Your Urinary System and How It Works

National Kidney and Urologic Diseases Information Clearinghouse

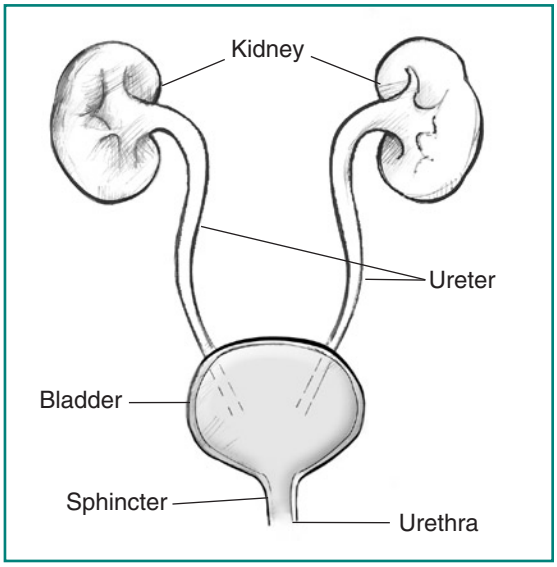
The organs, tubes, muscles, and nerves that work together to create, store, and carry urine are the urinary system. The urinary system includes two kidneys, two ureters, the bladder, two sphincter muscles, and the urethra.

How does the urinary system work?

Your body takes nutrients from food and uses them to maintain all bodily functions including energy and self-repair. After your body has taken what it needs from the food, waste products are left behind in the blood and in the bowel. The urinary system works with the lungs, skin, and intestines—all of which also excrete wastes—to keep the chemicals and water in your body balanced. Adults eliminate about a quart and a half of urine each day. The amount depends on many factors, especially the amounts of fluid and food a person consumes and how much fluid is lost through sweat and breathing. Certain types of medications can also affect the amount of urine eliminated.

The urinary system removes a type of waste called urea from your blood. Urea is produced when foods containing protein, such as meat, poultry, and certain vegetables, are broken down in the body. Urea is carried in the bloodstream to the kidneys.

The kidneys are bean-shaped organs about the size of your fists. They are near the middle of the back, just below the rib cage. The kidneys remove urea from the blood



Front view of urinary tract.

through tiny filtering units called nephrons. Each nephron consists of a ball formed of small blood capillaries, called a glomerulus, and a small tube called a renal tubule. Urea, together with water and other waste substances, forms the urine as it passes through the nephrons and down the renal tubules of the kidney.

From the kidneys, urine travels down two thin tubes called ureters to the bladder. The ureters are about 8 to 10 inches long. Muscles in the ureter walls constantly tighten and relax to force urine downward away from the kidneys. If urine is allowed to stand still, or back up, a kidney infection can develop. Small amounts of urine are emptied into the bladder from the ureters about every 10 to 15 seconds.

The bladder is a hollow muscular organ shaped like a balloon. It sits in your pelvis and is held in place by ligaments attached to other organs and the pelvic bones. The bladder stores urine until you are ready to go to the bathroom to empty it. It swells into a round shape when it is full and gets smaller when empty. If the urinary system is healthy, the bladder can hold up to 16 ounces (2 cups) of urine comfortably for 2 to 5 hours.

Circular muscles called sphincters help keep urine from leaking. The sphincter muscles close tightly like a rubber band around the opening of the bladder into the urethra, the tube that allows urine to pass outside the body.

Nerves in the bladder tell you when it is time to urinate, or empty your bladder. As the bladder first fills with urine, you may notice a feeling that you need to urinate. The sensation to urinate becomes stronger as the bladder continues to fill and reaches its limit. At that point, nerves from the bladder send a message to the brain that the bladder is full, and your urge to empty your bladder intensifies.

When you urinate, the brain signals the bladder muscles to tighten, squeezing urine out of the bladder. At the same time, the brain signals the sphincter muscles to relax. As these muscles relax, urine exits the bladder through the urethra. When all the signals occur in the correct order, normal urination occurs.

What causes problems in the urinary system?

Problems in the urinary system can be caused by aging, illness, or injury. As you get older, changes in the kidneys' structure cause them to lose some of their ability to remove wastes from the blood. Also, the muscles in your ureters, bladder, and urethra tend to lose some of their strength. You may have more urinary infections because the bladder muscles do not tighten enough to empty your bladder completely. A decrease in strength of muscles of the sphincters and the pelvis can also cause incontinence, the unwanted leakage of urine. Illness or injury can also prevent the kidneys from filtering the blood completely or block the passage of urine.

How are problems in the urinary system detected?

Urinalysis is a test that studies the content of urine for abnormal substances such as protein or signs of infection. This test involves urinating into a special container and leaving the sample to be studied.

Urodynamic tests evaluate the storage of urine in the bladder and the flow of urine from the bladder through the urethra. Your doctor may want to do a urodynamic test if you are having symptoms that suggest problems with the muscles or nerves of your lower urinary system and pelvis—ureters, bladder, urethra, and sphincter muscles.

Urodynamic tests measure the contraction of the bladder muscle as it fills and empties. The test is done by inserting a small tube called a catheter through your urethra into your bladder to fill it either with water or a gas. Another small tube is inserted into your rectum or vagina to measure the pressure put on your bladder when you strain or cough. Other bladder tests use x-ray dye instead of water so that x-ray pictures can be taken when the bladder fills and empties to detect any abnormalities in the shape and function of the bladder. These tests take about an hour.

What are some disorders of the urinary system?

Disorders of the urinary system range in severity from easy to treat to life threatening.

Benign prostatic hyperplasia (BPH) is a condition in men that affects the prostate gland, which is part of the male reproductive system. The prostate is located at the bottom of the bladder and surrounds the urethra. BPH is an enlargement of the prostate gland that can interfere with urinary function in older men. It causes blockage by squeezing the urethra, which can make it difficult to urinate. Men with BPH frequently have other bladder symptoms including an increase in frequency of bladder emptying both during the day and at night. Most men over age 60 have some BPH, but not all have problems with blockage. There are many different treatment options for BPH.

Painful bladder syndrome/Interstitial cystitis (PBS/IC) is a chronic bladder disorder also known as frequency-urgency-dysuria syndrome. In this disorder, the bladder wall can become inflamed and irritated. The inflammation can lead to scarring and stiffening of the bladder, decreased bladder capacity, pinpoint bleeding, and, in rare cases, ulcers in the bladder lining. The cause of IC is unknown at this time.

Kidney stones is the term commonly used to refer to stones, or calculi, in the urinary system. Stones form in the kidneys and may be found anywhere in the urinary system. They vary in size. Some stones cause great pain while others cause very little. The aim of treatment is to remove the stones, prevent infection, and prevent recurrence. Both nonsurgical and surgical treatments are used. Kidney stones affect men more often than women.

Prostatitis is inflammation of the prostate gland that results in urinary frequency and urgency, burning or painful urination, a condition called dysuria, and pain in the lower back and genital area, among other symptoms. In some cases, prostatitis is caused by bacterial infection and can be treated with antibiotics. But the more common forms of prostatitis are not associated with any known infecting organism. Antibiotics are often ineffective in treating the nonbacterial forms of prostatitis.

Proteinuria is the presence of abnormal amounts of protein in the urine. Healthy kidneys take wastes out of the blood but leave in protein. Protein in the urine does not cause a problem by itself. But it may be a sign that your kidneys are not working properly.

Renal (kidney) failure results when the kidneys are not able to regulate water and chemicals in the body or remove waste products from your blood. Acute renal failure (ARF) is the sudden onset of kidney failure. This condition can be caused by an accident that injures the kidneys, loss of a lot of blood, or some drugs or poisons. ARF may lead to permanent loss of kidney function. But if the kidneys are not seriously damaged, they may recover. Chronic kidney disease (CKD) is the gradual reduction of kidney function that may lead to permanent kidney failure, or end-stage renal disease (ESRD). You may go several years without knowing you have CKD.

Urinary tract infections (UTIs) are caused by bacteria in the urinary tract. Women get UTIs more often than men. UTIs are treated with antibiotics. Drinking lots of fluids also helps by flushing out the bacteria.