

# Management of Renal Calculi: A Review

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## Abstract

Renal calculi are a common cause of blood in the urine (hematuria) and pain in the abdomen, flank, or groin. They occur in one in 11 people at some time in their lifetimes with men affected 2 to 1 over women. Development of the stones is related to decreased urine volume or increased excretion of stone-forming components such as calcium, oxalate, uric acid, cystine, xanthine, and phosphate. Calculi may also be caused by low urinary citrate levels or excessive urinary acidity. Renal calculi present with excruciating pain and most patients present to the emergency department in agony. A single event does not cause kidney failure but recurrent renal calculi can damage the tubular epithelial cells, which can lead to functional loss of the renal parenchyma.

**Keywords:** Oxalate; Uric acid; Cystine; Xanthine.

## Introduction

Kidney stones (also called renal calculi, nephrolithiasis or urolithiasis) are hard deposits made of minerals and salts that form inside the kidneys.

Diet, excess body weight, some medical conditions, and certain supplements and medications are among the many causes of kidney stones. Kidney stones can affect any part of urinary tract—from the kidneys to your bladder. Often, stones form when the urine becomes concentrated,

allowing minerals to crystallize and stick together. Passing kidney stones can be quite painful, but the stones usually cause no permanent damage if they're recognized in a timely fashion. Depending on situation, it may need nothing more than to take pain medication and drink lots of water to pass a kidney stone. In other instances—for example, if stones become lodged in the urinary tract, are associated with a urinary infection or cause complications—surgery may be needed.

## Causes

Kidney stones often have no definite, single cause, although several factors may increase risk. Kidney stones form when urine contains more crystal-forming substances—such as calcium, oxalate and uric acid—than the fluid in your urine can dilute. At the same time, your urine may lack substances that prevent crystals from sticking together, creating an ideal environment for kidney stones to form.

## Type of Kidney Stones

### *Types of kidney stones include*

- Calcium stones. Most kidney stones are calcium stones, usually in the form of calcium oxalate. Oxalate is a substance made daily by the liver or absorbed from diet. Certain fruits and vegetables, as well as nuts and chocolate, have high oxalate content. Dietary factors, high doses of vitamin D, intestinal bypass surgery and several metabolic disorders can increase the concentration of calcium or oxalate in urine. Calcium stones may also occur in the form of calcium phosphate. This type of stone is more common in

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metabolic conditions, such as renal tubular acidosis. It may also be associated with certain medications used to treat migraines or seizures, such as topiramate (Topamax, Trokendi XR, Qudexy XR).

- Struvite stones. Struvite stones form in response to a urinary tract infection. These stones can grow quickly and become quite large, sometimes with few symptoms or little warning.
- Uric acid stones. Uric acid stones can form in people who lose too much fluid because of chronic diarrhea or malabsorption, those who eat a high-protein diet, and those with diabetes or metabolic syndrome. Certain genetic factors also may increase your risk of uric acid stones.
- Cystine stones. These stones form in people with a hereditary disorder called cystinuria that causes the kidneys to excrete too much of a specific amino acid.

## Diagnosis

If doctor suspects that patient have a kidney stone, it may have diagnostic tests and procedures, such as:

*Blood testing:* Blood tests may reveal too much calcium or uric acid in blood. Blood test results help monitor the health of kidneys and may lead doctor to check for other medical conditions.

*Urine testing:* The 24-hour urine collection test may show that excreting too many stone-forming minerals or too few stone-preventing substances. For this test, doctor may request that you perform two urine collections over two consecutive days.

*Imaging:* Imaging tests may show kidney stones in urinary tract. High-speed or dual energy computerized tomography (CT) may reveal even tiny stones. Simple abdominal X-rays are used less frequently because this kind of imaging test can miss small kidney stones. Ultrasound, a noninvasive test that is quick and easy to perform, is another imaging option to diagnose kidney stones.

*Analysis of passed stones:* It may be asked to urinate through a strainer to catch stones that you pass. Lab analysis will reveal the makeup of kidney stones. Doctor uses this information to determine what's causing kidney stones and to form a plan to prevent more kidney stones.

## Medical Management of Renal Calculi

Management of stone disease needs individualization. Clinical presentation, proper

history, and laboratory tests help to identify whether one needs urgent surgical or medical treatment.

Medical management is indicated for clinically stable patients with non-obstructive urinary stones, recurrent stone formers, and the patients with underlying systemic diseases. Detailed history of patient illness including family history, drug history, and history of previous similar illness and previous interventions needs to be recorded. Assessment of risk factors for stone disease should be carried out. Medical management of stone disease includes laboratory evaluation and treatment.

Medical treatment of kidney stones includes dietary management, disease-specific therapies, and medical expulsion therapy (MET) of stones.

### *Small stones with minimal symptoms*

Most small kidney stones won't require invasive treatment. It may pass a small stone by:

*Drinking water:* Drinking as much as 2 to 3 quarts (1.8 to 3.6 liters) a day will keep urine dilute and may prevent stones from forming. drink enough fluid – ideally mostly water – to produce clear or nearly clear urine.

*Pain reliever:* Passing a small stone can cause some discomfort. To relieve mild pain, Doctor may recommend pain relievers such as ibuprofen (Advil, Motrin IB, others) or naproxen sodium (Aleve).

*Medical therapy:* Doctor may give a medication to help pass a kidney stone. This type of medication, known as an alpha blocker, relaxes the muscles in ureter, helping to pass the kidney stone more quickly and with less pain. Examples of alpha blockers include tamsulosin (Flomax) and the drug combination dutasteride and tamsulosin (Jalyn).

### *Large stones and those that cause symptoms*

Kidney stones that are too large to pass on their own or cause bleeding, kidney damage or ongoing urinary tract infections may require more-extensive treatment. Procedures may include:

*Using sound waves to break up stones:* For certain kidney stones – depending on size and location – Doctor may recommend a procedure called extracorporeal shock wave lithotripsy (ESWL).

ESWL uses sound waves to create strong vibrations (shock waves) that break the stones into tiny pieces that can be passed in urine. The procedure lasts about 45 to 60 minutes and can cause moderate pain, so it may be under sedation or light anesthesia to make patient comfortable.

ESWL can cause blood in the urine, bruising on the back or abdomen, bleeding around the kidney and other adjacent organs, and discomfort as the stone fragments pass through the urinary tract.

Surgery to remove very large stones in the kidney: A procedure called percutaneous nephrolithotomy (nef-row-lih-THOT-uh-me) involves surgically removing a kidney stone using small telescopes and instruments inserted through a small incision in patient's back.

A general anesthesia is given during the surgery and be in the hospital for one to two days while you recover. Doctor may recommend this surgery if ESWL is unsuccessful.

Using a scope to remove stones: To remove a smaller stone in ureter or kidney, Doctor may pass a thin lighted tube (ureteroscope) equipped with a camera through your urethra and bladder to your ureter. Once the stone is located, special tools can

snare the stone or break it into pieces that will pass in your urine. Your doctor may then place a small tube (stent) in the ureter to relieve swelling and promote healing. You may need general or local anesthesia during this procedure.

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