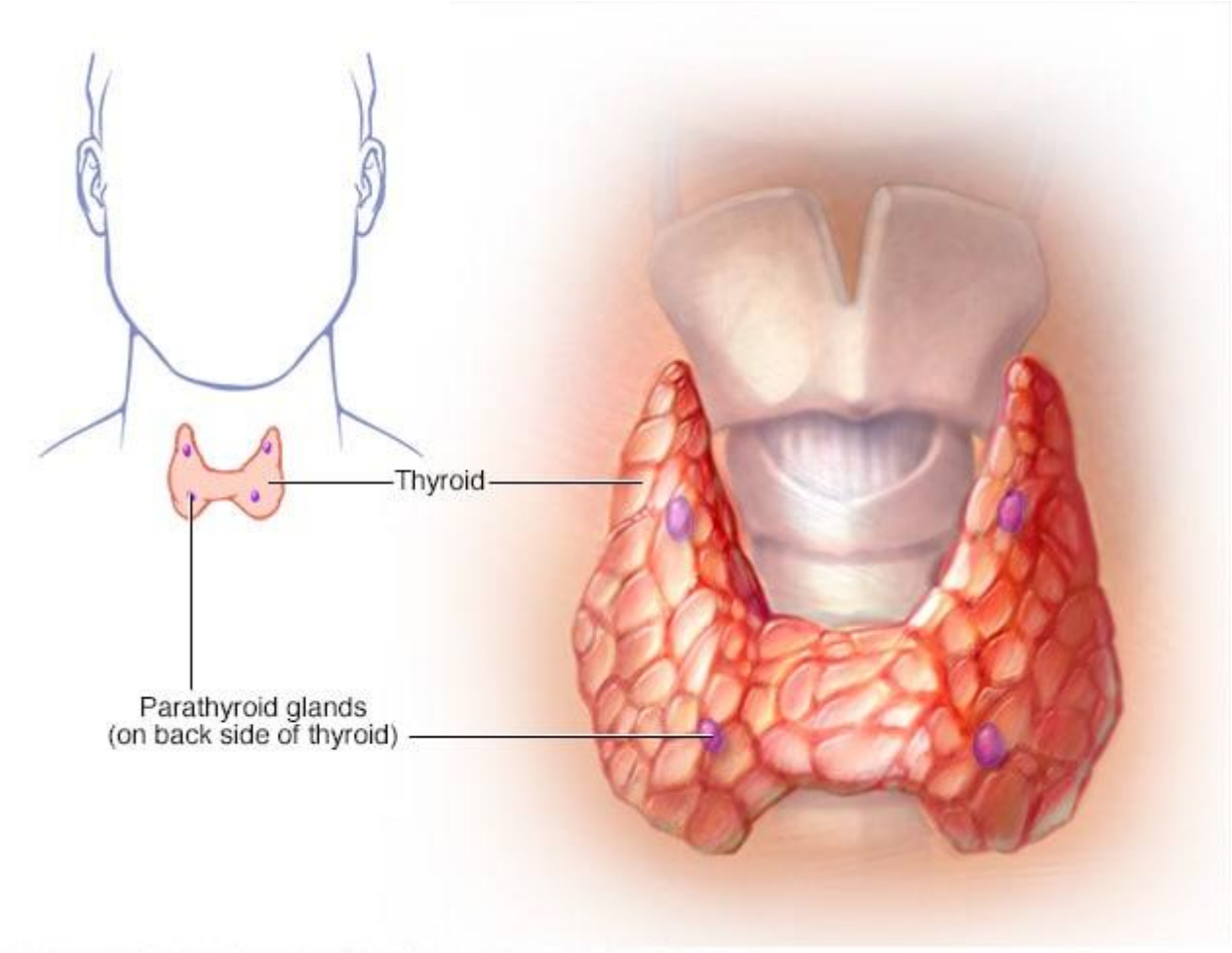
Most small kidney stones won't require invasive treatment. You may be able to pass a small stone by:

- **Drinking water.** Drinking as much as 2 to 3 quarts (1.8 to 3.6 liters) a day will keep your urine dilute and may prevent stones from forming.

Unless your doctor tells you otherwise, drink enough fluid — ideally mostly water — to produce clear or nearly clear urine.

- **Pain relievers.** Passing a small stone can cause some discomfort. To relieve mild pain, your doctor may recommend pain relievers such as ibuprofen (Advil, Motrin IB, others) or naproxen sodium (Aleve).
- **Medical therapy.** Your doctor may give you a medication to help pass your kidney stone. This type of medication, known as an alpha blocker, relaxes the muscles in your ureter, helping you pass the kidney stone more quickly and with less pain. Examples of alpha blockers include tamsulosin (Flomax) and the drug combination dutasteride and tamsulosin (Jalyn).

Large stones and those that cause symptoms



Kidney stones that are too large to pass on their own or cause bleeding, kidney damage or ongoing urinary tract infections may require more-extensive treatment. Procedures may include:

- **Using sound waves to break up stones.** For certain kidney stones — depending on size and location — your doctor may recommend a procedure called extracorporeal shock wave lithotripsy (ESWL).

  ESWL uses sound waves to create strong vibrations (shock waves) that break the stones into tiny pieces that can be passed in your urine. The procedure lasts about 45 to 60 minutes and can cause moderate pain, so you may be under sedation or light anesthesia to make you comfortable.

  ESWL can cause blood in the urine, bruising on the back or abdomen, bleeding around the kidney and other adjacent organs, and discomfort as the stone fragments pass through the urinary tract.

- **Surgery to remove very large stones in the kidney.** A procedure called percutaneous nephrolithotomy (nef-row-lih-THOT-uh-me) involves surgically removing a kidney stone using small telescopes and instruments inserted through a small incision in your back.

  You will receive general anesthesia during the surgery and be in the hospital for one to two days while you recover. Your doctor may recommend this surgery if ESWL is unsuccessful.

- **Using a scope to remove stones.** To remove a smaller stone in your ureter or kidney, your doctor may pass a thin lighted tube (ureteroscope) equipped with a camera through your urethra and bladder to your ureter.

  Once the stone is located, special tools can snare the stone or break it into pieces that will pass in your urine. Your doctor may then place a small tube (stent) in the ureter to relieve swelling and promote healing. You may need general or local anesthesia during this procedure.

- **Parathyroid gland surgery.** Some calcium phosphate stones are caused by overactive parathyroid glands, which are located on the four corners of your thyroid gland, just below your Adam's apple. When these glands produce too much parathyroid hormone (hyperparathyroidism), your calcium levels can become too high and kidney stones may form as a result.

Hyperparathyroidism sometimes occurs when a small, benign tumor forms in one of your parathyroid glands or you develop another condition that leads these glands to produce more parathyroid hormone. Removing the growth from the gland stops the formation of kidney stones. Or your doctor may recommend treatment of the condition that's causing your parathyroid gland to overproduce the hormone.

Prevention

Prevention of kidney stones may include a combination of lifestyle changes and medications.

Lifestyle changes

You may reduce your risk of kidney stones if you:

- **Drink water throughout the day.** For people with a history of kidney stones, doctors usually recommend drinking enough fluids to pass about 2.1 quarts (2 liters) of urine a day. Your doctor may ask that you measure your urine output to make sure that you're drinking enough water.

  If you live in a hot, dry climate or you exercise frequently, you may need to drink even more water to produce enough urine. If your urine is light and clear, you're likely drinking enough water.

- **Eat fewer oxalate-rich foods.** If you tend to form calcium oxalate stones, your doctor may recommend restricting foods rich in oxalates. These include rhubarb, beets, okra, spinach, Swiss chard, sweet potatoes, nuts, tea, chocolate, black pepper and soy products.
- **Choose a diet low in salt and animal protein.** Reduce the amount of salt you eat and choose nonanimal protein sources, such as legumes. Consider using a salt substitute, such as Mrs. Dash.
- **Continue eating calcium-rich foods, but use caution with calcium supplements.** Calcium in food doesn't have an effect on your risk of kidney stones. Continue eating calcium-rich foods unless your doctor advises otherwise.

Ask your doctor before taking calcium supplements, as these have been linked to increased risk of kidney stones. You may reduce the risk by taking supplements with meals. Diets low in calcium can increase kidney stone formation in some people.

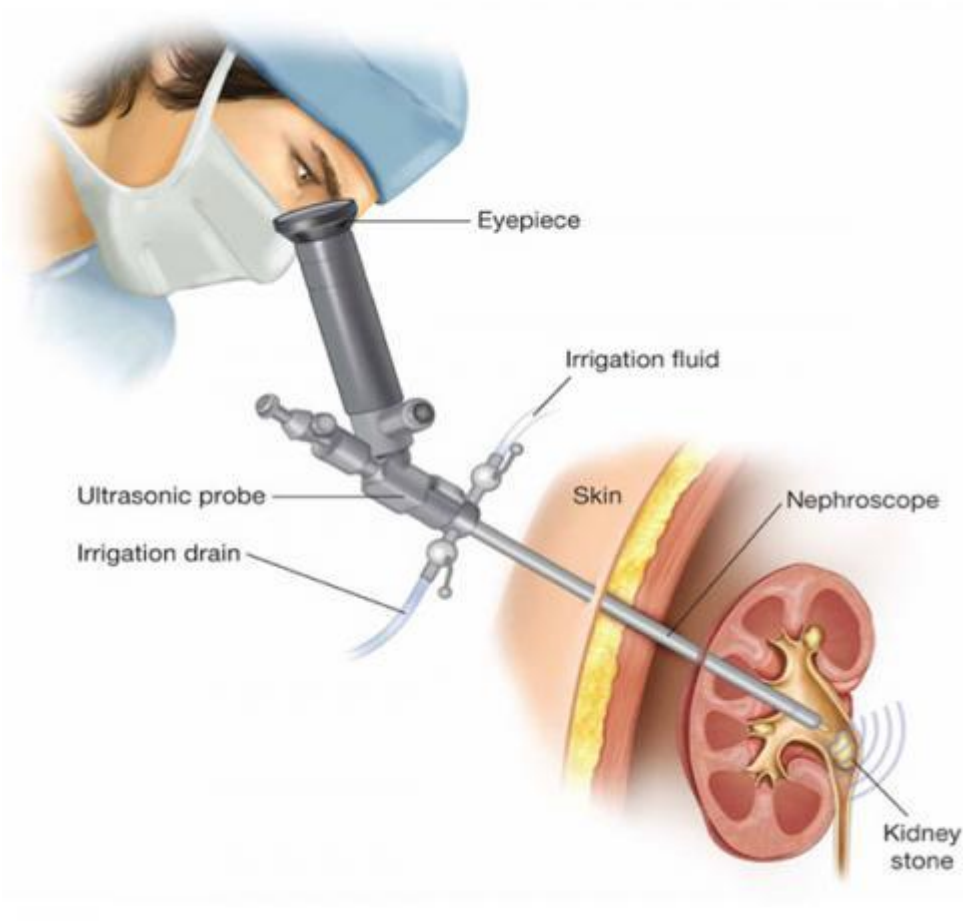
Ask your doctor for a referral to a dietitian who can help you develop an eating plan that reduces your risk of kidney stones.

Medications

Medications can control the amount of minerals and salts in the urine and may be helpful in people who form certain kinds of stones. The type of medication your doctor prescribes will depend on the kind of kidney stones you have. Here are some examples:

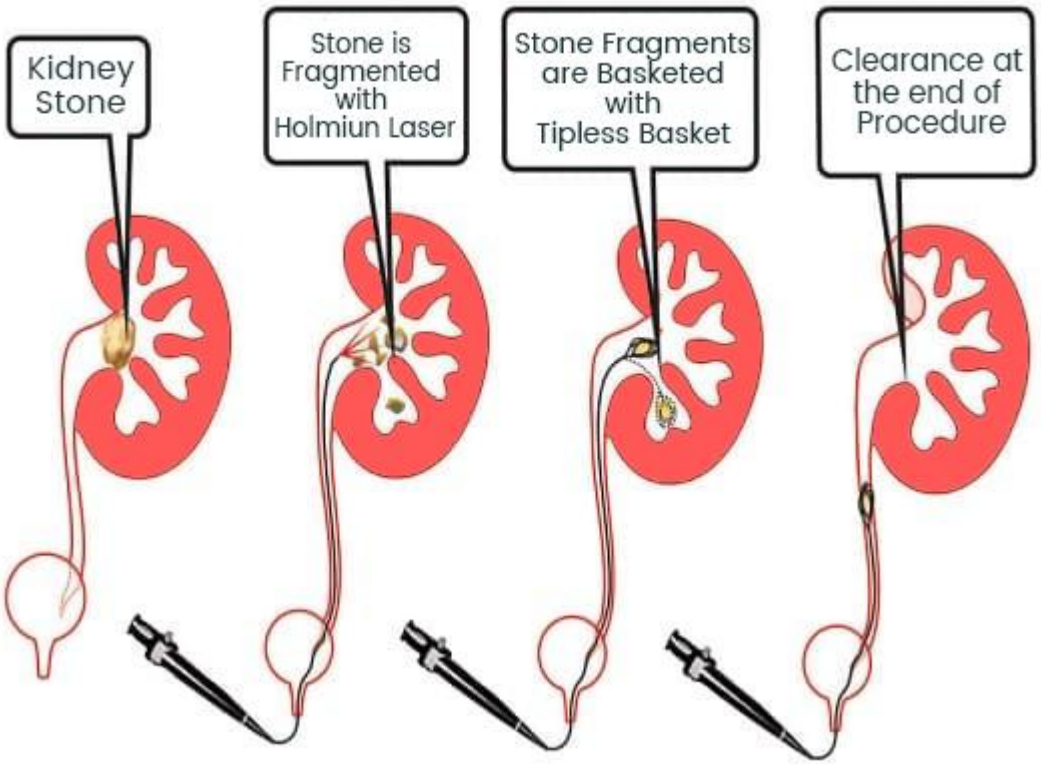
- **Calcium stones.** To help prevent calcium stones from forming, your doctor may prescribe a thiazide diuretic or a phosphate-containing preparation.
- **Uric acid stones.** Your doctor may prescribe allopurinol (Zyloprim, Aloprim) to reduce uric acid levels in your blood and urine and a medicine to keep your urine alkaline. In some cases, allopurinol and an alkalizing agent may dissolve the uric acid stones.
- **Struvite stones.** To prevent struvite stones, your doctor may recommend strategies to keep your urine free of bacteria that cause infection, including drinking fluids to maintain good urine flow and frequent voiding. In rare cases long-term use of antibiotics in small or intermittent doses may help achieve this goal. For instance, your doctor may recommend an antibiotic before and for a while after surgery to treat your kidney stones.
- **Cystine stones.** Along with suggesting a diet lower in salt and protein, your doctor may recommend that you drink more fluids so that you produce a lot more urine. If that alone doesn't help, your doctor may also prescribe a medication that increases the solubility of cystine in your urine.

Surgical Treatment



Percutaneous Nephrolithomy (PCNL) (Minimally Invasive)

Key hole surgery – Mini PCNL – when stone size is small



RIRS – Retrograde Intrarenal Surgery

For multiple stones in different positions in the kidney