

# Kidney Stones in Adults



**KIDNEY STONES OVERVIEW** — Kidney stones (also called nephrolithiasis or urolithiasis) affect approximately 12 percent of men and 5 percent of women by age 70. Fortunately, treatment is available to effectively manage most stones, and steps can be taken to prevent their recurrence. Recurrence can occur at a rate of up to 5 percent per year in people who are not treated.

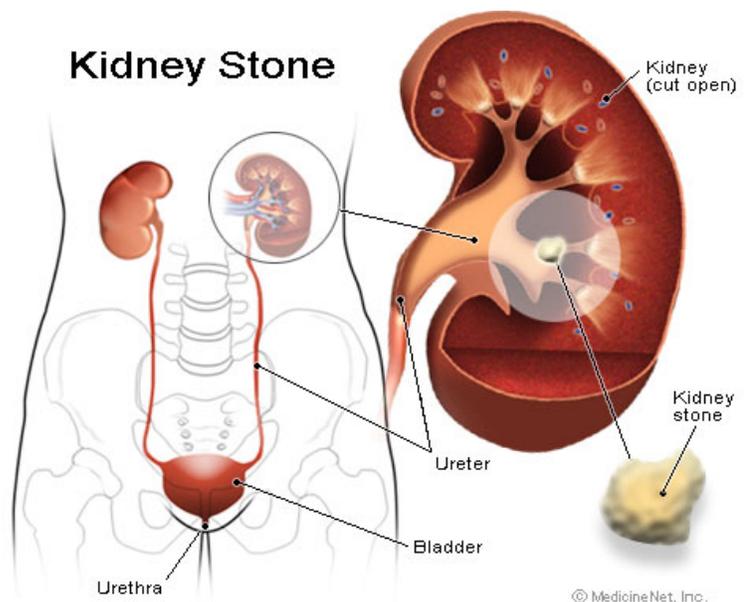
**HOW KIDNEY STONES DEVELOP** — A brief overview of the anatomy of the urinary tract will help in the understanding of kidney stones. The urinary tract is composed of two kidneys and ureters, a bladder, and a urethra. Urine is produced by the kidneys, which are located towards the middle of the back, below the ribs. The kidneys remove waste products and excess fluid from the blood and convert this to urine. The urine collects in the bladder until it passes out of the body through the urethra.

A kidney stone can form when substances such as calcium, oxalate, cystine, or uric acid are at high levels in the urine, but stones can also form if these substances are at normal levels. The substances form crystals, which become anchored in the kidney and gradually increase in size, forming a kidney stone.

Typically, the stone will move through the urinary tract to be expelled in the urine. A larger stone may cause pain

if it becomes lodged in the urinary tract and obstructs the flow of urine.

Occasionally, a stone may not pass into the ureters and can enlarge to fill the entire renal pelvis, which can damage the kidney if it produces infection or obstruction.



**KIDNEY STONE RISK FACTORS** — Certain diseases and habits can affect a person's risk for developing kidney stones.

**History of kidney stones** — Patients who have had a kidney stone in the past or have a family history of stones have the highest risk of a future stone. The likelihood of forming a second stone is about 5 to 10 percent at one year and 50 percent or higher at 10 years.

**Dietary risk factors** — The amount and type of food and drink that a person consumes can play an important role in the development of kidney stones.

**Low fluid intake** — The amount of fluids a person drinks directly affects the amount of urine that is made. Drinking a small amount of fluids means that less urine is made, compared to if more liquids are consumed. Making less urine can increase the risk of kidney stone formation because the concentration of stone-forming substances in the urine is higher.

**Type of fluid** — The type of fluid consumed may also be important, although data about the "best" fluids are conflicting. Grapefruit juice has been associated with an increased risk of kidney stones while coffee and tea may lower risk of kidney stone formation. Beer and wine do not usually increase the risk of kidney stones.

**Calcium** — There is little evidence that consuming large amounts of calcium (from foods and drinks) increases the risk of kidney stones, or that consuming small amounts of calcium decreases the risk. However, avoiding dairy products is likely to increase the risk of kidney stones. You should consume the amount of calcium that is recommended for bone health based upon your age and gender. On the other hand, use of calcium supplements may increase the risk of kidney stones in susceptible individuals by raising the level of calcium in the urine. This is particularly true if the supplement is taken between meals or at bedtime. People with a history of kidney stones should consult their healthcare provider about the risks and benefits of taking a calcium supplement.

**Medical conditions** — Some medical conditions are associated with an increased risk for stone formation, including the following:

- Conditions that increase the absorption of oxalate from the gastrointestinal tract (like short bowel syndrome, chronic diarrhea, or previous bowel surgery or gastric bypass surgery)
- Conditions that increase the chance of urinary tract infection, such as anatomic abnormalities of the kidneys or ureters, or difficulties with bladder emptying
- Hyperparathyroidism and sarcoidosis, which can be associated with high blood levels of calcium
- Gout, which may result in acidic (low pH) urine
- Diabetes, which may be associated with increased calcium excretion in the urine
- Cystinuria, an inherited condition that is associated with an increased level of cystine in the urine

Medications — Some medications that promote formation of urine crystals increase the risk of stone formation. Excessive intake of vitamin C (more than 1000 milligrams per day) can promote calcium oxalate kidney stone formation.

Diarrhea and dehydration — Uric acid stones are sometimes seen in patients who have chronic diarrhea, because of their concentrated, acidic urine. People who are predisposed to developing kidney stones have an increased risk of stone formation if they become dehydrated. This includes patients who engage in heavy physical exercise (such as marathon running).

KIDNEY STONE TREATMENT — Initial treatment for symptomatic kidney stones is similar for all patients. However, measures to prevent future stones vary depending upon a person's risk of recurrence.

Initial treatment — During the initial phase of kidney stone symptoms, many patients require only pain medication and fluids until the stone is passed. Nonsteroidal antiinflammatory drugs (NSAIDs, such as ibuprofen [Advil, Motrin] or naproxen [Aleve]) may be prescribed for pain and can be taken in pill form. If the pain is not controlled by an NSAID, narcotics (such as morphine) may be given. Fluids are recommended to increase urine flow and facilitate passage of the stone. Other medications, such as nifedipine (Procardia®) or tamsulosin (Flomax®), may also be recommended to speed the passage of ureteral stones.

Patients are often asked to strain their urine to recover the stone; it can then be analyzed in a laboratory to determine the type of stone. Once the stone is passed, an imaging test is sometimes performed to confirm that passage is complete and that no fragments or additional stones remain. Stones smaller than 5 millimeters, and even those up to 9 or 10 millimeters, often pass on their own without requiring a procedure.

If the stone does not pass — Several procedures are available.

1. Shock wave lithotripsy (SWL) — SWL is the treatment of choice in many patients who need help passing a stone, and is particularly good for stones in the renal pelvis and upper ureter. SWL requires an x-ray or ultrasound to pinpoint the location of the stone. A high-energy shock wave is then directed toward the stone, passing through the skin and bodily tissues and causing a release of energy at the stone surface. This energy causes the stone to break into fragments that can be more easily passed. SWL therapy may not be effective for treating large, hard, or complex stones (such as staghorn calculi).
2. Percutaneous nephrolithotomy (PNL) — Extremely large or complex stones, or stones resistant to shock wave lithotripsy, may require a minimally invasive surgical procedure to remove the stone. In this procedure, small telescopic instruments are passed through the skin (percutaneously) into the kidney to remove the stone.
3. Ureteroscopy — Ureteroscopy is often used to remove stones obstructing the middle and lower portion of the ureter. In this procedure, a very small telescopic instrument is passed through the urethra and bladder, into the ureter and kidney. This scope contains a camera and other instruments,

which allows the physician to visualize the obstructing stone and remove it, or to break it up into smaller pieces that can pass more easily.

**KIDNEY STONE PREVENTION** — A number of steps can be taken to decrease the chance that another kidney stone will develop.

- Drink more fluids. Try to drink enough water to keep your urine clear, about 8 to 10 glasses of water per day. Slowly increase how much you drink, perhaps adding one more glass of water a day until you are drinking 8 to 10 glasses a day. This slow increase will give your body time to adjust to the extra fluids. You are drinking enough water when your urine is clear or light yellow. If it is dark yellow, you are not drinking enough fluids. If you have kidney, heart, or liver disease and have fluid restrictions, talk with your doctor before increasing how much you drink.
- Change your diet. This may be helpful, but it depends on what is causing your kidney stones. Your doctor may do more tests before deciding whether changing your diet will help reduce your risk of developing another stone. The results of these tests may suggest that it could be helpful to do one or more of the following:
  - Increasing how much fiber you eat. Fiber includes oat bran, beans, whole wheat breads, wheat cereals, cabbage, and carrots.
  - Eating less beef, pork, and poultry.
  - Eating a moderate or high amount of calcium-rich foods, such as dairy products. Getting your recommended amounts of calcium, combined with a diet low in sodium and protein, may decrease your risk of kidney stones. In older people and younger women, one study indicates that eating more calcium-rich foods reduces the risk of kidney stones.
  - Avoiding foods that are high in oxalate, such as dark green vegetables, nuts, and chocolate.
  - Not adding salt when you cook or eat. Try removing the salt shaker from your table.

