Urinary Tract Infections
Definition & Prevalence.

Definition and Prevalence

What is a urinary tract infection?

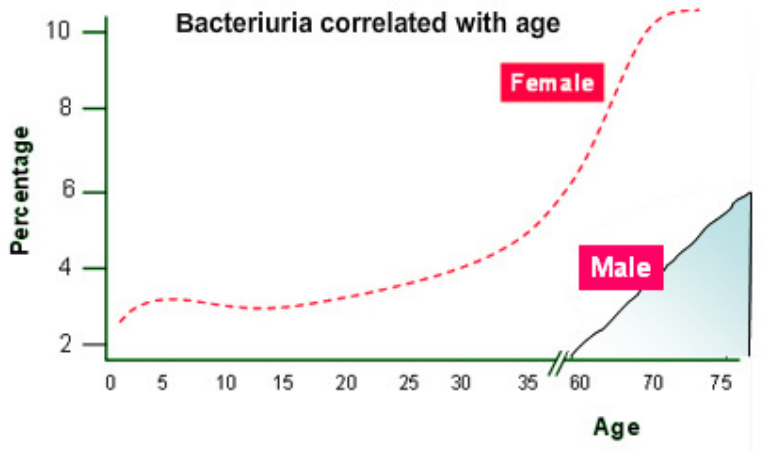
A urinary tract infection – or UTI – is an infection that begins in your urinary system. Urinary tract infections are a common cause of abdominal pain and a frequent complaint at emergency departments. Proper diagnosis, treatment and patient education are, without a doubt, key to optimal outcomes.

How common is urinary tract infection?

Urinary tract infections are a serious health problem affecting millions of people each year.

UTI is a prevalent condition as it is the second most common type of infection in the body. Infections of the urinary tract account for about 8.3 million doctor appointments each year.

Women are more frequently prone to UTIs for reasons that are not yet well understood. About to 20% of women develop UTI symptoms during their lifetime. In men, the numbers are not so high, but when UTI occurs in men, it can be very serious.



Urinary Tract Infections

The urinary tract: anatomy and function.

The Urinary Tract: Anatomy and Function

What is the urinary tract?

The urinary tract consists of several organs that produce, store and excrete urine. Your urinary system is composed of the kidneys, the ureters, the bladder and the urethra. Any organ in this system can become infected, but most infections involve the lower urinary tract, i.e., the urethra and the bladder[1].

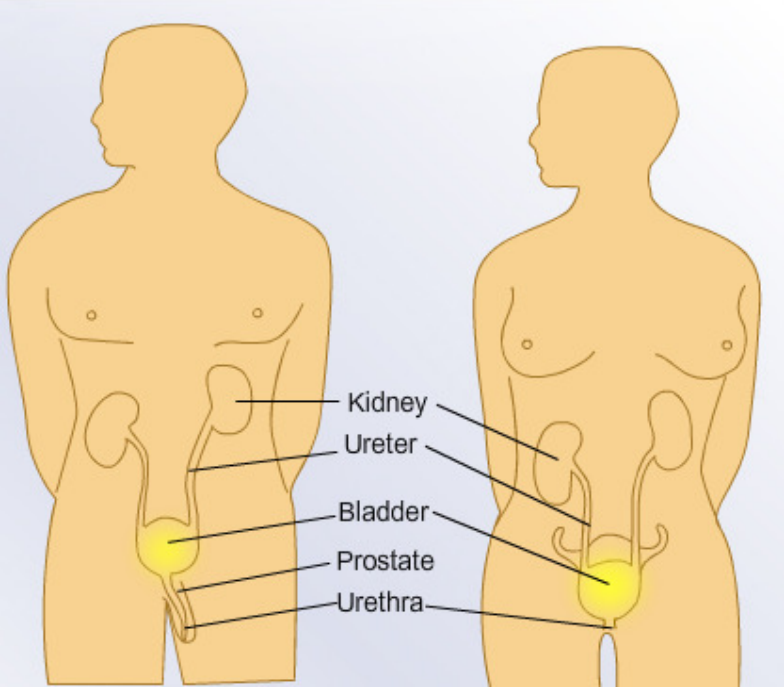
How does the urinary system work?

The kidneys remove excess liquid and waste products from the blood in the form of urine, keep a stable balance of salts and other metabolites of the blood, and produce a hormone which helps in the formation of red blood cells.

Our kidneys are the real chemical filters of the blood in the body. Almost 25% of the blood that is pumped out of the heart goes to the kidneys to be purified. The blood that is filtered by the kidneys is processed to isolate waste products and excess minerals, sugar and other chemicals. Kidneys also contain a pressure-sensitive tissue to help the body to maintain the

normal blood pressure range. Through this tissue, some minerals and water are partly discarded or saved so that the proper equilibrium is reached.

Urine is composed of waste products which flow through the ureters (one per kidney); each ureter is a narrow tube that penetrates into the bladder, a sack-like organ in the lower abdomen, where urine accumulates until voiding. During urination, muscles in the bladder wall help to push urine out of the bladder, through the urethra and to the outside.[2] In men, the urethra runs through the middle of the penis, whereas in women, it opens right in front of the vagina.



Most of the time, a muscle called the sphincter squeezes the urethra shut to keep urine in when you are not urinating; the sphincter relaxes when you urinate so that the urine flows easily.

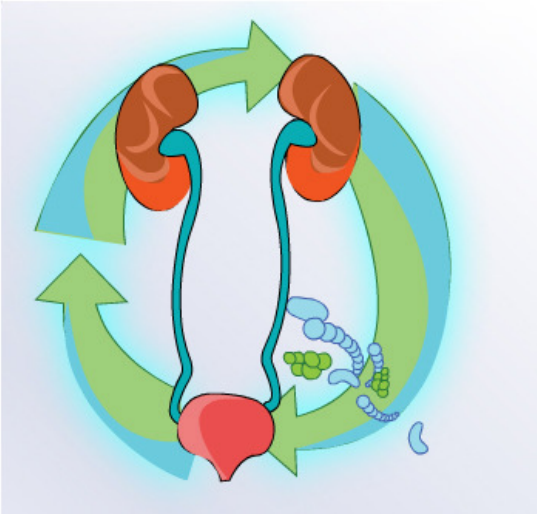
Urinary Tract Infections
Etiology: How and Where an Infection Starts

Urine is sterile under normal conditions

Urine is normally sterile, which means that it is free of microorganisms (including bacteria). Several factors keep bacteria out of the urine.[3] These include:

- The urethral sphincter: when the urethra is squeezed shut, bacteria cannot flow back into the urethra from the meatus (the opening through which the urine flows out of the body) into the bladder.
- The length of the urethra: this makes for a long route for the bacteria to travel up to the bladder. The urethra in women is shorter than in men, which may explain why women have greater risk than men of developing a urinary tract infection.
- Frequent flushing of the urethra: any microorganism that makes it into the urethra is flushed out during the next urination, and, since most people empty their bladders almost completely any other bacteria that may reach the bladder will be washed out as well.

From an anatomical standpoint, there are also valves inside the ureters that prevent the reflux of urine from the bladder up to the kidneys. This mechanism prevents bacterial infection in the kidneys, even when the bladder and the urine are infected.



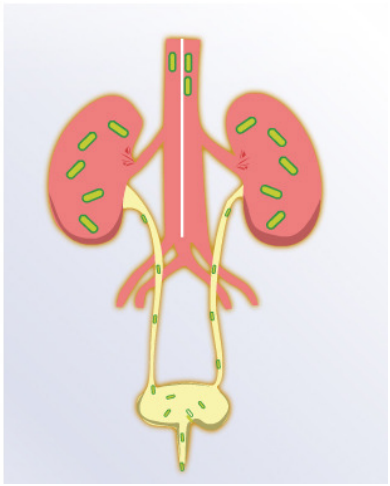
Continuación de Etiology

How does an infection start?

Despite of the fact that urine can be a sterile fluid, it is paradoxically a good culture medium for bacteria.[4] An infection occurs when tiny organisms, usually different species of bacteria from the digestive tract, cling to the opening of the urethra and begin to multiply.

Common pathogens

- *Escherichia coli* is the number-one uropathogen, accounting for approximately 85-90% of UTIs. This Gram-negative bacterium normally lives in the colon and is able to adhere to the bladder wall with its finger-like projections known as fimbriae or *Pili.* There other bacterial species that, like *E. coli,* have fimbriae to help them attach to urinary tract epithelium.
- *Pseudomonas aeruginosa* is another Gram-negative bacterium, more commonly found in nursing homes and frequently isolated in samples from hospitalized patients. It is mainly responsible for UTIs in patients with urethral catheters.
- Microorganisms called *Chlamydia* and *Mycoplasma* may also cause UTIs in both men and women, but these infections tend to remain limited to the urethra and the reproductive system. Unlike *E. coli*, *Chlamydia* and *Mycoplasma* may be sexually transmitted, and infections require the treatment of both partners.



Urinary Tract Infections

Where do UTIs occur in the urinary tract?

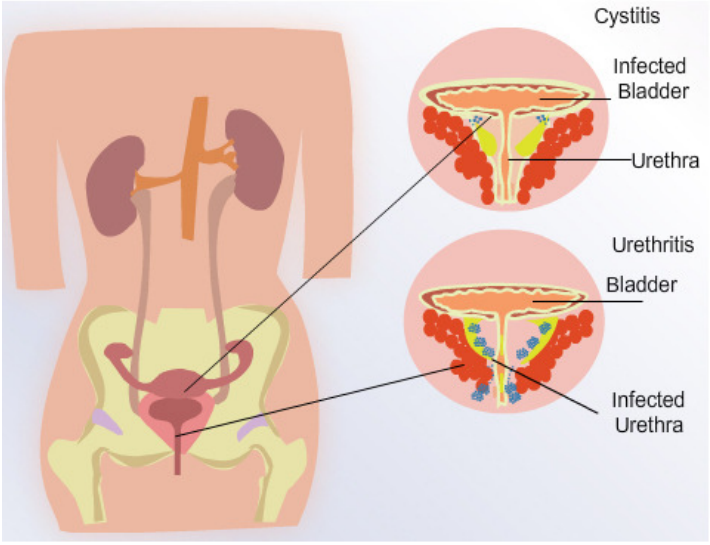
The urinary tract can be infected from above (by entering the kidneys from the bloodstream and travelling downward) or from below (by bacteria entering the urethra and travelling upward). In general, the farther the organ in the urinary tract is from the site of entry of bacteria, the less likely the organ is to be infected.

There are several types of urinary tract infection according to the site of infection. Each type may result in more specific signs and symptoms, depending on which part of your urinary system is infected.[5] These types have been summarized as follows:

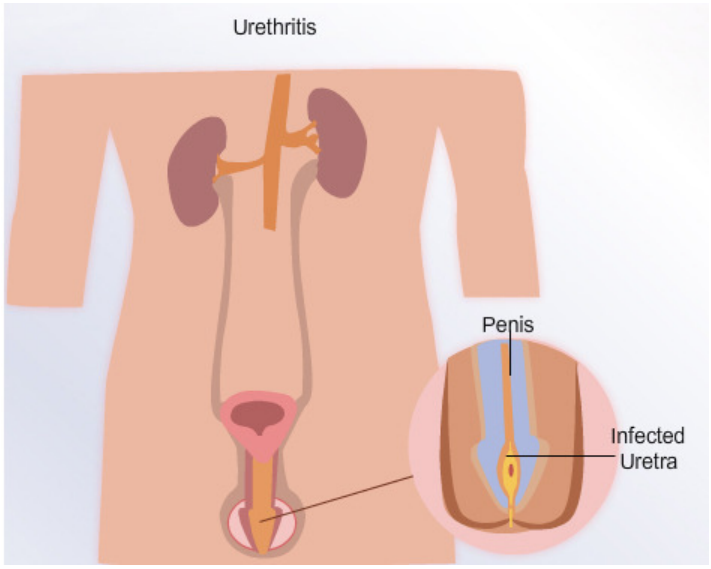
Affected part of the urinary tract	Type of infection	Description
Urethra	Urethritis	Many sexually transmitted diseases start with urethritis
Bladder	Cystitis	Acute cystitis occurs when bacteria attach to and/or invade the bladder wall
Ureter	Ureteritis	Bacteria enter the urinary tract from above. The ureter-to-bladder valves may allow urine to reflux from the bladder into the ureters.
Kidneys	Pyelonephritis	Urine can reflux all the way to the kidneys. If the infection remains untreated, bacteria may then travel further up the ureters to multiply and infect the kidneys.

The urinary system itself usually helps ward off infection. Ureters and bladder prevent urine from backing up toward the kidneys, and urine itself allows bacteria to be washed out of the body. In both sexes, the immune system works to avoid infections, but despite all these safeguards, infections still occur.

Infections in Women



Infections in Men



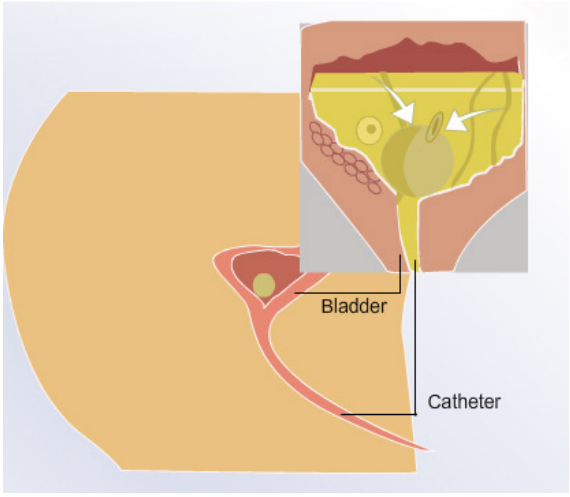
Urinary Tract Infections
Epidemiology: Population at Risk

Who is at risk of UTI?

Some people seem to be more likely than others to develop UTIs. Risk factors include the following:[3]

- **Being Female**. Almost half of the female population will develop a UTI at some point in their life, and many will experience more than one. Anatomical structure could explain this high occurrence. Women have a shorter urethra, which shortens the distance that bacteria must travel to reach the bladder.
- **Being sexually active**. Sexually active women tend to have more UTIs. In addition, the urethral opening in women is very close to various sources of bacteria from the anus and vagina. Sexual intercourse can trigger an infection by irritating the urethra and allowing the germs to more easily reflux into the bladder.
- **Certain types of birth control**. According to several studies, women who use a diaphragm or spermicidal foam are more likely to develop a UTI than those who use other types of birth control.
- **Pregnancy**. Pregnant women seem to have no more UTIs than other women. However, when they do occur it is more likely for the bacteria to travel to the kidneys due to hormonal changes and shifts in the position of the urinary tract.
- **Aging**. After menopause, tissues of the vagina, urethra and the base of the bladder become thinner and more fragile due to loss of estrogen. This makes women more likely to develop UTIs.
- **Anatomical abnormalities**. Any abnormality produced in the anatomical structure that obstructs the urinary tract may obstruct the flow of urine as well. A kidney stone sets the stage for an infection. An enlarged prostate impedes urine flow (urine retention) and this can also be a risk factor for developing a urinary infection.
- **Some chronic diseases**. Diabetes and any other disorder that suppresses the immune system raise the risk for a future infection.

- **Catheters**. The prolonged use of tubes (catheters) placed in the urethra and the bladder is a common source of infection. Elderly, or unconscious people, or those with nervous system disorders who lose bladder control, may need a catheter for life. Hospitalized patients are therefore at higher risk to acquire a tube-based bacterial infection.



Recurrent UTIs

Nearly 20% of women who have a UTI will develop another one. Women who have had three UTIs are likely to continue having them. Four out of five such women get another UTI within 18 months of the last one. Many women have them even more frequently.[6]

Usually, the latest infection stems from a strain or type of bacteria that is different from the previous infection, indicating a separate infection. Even when several UTIs in a row are caused by *E. coli*, slight differences in the bacteria indicate distinct infections.

One recent study funded by the National Institutes of Health (NIH) has suggested that one factor behind recurrent UTIs may be the ability of bacteria to attach to cells lining the urinary tract.

Urinary Tract Infections
Symptoms

What are the symptoms of UTI?

The symptoms a person with a UTI has depend on the age of the person is and on the location of the infection in the urinary tract.[7] Not everyone with a UTI develops recognizable signs and symptoms, but most people have some. The greatest concern with a UTI is if it progresses to pyelonephritis. This can result in scarring and damage to the kidney tissue.

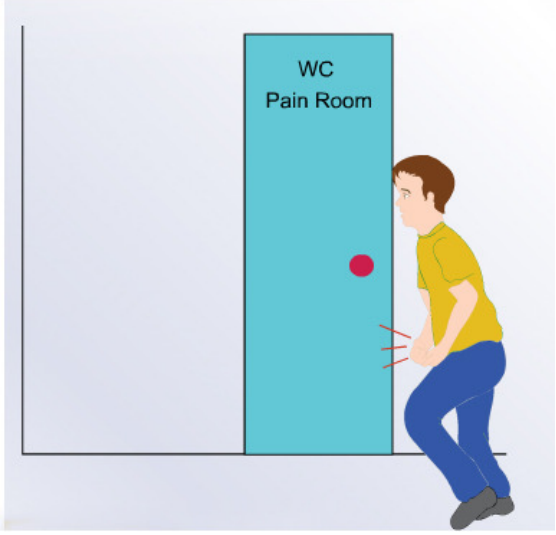
The symptoms of UTI vary, but the most common ones involve changes or problems detected with urination. In general, these may include:

- A strong and frequent urge to urinate
- A burning sensation in the area of the bladder or the urethra during urination
- Passing a small amount of urine
- Blood in the urine (called hematuria), or cloudy or milky, strong-smelling urine
- Bacteria in the urine (bacteriuria)

Normally, people affected by this type of infection feel generally unwell – tired, shaky, drained of energy – and feel pain even when not urinating.

Fever is usually absent in these patients whenever the infection is in the bladder or urethra. A fever may mean that the infection has reached the kidneys. Since your kidneys are located in your back, just below your lower ribs, pyelonephritis may appear as pain in your back or flank(s), or in the abdomen. Fever usually (but not always) accompanies the pain. If your kidneys are severely affected, you may also start seeing some of the complications caused by kidney malfunction. Other signs of pyelonephritis include nausea, vomiting, shaking and chills.

If you have symptoms of a urinary infection, contact your doctor without delay. Tell your doctor where in the urine stream the blood appears. This is important for your specialist to figure out what part of the urinary tract the infection comes from. Having this information helps your doctor select the best treatment.



Urinary Tract Infections
Tests and Diagnosis

How is UTI diagnosed?

Firstly, you on your own will notice any of the urinary symptoms related with UTI. If so, be sure to contact your doctor for a thorough check-up.

The first step in treating a UTI is to make sure there really is one. If your doctor suspects you have a urinary infection, you will be asked to turn in a urine sample to determine if pus, red blood cells or bacteria are present in your urine.[5] You will have to wash your genital area well and then collect a midstream sample of urine in a sterile container. This helps prevent a false-positive result of the test caused by external contamination of the sample.

In the laboratory analysis of the sample, the urine is examined for white and red blood cells and bacteria. Then the bacteria are grown in a culture and tested against different antibiotics to see which drug is the best to destroy the bacteria. This last step is called a sensitivity test and the test is called an “antibiogram”.

Urine is also analyzed by using a colorimetric test. Several types of test strips have a very good sensitivity and specificity to determine the presence of white blood cells (leukocytes). UTI symptoms combined with the presence of leukocytes are enough to make a real diagnosis of UTI.

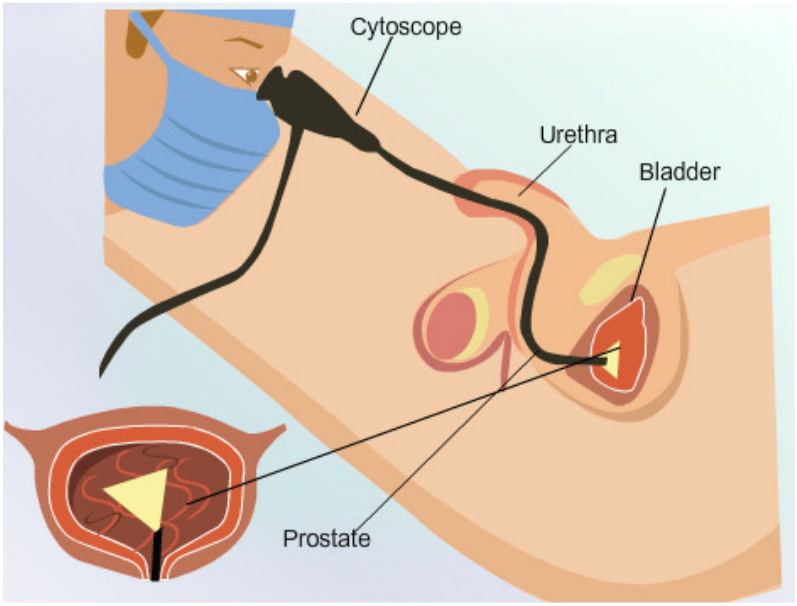
Some microbes such as *Chlamydia* and *Mycoplasma* require special bacterial cultures to grow. A doctor suspects one of these infections when a person has symptoms of a UTI and pus in the urine, but a standard culture fails to grow any bacteria.

When an infection does not clear up with treatment and is traced to the same strain of bacteria, the doctor may order some tests to determine if your system is normal. An example of this is the intravenous pyelogram, which gives x-ray images of the bladder, kidneys, and ureters. An opaque dye visible on x-ray film is injected into a vein and a series of x-rays is

taken. The film shows an outline of the urinary tract, revealing even small changes in its structure.

If you have recurrent infections, your doctor also may recommend an ultrasound exam, which provides images from the echo patterns of sound waves reverberating off the internal organs. Another useful test is cystoscopy. A cystoscope is an instrument comprising a hollow tube with several lenses and a light source, which allows the doctor to see inside the bladder from the urethra.

Cystoscopy of the Bladder.



Urinary Tract Infections
Treatment

How is UTI treated?

Antibacterial drugs (antibiotics) are the first-line treatment for UTI. The choice of drug and the duration of treatment depend on the health condition of the patient and the type of bacteria found in the urine.[7]

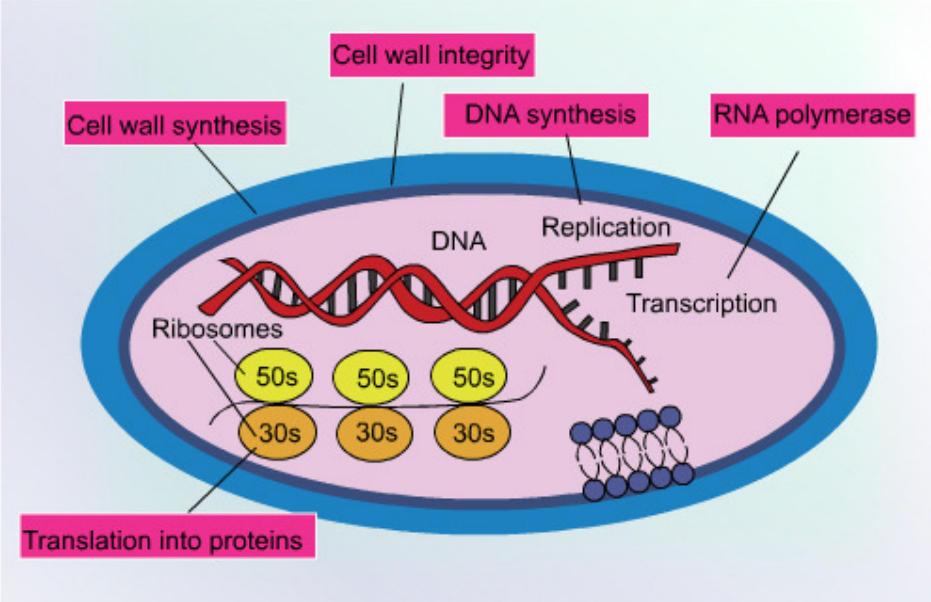
➢ Simple infection

Drugs commonly recommended for simple urinary tract infections include:

- **Amoxicillin.** This is a penicillin-type antibiotic whose function consists of inhibiting bacterial cell wall synthesis. It used to be a first-line choice, but significant resistance has been reported.
- **Nitrofurantoin.** This is bactericidal in urine and works by inhibiting a very important bacterial metabolite (acetyl-CoA), thus interfering with carbohydrate metabolism, and by inhibiting DNA and RNA synthesis (the genetic machinery essential for life).
- **Fluoroquinolones.** Ciprofloxacin and levofloxacin inhibit DNA synthesis and are thus bactericidal. They cover a large spectrum and are able to kill an extensive group of uropathogens. They have the additional benefit of once or twice-daily dosing. Unlike antibiotics, this class seems to show less resistance.
- **Trimethoprim/sulfamethoxazole.** This combination blocks a bacterial enzyme essential to the synthesis of folic acid. Trimethoprim alone is one of the drugs most often used to treat routine urine infections.

Symptoms usually clear up within a few days of treatment if the infection is not complicated by an obstruction or other disorder. Nonetheless, your doctor may ask you to take antibiotics for a week or two to be completely sure that the pathogen is fully eliminated. Longer treatments could be needed for patients with a UTI caused by *Mycoplasma* or *Chlamydia*, which are usually treated with trimethoprim/sulfamethoxazole.

Your doctor may also prescribe a pain medication (analgesic) that numbs your bladder and urethra to relieve the feeling of burning while urinating.



- Recurrent infection

When faced with recurrent infections of the urinary tract, your doctor may recommend a longer course of antibiotic treatment or a self-treatment program with short courses of antibiotics at the outset of your urinary symptoms.[8]

For infections related to sexual activity, taking a single dose of antibiotic after sexual intercourse is recommended.

Vaginal estrogen therapy is prescribed for postmenopausal women in order to minimize the chance of recurrent UTIs.

Severely ill patients with kidney infections may be hospitalized until they can take fluids and the necessary intravenous drugs on their own. Kidney infections normally require several weeks of antibiotic treatment.

Urinary Tract Infections

Prevention

How can UTI be prevented?

UTIs can be painful, but there are many things you can do to ease discomfort until drugs can provide relief.[3]

- Drink plenty of liquids, especially water every day
- Voiding as soon as you feel the need and not holding it, thus preventing pathogen replication, should urine become contaminated
- Use a heating pad on your abdomen to minimize bladder pressure or discomfort
- Making sure that wiping after urination and a bowel movement is from front to back. This will keep the bacteria from the anus away from the urethra
- Empty your bladder as soon as possible after intercourse
- Removing wet bathing suits promptly
- Avoidance of feminine deodorant products/perfumes and douches to prevent the irritation of the urethra
- Wearing cotton underwear and loose-fitting clothes, particularly in hot weather (to minimize a warm, moist environment and to prevent periurethral infection)

Conclusions

Urinary tract infections are common in the emergency health care setting. It is important to remember the common causative organisms and appropriate antibiotic treatments. Pyelonephritis is a more serious disorder that can be managed in an outpatient setting for select patients with good follow-up. Sometimes urinary symptoms or positive urine tests may indicate an infection that is not in the urinary system, such as a sexually transmitted infection, and can be much more serious and require different treatment. A good history with review of systems and a physical exam should help differentiate.

In the future, scientists may develop a vaccine that can prevent recurrence of UTIs.

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