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Kidney Stones

What is a kidney stone?

Kidneys filter wastes from blood to make urine. Urine is made up of waste products such as minerals or salts, dissolved in water. If there isn't enough water in the urine to dissolve the salts, then they crystalize and form stones. This can occur if there is too much of one kind of mineral in the urine or because the urine is too concentrated.

Kidney stones occur when minerals from your urine build up and form solid crystals in one or both kidneys. These crystals can grow and develop into stones. The stone may stay in the kidney or it may travel down the urinary tract.

Kidney stones can grow from the size of a small grain of sand to as large as a grape. In rare cases, they can be large enough to take up space within the kidney. In general, the larger the stone, the worse the symptoms. Usually kidney stones do not cause any symptoms until they begin to move within the kidney or pass into the ureter (the small tube that connects the kidney to the bladder). Kidney stones cause pain and discomfort when it blocks the flow of urine.

Types of kidney stones

There are 4 main types of kidney stones, named for the mineral they are made up of:

- Calcium stones (most common type)
- Uric acid stones
- Struvite stones
- Cystine stones (caused by an inherited condition)

What are the risk factors for developing kidney stones?

- Family history of kidney stones
- Diet
- Obesity
- Certain medications
- Children who have limited mobility
- Genetic and medical conditions associated with kidney stones
- Metabolic disorders
- Other kidney conditions

Signs and symptoms

- Severe pain in back, side, lower abdomen, or groin
- Blood in the urine (also known as *hematuria*)
- Nausea or vomiting
- Pain while urinating (also known as *dysuria*)
- Needing to pee often or urgently
- Fever or chills

Testing and diagnosis

- Urine tests – to look for an infection and/or blood in the urine
- Blood tests – to look at how well kidneys are functioning; to look for signs of infection
- Imaging tests such as ultrasound, x-ray, or CT scan which can show the exact size, shape, and location of a stone.

****Seek immediate medical attention if your child experiences:** Severe pain not managed with medication, severe nausea or vomiting, inability to keep oral liquids down, fever (>100.5°F) or chills, difficulty passing urine.

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Treatment of Kidney Stones

There are many treatment options for kidney stones and the best option depends on the size, location, type of stone, and severity of symptoms.

Medical expulsive therapy at home

In most cases, your child may be able to pass the stone at home. He/She may be prescribed a medication called Cardura or Flomax to help the ureter widen, to aid with stone passage. Your child may also be sent home with over-the-counter pain medications (ibuprofen and acetaminophen) and potentially a stronger pain medication may be prescribed. You will be given a strainer to strain your urine in order to catch the stone and a collection cup to store the stone until your next follow-up visit. It may take several weeks to pass the stone.

Kidney Stone Prevention

Now that your child has had a kidney stone, it will be important to find out WHY your child is forming stones. There is about a 50% likelihood of your child forming another stone in the next 5 years.

- **Stone analysis (if you were able to collect the stone):** The stone is sent out for analysis to find out what type of stone it is.
- **24-Hour urine collection:** At least 4-weeks after the stone has passed or been removed, we may ask your child to collect urine for 24 hours. From this, the urine is sent to a lab to measure urine volume, acidity, and content (calcium, sodium, uric acid, oxalate, citrate, and creatinine). This information gives clues as to how your child's kidneys function. You will be provided with the instructions on how to obtain the 24-hour urine collection kit from Litholink.
- **Referral to nephrology:** While urologists specialize in the structure of the kidney, *nephrologists* specialize in the function of the kidney and will work with you and your child to find out why your child is forming stones.
- **Referral to a dietician:** To help with healthy food choices in order to prevent future stones from forming.
- **Possible referral to pediatric weight management clinic:** Obesity is known risk factor for developing kidney stones. At the weight management clinic, a group of specialists will work with your child to achieve a healthier lifestyle.
- **Dietary recommendations:**
    - Encourage water intake. Your child should drink *at a minimum* half their body weight in ounces of water per day. For example, a child that weighs 100-pounds should drink at least 50 oz. of water per day. Good hydration flushes out stone-forming minerals from the kidneys. Tip: Your child should drink enough water so that urine is clear. If urine is yellow, your child needs to drink more water.
    - Increasing citric acid intake, such as adding lemons to water, can help prevent formation of new stones.
    - Limit salt (sodium) intake in your child's diet.
    - Do not limit calcium intake.

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Surgical Treatment of Kidney Stones

There are many treatment options for kidney stones and the best option depends on the size, location, and type of stone. In most cases, you will be given a strainer to strain your urine in order to catch the stone, as well as a collection cup to store the stone until your next follow-up visit.

Sometimes your child may be unable to pass the stone after attempting medical expulsive therapy at home. In addition, stones larger than 6 millimeters are less likely to pass on their own. In these instances, your child may require more invasive treatments to eliminate the stone. Other reasons for surgical treatment include severe, uncontrolled pain and vomiting or if the stone is blocking the urinary tract.

Extracorporeal Shockwave lithotripsy (ESWL)

For ureteral stones in the kidney or upper ureter. An outpatient procedure done under sedation. Outpatient procedure where high energy shockwaves are sent through water and aimed at the stone's location. This causes the stone to break apart into multiple small pieces that can be easily passed through the urinary tract.

Ureteroscopy and laser lithotripsy

A procedure performed under general anesthesia where a small, thin scope is passed up the urethra, into the bladder, and up into one or both ureters (the tubes that connect the kidneys to the bladder) until it reaches the stone. If small enough, a tool will be used to grab the stone and remove it. Sometimes, a small laser can be used to break a larger stone into smaller fragments. After this, a small tube, called a stent, may be left in the ureter to prevent obstruction and swelling, and to aid in passage of the stone fragments. A second procedure under general anesthesia is done to remove the stent.

Percutaneous nephrolithotomy

Indicated for larger stones, complex stones, cystine stones (resistant to ESWL) or stones that have failed other therapies. A procedure performed under general anesthesia where a needle is placed into the kidney through the back and instrument is used to remove the stone. A laser may be used to break the stone into smaller pieces. A small tube may be placed in your kidney and exiting out your back, draining to a bag. This tube drains urine and any small pieces of stone into a urine bag. In some cases, a small tube (stent) may also be left in the ureter to help with urine flow and stone passage. A second procedure under general anesthesia is done to remove the stent.