



What is a kidney stone, and how are they formed?

Kidney stones are hard deposits made of minerals and salts that form inside your kidneys. Kidney stones have many causes and can affect any part of your urinary tract — from your kidneys to your bladder. Often, stones form when the urine becomes concentrated (dark yellow or amber), allowing minerals to crystallize and stick together. Dehydration is the number one cause of concentrated urine. Passing kidney stones can be quite painful, but the stones usually cause no permanent damage if they're caught early. 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.

4 Types of Kidney Stones

Calcium stones make up the majority of all kidney stones at 80 percent. There are two types of calcium stones, calcium oxalate (most common) and calcium phosphate—both of which can be seen on a plain x-ray. Oxalates are a natural element in food. However, when there's an excessive amount of oxalates in your system, they can stick to calcium in your urine to form a calcium oxalate stone. It's vital if you are a calcium stone former, to consume fewer foods on the high oxalate list. Phosphate stones are much less common and typically develop in patients with metabolic or hormonal disorders such as hyperparathyroidism and renal tubular acidosis.

Uric acid stones make up approximately 10% of all kidney stones. They're usually formed in people with a high animal protein diet and people who suffer from gout. If you've had gout, you are 60 percent more likely to develop a kidney stone! Like calcium stones, these stones are formed in acidic urine (pH less than 7) but are not as visible on a plain x-ray. Uric acid stones can be frequently managed through a healthy diet with plenty of fruits and vegetables. But make sure you stay hydrated, which will help dilute the excess acid in your system. Uric acid stones are the only stones that can be dissolved using a diet which in part consists of increased levels of citric acid and apple cider vinegar.

Cystine stones are the least common stones comprising only four percent of cases. The result of an inherited (genetic) disorder, cystine stones occur when there's an excess of the amino acid cystine in the body. These stones are recurring and typically larger. Sadly, most patients will get their first cystine stone in their twenties or thirties.

Struvite, or infectious stones, comprise 6 percent of all kidney stones, which in contrast to most stones, form in alkaline urine. Struvite stones are more common in women, infants, and the elderly, and are often associated with recurrent bacterial urinary tract infections. It is not uncommon for struvite stones to start as calcium stones and then colonize with bacteria that develop the struvite component of the stone. If you had not had a stone initially, it lowers the risk of bacteria entering the urinary tract.

What are the symptoms of a kidney stone?

- Severe 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
- Painful urination
- Pink, red or brown urine
- Cloudy or foul-smelling urine
- Frequent urination
- Nausea and vomiting
- Fever and chills, if an infection is present

How are kidney stones diagnosed?

CT Scan: CT scans are one of the most useful tools for stone evaluation. A CT scan identifies the anatomy of the kidneys and also demonstrates the position and size of the stone.

X-rays (KUB): KUB (Kidney, Ureter, Bladder) is a quick and helpful imaging study for the confirmation of kidney stones. KUB can locate many stones, and is often used over time to compare and track the progress of the stones.

Renal Ultrasound: Renal ultrasound requires no X-ray exposure or special preparation. Renal ultrasound shows the details of the kidneys and bladder. It can rule out or diagnose obstructions, developmental abnormalities, tumors, and stones in the kidneys and entire urinary tract.

What are the treatment options?

The treatment for kidney stones usually depends on their size, location in the urinary tract, and type of stone. Often, if a stone is larger than 5mm, it is less likely to pass without surgical intervention.

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

Hydration. Drink plenty of water to flush out your stone.

Pain relievers. Passing a small stone can cause some discomfort. To relieve mild pain, your doctor may recommend pain relievers. A prescription pain reliever may also be an option.

Medical therapy. Your doctor may give you a medication to help pass your kidney stone. This type of medication, known as an alpha-blocker (Flomax), relaxes the muscles in your ureter, helping you pass the kidney stone more quickly.

Procedures

Shock Wave Lithotripsy (ESWL). Shock wave therapy is used on a patient who has a kidney stone that is causing pain or blocking the urine flow. It is an outpatient procedure performed under general anesthesia. This procedure uses shock waves to break a kidney stone into small pieces that can more easily travel through the urinary tract and pass from the body. Your surgeon may use a stent if you have a large stone. A stent is a small, short tube of flexible plastic mesh that holds the ureter open. A stent helps the small stone pieces to pass without blocking the ureter.

Ureteroscopy. To remove a smaller stone in your ureter or kidney, your doctor may pass a thin, lighted tube equipped with a camera through your urethra and bladder to your ureter. Once the stone is located, special tools can snare the stone or a laser can be used to 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.

Percutaneous Nephrolithotomy. Stones are removed through a small incision in your back. This is an outpatient procedure performed under general anesthesia. You may need this procedure when the stone causes obstruction and infection or is damaging the kidneys. This procedure is typically used if the stone has become extremely large.

Kidney Stone Prevention

Family history, diet, and hydration all play a role in the formation of stones. If you have experienced kidney stones once, you have a 75% chance of reoccurrence. Prevention of kidney stones may call for lifestyle changes, medications, and supplements. 24-hour urine collection will be performed to determine the treatment plan best for you. 24-hour urine collection is used to determine how much oxalate, calcium, sodium, citrate, pH, and volume of urine you produce in 24 hours. Urine chemistries change over time, so it is essential that you complete a yearly collection to ensure your treatment plan is still working for you. Once your cause of kidney stones is determined, our providers will give you a plan of action. This plan may include some of the following prevention methods.

Make hydration a priority. For people with a history of kidney stones, we recommend passing about 2.5 liters of urine a day. Your doctor may ask that you measure your urine output to make sure that you're drinking enough water. One rule of thumb is to drink half your body weight in ounces. For example, if you weigh 100 lbs, you should be drinking at least 50 oz of water. If you live in a hot, dry climate or you exercise frequently, you need to drink 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, we recommend restricting foods rich in oxalates. (Last page) If there is too much oxalate and too little liquid in the urine, calcium oxalate fragments create crystals. As the crystals begin to increase in number, they stick to one another to form a kidney stone.

Choose a diet low in salt and animal protein. Reduce the amount of daily salt intake and choose nonanimal protein sources. Consider replacing some of the meat and animal protein you would typically eat with plant-based foods that are high in protein. It is recommended to limit your daily intake of animal protein to 12 oz. Protein can cause too much uric acid in the urine, which can create uric acid stones.

Get enough calcium from foods. Even though calcium sounds like it would be the cause of calcium stones, it's not. In the right amounts, calcium can block other substances in the digestive tract that may cause stones. It may be best to get calcium from low-oxalate, plant-based foods such as calcium-fortified juices, cereals, breads, some kinds of vegetables, and some types of beans.

Supplements

Citrate- Compound found in lemons and limes is a potent stone inhibitor that also raises urine pH. Hard to get in high enough concentrations from citrus fruit alone.

Magnesium- Natural stone inhibitor.

B6- Helps with oxalate metabolism.

Sodium bicarbonate can prevent the formation of uric acid kidney stones.

KSPTabs are over the counter, dissolvable tablets that provide the needed minerals to optimize urine pH balance and support your kidneys. Ingredients include: potassium citrate, magnesium, and B6.

Prescription Medications

Allopurinol decreases uric acid found in high animal diets and other sources.

HCTZ (Hydrochlorothiazide)- Diuretic that lowers calcium levels in urine.

Food	Serving	Oxalate Content
Beet Green	½ Cup	916 Mg
Purslane, leaves	½ Cup	910 Mg
Rhubarb, stewed, no sugar	½ Cup	860 Mg
Spinach, cooked	½ Cup	750 Mg
Beets, cooked	½ Cup	675 Mg
Chard, swiss leaves	½ Cup	660 Mg
Rhubarb, canned	½ Cup	600 Mg
Spinach, frozen	½ Cup	600 Mg
Beets, pickled	½ Cup	500 Mg
Endive, raw	20 long leaves	273 Mg
Coca, dry	1/3 Cup	254 Mg
Okra, cooked	8-9 Pods	146 Mg
Sweet Potatoes, cooked	½ Cup	141 Mg
Kale, cooked	½ Cup	125 Mg
Peanuts, raw	1/3 Cup	113 Mg
Turnip Greens, cooked	½ Cup	110 Mg
Chocolate, unsweetened	1 Oz	91 Mg
Parsnips, diced, cooked	½ Cup	81 Mg
Collard Greens, cooked	½ Cup	74 Mg
Pecan Halves, raw	1/3 Cup	74 Mg
Tea Leaves	1 TSP	72 Mg
Wheat Germ, toasted	½ Cup	67 Mg
Gooseberries	½ Cup	66 Mg
Potatoes, baked	1 Medium	64 Mg
Carrots	½ Cup	45 Mg
Apple	1 Medium	41 Mg
Brussel Sprouts, cooked	6-8 Medium	37 Mg
Strawberries	½ Cup	35 Mg
Celery, raw	2 Stalks	34 Mg
Milk Chocolate Bar	1 Bar	34 Mg
Raspberries	½ Cup	33 Mg
Orange	1 Medium	24 Mg
Green Beans, cooked	½ Cup	23 Mg

Chives, chopped	1 Tablespoon	19 Mg
Leeks	½ Cup	15 Mg
Blackberries	½ Cup	13 Mg
Concord Grapes	½ Cup	13 Mg
Blueberries	½ Cup	11 Mg
Currants	½ Cup	11 Mg
Apricots	2 Medium	10 Mg
Dark Liquids, including coffee, soda and tea		