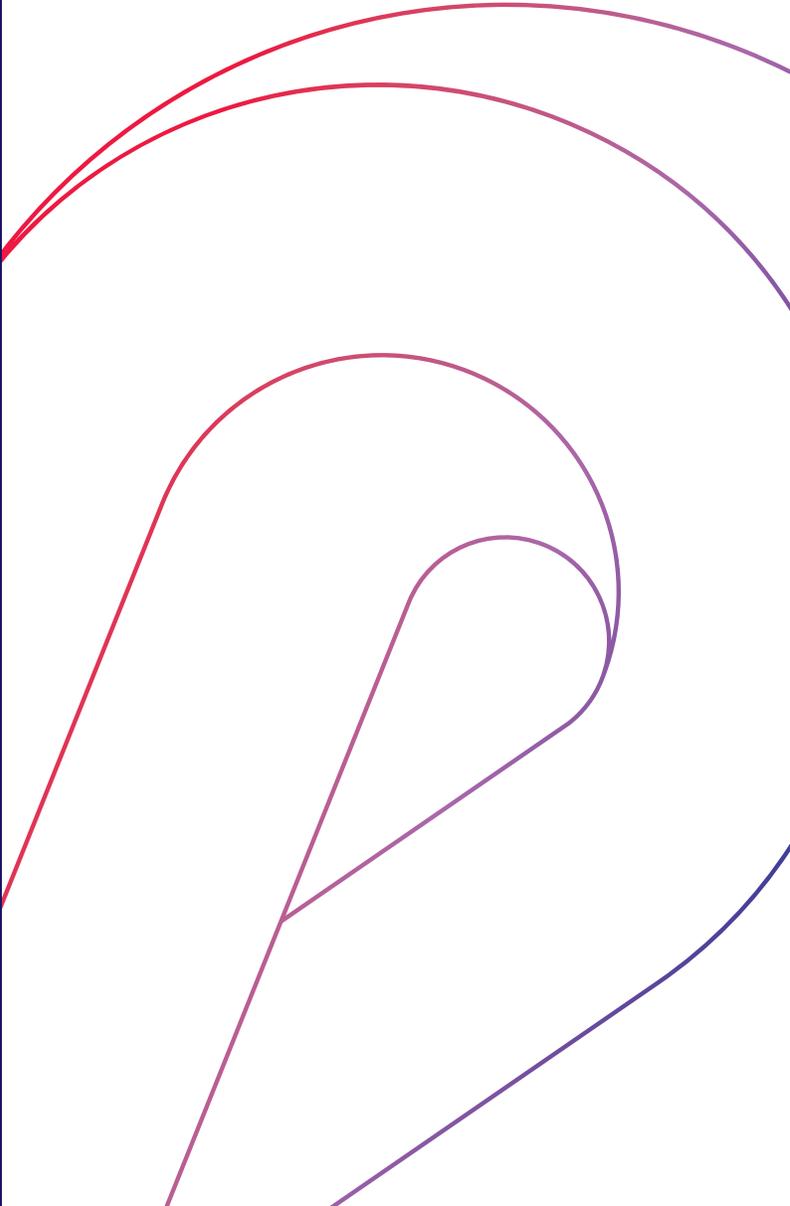


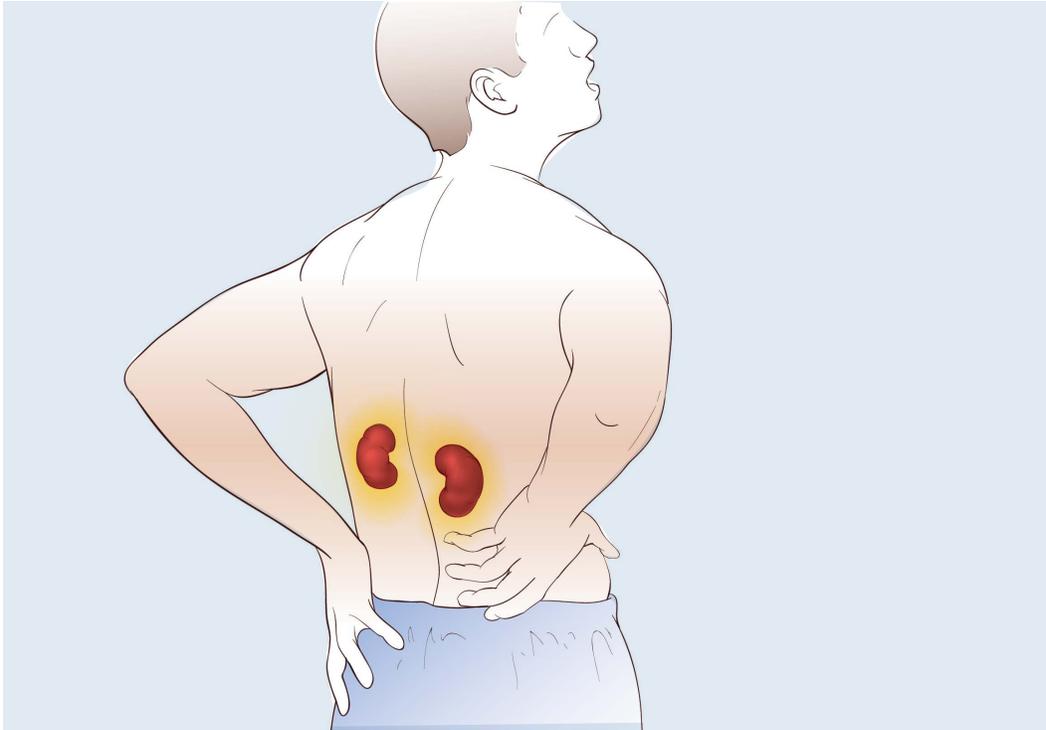


Kidney Stone Owner's Manual

What's Inside:

- How the Urinary System Works 4**
- What is a Kidney Stone? 6**
- Can I Make Passing a Stone
Any Easier? 11**
- Can my Doctor Help Prevent
Another Kidney Stone?..... 13**
- General Prevention Guidelines 15**





How common are kidney stones?

Kidney stones are surprisingly common. In fact, more than 5% of the U.S. population has had one, and the lifetime risk of having a kidney stone is about 1 in 7.

The most common age group is 20 to 40 years old, but they can occur in children and senior citizens alike. Men are three times more likely than women to have kidney stones.

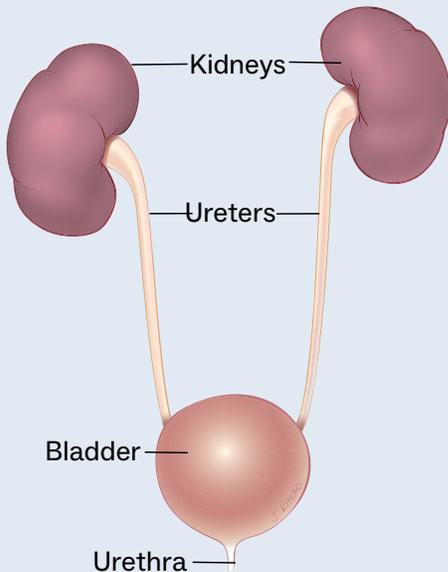
Even urologists [yur-AWL-uh-jists] (kidney doctors) get kidney stones. In fact, the information in this booklet was originally prepared by a urologist who is also a kidney stone patient — in other words, someone who knows what you're going through.

Whether this is your first kidney stone or the most recent of many, this booklet can be helpful. If you're in pain, you may not feel much like reading, but learning more about your stone and your options can be a powerful way to regain a sense of control. Read on for information about kidney stones and your treatment options, along with tips on how to care for yourself and prevent future stones.

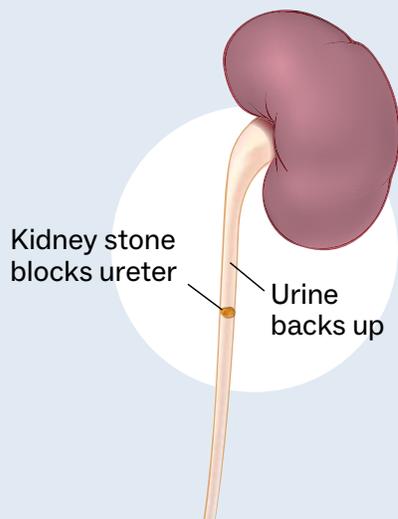


How the Urinary System Works

The Urinary System



How a kidney stone happens



To understand what happens with a kidney stone, first you need to know a little about your “plumbing,” or **urinary system**.

Your **kidneys** are 2 purplish-brown organs that sit below your ribs toward the middle of your back. They filter extra fluids, salts, and waste products from your blood to form urine (pee).

Urine flows through narrow tubes called **ureters** [YUR-eh-terz] to the bladder.

The bladder stores urine. When you urinate, it squeezes to send the urine through your **urethra** [yuh-REETH-ruh] and out of your body.

The urinary system works the same for men and women.

What is a kidney stone?

A kidney stone forms when concentrated chemicals in your urine form a crystal in your kidney, and the crystal grows over time. It's not always clear why this happens (see page 15 for information on prevention). A stone isn't usually painful while it's still in your kidney.

When the stone leaves your kidney, it travels down your ureter so it can leave your body. Some stones are tiny and pass through without causing symptoms. But because the ureter is such a small tube (about $\frac{1}{8}$ of an inch wide), a kidney stone can get stuck and block the ureter. If this happens, urine backs up and flows back to the kidney.

The pressure on the kidney caused by the backflow of urine, combined with spasms in the ureter as your body tries to clear the stone, can cause intense pressure and pain in your lower back, side, groin, or all three areas. In fact, kidney stone pain is one of the most severe types of pain physicians treat. Kidney stones can also cause sweating, nausea, and vomiting. You might see blood in your urine. And if the stone causes an infection, you can experience fever and chills.

Once the stone passes out of your ureter and into your bladder, you usually don't have any problem passing it the rest of the way out of your body. The urethra is at least twice as wide as the normal ureter, so the stone doesn't usually block it.

Will my kidney stone pass on its own?

If you have a kidney stone, of course you want the stone and the pain to go away as quickly as possible. Your doctor wants this also. At the same time, patients usually want to avoid having an operation or procedure to get the stone out. Whether a stone will pass on its own depends on its size. Stone size is measured in millimeters (mm).

Stones smaller than 4 mm: The good news is that about 80% of stones this size will pass on their own. The bad news is that passing a stone takes time — an average of 31 days.

Stones 4 mm or larger: The chances of passing a stone this size are pretty low. In fact, most patients with stones this large end up having a procedure because the stone doesn't move forward or because the pain of passing it can't be controlled with medication.

For stones that may pass naturally, you can take steps to care for yourself during the process, and your doctor can help with medication. See pages 8 and 9 for more information.

For stones that likely will not pass naturally, your doctor will recommend a treatment procedure. See the next page to learn more about treatment options.

Stone size and the chance it will pass

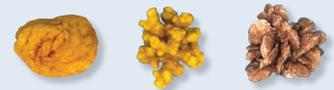
The larger the stone, the less chance it will pass on its own and the longer it will take.

Stone size	How many pass on their own?	How long does it typically take?
Smaller than 4 mm	About 80%	31 days (average)
4 to 6 mm	About 60%	45 days (average)
Larger than 6 mm	About 20%	12 months (average)

What do kidney stones look like?

Kidney stones are formed when chemicals in the urine form a crystal. The shape depends on the type of chemical concentrate that forms the stone:

Calcium oxalate



Calcium phosphate



Struvite



Uric Acid

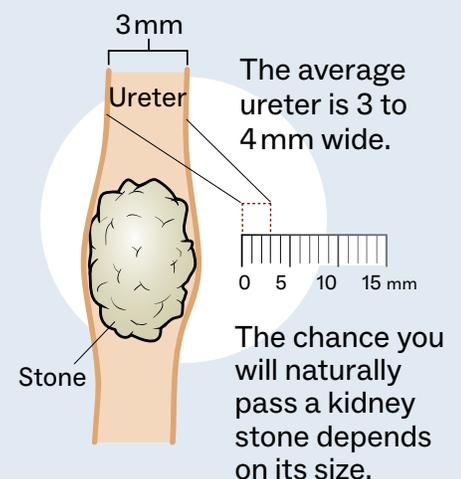


Cystine



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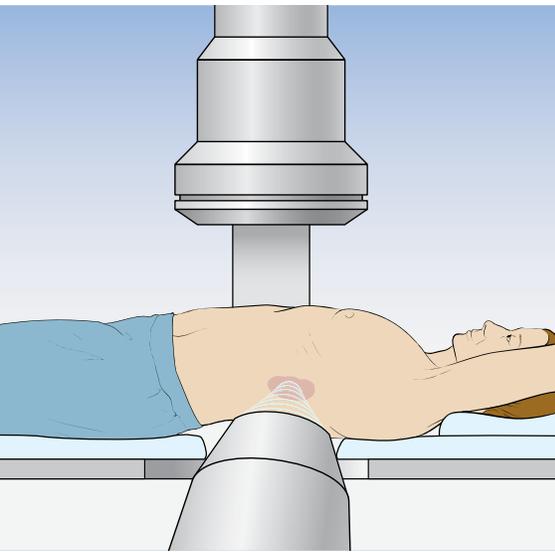
How they measure up



What Are My Treatment Options?

Treatments help remove kidney stones, using one or more of these strategies:

- **Breaking up the stone so the smaller pieces can pass** (a procedure called ESWL, sometimes called “shocking”)
- **Removing the stone through the ureter** (a procedure called ureteroscopy, sometimes called “basketing”)
- **Removing the stone from the kidney** (a procedure called PCNL, and sometimes called PERC)
- **Holding the ureter open using a temporary tube called a stent so stone fragments pass more easily**



ESWL

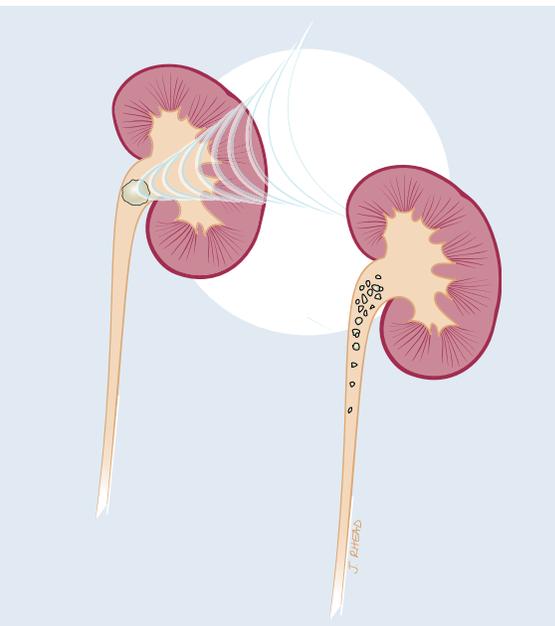
ESWL stands for **Extracorporeal** [ex-trah-ko-POR-ee-uh] **Shock Wave Lithotripsy** [LITH-uh trip-see], a procedure that uses focused shock waves to break up kidney stones.

What happens during ESWL?

- 1 Getting ready.** In most cases, you'll have an IV (intravenous) line placed in your wrist or arm to give you a sedative that helps you relax. Then you'll lie on an exam table with a shock wave generator.
- 2 Finding the stone.** Your healthcare provider will use x-rays or ultrasound to find the stone. You will be positioned so the stone is directly in line with the shock wave generator.
- 3 Breaking up the stone.** When the stone is in position, the generator sends approximately 2,000 to 3,000 shock waves at the stone. The shock waves cause the stone to break into small pieces. You can usually go home the same day, and the smaller stone fragments should pass on their own.

When can ESWL be used?

ESWL works best for stones smaller than 10 mm that are located in the kidney or high in the ureter. Stones low in the ureter (near the pelvis and bladder) don't usually respond well to ESWL treatment. Some stones, such as monohydrate [mono-HY-drate] and cystine [SIS-teen], are too hard to break with ESWL and require other treatment.



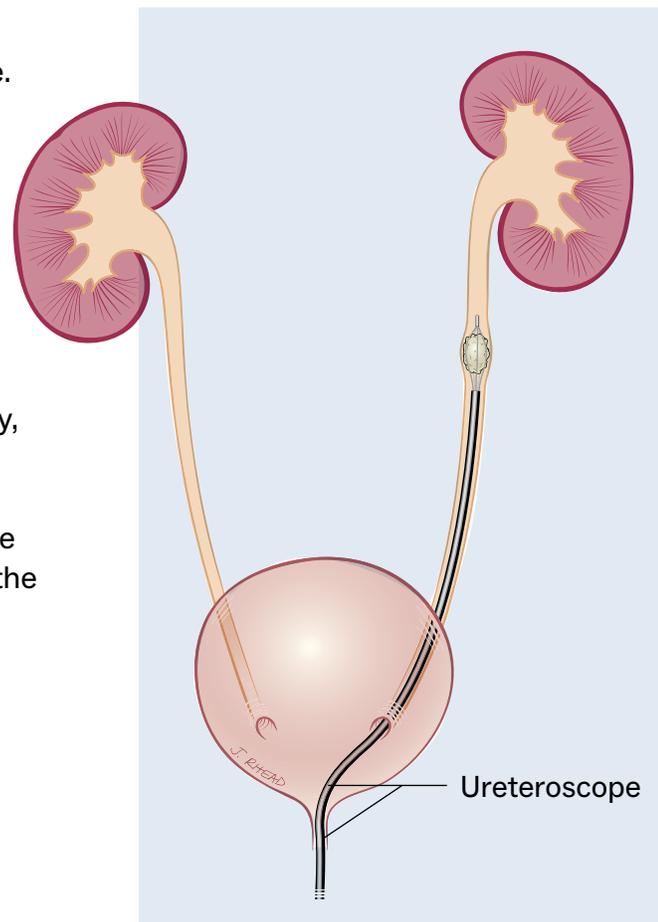
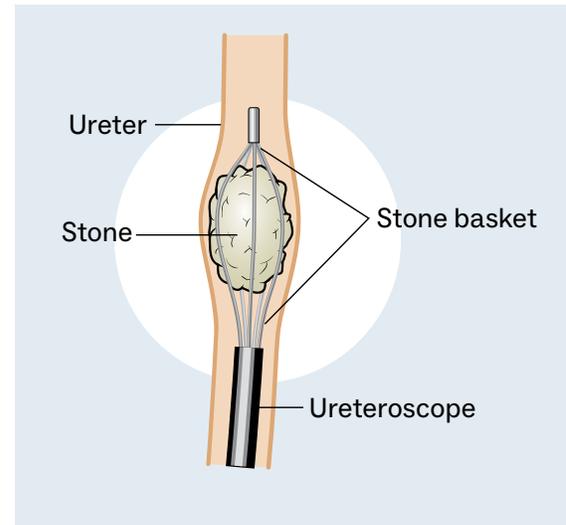
Ureteroscopy

Ureteroscopy [yur-eh-ter-OSS-kuh-pee] involves moving a catheter up through your bladder and ureter to find and remove the stone.

What happens during ureteroscopy?

- 1 General anesthesia.** You'll have medication to help you sleep through the surgery so you won't feel it or remember it.
- 2 Inserting a scope and finding the stone.** Your doctor will insert a catheter (a tiny tube with a camera called a ureteroscope) into your urethra, up through your bladder, and then up the ureter to find the stone.
- 3 Removing the stone.** Some stones can be taken out using a tiny snare or "basket" passed through the scope. Other stones will need to be broken up, using a special stone laser attached to the scope, before they can be removed using the basket.
- 4 Inserting a stent.** A stent (tube) is often placed inside the ureter. The stent is temporary and will need to come out several weeks later. See page 9 to learn more about stents.

Risks of ureteroscopy include bleeding, infection, or, rarely, injury to the ureter. Sometimes the ureter is very narrow and will not allow the small scope to move up to the level of the stone. In these cases, you may need a stent in place for 1 to 2 weeks to dilate (widen) the ureter before trying the ureteroscopy again. Once the ureter is wider, it is usually easier to get to the stone.



PCNL

PCNL stands for **percutaneous** [per-cue-TANE-ee-ous] **nephrolithotomy** [neff-roh-lith-AH-tuh-mee], a surgery that removes the stone directly from the kidney. For a large stone (10 mm to 20 mm or more), it can be faster and easier if the surgeon goes directly from your back into the kidney to take out the stone, avoiding the ureter.

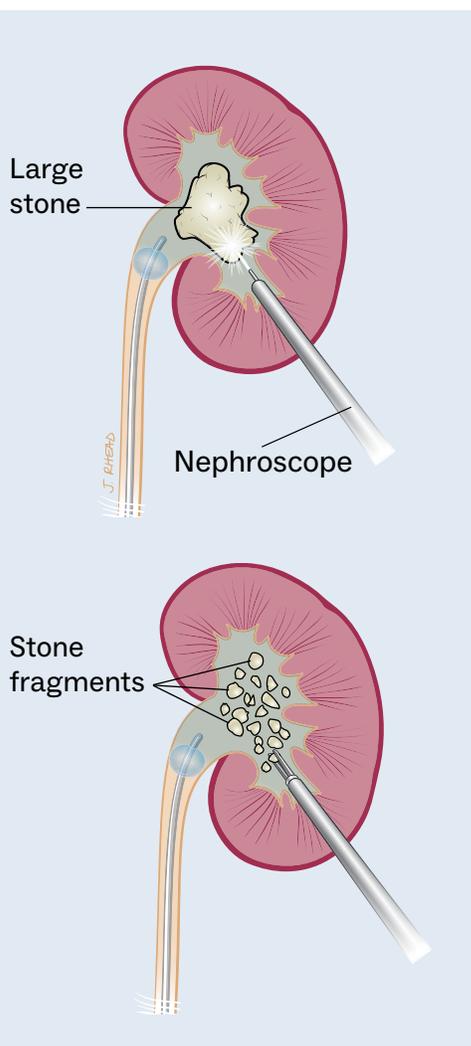
For very large stones (often called “staghorn stones”) that fill the entire hollow part of the kidney, several PCNL procedures might be needed to remove all the pieces of the stone.

What happens during PCNL?

- **General anesthesia.** You’ll have medication to help you sleep through the surgery so you won’t feel it or remember it.
- **Inserting a tube.** Your doctor will make a small incision (cut) in your back and insert a small tube called a **nephroscope** [NEFF-ruh-scope]. Using x-ray guidance, your doctor will put the tube directly into the kidney.
- **Removing the stone.** Using laser or ultrasound, your doctor will break the stone into small pieces. The pieces will be removed through the tube.
- **Inserting a stent.** In some cases, a ureteral stent will be inserted during the surgery (see the page 9 for more information).
- **Short hospital stay.** In most cases, you’ll need to stay in the hospital for a day or two. A tube will be left in the kidney. The tube runs directly out of the skin to your back or side and drains the kidney until the urine clears and the swelling goes down.

PCNL can cause complications in rare cases. These include:

- Rarely, tearing of the kidney that can cause bleeding or urine leaking around the kidney.
- Rarely, bleeding from the hole in the kidney that can’t be controlled. This requires another procedure to place a small clot in the artery, using x-ray guidance.
- Very rarely, injury to the intestine, liver, or spleen.



About ureteral stents

A ureteral stent is a tiny, hollow tube that runs from the kidney to the bladder and stays in place for several weeks after a kidney stone procedure. A stent helps you in 3 important ways:

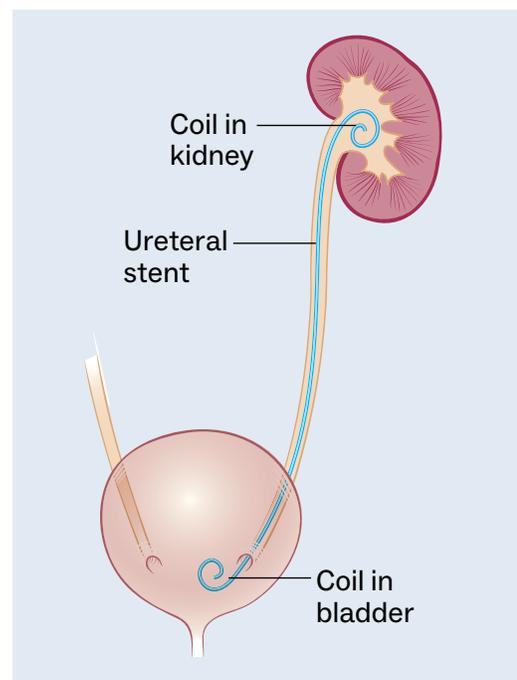
- **It holds your ureter open.** Your ureter has some normal swelling after a kidney stone procedure. The stent keeps this swelling from blocking the ureter.
- **It prevents severe pain after a procedure.** If your ureter is swollen shut, you can have severe stone-like pain for 3 to 7 days. With a stent, urine flows freely and you don't experience this pain.
- **It can widen the ureter** so small stone fragments pass more easily.

A stent also causes its own temporary difficulties. Be sure to ask your doctor what to expect. Some common questions are answered below.

Why does urination hurt while I have the stent?

While you have the stent, you can expect pain in your bladder, urethra, and kidney when you urinate. Why? The stent temporarily changes the way the bladder, ureter, and kidney work together.

- **Normally:** The ureter has a one-way valve where it enters the bladder. When the bladder squeezes to during urination, the valve keeps the urine from flowing back into the ureter and kidney.
- **With a stent:** The stent is a hollow tube that extends through your ureter and into the bladder, and temporarily keeps the one-way valve from closing. This means that when your bladder squeezes as you urinate, some of the urine flows back up the ureter and presses on the kidney. This causes pain while you urinate.



Taking prescription pills wisely

Follow these steps:

- Tell your doctor about ALL the medications you take. This includes prescriptions, over-the-counter remedies, patches, inhalers, vitamins, and herbal supplements.
- Follow the directions exactly. Don't change your dose without talking to your doctor.
- Don't drink alcohol of any kind.
- Talk to your doctor before you take sleep aids, anti-anxiety medication, or other pain relievers.
- Keep track of your pills and don't share them with others. Lock them up where they are safe.
- Get rid of unused pills. "Extra" pain pills can be dangerous to children or a target for thieves. Don't just toss them in the trash. Ask your pharmacist for directions on how to safely dispose of them.

What else can happen with a stent?

A stent typically causes two other symptoms:

- **Feeling like you have to "go" all the time:** The end of the stent sits near the opening of the bladder and stimulates the area that tells your brain you have to urinate. The result is that even when your bladder is empty, it may still feel full.
- **Blood in your urine.** Expect to see blood in your urine until the stent is removed. This can come and go; some days the urine will be clear and the next day it may be bloody.

These symptoms, along with pain while you urinate, are normal so don't be alarmed when you see them. These symptoms don't mean anything is wrong. And keep in mind that having a stent is worth the difficulty.

When can it come out?

Stents usually stay in for a few weeks, depending on the procedure you had. With some operations, the stent will stay in place for 6 weeks afterward. Your surgeon will give you the details.

How is it removed?

To remove most stents, a soft, flexible scope (about the size of a urine catheter) is sent up the urethra to the bladder. A grasper on the scope catches the stent and pulls it out through the urethra.

The urologist will put numbing jelly inside the urethra before inserting the scope. You may feel some burning as the scope moves past certain parts of the urethra, but the procedure lasts just a few minutes. Pulling the stent feels a bit like pulling out a bladder catheter.

Sometimes a short string is attached to the stent and hangs out of the urethra. In these cases, the stent is removed by pulling the string.

Can I Make Passing a Stone Any Easier?

While you wait for a stone to pass (or for stone fragments to pass after a procedure) you can take steps to manage the pain, care for yourself, and help make the process go better.

Managing the pain

The pain of passing a stone, or living with a temporary stent, can't be removed entirely, but there are several ways you can manage and control it:

- **Pain medication.** Your doctor might suggest over-the-counter medication such as **acetaminophen** [ah-seat-uh-MIN-oh-fen] (Tylenol) to ease the pain. Or, your doctor might prescribe pain medication for you to take while you're passing the stone. See the information at left on how to safely take prescription pain medication.
- **Focus techniques.** When the pain surges, it can help to focus specifically on something else. This doesn't make the pain go away, but focusing your attention elsewhere can distract you. Try these tricks:
 - **Breath focus.** Count to 4 each time you inhale and exhale. Focus on your breath coming in and going out.
 - **Meditation.** Clear your mind while you focus on a specific word, phrase, or mental image. There are books and CDs that give instructions on how to do this.
 - **Distraction.** Focus intensely on a spot in the room, a mental puzzle, a movie, or music.
- **Warmth.** For some people using a hot water bottle or heating pad, or taking a hot shower or bath, can ease the pain somewhat.
- **Acute pain treatment.** If the pain is unbearable and no other pain management strategy helps, your doctor might admit you to the hospital to have stronger pain medication through an IV (intravenous) line.
- **Family or friends.** When you're in a lot of pain, the people around you often worry and want to help. Let them listen, take over some of your daily responsibilities, or help in some other way.





Other steps to take

Follow these helpful steps during and after passing a stone:

- **Drink plenty of fluids.** Extra fluid can help flush the stone out in your urine. Water, coffee, soda, sports drinks, and juice all help!
- **Take other medications as directed.** Your doctor might prescribe medication to relax the ureter and encourage the stone to pass. If you have an infection, you might be prescribed antibiotics.
- **Capture the stones.** Your doctor might give you a strainer to urinate over, or you can urinate into a cup or jar and strain stones out of your urine using a strainer or coffee filter. Allow the stones to dry and store them in a container to take to your doctor. Analyzing the stones can help your doctor know how to prevent future stones.
- **If your doctor asks, collect your urine.** Your doctor might want you to collect your urine for 24 hours after passing the stone. Analyzing the urine can show the type and cause of the stone. Other steps to take

What about home remedies?

The pain of passing a kidney stone is so intense that many home remedies have been suggested. Friends, family members, and colleagues will probably give you ideas, and you can find dozens of treatments and remedies that claim to dissolve kidney stones or cure the condition online.

Most of these home remedies don't have any research to support them, but you may want to do something—anything—to feel you're taking control and making the stone pass faster. If you decide to try a home remedy, keep these guidelines in mind:

- **Be wary of expensive “miracle cures.”** If a product or remedy seems too good to be true, it probably is. Most stones can't be dissolved by taking medications or special drinks. Don't waste your money.
- **Use common sense.** Don't try anything that could be dangerous. If you wouldn't recommend that a loved one do it, don't try it yourself.
- **Don't go it alone.** Let your doctor know what you're doing, especially if you plan to drink, eat, or take something as part of the solution. The information can be useful if you have complications and your doctor needs to help.

Can My Doctor Help Prevent Another Stone?

Once you've had a kidney stone, you have a good chance of getting another one. In fact, you have a 50% chance of getting another stone in the next 10 years. Fortunately, you take steps to prevent them.

How do you prevent kidney stones?

The answer is more complicated than you would think. You might get a lot of advice from family, friends, and colleagues who readily share their ideas, but you can't always count on these tips.

For example, one common piece of advice is to take calcium out of your diet, but the answer isn't that simple. For patients with a risk of osteoporosis, it can be the wrong thing to do. Some patients may need to increase the calcium in their diet or take a calcium supplement to prevent kidney stones, while others need to decrease their calcium. The cause of kidney stones for you may be completely different than for another patient.

The key to prevention is a workup — a set of tests — to figure out why you are making kidney stones. The workup is simple and painless, and has 3 basic steps.

- 1 Identifying the stone.** To prevent more kidney stones, it's necessary to know what kind of stones you make. Most people make calcium stones, but there are different kinds of calcium stones. In fact, your body can produce about 16 different types of kidney stones.
- 2 The first step is analyzing the stone.** For your stone to be analyzed, you'll need to capture it when you urinate (unless your doctor took it out during a procedure). Your doctor will give you a strainer to urinate in, or you can urinate into a cup and filter your urine. Your doctor will send the stone to a lab to determine the chemicals in the stones.
- 3 Identifying the cause.** There are at least 24 different reasons why the body might make kidney stones. So the next step is figuring out the exact reason why your kidneys are making them. About 90% of the time, the reason you're getting kidney stones can be shown by doing one or more of the tests on the next page.

Your risk of more stones

Unfortunately, after your first stone, you have a strong risk of developing another one.

Years after your first stone	Your risk of another stone
1 year	10% to 15%
5 years	35% to 40%
10 years	About 50%

Which type of stone do you make?

The body can make about 16 different types. To prevent more stones, it's important to know what type **you** make.

- Calcium oxalate monohydrate 
- Calcium oxalate dihydrate 
- Cystine 
- Calcium phosphate 
- Uric acid 
- Struvite 
- Carbonate apatite 
- Magnesium ammonium phosphate 
- Hydroxyapatite 
- Brushite 
- Magnesium hydrogen phosphate 
- Tricalcium phosphate 
- Octacalcium phosphate 
- Matrix 
- Indinavir 
- Ammonium acid urate 



Creating a prevention plan

Knowing the type of kidney stones you make and why, allows your doctor to recommend specific ways to prevent them. You might need to take prescription medication, alter your diet, or make other changes. After you've been following the plan for a while, your urologist will repeat some of the tests to see if the treatment is working to make your kidneys less likely to form another stone.

- **X-ray studies.** X-ray tests such as a CT scan or IVP scan can show whether there is a problem with the way your kidney drains urine into the bladder. A CT scan combines x-ray images to create a detailed picture of your urinary system. With an IVP scan, a special dye is injected into your vein to highlight parts of the urinary system on the x-rays. These tests can uncover:
 - Kidney cysts or growths
 - Blockages in the part of the kidney that connects to the ureter
 - Other structural problems with the kidney, such as your two kidneys being connected at one point (“horseshoe kidney”)
- **Basic urine tests.** Testing a urine sample can show:
 - The acid-base balance (pH level) of your urine
 - Whether you have an infection in your urinary system
- **24-hour urine test.** For this test, you’ll collect all your urine in a special container for 24 hours. Your doctor will give you special instructions. This test can reveal:
 - The amount of materials in your urine that can cause stones, such as calcium, oxalate, uric acid, sodium, and phosphate
 - The amount of citrate in your urine (citrate can help prevent stones)
 - How much urine you typically produce in a day
 - The acid-base balance (pH level) of a full day’s urine
- **Blood tests.** Testing a blood sample can show problems such as:
 - Too much calcium in your blood
 - Problems with your parathyroid glands which make a hormone that causes you to have too much calcium in your blood
 - Problems with your thyroid gland
 - Problems with your kidneys

General Prevention Guidelines

Along with a specific workup and prevention plan (see pages 10 and 11), there are 4 basic prevention steps you can try. While these aren't guaranteed to work for everyone, in most cases they can help make kidney stones less likely.

- 1 Drink more fluid.** Unless you have poorly functioning kidneys, you should drink enough fluid to make 2 liters of urine each day. How much do you have to drink? It depends on your situation (see the box at the right). If you're drinking enough, your urine will be clear or pale yellow. If it's dark yellow, it means your urine is very concentrated, so calcium and other crystals will be more likely to form and grow another kidney stone.
- 2 Eat less protein.** Extra protein can cause you to make kidney stones. And most Americans eat more protein than they need. The recommended daily allowance of protein for the average adult is just 0.4 grams of protein per pound of body weight. This means a 200-pound man needs only 80 grams of protein a day. Extra protein is converted to fat and changes urine conditions so kidney stones are more likely.
- 3 Cut the salt.** For a normal adult, the maximum recommended daily amount of sodium is 2400 mg. The average American consumes almost twice the recommended amount, and 5 times more than the body needs for survival. Sodium causes your urine calcium to increase, making you more likely to have a kidney stone.
- 4 Start by eating your food without any added salt.** In most cases, you're already getting more sodium than you need, since many prepared, canned, or frozen foods contain salt already.
- 5 Take in more citrate.** Citrate is a chemical that inhibits the production of kidney stones. The more you have in your urine, the less chance you have of getting a stone. Citrate is naturally found in lemons, oranges, and grapefruit — so put more of these into your diet and drink more juice from these fruits. Your urologist can also prescribe a citrate supplement.

How much do I need to drink to make 2 liters per day?

How much you have to drink each day depends on your job and day-to-day activities.

If you work outside in the heat, you might need to drink gallons of fluid.

If you work in an office, you can drink less and still make 2 liters of urine.

As your activities change, your fluid needs change. You may work indoors but have fun outside on the weekend, when you'll need more fluid. On a hike or at the lake, drink more.

Check your protein

To figure the grams of protein you need, multiply your weight by 0.4.

For example:

150 lbs x .4 = 60 grams daily

175 lbs x .4 = 70 grams daily

200 lbs x .4 = 80 grams daily

Examples of protein in foods:

Food	Protein
Hamburger (¼ lb.)	28 grams
Steak (6 oz.)	42 grams
Fish (3 oz.)	22 grams
Chicken breast	30 grams
Egg (large)	6 grams
Yogurt (1 cup)	8 to 12 grams

To find this booklet and other patient education, go to:
intermountainhealth.org



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