



**The American Urological Association  
Ureteral Stones Clinical Guidelines Panel**

# **The Management of Ureteral Stones**

**A Doctor's Guide for Patients**

## **Ureteral Stones Clinical Guidelines Panel**

### **Members:**

Joseph W. Segura, MD, Chair  
Glenn M. Preminger, MD, Facilitator  
Dean G. Assimos, MD  
Stephen P. Dretler, MD  
Robert I. Kahn, MD  
James E. Lingeman, MD  
Joseph N. Macaluso, Jr., MD

### **Consultants:**

Hanan S. Bell, PhD  
Patrick M. Florer  
Curtis Colby

## *Foreword*

Ureteral stones have been causing people pain since very early times. Today there are a number of effective treatment choices for the ureteral stones patient.

This guide provides you with information answering three basic questions: What are ureteral stones? What are the choices for treating them? What are the likely benefits and risks of each treatment choice? We present this information to further your general understanding of ureteral stones and current treatments and to assist in discussing this information with your doctor.

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## What are ureteral stones?

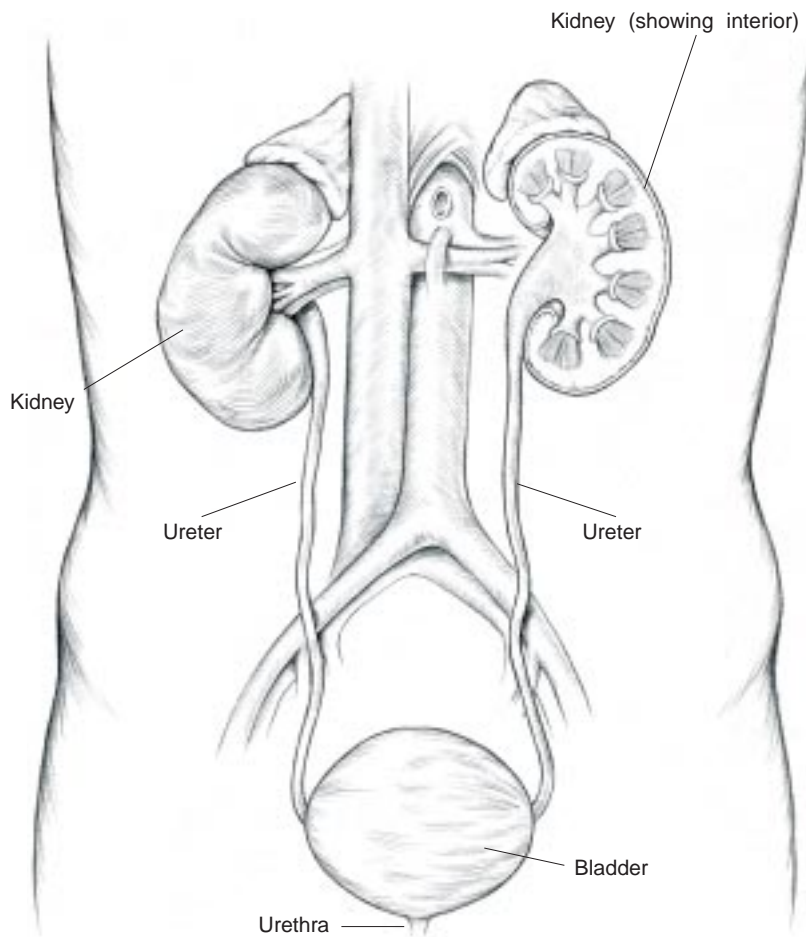
A ureteral stone is a kidney stone that has moved down into the ureter. The stone begins as a tiny grain of solid matter deposited where urine collects in the kidney. When the urine flows out of the kidney, the grain of undissolved material is left behind. The material deposited is usually a mineral called calcium oxalate. Other less common materials that may go into forming a kidney stone are cystine, calcium phosphate, uric acid and struvite.

Over time, more undissolved material is deposited and the stone becomes larger. Some kidney stones remain in place, continuing to grow

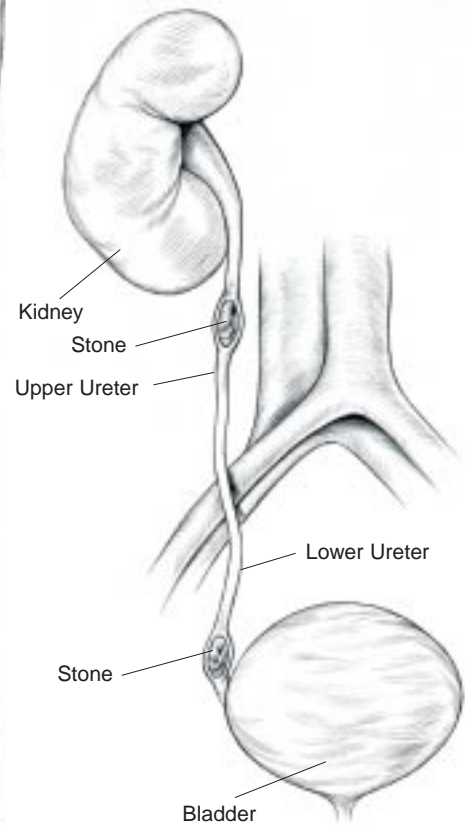
larger. Some stones are carried by urine to other parts of the kidney. The majority of stones are eventually carried out of the kidney into the ureter.

Most stones enter the ureter when they are still small enough to move down into the bladder. From there, they pass out of the body with urination. Some stones, however, have grown larger by the time they leave the kidney. They may become lodged in a narrow part of the ureter (see Figure 2), causing pain and possibly blocking the flow of urine. These stones may need to be treated.

### The urinary tract



**Figure 1.** The urinary tract is the body's urine removal system. The above illustration shows the major organs that make up this system: the kidneys, ureters, bladder and urethra. Kidneys produce the urine. They filter out waste materials from the blood and dissolve them in water. The fluid that results is urine. Ureters transport the urine from the kidneys to the bladder, where it is stored until discharged through the urethra during urination.



**Figure 2.** Close-up of a ureter—showing division into upper and lower ureter with a stone lodged in each section.

## How are ureteral stones diagnosed?

Stones that lodge in a ureter do not necessarily cause symptoms. A stone may remain in a ureter for as long as a year with no noticeable symptoms. Such a stone may become symptomatic at some point, it may be revealed in an x-ray taken for some other reason or it may eventually pass through the urinary tract and out the urethra undetected.

In most cases, however, a stone large enough to lodge in a ureter becomes apparent fairly quickly. The usual first symptom is severe pain,

prompting the person to seek medical help immediately. There may also be blood in the urine.

The doctor will use diagnostic imaging to confirm that a stone is causing the patient's symptoms. The imaging will include x-rays and possibly a sonogram (the image produced by ultrasound). These images will not only show the stone's location, but help the doctor determine its size and shape. Blood and urine samples will be analyzed for signs of infection and to help identify the stone's chemical composition.

## What are the choices for treating ureteral stones?

There are several treatments for ureteral stones. One approach is **observation**—waiting for the stone to pass out by itself without active treatment to remove it (spontaneous passage). The waiting period could last for several weeks or months. Medications may be used to relieve any pain that occurs during this time. The patient is asked to drink a lot of water (as much as three quarts a day) to produce more urine to help move the stone through the ureter.

The stone's size is a major consideration in deciding whether to wait for spontaneous passage or to actively remove the stone. For a stone less than half a centimeter wide (about three-sixteenths of an inch), observation may be a good choice. Other factors to consider include the amount of pain the stone is causing and whether the stone is blocking the flow of urine.

For active treatment to remove ureteral stones, there are four treatment choices: **extracorporeal shock wave lithotripsy, ureteroscopy, percutaneous nephrolithotomy and open surgery.**

### Extracorporeal shock wave lithotripsy

Shock wave treatment uses a machine called a lithotripter. The method is called extracorporeal shock wave lithotripsy (SWL). Lithotripsy fragments a stone into pieces small enough to pass out with urination. "Extracorporeal" means the shock waves come from outside the body.

For treatment with SWL, the patient is placed in a tub of water or against a water-filled cushion or mattress. A lithotripter makes shock waves, and

the doctor, using ultrasound, focuses the waves exactly on the ureteral stone inside the patient's body. They travel easily through both the water and the patient's soft body tissues, until they hit the stone. The impact causes stress on the stone. Repeated shock waves cause more stress, until the stone eventually crumbles into small pieces (see Figure 3).

Because of possible discomfort during the procedure, the patient may need general, regional or local anesthesia or some form of sedation. Also, a tube called a stent may be inserted through the urethra and bladder and into the ureter. The stent

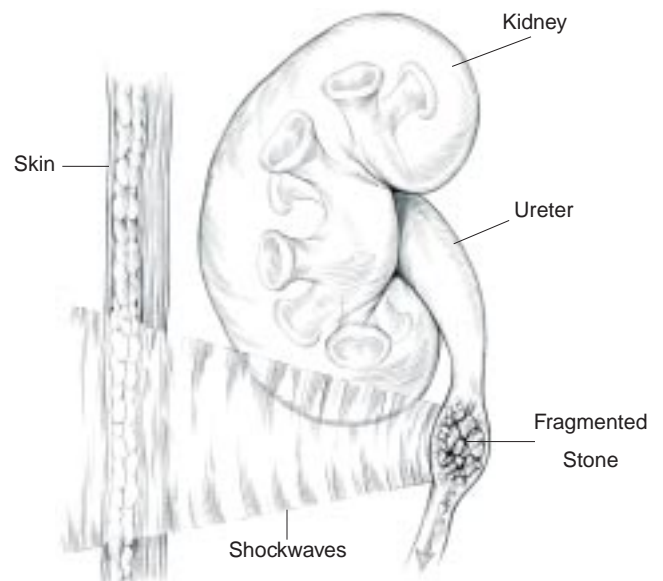


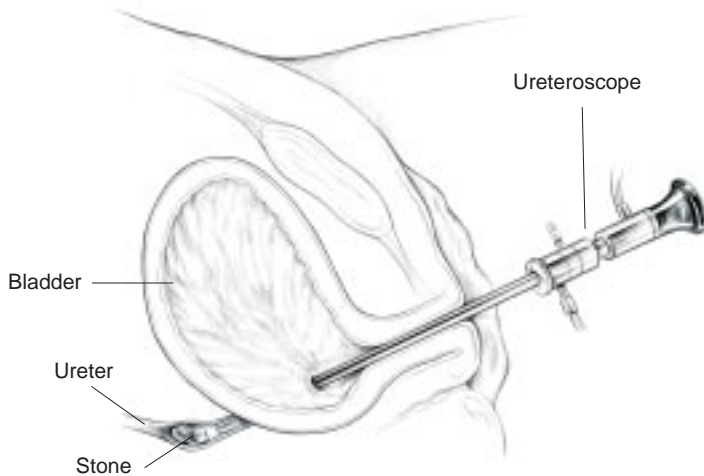
Figure 3. Close-up of shock waves fragmenting a stone in the ureter.

may assist in locating the stone or in helping the fragments pass following treatment.

SWL is the least invasive of the four active treatments and has a short recovery time. Most patients can resume normal activities in a few days. However, one SWL session by itself may not free the ureter of all stone material. A repeat SWL session may be necessary.

## Ureteroscopy

Ureteroscopy (URS) involves the use of ureteroscopes. These are instruments that can be inserted up the urethra, through the bladder and into the ureter without an incision (see Figure 4). Ureteroscopes allow the doctor to view a ureteral stone directly. They also have working channels



**Figure 4.** Ureteroscopy being used, showing the ureteroscope going through the urethra and bladder into the lower ureter while the patient is lying down.

through which various devices can be passed to remove or fragment the stone. Anesthesia is generally used, and a stent is left in the ureter for a few days after treatment while healing takes place.

Ureteroscopy was developed in the 1970s and came into wide use during the 1980s. Before then, a type of treatment called “blind basketing” was often used. A basket-like device was passed—blindly, with no viewing instrument—through the urethra and bladder and into the ureter to pull out the stone.

This type of “blind” treatment risks injury to the ureter and is less effective than other methods used today. In particular, as ureteroscopy has



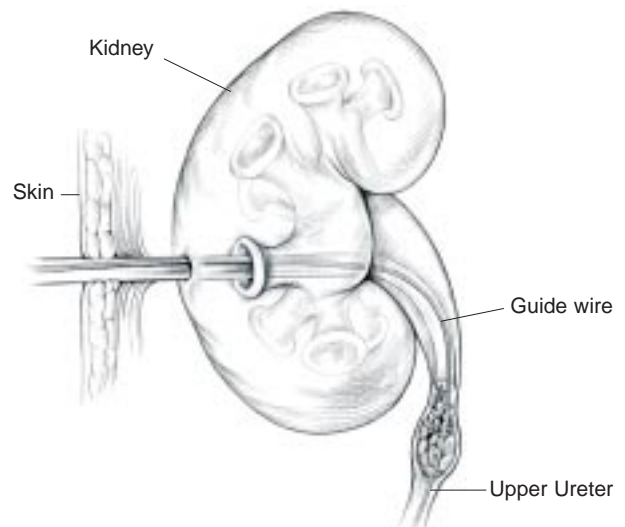
**Figure 5a.** Where the cut is made for a percutaneous nephrolithotomy.

advanced with continual instrument improvements, blind basketing is no longer a satisfactory treatment choice.

## Percutaneous nephrolithotomy

For percutaneous nephrolithotomy (PNL), the doctor makes a small surgical cut in the flank area of the skin. “Percutaneous” means “through the skin.” The cut is about one centimeter in diameter. “Nephrolithotomy” means a surgical cut into the kidney. This cut too is quite small (see Figure 5a).

A thin guide wire is inserted through the skin, then into the kidney and down the ureter (see Figure 5b). This is done with the aid of x-rays to



**Figure 5b.** In percutaneous nephrolithotomy, a tract is created, which allows the physician to insert a device to fragment or extract the stone.

be sure the wire is placed exactly. Except in special cases, PNL is used only for stones in the upper ureter that can be easily approached through the kidney.

Dilators are used to stretch the tissues along the guide wire. They create a “tunnel” path or tract. A viewing instrument about the width of a fountain pen is inserted. This instrument allows the doctor to see the stone and introduce a device to remove it.

The stone may be broken into pieces with high-frequency sound waves (ultrasound), laser light or other means. The doctor takes the pieces out through the dilated tract. All of this is done while the patient is sedated or under anesthesia. A

tube going into the kidney is generally left in place for two or three days. A second PNL may be necessary through the same dilated tract. Once the stone is removed, most patients can resume light activity in one to two weeks.

### Open surgery

In open surgery for ureteral stones, the doctor makes a surgical cut to expose the ureter where the stone is located. Another cut is made in the ureter itself, and the stone is directly removed.

Open surgery is the most invasive treatment. It is usually reserved for complicated, difficult cases. Most patients need about six weeks to recover after the operation.

## What are the likely benefits and risks of each treatment?

Tables 1 and 2 show likely benefits and risks of the four active treatment choices: SWL, URS, PNL and open surgery. For some treatments, benefits and risks may differ depending on whether the stone is located in the upper or lower ureter (see Figure 2 on page 1). Thus, there are two tables—Table 1 for stones in the upper ureter and Table 2 for stones in the lower ureter. The type of information is the same in each table. With this information, the benefits and risks for each treatment can be weighed and the four treatments compared.

Types of treatment outcomes, both beneficial and harmful, are numbered down the left side of each table. Across the top are the four treatment choices. Under each treatment choice, in percentages, are the best-estimated chances for outcomes to occur.

Shown also is the range of uncertainty for the chance of an outcome to occur. For example, with SWL treatment of stones wider than one centimeter in the upper ureter (Table 1), the chances of being completely stone free after treatment could

OUTCOMES	SWL	URS	PNL	Open Surgery
1. Chances of being stone free with stones <b>less than 1 cm. wide</b> (small to medium stones)	84% Range: 83% – 85%	56% Range: 43% – 70%	76% Range: 33% – 98%	99% Range: 96% – 100%
2. Chances of being stone free with stones <b>more than 1 cm. wide</b> (large stones)	72% Range: 68% – 76%	44% Range: 28% – 60%	74% Range: 53% – 89%	71% Range: 23% – 98%
3. Chances of significant acute complications	4% Range: 2% – 7%	11% Range: 5% – 18%	9% Range: 5% – 15%	8% Range: 2% – 19%
4. Chances of unplanned secondary interventions	15% Range: 12% – 19%	27% Range: 22% – 33%	15% Range: 10% – 21%	11% Range: 2% – 28%
5. Chances of long-term complications: ureteral stricture	No data	2% Range: 1% – 4%	8% Range: 3% – 16%	1% Range: 0% – 5%

**Table 2. Estimated outcomes for treatments of ureteral stones in the LOWER ureter**

OUTCOMES	SWL	URS	PNL	Open Surgery
1. Chances of being stone free with stones <b>less than 1 cm. wide</b> (small to medium stones)	85% Range: 84% – 86%	89% Range: 82% – 95%	No data	90% Range: 33% – 100%
2. Chances of being stone free with stones <b>more than 1 cm. wide</b> (large stones)	74% Range: 71% – 77%	73% Range: 63% – 82%	No data	84% Range: 15% – 100%
3. Chances of significant acute complications	4% Range: 2% – 7%	9% Range: 3% – 20%	No data	No data
4. Chances of unplanned secondary interventions	10% Range: 8% – 12%	7% Range: 5% – 10%	No data	18% Range: 4% – 45%
5. Chances of long-term complications: ureteral stricture	No data	1% Range: 0% – 2%	No data	No data

be as low as 68 percent or as high as 76 percent. The best estimate is 72 percent.

Following are explanations and discussions of the treatment outcomes listed in the two tables.

### Chances of being stone free

“Stone free” means that no ureteral stones remain after treatment. This beneficial outcome is the major treatment goal. Estimated chances of being stone free are shown for each of the four treatment choices—depending on where the stone is located and on the size of the stone.

Note, for example, that the chances of being stone free after a single treatment by ureteroscopy (URS) are better for stones located in the lower ureter than for stones in the upper ureter. With all four treatments in both tables, the chances of being stone free are better for smaller stones (width less than one centimeter) than for larger stones.

For observation, or waiting for a stone to pass by itself (see page 2), not enough information was available to calculate estimated chances of spontaneous passage. However, the information that was available indicates that small stones (width less than half a centimeter) located in the lower ureter have the best chance of passing on their own.

### Chances of significant acute complications

Acute complications are unexpected problems that might occur in the short term as a result of treatment. Some may be minor, some quite

severe. Possible significant acute complications include death, loss of kidney and the need for a blood transfusion.

Both death and loss of a kidney are rare in the treatment of ureteral stones. The risk of either occurring is extremely low. The chances of needing a blood transfusion vary depending on the type of treatment. The chances are greater for an invasive treatment like PNL than for a minimally invasive treatment like SWL.

Other possible significant acute complications include ureteral avulsion, visceral injury, sepsis, vascular injury, hydrothorax/pneumothorax, pulmonary embolism and urinoma. See the glossary on page 7 for definitions of each of these complications.

### Chances of unplanned secondary interventions

An unplanned secondary intervention is a second procedure needed because of an unexpected problem with the first procedure. The most common problem in treating ureteral stones is not removing all of the stone the first time, so that a second attempt becomes necessary.

### Chances of long-term complications

Not enough reported information was available to calculate estimated chances of long-term complications other than ureteral stricture. Ureteral stricture is the scarring of tissue in the ureter, which can narrow the channel.

## Questions to ask the doctor

- In what part of the ureter is my stone located? About how large is my stone?
- What treatment choices do I have for my stone?
- How much experience do you have using these techniques?
- What are your results with these procedures?
- What treatment or treatments do you believe I should undergo?
- What is the likelihood that I will be completely stone free after treatment?
- How many different treatments will I need to be stone free?
- How many times will I need to be treated?
- What is the risk of complications? What kinds of complications are likely?  
How are these complications treated?
- How much will the treatment or treatments for my stone cost?
- How much time will I need after treatment before I can resume my normal activities?

Additional questions to ask the doctor:

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- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_



## Glossary

**Acute:** Short-term, relatively severe.

**Anesthesia, general:** Unconsciousness, with muscular relaxation and no pain sensation over entire body, induced by use of an anesthetic agent.

**Anesthesia, local:** Loss of sensation only in one part of the body, induced by use of an anesthetic agent.

**Bladder (urinary):** Balloon-shaped pouch of thin, flexible muscle in which urine is temporarily stored before being discharged through the urethra.

**Dilator:** An instrument to stretch body tissues and enlarge an opening, passage or canal.

**Hydrothorax/pneumothorax:** Collection of fluid (hydro) or air (pneumo) in thoracic (chest) cavity.

**Incision:** Surgical cut for entering the body to perform an operation.

**Invasive:** Involving cutting or puncture of the skin or insertion of instruments into the body.

**Kidney:** One of two body organs, each about four inches long and two inches wide, that filter out waste products from the blood and discharge these waste products in urine.

**Pulmonary embolism:** A condition in which a blood clot (called an embolus) travels through the bloodstream and lodges in an artery of the lung. Most such blood clots can be dissolved within a short time after injection of a medication for that purpose.

**Sedation:** State of calm relaxation induced in one or more body systems by administration of medical agents (sedatives).

**Sepsis:** Presence in blood or other body tissues of harmful bacteria spreading from a focal point of infection.

**Stent:** With regard to treating ureteral stones, a tube inserted through the urethra and bladder and into the ureter. Stents are used to aid treatment in various ways, such as preventing stone fragments from blocking the flow of urine.

**Ureter:** One of two tubes that carry urine from the kidneys to the bladder.

**Ureteral avulsion:** Ripping or tearing of ureteral tissue.

**Ureteral stricture:** The scarring of tissue in the ureter, which can narrow the channel.

**Urethra (female):** A short tube, not quite one and a half inches long, located above the vagina and through which urine flows from the bladder out of the body.

**Urethra (male):** A tube, extending from the bladder to the tip of the penis, through which urine flows from the bladder out of the body.

**Urine:** Fluid excreted by the kidneys, about 96 percent of which is water and the rest waste products.

**Urinoma:** A cyst (sac) containing urine.

**Vascular injury:** An injury having to do with blood vessels.

**Visceral injury:** An injury having to do with large interior body organs (viscera) such as the bladder and intestines.

## *Where to find more information*

American Foundation for Urologic Disease  
1128 N. Charles Street  
Baltimore, MD 21201  
410-468-1800

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National Kidney Foundation  
30 East 33rd Street  
New York, NY 10016  
800-622-9010

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National Kidney and Urologic Diseases  
Information Clearinghouse  
3 Information Way  
Bethesda, MD 20892-3580  
301-654-4415

This publication is intended for patients and lay readers. It is derived from the *Report on the Management of Ureteral Calculi*, developed by the American Urological Association, Inc., and its Ureteral Stones Clinical Guidelines Panel.

*A Doctor's Guide for Patients* is intended to stimulate and facilitate discussion between the patient and doctor regarding the types of treatment described in summary fashion in this booklet. The full Report of the guidelines panel provides the physician with a more detailed discussion of treatment standards, guidelines and options to be considered.

For additional copies, physicians may contact:

American Urological Association, Inc.  
Health Policy Department  
1120 N. Charles Street  
Baltimore, MD 21201  
Phone: 410-223-4367

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