

# Treatment for stones

Dr. Roland I. Sing  
Urologist  
Orillia, ON, Canada

Dr. Rajiv K. Singal  
Urologist  
Lecturer, Department of Surgery, University of Toronto, Toronto East General Hospital Toronto, ON, Canada

Dr. Luc Valiquette  
Urologist  
Professor and Director, Department of Surgery, Université de Montréal, Montréal, QC, Canada

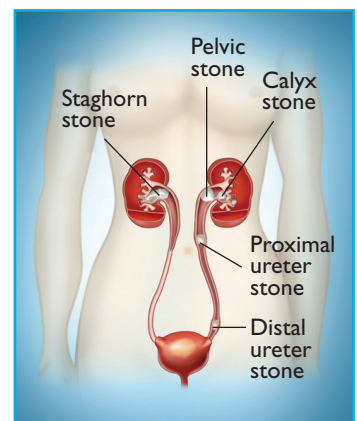
Dr. Naeem Bhojani  
Endourologist  
Université de Montréal, Montréal, QC, Canada

If you have painful kidney stones, it is possible for the stone pass on its own. Specific medications can increase the likelihood of your stone passing. In some cases, surgery or a small procedure may be needed.

The decision to surgically break and/or extract a stone is unique to each patient. In some cases, you may need this surgery. These cases include:

1. If you have uncontrollable pain, nausea and/or vomiting that prevents you from working or from your daily activities. If you are not treated, you will likely often go to the emergency room.
2. If you cannot pass the stone after a period of time (usually between four to eight weeks). Often these stones will be larger than 0.5 cm.
3. If you have signs of a systemic infection (fever, chills, sweats, and/or generalized malaise) secondary to urinary infection and kidney obstruction. You will need urgent care to get rid of the obstruction. If your infection goes untreated, this may be very dangerous.
4. If you have only one functioning kidney. In this case, passing a stone may block the solitary kidney, which may result in kidney failure. You should be closely monitored and may need urgent care.

Beyond these specific cases, treatment is also tailored based on other factors, such as: stone factors (size, number and type), patient factors (underlying health, body size/shape, internal anatomy), and factors relating to the medical expertise and resources that are locally available (Figure 1). Your doctor will carefully assess your situation.



**Figure 1.** Anatomy of the urinary tract and various possible stone obstruction sites.

## How did we treat stones in the past?

Before 1980, open surgery through a large incision was used to treat stones in the urinary tract. Since then, it has been virtually abandoned because of minimally invasive techniques that have reduced complications and recovery time.

Currently there are three established options that can be used to treat kidney stones:

- (1) extracorporeal shock wave lithotripsy (ESWL)
- (2) ureteroscopy (URS)
- (3) percutaneous nephrolithotomy (PCNL)

## Getting emergency treatment for stones

Urgent care may be needed if a kidney is blocked and there is an infection that has gone into the blood stream. In these situations, doctors may need to bypass the obstruction without immediately removing the stone. The safer option is to deal with the potentially life-threatening situation first by inserting a ureteral stent or by inserting a nephrostomy tube through the skin (for example through the skin in the back). These tubes are left in place temporarily to relieve the blockage until a procedure to remove the stone can be planned.

Once your serious situation (like draining a blocked, infected kidney) is managed, the stone can be treated. If there is no infection or renal failure, these temporizing measures are not necessary.

Now let's talk about the three treatments:

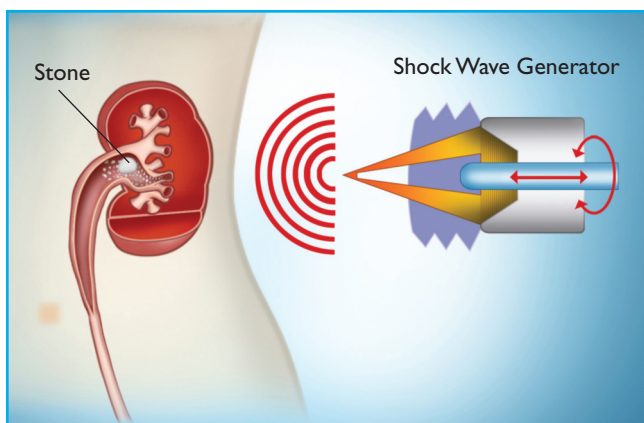
### I. Extra-corporeal shock wave lithotripsy (ESWL)

This is the least invasive treatment. It has the unique ability to break stones from outside the body. The first ESWL treatment in North America was performed in 1984.

ESWL uses a machine as seen in Figure 2 to generate shock waves that are targeted on the offending stones by X-ray or ultrasound. In ESWL, you lie on a machine and the waves move from the machine through you. The targeted stone is repeatedly struck by multiple shock waves and is ultimately broken into smaller pieces (Figure 3). These smaller pieces should pass painlessly spontaneously through you.



**Figure 2.** Typical ESWL setup.



**Figure 3.** Mechanism of ESWL.

ESWL can be performed as an outpatient procedure (you go home the same day and do not need to spend the night in hospital).

ESWL is not as effective when stones are very hard, located in the lower portion of the kidney (lower pole), when there are many stones or when they are large (greater than 1.5–2 cm). Clearing the passage for your stone is much more difficult in these cases.

### What can I expect with ESWL?

Most ESWL treatments are conducted using a light anesthetic. You are lying on your back on the machine. With an x-ray or ultrasound, your stone is located and your doctor can directly send shockwaves to the stone. This will be loud. Once your urologist thinks the stone is broken up, then the procedure is complete. You will be allowed to leave the hospital once the anesthetic has worn off.

When you get home, you may see some blood in your urine and you may have back pain or flank pain (pain in one side of the body between the upper abdomen and the back). These are typical symptoms that will go away within a few hours, but may last up to a few days after the procedure. Follow-up with your doctor to make sure the stone has broken up and passed.

### What are potential complications?

Although uncommon, some complications do exist.

One of the main complications is the failure to pass the stone pieces which can cause ongoing blockage. You may need another procedure to relieve or bypass the obstruction.

## 2. Ureteroscopy

Ureteroscopy is common when stones become lodged in the ureter. Stones of all sizes that are unable to pass spontaneously and those larger than 1 cm in size are treated this way.

With a ureteroscopy, a fiberoptic endoscope is placed into the ureter (Figure 4). This device can be rigid or flexible. The instrument is inserted into the bladder through the urethra (urinary passageway) and then into the ureter. The ureter is a thin muscular tube that connects the kidney and bladder and allows the flow of urine. Once the ureteroscope is in the ureter, your surgeon can identify the stone and manipulate or remove it.

Smaller stones may be removed with a basket or grasping device. Alternatively, larger and more difficult stones can be broken into pieces before extraction. This is usually done using laser energy delivered to the stone by a fibre passed through the ureteroscope. Mechanical or ultrasonic energy can be used to break up the stone.

Sometimes if the fragmented stones are small enough, the urologist may not extract them and instead allow them to pass spontaneously.

A stent (or Double J stent, see Figure 5) is often placed after the procedure to either facilitate the passage of small stones or to let the tissue heal correctly. Stents cannot be left permanently and are later removed anywhere from days to weeks after ureteroscopy. Stents can be removed with or without additional procedures, depending on the kind of stent used. Your stent should be removed or else it can cause kidney damage.

Stones located in the kidney can also be treated with ureteroscopy. In this scenario, the surgeon will opt to use a flexible instrument, which is longer and has a deflectable tip to deal with the internal contours of the kidney (Figure 6). Similar to a rigid ureteroscopy, you may also need stenting.

### What can I expect with ureteroscopy?

You will be given a general or regional anesthetic (for example a spinal anesthetic) for this procedure. You will likely also need an antibiotic before the procedure. This procedure is usually done on an outpatient basis – you will be sent home the same day and will not need to spend the night in the hospital.

Aside from being a little tired from the procedure and the anesthetic, you may have blood in your urine or some pain on urination, as well as feeling the urgent and frequent need to go to the bathroom. You may have some flank pain but this will be relieved with painkillers. Your symptoms will usually go away within a few days or when the stent is removed.

### What are potential complications?

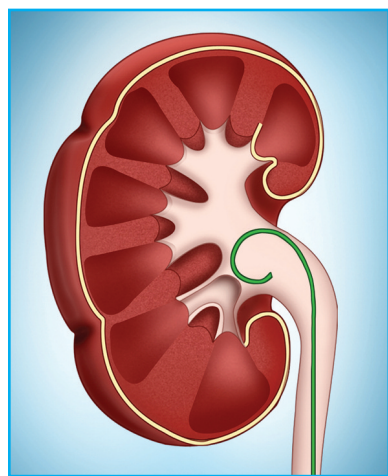


Figure 5. Ureteral stent.

Ureteroscopy is very safe and widely done throughout the world. It can even be performed on most patients taking blood thinners and in very select patients during pregnancy; nevertheless, there can be complications.

Apart from general complications from the anesthetic, some degree of blood in the urine is not uncommon for a few days. If you develop chills and/or fever, you may have a urinary tract infection. Very rarely, you may have an injury to the ureter with resulting scar tissue (or stricture). Strictures block drainage of the kidney and typically require further surgery to correct the scar tissue and maintain kidney drainage. An even more rare complication is a large tear in the ureter during ureteroscopy which would require further surgery to repair the tear or even to remove the kidney.

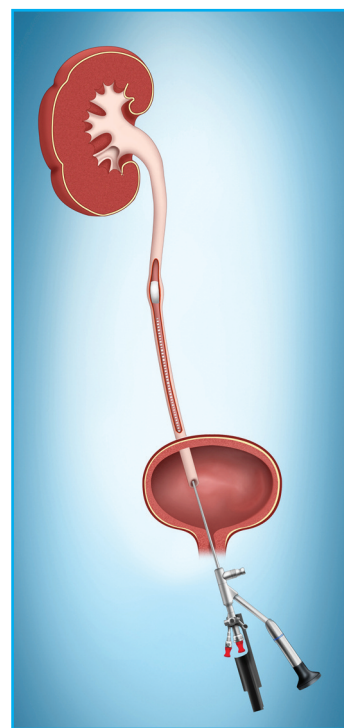


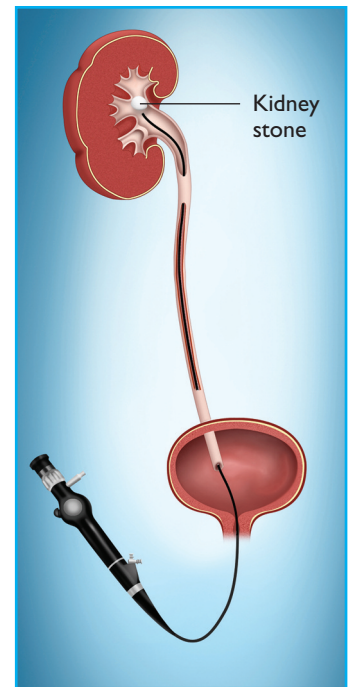
Figure 4. Rigid ureteroscopy.

### 3. Percutaneous nephrolithotomy (PCNL)

This procedure is often used to treat larger stones (great than 1.5-2 cm) in the kidney. It may also be an alternative for a stone in the upper ureter that is quite large and difficult to access from below with other techniques. This will occasionally happen if the stone has been lodged for a long time. This procedure can also be used if previous ESWL and/or ureteroscopy were unsuccessful.

In this procedure, you are placed onto your abdomen with your back exposed to the surgeon. Using an X-ray, the doctor will insert a small hollow needle through the back into the kidney. Once the kidney is accessed with this needle, a guide wire is passed through the needle into the kidney.

This guide wire acts as a railroad track to pass devices along, allowing for stone access and extraction (Figure 7). Your surgeon can then see the stone or stones using a telescope and can pass instruments through it to remove the stone(s). In many cases the stone material must first be broken into smaller pieces. This fragmentation can be done using lasers, ultrasound or compressed air that crushes the stone. Once the stone is removed, the surgeon will often leave a drainage tube (nephrostomy tube) that would exit your back. Occasionally, you will not need the tube if the PCNL was simple and straightforward.

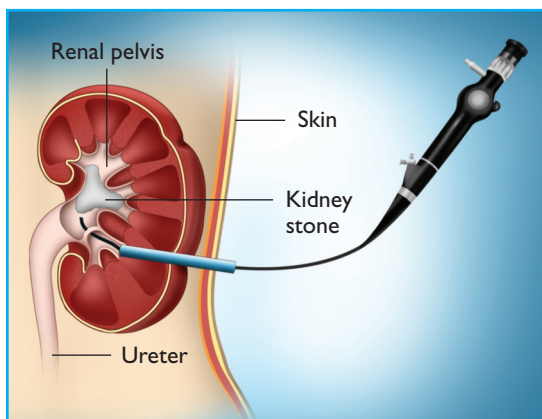


**Figure 6.** Flexible ureteroscopy.

#### What can I expect with PCNL?

Antibiotics are given before the procedure.

A PCNL is usually done with a general anesthetic (you will be asleep during the procedure). Also, you will have to stay overnight at the hospital after surgery. Occasionally, you may be sent home the same day.



**Figure 7.** A small hollow tube (working sheath) is passed over a balloon or rigid dilator and will give direct access to the interior of the kidney.

To make sure your kidney is free of stones, your surgeon may do some type of X-ray while injecting dye through the external drainage tube or a CT scan the next day. If there are stones leftover, you will need a second procedure to remove the remaining stones. If you have really large stones or stones that are branching out into other areas, your doctor will have to access your kidney in different areas or you may need a multiple staged procedure. This is more challenging and can often be anticipated in advance and discussed with your surgeon.

When you are discharged, you may see a little blood in your urine or feel the urgent and frequent need to go to the bathroom. You may also have a bit of fluid draining through the incision made in your back. This will dry up and stop over the next week. A stent, if present, will be left for one to two weeks. Tell your surgeon if you develop any fever, shortness of breath or excessive blood loss in the urine.

### What are potential complications?

Your kidneys store a lot of blood so one of the complications may be bleeding. In most cases, the bleeding will stop within the first 24–48 hours. Very rarely will a patient bleed for days or even weeks or have blood and/or blood clots in the urine. The chance of needing a blood transfusion is 3–5%.

If the bleeding does not stop, you will need more interventions to correct it. This requires a procedure through a needle and wires through an artery in the groin to stop the bleeding in the kidney (embolization).

The other significant complications are related to organs next to the kidney. Rarely, the lung, lung space, spleen, liver and bowel are injured during percutaneous access or from the actual procedure.

When **not** to have a PCNL

- If you have a urinary tract infection
- If you have a blood clotting problem
- If you are on blood thinners
- If you are pregnant

## Laparoscopy for stone removal

Laparoscopy is a minimally invasive technique. Doctors use this to access organs within the abdominal cavity using specialized ports (or holes) that are inserted into the abdominal wall, thus avoiding a large cut.

Cameras and other instruments can be inserted through these ports to carry out a number of operations. The latest evolution in this field is using a robot to manipulate these instruments. Laparoscopic procedures mimic the open procedures that they have replaced with the benefits of faster patient recovery. Very rarely will laparoscopy be required to remove a stone. ESWL, ureteroscopy and percutaneous nephrolithotomy alone or in combination are usually effective.

Laparoscopy may be used to treat large kidney stones when there is an associated narrowing or kink where the ureter leaves the kidney. This is known as uretero pelvic junction obstruction (UPJO). The stone can be removed and the narrowing corrected at the same time.

## Nephrectomy

A nephrectomy is a surgical procedure to remove the kidney. Thankfully, it is rarely needed if you have kidney stones.

You may need a nephrectomy if your kidney loses its function as a result of significant long-term obstruction from a stone. In these cases, the delay in getting a diagnosis and treatment is caused by the fact that the patient had no symptoms. A nephrectomy would only be considered if your kidney does not recover its function. Even in this situation, your surgeon may simply choose to avoid a nephrectomy and follow you closely to make sure you have no infection, bleeding or pain.

## The Evolution in the Surgical Treatment of Kidney Stones

Treating kidney stones has undergone a remarkable transformation over the past 30 years. Thankfully, many stones will pass spontaneously and require no treatment. If you need treatment, you have many options.

If you had stones 30 years ago, you would have had days of pain and suffering, with the only treatment choice being a large incision and often weeks of recovery. Now, your treatment is minimally invasive and can be done in a day without a hospital stay. You can expect to fully recover and return to work within days.