CONDITION

Kidney stones

Kidney stones are hard crystals that form in urine and may cause pain or block urine flow.

WHAT IT IS
Hard crystals formed from substances in urine

BODY SYSTEM
Urinary system

MAIN SYMPTOMS
Severe side pain, nausea, bloody urine, painful urination

WHAT CAUSES IT
Concentrated urine and crystal-forming substances

HOW IT IS DIAGNOSED
Urine tests and CT or ultrasound imaging

MAIN TREATMENT
Pain relief, fluids, and stone removal when needed

CAN IT BE CURED?
Sometimes - stones pass or are removed

IS IT AN EMERGENCY?
Sometimes - fever with blockage symptoms

LONG-TERM OUTLOOK
Most recover, but stones can return

Overview

Kidney stones are hard lumps made from substances that normally dissolve in urine. They can form in one or both kidneys and range from tiny crystals to larger stones.

A stone may stay in the kidney without causing symptoms. Problems often begin when it moves into a ureter, one of the narrow tubes carrying urine from the kidneys to the bladder. A stone there can block urine flow and cause intense, wave-like pain called renal colic.

Small stones may pass out of the body in urine. Larger stones, or stones causing infection, blockage, or continuing pain, may need a procedure.

Most people recover without lasting kidney damage. However, kidney stones can return. Finding out what a stone is made of and checking for contributing factors can help guide prevention.

Symptoms

Kidney stones do not always cause symptoms. A stone that remains in the kidney may be found during a scan performed for another reason.

When a stone enters a ureter, symptoms may include:

You may not be able to find a comfortable position during renal colic. The pain may change as the stone moves.

Fever, chills, or feeling very unwell are not routine stone symptoms. They may mean that infection is present behind a blockage and require urgent assessment.

- Severe pain in the side or back, usually below the ribs
- Pain that moves toward the lower abdomen, groin, or genitals
- Pain that comes in waves and changes in intensity
- Nausea or vomiting
- Blood in the urine, which may look pink, red, or brown
- Burning or pain when urinating
- Needing to urinate more often or urgently

Causes and risk factors

Stones form when urine contains more crystal-forming substances than its fluid can dilute. Crystals may then join together and grow. Substances that normally stop crystals sticking together may also be too low.

The most common stones contain calcium, usually combined with oxalate. Oxalate occurs naturally in the body and in many foods. Having a calcium stone does not automatically mean that you eat too much calcium.

Other types include uric acid stones, infection-related struvite stones, and cystine stones. Cystine stones result from an inherited condition called cystinuria.

Factors that may raise the chance of stones include:

Risk factors do not prove why a particular stone formed. A stone analysis and urine or blood testing may provide more useful information.

- Not drinking enough fluid or losing fluid through heavy sweating
- A previous stone or a family history of stones

- A diet high in salt
- Certain bowel conditions, weight-loss surgery, or long-lasting diarrhoea
- Repeated urinary infections
- Conditions affecting calcium, uric acid, or the parathyroid glands
- Some medicines and supplements
- Limited movement over a long period
- Inherited conditions such as cystinuria

Diagnosis

Your symptoms and medical history help guide the assessment. A physical examination may check where the pain is and whether there are signs of infection or dehydration.

A urine test can look for blood, crystals, and signs of infection. If infection is possible, a urine culture may be used to identify bacteria. Blood tests can assess kidney function and measure substances such as calcium and uric acid.

Imaging confirms whether a stone is present and shows its size and location. A low-dose CT scan without contrast is commonly used in adults because it can detect most stones and other possible causes of pain. Ultrasound avoids radiation and is often preferred during pregnancy and for children. An X-ray may help monitor some stones, but not every stone appears on an X-ray.

If you catch or pass a stone, it may be sent to a laboratory. Knowing its chemical type helps shape future prevention.

People with repeated stones, certain medical conditions, or higher-risk stone types may have additional testing. This can include collecting urine over 24 hours to measure its volume and mineral content.

Treatment and management

Treatment depends on the stone's size and position, whether urine flow is blocked, and whether pain, infection, or kidney problems are present.

For a stone likely to pass, care may include pain relief, medicine for nausea, and instructions about fluid intake. Anti-inflammatory pain medicines are often used for renal colic when they are medically suitable. Other pain relief may be needed in some situations.

A healthcare professional may sometimes offer medicine that relaxes the ureter and helps selected stones pass. It is not appropriate for every stone.

Drinking enough to avoid dehydration is important, but rapidly forcing down large amounts of water during severe pain will not push out a blocked stone. Vomiting or difficulty keeping fluids down may require medical treatment.

You may be asked to urinate through a strainer so the stone can be collected. Follow-up imaging may be needed because an improvement in pain does not always prove that the stone has passed.

A procedure may be recommended if the stone is unlikely to pass, pain continues, kidney function is threatened, or blockage or infection is present. Options include:

An infected, blocked kidney usually needs urgent drainage as well as antibiotics like amoxicillin or doxycycline . Antibiotics alone may not clear an infection when urine cannot drain.

- Shock wave lithotripsy: Sound waves break the stone into smaller pieces
- Ureteroscopy: A thin instrument passes through the bladder into the ureter so the stone can be removed or broken up
- Percutaneous nephrolithotomy: A larger kidney stone is removed through a small opening in the back
- Ureteric stent or nephrostomy: A tube drains blocked urine, especially when urgent pressure relief is needed

Complications

A stone can partly or fully block urine flow. A short-lived blockage often resolves without permanent harm, but a severe or prolonged blockage can reduce kidney function.

Urine trapped behind a blockage can become infected. Infection combined with obstruction can spread quickly and requires urgent treatment.

Other possible complications include repeated urinary infections, bleeding, and ongoing discomfort. Procedures can occasionally cause infection, bleeding, injury to the urinary tract, or small stone fragments that need further treatment.

Repeated stones can affect kidney health over time, especially when they cause frequent infections or blockages. Serious lasting kidney damage is not the usual outcome after a single stone that is treated promptly.

Prevention

Not every kidney stone can be prevented. Inherited conditions such as cystinuria cannot be removed, although treatment may reduce stone formation. Even with careful prevention, stones may return.

For many people, keeping urine diluted is the most important step. Drink regularly through the day and more during hot weather, exercise, or other times when you sweat. Your urine will usually be pale when you are well hydrated, although medicines and foods can change its colour.

Dietary changes should match your stone type and test results. General measures may include:

Cutting out calcium without advice may not prevent calcium oxalate stones and can sometimes increase risk. If oxalate is a concern, eating calcium-containing foods with meals can help bind oxalate in the bowel.

Medicines may be offered for repeated stones or specific urine abnormalities. These can reduce urine calcium, raise citrate, lower uric acid, or change urine acidity. The choice requires test results and medical follow-up rather than a one-size-fits-all plan.

- Limiting salt, which can increase calcium in urine
- Eating a balanced amount of calcium from food rather than severely restricting it
- Avoiding excessive amounts of animal protein if advised
- Adjusting high-oxalate foods only when this is relevant to your stones
- Maintaining a weight that supports your overall health

Living with it and what to expect

A small ureter stone may pass over days or weeks, but there is no guaranteed timetable. Pain may stop and restart as the stone moves. Larger stones and stones higher in the ureter are generally less likely to pass without treatment.

After the stone passes or is removed, most people return to their usual activities. You may need a follow-up scan to confirm that the urinary tract is clear, particularly if the stone was not collected.

A temporary ureteric stent can cause urinary urgency, bladder discomfort, blood in the urine, or pain around the kidney when urinating. These symptoms usually improve after the stent is removed. Make sure you know when and how removal is planned.

Kidney stones can recur months or years later. Follow-up may include blood tests, urine tests,

stone analysis, or repeat imaging. People with repeated stones may benefit from long-term monitoring and a prevention plan based on their stone type.

Living with recurrent stones can make new side pain worrying. Not every pain is a stone, so symptoms that are different, persistent, or accompanied by fever should be assessed rather than assumed to be another routine episode.

When to get medical help

Seek prompt medical assessment for new severe side, back, abdominal, or groin pain, especially if you also have blood in your urine, vomiting, or pain when urinating. Similar symptoms can have other causes that need different treatment.

Get urgent or emergency help if you have:

Urgent assessment is also important if you may be pregnant, have only one functioning kidney, have reduced kidney function, or have a weakened immune system.

Routine follow-up is appropriate after a stone episode to confirm that the stone has passed, review test results, and discuss recurrence prevention. Arrange a review if urinary symptoms continue, pain keeps returning, or you are unsure whether a stone has passed.

- Fever or chills with suspected stone pain
- Severe pain that is not controlled
- Repeated vomiting or inability to keep fluids down
- Inability to urinate or only a very small urine output
- Confusion, faintness, marked weakness, or rapidly worsening illness

Common questions

How long does it take to pass a kidney stone?

A small stone may pass within days, but some take several weeks. Size and location affect the chance of passing. Continuing blockage may be present even after pain improves, so follow-up may be needed.

Can I pass a kidney stone at home?

Some small stones can pass with appropriate pain control and medical follow-up. Home management is not suitable when there is fever, uncontrolled pain, repeated vomiting, reduced urine output, or concern about kidney function.

Can kidney stones be dissolved?

Most calcium stones cannot be dissolved with medicine. Some uric acid stones can be dissolved by changing the urine's acidity under medical supervision. Procedures can break up or remove stones that will not pass.

What does a kidney stone look like?

A passed stone may look like a grain of sand, a small pebble, or an irregular crystal. Colour and shape differ. Even a very small stone can cause severe pain while moving through a ureter.

Can kidney stones damage my kidneys?

Most single stone episodes do not cause permanent damage. Risk increases when a blockage lasts, infection is present, or stones repeatedly affect the kidneys.

Why do kidney stones keep coming back?

Recurrence may relate to low urine volume, diet, body chemistry, medical conditions, infection, medicines, or inherited factors. Stone analysis and blood or urine testing can help identify changes most relevant to you.

Sources

- National Institute of Diabetes and Digestive and Kidney Diseases: Kidney Stones
- National Institute for Health and Care Excellence: Renal and ureteric stones-assessment and management, guideline NG118
- European Association of Urology: Guidelines on Urolithiasis
- NHS: Kidney stones
- American Urological Association: Medical Management of Kidney Stones