

Vesicoureteral Reflux

What is the normal urinary tract?

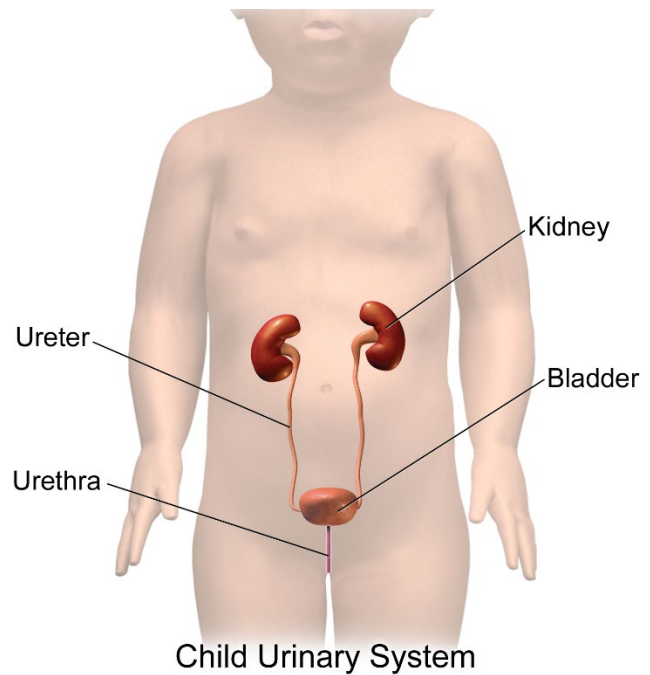
The kidneys filter the blood and extract waste products from the blood to make urine. Urine passes from the kidneys, down the ureters, and into the bladder for storage before leaving the body (urination).

As the ureter enters the bladder wall, it creates a tunnel through which the urine flows inside. The ureter enters the bladder wall at an angle so that a flap valve is created. This area is called the ureterovesical junction

(where the ureter enters the bladder). When the bladder fills, it squeezes down to empty, and the valve prevents the urine from going backwards and returning into the ureter and kidney.

When the valve operates normally, it creates an important barrier that helps to keep the kidneys free of bacteria. It also ensures that the high pressures created at the moment of urination are not transmitted to the kidneys. The valve also permits the removal of all of the stored urine from the body with a single act of urination - because the bladder urine has nowhere to go other than out the urethra and away from the body.

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What is Vesicoureteral Reflux?

Reflux occurs if the valve fails and urine backs up from the bladder into the ureter and kidney.

This valve may fail because of the following reasons:

In many patients, the tunnel of the lower ureter through the wall of the bladder, may not be long enough. To function properly, the length of the tunnel needs to be at least 4 times as long as it is wide (a ratio of at least 4 to 1 of tunnel length to ureteral width). For some children, there is a good chance that growth (in their own height) may provide the necessary difference to allow the valve to work.

Sometimes the location where the ureter enters the bladder is abnormal, usually too much to the side. This results in a tunnel that is too short. If reflux is because of this reason, it is less likely to resolve with growth. This is called ectopia.

Some children have reflux because of underlying problems such as lower urinary obstruction (such as urethral valves), abnormal bladder behavior, infrequent voiding, or constipation.

What are the problems with reflux?

The main problem with reflux is that it exposes the kidneys to infection. Since the urine backs up from the bladder into the ureter and kidney, it may allow bacteria to invade and infect the kidneys.

In children, particularly those in the first six years of life, a urinary infection can lead to kidney damage. Repeated infections in the kidney may result in a small area of scarring, loss of future growth potential, or widespread scarring

and weakening of the kidney. Even a small area of scarring in one kidney may be a cause of high blood pressure later in life.

In some patients, the reflux may also increase the risk of forming kidney stones.

How do we diagnose vesicoureteral reflux?

In order to diagnose reflux, we study the upper and lower urinary with imaging tests.

To evaluate the lower tracts, reflux is evaluated by a test called a Voiding Cystogram or a VCUG. To do this test, your child's health care provider inserts a catheter into the bladder and uses it to fill the bladder with an imaging substance that shows up in an x-ray. The catheters used are very small (usually the same size used for newborn babies) but for a "first-timer" this procedure can be scary and requires some preparation and reassurance. Child Life Specialists help prepare children for the test and help distract them during the test.

A contrast voiding cystourethrogram (VCUG), allows us to see the entire urethra with an x-ray. The amount of x-ray exposure is minimal and there is a process in place to protect the testicles in boys. Another type of VCUG, called a Nuclear Voiding Cystogram utilizes a radioactive imaging substance, but the amount of radiation is very small and the radioactive substance has a very short life. It passes directly out of the urinary tract without absorption into the body. With this test, the doctor uses a special camera to scan the kidney and ureters as the bladder fills and empties (voids) the imaging substance. This test is more sensitive than the x-ray VCUG although not quite as specific in showing the degree of reflux.

To examine the upper tracts, most children have an ultrasound. The quality of

ultrasound at Mott has become so high that more invasive tests that require an injection into the vein and an x-ray are not needed in all cases. Your doctor may decide to do a more invasive test if the ultrasound suggests reflux, if they need to assess for scarring on the kidneys or if there is a difficulty draining down with a nuclear VCUG. If the anatomy is unclear on an ultrasound or a VCUG, doctors sometimes order a Magnetic Resonance Urogram (MRU), a type of MRI scan of the urinary tract. This test has the advantage of not using any ionizing radiation and offering very clear images.

Reflux is classified into five grades - grade 1 is the least and grade 5 is the most severe.

What are the options for managing reflux without surgery?

When reflux is caused by an underlying problem such as constipation, infrequent voiding, abnormal bladder activity, or blockages such as strictures or valves, we treat the underlying factor and re-evaluate the reflux. The majority of reflux in children in this situation have bladder overactivity which may resolve with time, medicines, treatment of infection, voiding training, or biofeedback.

Mild degrees of reflux have a good chance to correct on their own (resolution of reflux) with age. 4 out of 5 children with mild to moderate degrees of reflux outgrow the problem over the course of some years. Unfortunately, we do not know exactly when the reflux will go away for a particular child. Although, recent data suggest that resolution should be expected within a few years. The chance of resolution of high-grade reflux related to an anatomic problem is much lower.

While we wait for the reflux to resolve on its own, it is essential that we protect the child from developing urinary tract infections that may lead to scarring and long term problems. To prevent infection, we treat the child with a low dose of antibiotics (prophylactic/preventative antibiotics). After 1 to 2 years with antibiotics, we re-evaluate the reflux. At the same time, we check the kidneys with ultrasound to be certain they are growing properly.

Bactrim or Septra (same drug, different brand) have proved the most effective prophylactic agents with minimal side effects and these are usually our first choice, but no antibiotic is risk-free and no antibiotic will destroy all bacteria.

Occasionally we will try to manage some patients without antibiotics and trust in close observation and prompt evaluation and treatment of a urinary tract infection if it occurs. A recent study involving 600 children showed that prophylactic antibiotics decrease the risk (cuts the risk in half) of further UTI but may not affect scarring. That last finding may be due to the strict follow-up criteria. If a child in this study developed a fever they had to undergo urine cultures (with a catheter or clean catch) within 48 hours of onset. Some researchers suggested that this very aggressive and close follow up and culture taking prevented the onset of some infections that can lead to scarring. This last finding suggests that with very close and careful follow up it may be possible to manage patients with reflux off of antibiotics and without incurring a major risk of scarring. The question that is not clearly answered is whether such an approach is practical for most families.

During the course of non-surgical management (with antibiotics or close observation) we must closely evaluate any signs that may indicate a urinary infection including:

- fever
- burning

- frequency
- urgency
- straining
- foul odor
- bloody urine
- unusual incontinence

If the child has any of the above they must be promptly evaluated with urine analysis and urine culture. If a child develops a urinary infection despite taking prophylactic antibiotics (breakthrough infection) this indicates a more serious situation because it shows we are not able to protect the kidneys with non-surgical management. If this happens, the next step may be surgery to correct the reflux.

What is the surgery to correct a reflux?

The medical name for the surgery to correct a reflux is ureteral reimplantation (or ureteroneocystostomy). This surgery is recommended for high grades of reflux, for reflux that fails to get better on its own, and for some patients with breakthrough infections.

Open surgery methods

Traditional surgical approaches (intravesical repair) have a high degree of success. 98 to 99 out of 100 surgeries (98% to 99%) are successful. They usually involve opening the bladder and creating a new longer tunnel for the ureter to pass through the bladder wall. If the ureter is very wide, it may need to be narrowed to make a successful flap valve with at least a 4-to-1 ratio of tunnel length to ureter width. In many cases, surgical correction can be done without opening the bladder (detrusorraphy or extravesical repair) by using the bladder muscle to create a valve where the ureter enters the bladder. Complications of

this surgery include:

- bleeding and infection - these may occur soon after the surgery
- urinary leakage and bladder spasms - may last a few weeks or months after the surgery
- obstruction or persistent reflux - these may remain long term

After the surgery, the child may be asked to continue taking prophylactic antibiotics for several months until studies prove that the reflux has been corrected.

Intravesical correction

Reflux can also be corrected by injecting material directly into the bladder through a cystoscope. This potentially will spare the patient a traditional open surgery with incision and can be done on an outpatient basis. We usually use a substance called Deflux. This is a gel-like material that forms a bulge at the place where the ureter enters the bladder. This reduces the size of the opening and prevents the urine from backing up. Deflux has been approved by the FDA and appears to be stable. Studies suggest that some patients take 2 to 3 injections and about 78-85% achieve full resolution of the reflux.

What is the follow-up process for patients with reflux?

We think that all patients with a history of reflux should be monitored life-long. Children who outgrew their reflux should have periodic visits after the reflux has resolved to measure height and weight, blood pressure and for urine analysis. Kidney function can also be evaluated by blood tests. Occasional ultrasound tests will assure that kidney growth is on target for size and age.

Children who had surgery to correct a reflux will have a similar follow up after the initial post-surgery studies.

By the time surgical correction has been performed, some children have already

had significant kidney damage. Studies have shown that close to 20 out of 100 patients (20%) who had surgery to correct the reflux later developed high blood pressure. In other patients, the kidney damage from reflux earlier in life may result in kidneys that don't grow in size or function properly and seem to deteriorate with age. If tests indicate worsening kidney function, the Pediatric Nephrology Team must begin careful follow up with appropriate medication and dietary restrictions.

What are the chances of a sibling having reflux?

A sibling of a child with reflux has a 1 in 3 chance to have a reflux as well. Even without previous urinary infections, the reflux might have already caused kidney damage. Because we know that the chances of kidney damage are highest in the first 6 years of life, we may suggest testing the sibling with ultrasound and possibly VCUG.

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