Information for Patients

English

Kidney and ureteral stones

eauPI
Patient Information

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This leaflet contains general information about kidney and ureteral stones. If you have any specific questions about your individual medical situation you should consult your doctor or other professional healthcare provider.

This information was produced by the European Association of Urology (EAU) in collaboration with the EAU Section of Urolithiasis (EULIS), the Urolithiasis Section of the EAU Young Academic Urologists Group, and the European Association of Urology Nurses (EAUN).

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Kidney and ureteral stones

Kidney and ureteral stones are very common, but it is difficult to get an accurate figure for the number of sufferers in Europe. In countries with a high standard of living, kidney and ureteral stones are frequently encountered. This is believed to be due to diet and lifestyle changes.

Kidney or ureteral stones might pass without any discomfort, but patients express the disease as one of the most painful experiences that they know.

What is a stone?

A stone is a hard, solid mass that can form in various organs with a lumen like the gallbladder, bladder, and kidneys. Apart from its location in the body, each stone has a different molecular composition. Stones can happen due to an underlying pathology and they can be treated in different ways.

Kidney and ureteral stones develop in the kidney and either stay there or move to the ureter (Fig. 1).

Kidney stones form when minerals or acid salts in your urine form crystals which later become stones. Most stones leave your body while you urinate. However, sometimes stones get stuck in the ureter, block the normal flow of urine, and cause symptoms. Stones can also be too big to leave the kidney. In both cases, you may need treatment to remove the stone.

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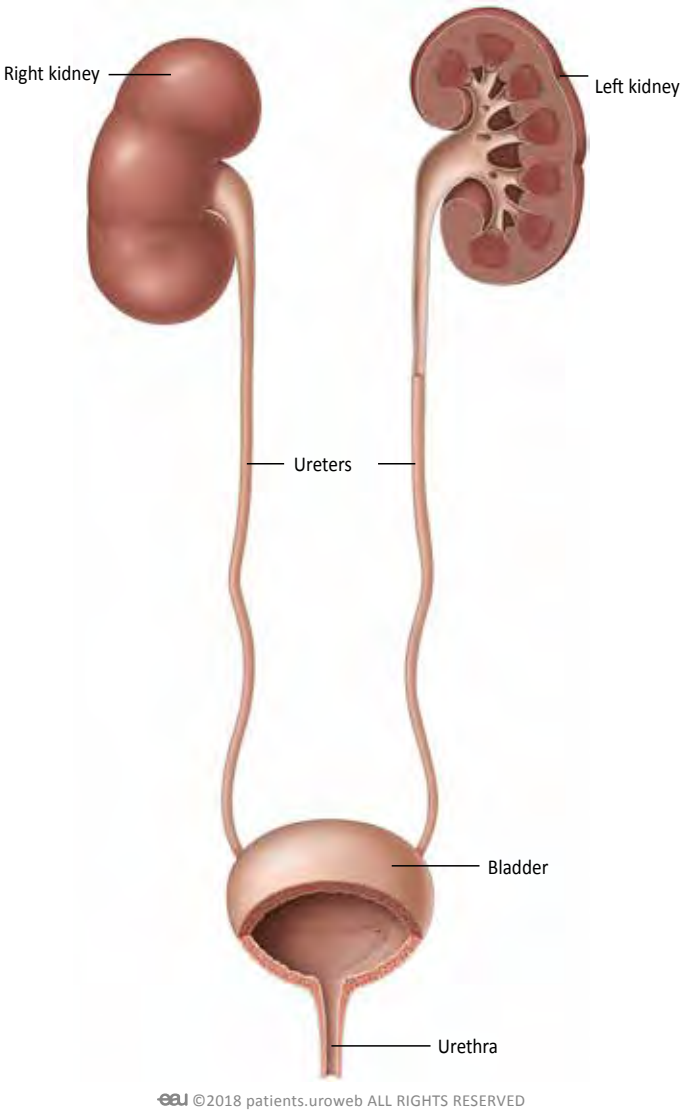

Fig. 1: The urinary tract.

Symptoms of kidney stones

People often associate kidney and ureteral stones with pain. However, symptoms can vary from severe pain to no pain at all, depending on stone characteristics – such as the size, shape, and location of the stone in the urinary tract (Fig. 1).

Severe pain (renal colic)

If the stone blocks the normal urine flow through the ureter you will experience severe pain, known as renal colic. This is a sharp pain in the loin and the flank (the side of your abdomen, from the ribs to the hip) (Fig. 2). If the stone is not in your kidney but in your ureter, you may feel pain in the groin. Men can even have pain in their testicles.

Renal colic is caused by a sudden increase of pressure in the urinary tract and the ureteral wall. The pain comes in waves and does not decrease if you change positions. It is described as one of the most painful experiences, similar to giving birth. Other symptoms that may accompany renal colic are:

- Nausea
- Vomiting
- Blood in the urine (urine appears pink or red)
- Painful urination
- Fever

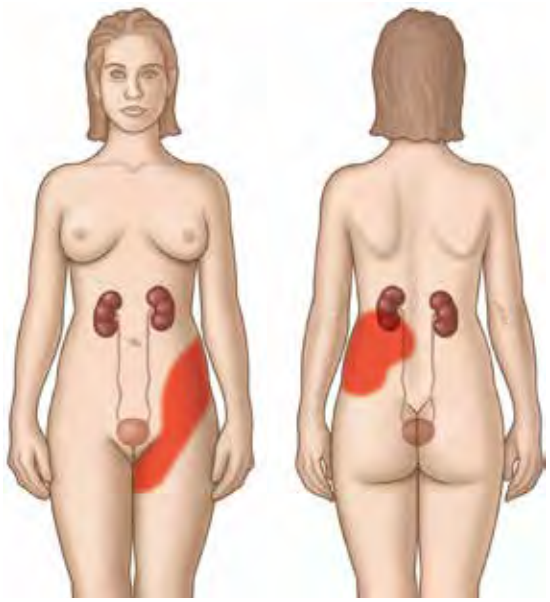

Fig. 2: Area of possible renal colic pain shown in red.

Renal colic is an emergency situation and you should contact your family doctor or nearest hospital to relieve the pain. In case of high fever, you must seek immediate medical help.

Dull pain
Stones that do not block the ureter completely can cause a recurrent, dull pain in the flank. This kind of pain may also point to other diseases, so you will need to take medical tests to find out if you have kidney or ureteral stones.

No symptoms
Some stones do not cause any discomfort or clinical problems. These are called asymptomatic stones and are usually small. They do not block the flow of urine. In general, asymptomatic stones are found during x-ray, ultrasound or in any other imaging procedures for other conditions. Discuss your individual circumstances with your doctor and what would be the best possible treatment for you.

Facts about kidney stones

- Stones are common and their frequency among population differs from country to country.
- Every person has a 5 to 10% chance of forming a urinary stone in their whole life.
- Men form stones more often than women, however, this difference seems to get smaller in the last 20 years.
- It is a rare entity to have a stone in children and young adults.
- In a lifetime, most of the patients with a urinary stone history experience more than one stone episode.

Diagnosis of kidney stones

The doctor will ask for a series of tests to understand what causes your symptoms. This is called a diagnosis. First, the doctor or nurse will take your medical history and do a physical examination. Then, they will take images of your body and perform other tests if needed.

Imaging techniques
To locate your stone the doctor needs imaging of your internal organs. You will get an ultrasonography (also known as ultrasound), which uses high-frequency sounds to create an image.

The doctor can see whether the stone causes an obstruction by checking if the urinary collecting system is enlarged. In addition to ultrasonography, you may need an x-ray of the urinary tract.

Another common method of diagnosis is a CT-scan (computed tomography). For stone disease, a non-contrast- enhanced computed tomography (NCCT) or a low-dose CT is done. This scan can clearly show the size, shape, and density of the stone.

In some situations, your doctor may decide to do a contrast-enhanced CT-scan or an intravenous urography. These images give additional information about your kidney function and your anatomy.

Stone analysis and other tests
In case of renal colic, your urine and blood are tested to see if you have an infection or kidney failure.

If your stone is expected to pass with urine, your doctor may recommend that you filter your urine to collect the stone. The doctor should analyse it in order to understand what type of stone you have. This information is important because it helps to select the best options for treatment and prevention.

If you have a high risk of forming more stones in future, you will get additional tests known as metabolic evaluation to understand the composition of urine for preventive measures.

Treatment of kidney and ureteral stones

You have been diagnosed with a kidney or ureteral stone. This section describes the different treatment options which you can discuss with your doctor. Together you can decide which approach is right for you.

Factors that influence the decision include:

- Your symptoms
- Your body features
- Stone characteristics like its location, size, and hardness
- Your medical history
- The kind of treatment available at your hospital and the expertise of your doctor
- Your personal preferences and value

Not all stones require treatment. You need treatment if your stone causes discomfort and does not pass naturally with urine. Your doctor may also advise treatment if you have pre-existing medical conditions. There are different treatment methods for emergency and non-emergency situations.

If you have a kidney or ureteral stone which does not cause discomfort, you will generally not receive treatment. Your doctor will give you a time schedule for regular control visits to make sure your condition does not get worse.

If your stone is likely to pass with urine, your doctor can prescribe drugs to ease this process. This is called conservative treatment.

If your stone continues to grow or causes frequent and severe pain, you will get active treatment.

Most kidney or ureteral stones will leave your body while you urinate. However, depending on the size and location of the stone, it will take you some time to pass the stone. You may suffer from renal colic when the stone moves. If you have a very small stone with a very high chance you may pass the stone within a couple of weeks.

In general, you can keep this in mind:

- The closer the stone is to the bladder, the higher the chance of passing it
- The bigger the stone, the smaller the chance of passing it

There are 2 common conservative treatment options: Medical Expulsive Therapy (MET) to help to expulse stone, and treatment to dissolve uric acid stones. In both cases you get medication.

Active stone treatment

Kidney or ureteral stones should be treated if they cause symptoms. There are 3 common ways to remove stones: shock-wave lithotripsy (SWL), ureteroscopy (URS), and per-cutaneous nephrolithotomy (PCNL).
Which active treatment option is best for you depends on many aspects. The most important factor is the symptoms the stone causes. Based on whether the stone is in your kidney or your ureter, the doctor may recommend different treatment options.

If you don't have symptoms you may still get treatment in case:

- The stone continues to grow
- You are at high risk of forming another stone
- You have an infection
- You have an obstructive stone
- Your stone is very large
- You prefer active treatment
- Your social situation (e.g. profession or travelling)

Your doctor will recommend removing a stone in the ureter if:

- It seems too big to pass with urine
- You continue to suffer from pain while you take medication
- Your kidneys have stopped or may stop to function properly

General information

Causes of kidney and ureteral stones

Anyone may develop a kidney stone during his or her lifetime. The most common cause of urinary stones is the imbalance in the composition of urine. This may be connected to how much you drink and whether there are substances in your urine which trigger stone formation or deficiency of some substances which prevents stone formation. However, there are other causes as well, such as urinary tract infection and obstructive pathologies of the urinary tract.

You are at higher risk if you have:

- Onset of stone disease in a younger age, especially in childhood or in teenage years
- A family history of stone disease
- Any of the following stone types: brushite, uric acid, or urate
- Stones due to urinary tract infection
- A genetic condition which makes you prone to forming stones
- A narrowing in your ureters
- An obstruction at the junction where your kidney meets your ureter

Certain urological conditions may increase the risk of stone disease, like the following:

- Medullary sponge kidney (a birth defect)
- Ureteropelvic junction obstruction
- Calyceal diverticulum
- Polycystic kidney disease
- Nephrocalcinosis (high calcium levels in the kidneys)

- Vesicoureteric reflux (an abnormal movement of urine into the ureters or kidneys)
- Horseshoe kidney (a birth defect)
- A cystic dilation of the terminal ureter, called ureterocele

Some other non-urological conditions are also associated with stone disease. These include:

- Hyperparathyroidism (excessive production of the parathyroid hormone by the parathyroid glands)
- Gastrointestinal diseases (jejuno-ileal bypass, intestinal resection, Crohn's disease, malabsorptive conditions, and urinary diverson)
- Sarcoidosis (inflammation that causes tiny lumps of cells in various organs in your body)

Additionally, stone formation is also associated with some drugs. Do not stop any prescribed medication unless your doctor advises you to.

The different types of stones and the measures used to prevent them

Calcium-oxalate stones

If you had a calcium-oxalate stone you may have a high risk of forming more stones but this is not always the case.

After you have had a calcium-oxalate stone you should:

- Eat fewer oxalate-rich foods (for instance rhubarb, beet, okra, spinach, Swiss chard, sweet potatoes, tea, chocolate, and soy products)
- Reduce consumption of purine rich foods
- Don't take more than the daily recommended amount of vitamin C
- In all cases, check with your doctor for personal advice

If the metabolic evaluation shows that you have a high risk of forming more stones you will get medication to reduce the risk of recurrence.

Calcium-phosphate stones

If you had a calcium-phosphate stone you may have a high risk of forming more stones but this is not always the case. The type of treatment you get depends on the cause of the stone.

Uric acid stones

If you had a uric acid stone you have a high risk of forming more stones. Eating less purine rich foods can lower the chance of you forming another stone. High levels of purine are found in certain types of fish (like herring, mussels, smelt, sardines, anchovies), red meat and organs (heart, liver, kidney). You will get medication to keep the pH-value of your urine between 6.2 and 6.8. You can check the pH-value of the urine easily at home with dipstick tests.

Ammonium urate stones

If you had an ammonium urate stone you have a high risk of recurrence and you may also have a urinary tract infection. You will get antibiotics to treat the infection and you will need to take medication to keep your pH-levels between 5.8 and 6.2.

Struvite and infection stones

If you had a struvite or an infection stone, you have a high risk of forming more stones. You may need to take antibiotics to make sure the infection does not come back. The main treatment in struvite and infection stones is to remove every single piece of stone from the urinary tract, so your doctor might recommend another surgical intervention again even for a very small stone. Your doctor may ask you to take medications to acidify your urine.

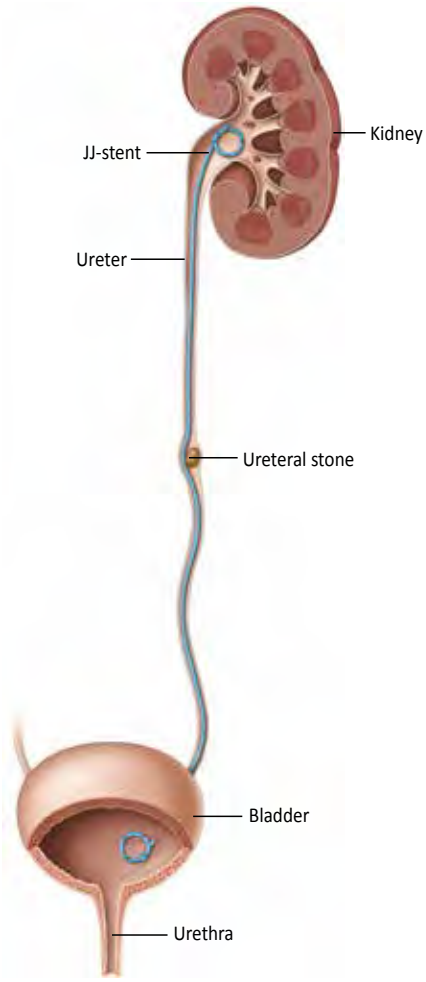

Fig. 3: A JJ-stent is inserted to make sure urine can flow through the urinary tract.

* The underlined terms are listed in the glossary.

Cystine stones
If you had a cystine stone you have a high risk of forming more stones. You need to drink enough fluids to produce at least 3 litres of urine every day. Eating less salt will lower the level of cystine in your urine. You will get medication to increase the pH-value of your urine to 7.5 or higher. On top of that you may get medication to reduce the level of cystine.

Other stones
There are other types of stones that are very uncommon. Your doctor will discuss your individual situation and treatment options with you.

Emergency situations

Acute renal colic
Renal colic is an acute, painful situation caused by a stone that blocks the ureter. Go to the family doctor or the nearest emergency room as soon as possible to relieve the pain.

Pain is usually relieved with NSAIDs (non-steroidal anti-inflammatory drugs), which you can take as a tablet or a suppository. If this first step of treatment does not help, you will get stronger painkillers called opioids. Usually, they are injected directly into the vein. The disadvantage of opioids is that they can make you nauseous.

On a rare occasion, drugs do not work. In this case, the doctor may need to drain urine from your kidney. This is called decompression.

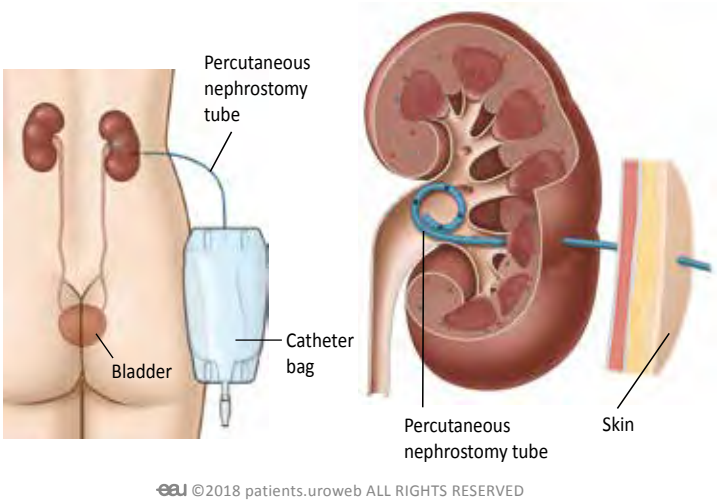

Fig. 4a: A percutaneous nephrostomy tube is used to drain urine directly from the kidney into the catheter bag.

Fig. 4b: A percutaneous nephrostomy tube inside the kidney.

There are two methods of decompression:
- By placing a ureteral stent in your ureter through your urethra (Fig. 3)
- By inserting a tube into your kidney directly through the skin (a percutaneous nephrostomy), Fig. 4 and 5.

Both methods are equally effective.

Obstructed and infected kidney
If you have renal colic together with a fever or if you feel unusually tired, you should go to the closest urological department at once. You will get blood and urine tests to check if you have an infected and/or obstructed kidney.

If you have an infected, obstructed kidney, you need immediate decompression to relieve the pressure in your kidney. After the decompression you will get antibiotics to clear the infection. Usually, you can only be treated to have your stone removed after the infection is gone.

Prevention of stone recurrence
Some patients who have had kidney or ureteral stones may form more stones in the future. After your stone passes or is removed, your doctor will determine if you are at high risk of recurrence. To do so, he or she will need to analyse the stone. In addition, the doctor will consult the results of your blood and urine tests which were done before treatment.

If your risk of recurrence is low, general lifestyle changes will be enough to cut the risk of forming another stone.

If you have a high risk of recurrence, the doctor will run a series of specific blood and urine tests called metabolic evaluation. Depending on the test results, the doctor will recommend preventive measures or further tests.

General lifestyle advice to prevent stones
Even if you have a low risk of forming another stone, your doctor and nurse will advise you to make some lifestyle changes. These measures reduce the risk of you getting another stone and improve your health in general. Depending on your individual situation, your doctor may recommend that you adapt your diet. The following drinking and diet suggestions are for adult patients with any stone type, but it is important to discuss them with the doctor first:

Drink more:
- Make sure you drink 2.5 to 3 litres every day
- Drink evenly throughout the day
- Choose pH-neutral drinks such as water or milk

- Monitor how much you urinate. It should be 2 to 2.5 litres every day
- Monitor the colour of your urine: it should be light

Drink even more if you live in a hot climate or do a lot of physical exercises. This will help you to balance your fluid loss.

- Have a balanced and varied diet
- Avoid excessive consumption of vitamin supplements
- Eat lots of vegetables, fibres, and fruits
- Make sure your diet contains a sufficient amount of calcium (about 1,000 to 1,200 milligrams a day). However, be careful with calcium supplements and always ask your doctor or nurse for advice
- Reduce the amount of salt in your diet (no more than 3 to 5 grams a day)
- Do not eat too much animal protein, especially meat from young animals.
- Maintain a healthy weight (your Body Mass Index should be between 18-25 kg/m2)

Healthy habits

- Adopting a healthy lifestyle is always a good idea.
- Try to exercise 2 or 3 times a week
- Avoid stress

Metabolic evaluation

- If you have a high risk of forming more stones, your doctor will perform a metabolic evaluation. This is a series of blood and urine tests in order to understand the way your body produces urine.
- Then, your doctor can tune your diet and determine if you need any additional treatment.

Glossary of terms

Active treatment
Procedures to remove a kidney or ureteral stone.

Anaesthesia (general or local)
Before a procedure you will get medication to make sure that you don't feel pain. Under general anaesthesia you are unconscious and unaware of what is happening to you. Under local anaesthesia you will not feel pain in the part of your body where the procedure is done. Anaesthesia wears off gradually after the procedure.

Asymptomatic stones
Stones that do not cause any symptoms. They are usually found during imaging tests done for another condition.

Bladder
Organ that collects urine from the kidneys (see also Kidneys).

Calculi
Stones.

Computed tomography (CT)
Imaging technique that makes a series of x-ray images of the body.

Conservative treatment
Monitoring the progress of the stone disease or treatment with medication to ease the natural passing of stones.

Contraindication
A symptom or condition that makes a certain treatment option undesirable.

Decompression
Relieving pressure in the kidneys. A nephrostomy tube is placed directly in the kidney through the skin so that urine can leave the body (see also Nephrostomy tube).

Endoscope
A tube-like instrument to examine the inside of the body. Can be flexible or rigid.

Fragments
Pieces of the stone broken during a procedure.

Intravenous urography
An imaging technique where x-ray contrast agent is injected into the vein, usually in the arm.

JJ-stent
A tube that is temporarily placed in the ureter to make sure urine can flow from the kidney to the bladder.

Kidneys
Two bean-shaped organs in the back of the abdomen that filter the blood and produce urine.

Medical Expulsive Therapy (MET)
Medication that makes the natural passing of stones easier and less painful.

Metabolic evaluation
Series of blood and urine tests for patients who have a high risk of forming stones.

Nephrostomy tube
A tube placed directly into the kidney through the skin. This allows the urine to leave the body (see also Decompression).

Non-contrast-enhanced CT
Type of CT scan with low radiation exposure (see also Computed tomography).

NSAIDs
A group of medicines used to relieve pain. It is often used to relieve renal colic.

Oxalate
A component found in many kinds of food which may be related to forming kidney or ureteral stones.

Percutaneous
Through the skin.

Percutaneous nephrolithotomy (PNL)
Treatment option to remove stones directly from the kidney by placing a tube through the skin.

pH-value
A measure between 0.0 and 14.0 to describe if a fluid is acidic or alkaline. pH values close to 7.0 are neutral, anything above is alkaline, anything below is acidic.

Glossary of terms

Renal colic
Severe pain in flank, loin, groin, or thigh caused by a stone blocking the normal flow of urine.

Shock-wave lithotripsy (SWL)
Treatment option to break stones into smaller pieces using high energy sound waves. Stone fragments pass with urine after the procedure.

Ultrasonography
Imaging technique that uses high-frequency sounds to make an image of the inside of the body.

Ultrasound
see Ultrasonography.

Ureter
One of the two tubes through which urine flows from the kidneys to the bladder.

Ureteroscope (rigid or flexible)
An endoscope used for the urinary tract. It is inserted into the urethra and can move through the bladder, up the ureter, and even into the kidney.

Ureteroscopy (URS)
Treatment option to remove kidney or ureteral stones. A ureteroscope is inserted into the urinary tract via the urethra to pull out the stone (see also Ureteroscope).

Urethra
The tube that carries urine from the bladder and out of the body.

Uric acid
A chemical that is created when the body breaks down substances called purines.

Urinary system
see Urinary tract.

Urinary tract
The organ system that produces and transports urine through and out of the body. It includes two kidneys, two ureters, the bladder and the urethra. The urinary tract is similar in men and women, only men have a longer urethra.

Urolithiasis
Stone disease.

Urologist
A doctor specialized in health and diseases of the urinary tract and the genitals.

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