

Urinary Tract Infection (UTI)

What is a urinary tract infection (UTI)?

The urinary tract is comprised of the kidneys, ureters, bladder, and urethra (see Figure 1). A urinary tract infection (UTI) is an infection caused by pathogenic organisms (for example, bacteria, fungi, or parasites) in any of the structures that comprise the urinary tract. However, this is the broad definition of urinary tract infections; many authors prefer to use more specific terms that localize the urinary tract infection to the major structural segment involved such as urethritis (urethral infection), cystitis (bladder infection), ureter infection, and pyelonephritis (kidney infection). Other structures that eventually connect to or share close anatomic proximity to the urinary tract (for example, prostate, epididymis, and vagina) are sometimes included in the discussion of UTIs because they may either cause or be caused by UTIs. Technically, they are not UTIs and will be only briefly mentioned in this article.

UTIs are common, more common in women than men, leading to approximately 8.3 million doctor visits per year. Although some infections go unnoticed, UTIs can cause problems that range from dysuria (pain and/or burning when urinating) to organ damage and even death. The kidneys are the active organs that, during their average production of about 1.5 quarts of urine per day, function to help keep electrolytes and fluids (for example, potassium, sodium, water) in balance, assist removal of waste products (urea), and produce a hormone that aids to form red blood cells. If kidneys are injured or destroyed by infection, these vital functions can be damaged or lost.

While some investigators state that UTIs are not transmitted from person to person, other investigators dispute this and say UTIs may be contagious and recommend that sex partners avoid relations until the UTI has cleared. There is no dispute about UTIs caused by sexually transmitted disease (STD) organisms; these infections (gonorrhea, chlamydia) are easily transmitted between sex partners and are very contagious.

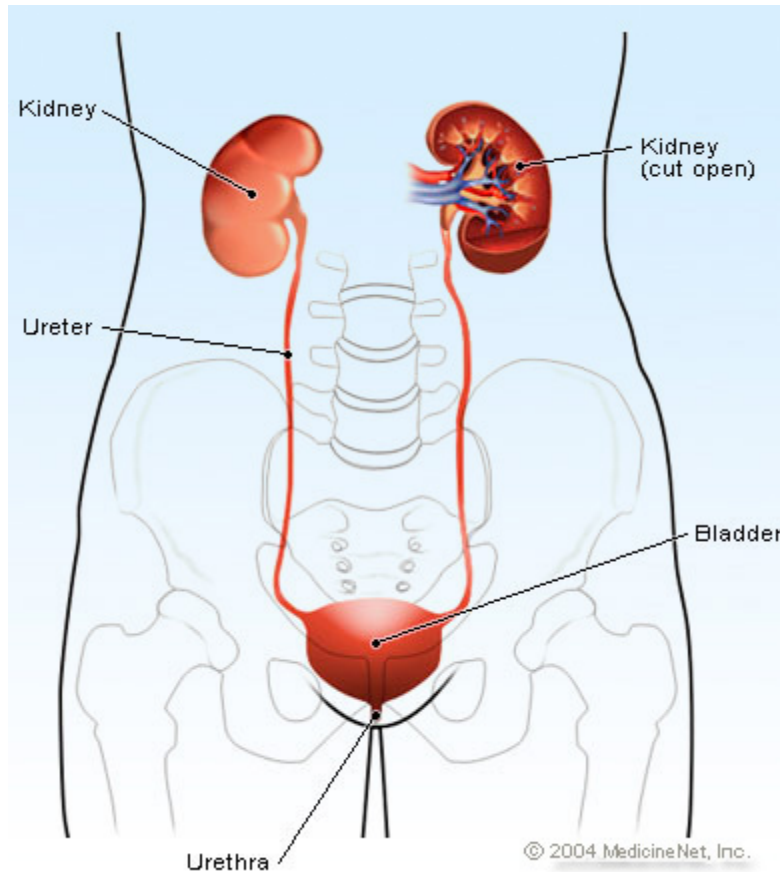


Figure 1: Picture of the urinary tract structures

What causes a UTI?

The most common causes of UTI infections (about 80%) are *Escherichia coli* bacterial strains that usually inhabit the colon. However, many other bacteria can occasionally cause an infection (for example, *Klebsiella*, *Pseudomonas*, *Enterobacter*, *Proteus*, *Staphylococcus*, *Mycoplasma*, *Chlamydia*, *Serratia* and *Neisseria* spp) but are far less frequent causes than *E. coli*. In addition, fungi (*Candida* and *Cryptococcus* spp) and some parasites (*Trichomonas*, *Schistosoma*) also may cause UTIs; *Schistosoma* causes other problems, with bladder infections as only a part of its complicated infectious process. In the U.S., most infections are due to Gram-negative bacteria with *E. coli* causing the majority of infections.

What are UTI risk factors?

There are many risk factors for UTIs. In general, any interruption or impedance of the usual flow of urine (about 50 cc per hour in normal adults) is a risk factor for a UTI. For example, kidney stones, urethral strictures, enlarged prostate, or any anatomical abnormalities in the urinary tract increases infection risk. This is due in part to the flushing or wash-out effect of flowing urine; in effect the pathogens have to "go against flow" because the majority of pathogens enter through the urethra and have to go retrograde (against a barrier, urine flow) to reach the bladder, ureters, and eventually the kidneys. Many investigators suggest that women are far more susceptible than men to UTIs because their urethra is short and its exit (or entry for pathogens) is close to the anus and vagina, which can be sources for pathogens.

People who require catheters have an increased risk (about 30% of patients with indwelling catheters get UTIs) as the catheter has none of the protective immune systems to eliminate bacteria and offers a direct connection to the bladder.

There are reports that suggest that women who use a diaphragm or who have partners that use condoms with spermicidal foam are at increased risk for UTIs. In addition, females who become sexually active seem to have a higher risk of UTI; some investigators term these UTIs as "honeymoon cystitis."

Men over 60 have a higher risk for UTIs because many men at or above that age develop enlarged prostates that may cause slow and incomplete bladder emptying.

Occasionally, people with bacteremia (bacteria in the bloodstream) have the infecting bacteria lodge in the kidney; this is termed hematogenous spread. Similarly, people with infected areas that are connected to the urinary tract (for example, prostate, epididymis, or fistulas) are more likely to get a UTI. Additionally, patients who undergo urologic surgery also have an increased risk of UTIs. Pregnancy does not apparently increase the risk of UTIs according to some clinicians; others think there is an increased risk between

weeks six through 26 of the pregnancy. However, most agree that if UTIs occur in pregnancy, the risk of the UTI progressing in seriousness to pyelonephritis is increased according to several investigators. In addition, their baby may be premature and have a low birth weight. Patients with chronic diseases such as diabetics or those who are immunosuppressed (HIV or cancer patients) also are at higher risk for UTIs.

What are UTI symptoms and signs in women, men, and children?

The UTI symptoms and signs may vary according to age, sex, and location of the infection in the tract. Some individuals will have no symptoms or mild symptoms and may clear the infection in about two to five days. Many people will not spontaneously clear the infection; some of the most frequent signs and symptoms experienced by most patients is a frequent urge to urinate, accompanied by pain or burning on urination. The urine often appears cloudy and occasionally reddish if blood is present. The urine may develop an unpleasant odor. Women often have lower abdominal discomfort or feel bloated and experience sensations like their bladder is full. Women may also complain of a vaginal discharge, especially if their urethra is infected, or if they have an STD. Although men may complain of dysuria, frequency, and urgency, other symptoms may include rectal, testicular, penile, or abdominal pain. Men with a urethral infection, especially if it is caused by an STD may have a pus-like drip or discharge from their penis. Toddlers and children with UTIs often show blood in the urine, abdominal pain, fever, and vomiting along with pain and urgency with urination.

Symptoms and signs of a UTI in the very young and the elderly are not as diagnostically helpful as they are for other patients. Newborns and infants may develop fever or hypothermia, poor feeding, jaundice, vomiting, and diarrhea. Unfortunately, the elderly often have mild symptoms or no symptoms of a UTI until they become weak, lethargic, or confused

Location of the infection in the urinary tract usually gives certain symptoms. Urethral infections usually have dysuria (pain or

discomfort when urinating). STD infections may cause a pus-like fluid to drain or drip from the urethra. Cystitis (bladder infection) symptoms include suprapubic pain, usually without fever and flank pain. Ureter and kidney infections often have flank pain and fever as symptoms. These symptom and signs are not highly specific, but they do help the physician determine where the UTI may be located.

How is a urinary tract infection diagnosed?

The caregiver should obtain a detailed history from the patient, and if a UTI is suspected, a urine sample is usually obtained. The best sample is a midstream sample of urine placed in a sterile cup because it usually contains only the pathogenic organisms instead of the transient organisms that may be washed from adjacent surfaces when the urine stream begins. Male patients with foreskin should retract the foreskin before providing a midstream urine sample. In some patients who cannot provide a midstream sample, a sample can be obtained by a catheter. The urine sample is then sent for urinalysis. Patients with a "discharge" or possibility of having an STD usually will have the discharge tested for STD organisms (for example, *Neisseria*, *Chlamydia*). A positive urinalysis is usually detection of about two to five leukocytes (white blood cells), about 15 bacteria per high-power microscopic field, and a positive nitrite test and/or positive leukocyte esterase test. Some clinicians and labs consider a positive test at least two of the above findings; still others report a positive for bacteria as > 1,000 bacteria cultured per milliliter of urine. At best, the initial urinalysis, depending on the various criteria used by clinicians and labs provide a presumptive positive test for a UTI. Most clinicians believe this presumptive test is adequate enough to begin treatment. A definitive test is usually considered to be isolation and identification of the infecting pathogen at a level of about 100,000 bacteria per cc of urine with genus of pathogen identified and antibiotic sensitivity determined by lab studies. This test takes 24-48 hours to obtain the results and your health-care provider will usually start treatment before this result is available.

In young children, infants, and some elderly patients, the best urine specimen is obtained by catheterization. Urine can also be collected

from "bags" placed over the urethral outlet (genital area), but these bagged specimens are only used for presumptive urinalysis as they are unreliable for culture. Some investigators consider any bagged urine samples as unreliable. Urine samples not processed within an hour of collection should either be discarded or be refrigerated before an hour passes because bacterial growth in urine at room temperature can yield false-positive tests. Special culture media and other tests are done for the infrequent or rare pathogens (for example, fungi and parasites).

Other tests may be ordered to further define the extent of a UTI. They may include blood cultures, a complete blood count (CBC), intravenous pyelogram, a CT scan, or other specialized tests.

What is the treatment for a urinary tract infection?

Treatment for a UTI should be designed for each patient individually and is usually based on how sick the patient is, what pathogen(s) are causing the infection, and the susceptibility of the pathogen(s) to treatments. Patients who are very ill usually require IV antibiotics and admission to a hospital; they usually have a kidney infection (pyelonephritis) that may be spreading to the bloodstream. Other people may have a milder infection (cystitis) and may get well quickly with oral antibiotics. Still others may have a UTI caused by pathogens that cause STDs and may require more than a single oral antibiotic. The caregivers often begin treatment before the pathogenic agent and its antibiotic susceptibilities are known, so in some individuals, the antibiotic treatment may need to be changed. In addition, pediatric patients and pregnant patients should not use certain antibiotics that are commonly used in adults. For example, ciprofloxacin (Cipro) and other related quinolones should not be used in children or pregnant patients due to side effects. However, penicillins and cephalosporins are usually considered safe for both groups if the individuals are not allergic to the antibiotics. Patients with STD-related UTIs usually require two antibiotics to eliminate STD pathogens. The less frequent or rare fungal and parasitic pathogens require specific antifungal or antiparasitic medications; these more complicated UTIs should often be treated in consultation with an infectious-disease expert.

All antibiotics prescribed should be taken even if the person's symptoms disappear early. Reoccurrence of the UTI and even antibiotic resistance of the pathogen may happen in individuals who are not adequately treated.

Over-the-counter medicines offer relief from the pain and discomfort of UTIs but they don't cure UTIs. Over-the-counter products like AZO or Uristat contain the medicine phenazopyridine (Pyridium, Urogesic), which works in the bladder to relieve pain. This medication turns urine an orange-red color, so patients should not be worried when this occurs. This medication can also turn other body fluids orange, including tears, and can stain contact lenses.

[Are there any home remedies for a UTI?](#)

The best "home remedy" for a UTI is prevention (see section below). However, although there are many "home remedies" available from web sites, holistic medicine publications, and from friends and family members; there is controversy about them in the medical literature as few have been adequately studied. However, a few remedies will be mentioned because there may be some positive effect from these home remedies. The reader should be aware while reading about these remedies (the term means to correct, relieve, or cure), they should not overlook the frequent admonition that UTIs can be dangerous and if no relief is given or the person's symptoms worsen over one to two days, the person should seek medical care. In fact, many of the articles about UTI remedies actually describe ways to reduce or prevent UTIs. Examples of home treatments that may help to prevent UTIs, that may have some impact on an ongoing infection, and are unlikely to harm people are as follows:

- Increase fluid intake may work by washing out organisms in the tract, making it more difficult for pathogens to adhere or stay in close proximity to human cells.
- Do not delay in emptying the bladder (urination): has the same effects of increased fluid intake and helps the bladder reduce the number of pathogens that may reach the bladder
- Eating cranberries or blueberries or drinking their unsweetened juice: These berries contain antioxidants that may help the immune system, and some investigators suggest they contain compounds

that reach the urine and reduce adherence of pathogens to human cells.

- Eating pineapple: Pineapple contains bromelain that has anti-inflammatory properties that may reduce UTI symptoms.
- Vitamin C may function to increase urine acidity to reduce bacterial growth
- Yogurt, Echinacea, baking soda, Oregon grape root, and aromatherapy have had people claim effectiveness in treating UTIs but the mechanisms are not clear

The problem with these remedies is that standard testing data and results with known amounts or concentrations of these compounds are usually not available. For example, how much cranberry juice is effective for a woman with known cystitis? Most publications do not answer this simple question, and some say that sweetened cranberry juice may aggravate the infection. In addition, it pays to read the entire label for these products as many have a caveat at the end of the ad that says the product does not claim it will cure UTIs. If people elect to try home remedies, they should clearly understand that if symptoms are not reduced or if they get worse, medical care should be sought.

There are over-the-counter tests available for detecting presumptive evidence for a UTI (for example, AZO test strips). These tests are easy to use and can provide a presumptive diagnosis if the test instructions are carefully followed; a positive test should encourage the person to seek medical care.

[What are possible complications of a urinary tract infection?](#)

Most UTIs cause no complications if they spontaneously resolve quickly (a few days) or if treated early in the infection with appropriate medications. However, there are a number of complications that can occur if the UTI becomes chronic or rapidly advances. Chronic infections may result in urinary strictures, abscesses, fistulas, and kidney damage. Rapid advancement of UTIs can lead to dehydration, kidney failure, sepsis, and death. Pregnant females with untreated UTIs may develop premature delivery and a low birth weight for the infant and run the risks of rapid advancement of the infection.

What is the prognosis for a UTI?

A good prognosis is usual for spontaneously resolved and quickly treated UTIs. Even patients that have rapidly developing symptoms and early pyelonephritis can have a good prognosis if quickly and adequately treated. The prognosis begins to decline if the UTI is not quickly recognized or treated. Elderly and immunodepressed patients may not have the UTI recognized early; their prognosis may range from fair to poor, depending on how much damage is done to the urinary tract or if complications like sepsis occur. Like adults, most adequately treated children will have a good prognosis. Children and adults with recurrent UTIs may develop complications and a worse prognosis; recurrent UTIs may be a symptom of an underlying problem with the urinary tract structure. These patients should be referred to a specialist (urologist) for further evaluation.

Is it possible to prevent recurrent UTIs with a vaccine?

Currently, there are no commercially available vaccines for UTIs, either recurrent or first-time infections. One of the problems in developing a vaccine is that so many different organisms can cause infection, a single vaccine would be difficult to synthesize to cover them all. Even with *E. coli* causing about 80% of all infections, the subtle changes in antigenic structures that vary from strain to strain further complicates vaccine development even for *E. coli*. Researchers are still investigating ways to overcome the problems in UTI vaccine development; injected, oral, mucosal, and nasal preparations are being investigated.

Can a UTI be prevented?

Many methods have been suggested to reduce or prevent UTIs. Some of these are considered home remedies and have been discussed (see above home remedies section). There are other suggestions that may help prevent UTIs. Good hygiene for males and females is useful; for females, wiping from front to back helps keep pathogens that may reside or pass through the anal opening away from the urethra; for males, retracting the foreskin before urinating reduces the chance of urine lingering at the urethral opening and

acting as a culture media for pathogens. Incomplete bladder emptying and resisting the normal urge to urinate can allow pathogens to survive and replicate easier in a non-flowing system. Some clinicians recommend washing before and urinating soon after sex to reduce the chance of urethritis/cystitis. Many clinicians suggest that anything that causes a person irritation in the genital area (for example, tight clothing, deodorant sprays, or other feminine products like bubble bath) may encourage UTI development. Wearing underwear that is somewhat adsorptive (for example, cotton) may help wick away urine drops that otherwise may be areas for pathogen growth.

Urinary Tract Infections (UTI) At A Glance

- Urinary tract infections are infections of the urethra, bladder, ureters, or the kidneys, which comprise the urinary tract
- *E. coli* bacteria cause the majority of UTIs, but many other bacteria, fungi, and parasites may also cause UTIs
- Females have higher risk for UTIs than most males, probably because of their anatomy; other risk factors for UTIs include any condition that may impede urine flow (enlarged prostate, congenital urinary tract abnormalities, inflammation). Patients with catheters or those who undergo urinary surgery and men with enlarged prostates are at higher risk for UTIs
- Symptoms and signs of UTI vary somewhat depending on sex, age, and area of the urinary tract that is infected; some unique symptoms develop depending on the infecting agent.
- Urinary tract infections are diagnosed usually by isolating and identifying the urinary pathogen from the patient; there are some home tests available for presumptive diagnosis.
- There are home remedies for UTI, but most may, at best, help reduce the risk or discomfort of UTIs but are not considered cures for the disease.
- There can be many complications to urinary tract infections, including dehydration, sepsis, kidney failure, and death
- If treated early and adequately, the prognosis is good for most patients with a UTI.
- Although there is no vaccine available for UTIs, there are many ways a person may reduce the chance of getting a UTI.