

URINARY TRACT INFECTION: CAUSES, SYMPTOMS, DIAGNOSIS AND IT'S MANAGEMENT

¹M. Komala*, ¹Debjit Bhowmik, ²K.P.Sampath kumar

¹Karpagam University, Coimbatore

²Department of Pharmaceutics, Coimbatore medical college, Coimbatore-114, Tamil Nadu, India

Corresponding author: E.Mail:komala.pharmacy@gmail.com

ABSTRACT

A urinary tract infection is an infection in any part of your urinary system - kidneys, ureters, bladder and urethra. Most infections involve the lower urinary tract — the bladder and the urethra. Women are at greater risk of developing a UTI than men are. Infection limited to your bladder can be painful and annoying. However, serious consequences can occur if a UTI spreads to your kidneys. Antibiotics are the typical treatment for a UTI. But you can take steps to reduce your chance of getting a UTI in the first place. Antibacterial agents are a major part of the treatment for UTI. Due to the side effects associated with antibiotic and drug resistance a need for an alternative therapy is emphasised. A major error in management of UTI has been that most clinicians give too many drugs for too longer period.

KEY WORDS: Urinary tract infection, Herbs, Antibiotic, Infection

1. INTRODUCTION

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 a 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 (e.g., enlarged prostate, congenital urinary tract abnormalities, and 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 the area of the urinary tract that is infected; some unique symptoms develop depending on the infecting agent. UTIs 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. They are not considered cures for the disease. There can be many complications of 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.

Urinary Tract Infection (UTI): UTI is a bacterial infection affecting urinary tract. When bacteria from the rectal area enter the urinary tract via the urethra to the bladder and multiply in the urine, an infection occurs. In many cases bacteria first travel to the urethra. When bacteria multiply an infection can occur. An infection limited to the urethra is called urethritis. If bacteria move to the bladder and multiply, a bladder infection called cystitis. If the infection is not treated promptly, bacteria may then travel further up the ureters to multiply and infect the kidneys, called pyelonephritis.

The urinary tract is comprised of the kidneys, ureters, bladder, and urethra. 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 be briefly mentioned in this article. UTIs are common, leading to between seven and 10 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 produce about 1.5 quarts of urine per day. They help keep electrolytes and fluids (for example, potassium, sodium and water) in balance, assist in the removal of waste products (urea), and produce a hormone that aids in the formation of red blood cells. If kidneys are injured or destroyed by infection, these vital functions can be damaged or lost.

There is general agreement that sexual intercourse can cause a UTI. This is mostly thought to be a mechanical process whereby bacteria are introduced into the urinary tracts during the sexual act. There is no dispute about the transmission of UTIs caused by sexually transmitted disease (STD) organisms; these infections (for example, gonorrhoea and Chlamydia) are easily transmitted between sex partners and are very

contagious. Some of the symptoms of UTIs and sexually transmitted diseases can be similar (pain and foul smell). A urinary tract infection, or UTI, is an infection that can happen anywhere along the urinary tract. Urinary tract infections have different names, depending on what part of the urinary tract is infected.

- Bladder -- an infection in the bladder is also called cystitis or a bladder infection
- Kidneys -- an infection of one or both kidneys is called pyelonephritis or a kidney infection
- Urethras -- the tubes that take urine from each kidney to the bladder are only rarely the site of infection
- Urethra -- an infection of the tube that empties urine from the bladder to the outside is called urethritis

Causes of UTI: Normally urine is sterile. It is usually free of bacteria, viruses and fungi but does contain fluids, salts and waste products. An infection occurs when tiny organisms, usually bacteria from the digestive tract, cling to the opening of the urethra and begin to multiply. Most infections arise from one type of bacteria, *E.coli* which normally lies in the colon. The organisms most commonly responsible for catheter-associated UTIs are *E.coli*, *Proteus mirabilis*, *P.aeruginosa*, and *Streptococcus faecalis*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Mycobacterium tuberculosis*, *Actinomyces*, *Nocardia*, *Candida* etc can cause UTI. In addition *Mycoplasma* and *Chlamydia* may be associated with sexually transmitted UTI.

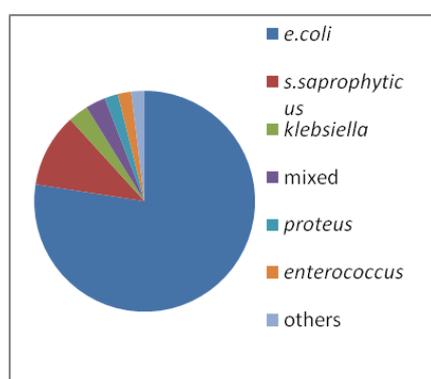


Figure.1. Diagram showing contribution of various microbes for causing the UTI: *E. coli* 79%, *S. Saprophyticus* 11%, *Klebsiella* 3%, Mixed 3%, *Proteus* 2%, *Enterococcus* 2%, others 2%.

SYMPTOMS

- Common urinary tract infection (UTI) symptoms in women include:
 - Urge to urinate frequently, often in small amounts
 - Burning with urination
 - Cloudy urine
 - Strong unpleasant smell of urine
 - Dark or bloody urine
 - Pelvic pain
 - Flank or back pain (kidney infection)
 - Fever, chills (usually with kidney infection)
 - Other possible symptoms include bloating, vaginal discharge
- Common urinary tract infection (UTI) symptoms in men include:
 - Urge to urinate frequently, often in small amounts
 - Burning with urination
 - Cloudy urine
 - Strong unpleasant smell of urine
 - Dark or bloody urine
 - Rectal pain (kidney infection)
 - Flank or back pain (kidney infection)
 - Other symptoms may include penile, testicular and abdominal pain, and penile discharge

Common urinary tract infection (UTI) symptoms in children include:

- Urge to urinate frequently, often in small amounts
- Burning with urination
- Cloudy urine
- Strong unpleasant smell of urine (not as reliable in children)
- Dark or bloody urine

- Abdominal pain
- Fever
- Vomiting
- Other symptoms (especially in newborns and infants) may include hypothermia, diarrhea, jaundice, poor feeding and in some children, bedwetting

The following also increase your chances of developing a UTI:

- Diabetes
- Advanced age (especially people in nursing homes)
- Problems emptying your bladder completely (urinary retention)
- A tube called a urinary catheter inserted into your urinary tract
- Bowel incontinence
- Enlarged prostate, narrowed urethra, or anything that blocks the flow of urine
- Kidney stones
- Staying still (immobile) for a long period of time (for example, while you are recovering from a hip fracture)
- Pregnancy
- Surgery or other procedure involving the urinary tract

Factors that may make increase the risk for UTI:

- Infrequent voiding – The bacteria spends a greater amount of time in the bladder allowing it time to replicate and take hold.
- Incomplete voiding – An excess amount of urine is left in the bladder and the bacteria is not completely flushed out with each void.
- Personal Hygiene – Perineal contamination with faeces increases the risk of coliform bacteria in the vagina and near the urethra will increase the risk of urinary tract infections.
- Sexual Activity – Trauma to the urethra and surrounding tissue may increase susceptibility to infection and also the bacteria can be mechanically pushed into the urethra.
- Use of spermicidal contraception – The actual spermicide changes the normal flora in the vagina and more coliform bacteria colonize the area. The presence of these strains of bacteria leads to a greater risk of a UTI.
- Genetics – Certain cells on the vaginal mucosa and the urethra can express receptors that actually allow certain bacteria to attach and pull themselves into the bladder causing an increase risk of a UTI.
- Hormonal Status - A lack of estrogen allows for thinning and deficiency of the tissue in the vagina and urethral that may allow for greater susceptibility to UTIs. This lack of estrogen also changes the pH of the vagina which allows for colonization with more coliform bacteria and increases the risk of UTIs.
- Diabetes – Persistently high blood sugar levels cause immunosuppression which allows for greater susceptibility to UTIs.
- Immunosuppression – There are a variety of causes of immunosuppression which decreases a person's ability to fight off infections.

Urinary tract problems: If you are not able to control when you urinate, your risk for a UTI increases. Your risk also increases if you have had a UTI or if you have had surgery on your urinary tract in the past.

Blockages: A blockage in your urinary tract stops your urine from flowing freely. Causes of a blockage include kidney and bladder stones.

Not being circumcised: The foreskin of the penis makes it easier for germs to get trapped and enter your urinary tract.

Prostate problems: An enlarged prostate gland or an infected prostate (prostatitis) increases your UTI risk.

Sexual intercourse: You are more likely to get an infection if your sex partner has an infection. Anal sex also increases your UTI risk.

Weak immune system: Your immune system is your body's defense against infection and disease. A weak immune system may not be able to fight the germs that can cause a UTI. Your immune system may become weak when you have a long-term illness, such as HIV or diabetes

Diagnosis: 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 and 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, provides 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 the genus of the pathogen (usually bacterial) identified and antibiotic sensitivity determined by lab studies. This test takes 24-48 hours to obtain the results and your health care professional will usually start treatment before this result is available. Sometimes blood in the urine is a sign of a UTI but it may also indicate other problems, such as a urinary calculus or "stone." In young children, infants, and some elderly patients, the best urine specimen is obtained by catheterization, as they are unable to deliver a "clean catch" urine sample as described above.

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.

Treatment: Treatment for a UTI should be designed for each patient individually and is usually based on the patient's underlying medical conditions, what pathogen(s) are causing the infection, and the susceptibility of the pathogen(s) to treatments. Patients who are very ill usually require intravenous (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 (OTC) medicines offer relief from the pain and discomfort of UTIs but they don't cure UTIs. OTC products like AZO or Uristat contain the medicine, phenazopyridine (Pyridium and 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.

Most commonly used Antibiotics for UTIs and its possible side effects:

1. Macro-dantin (Macrobid or nitrofurantoin) –Side effects of long-term use may include fibrosis or scarring of the lungs and peripheral neuropathy. Generally, the medication is considered safe during pregnancy, except with rare genetic metabolic deficiencies.
2. Bactrim (Septra or sulfa/TMP) –This drug should not be taken early during pregnancy and may affect the effectiveness of oral contraceptives.
3. Trimethoprim –It should not be taken during pregnancy.
4. Quinolones (Levaquin, Levofloxacin, or Cipro) - This drug should not be taken during pregnancy.
5. Cephalosporin (Keflex) – This may affect the effectiveness of oral contraceptives.
6. Doxycycline –It is not safe during pregnancy or breastfeeding.

Table.1. Parenteral antibiotics used for the treatment of pyelonephritis and its side effects

Antibiotic	Dose (Adult)	Side effects
Cefuroxime	750mg i.v every 8hr	Diarrhoea, nausea, allergic reactions
Ceftazidime	1g i.v every 8hr	Diarrhoea, nausea, allergic reactions
Co-amoxiclav	1.2g i.v every 8hr	Nausea, diarrhoea, rashes, hepatitis, erythemamultiforme
Gentamicin	80-120mg i.v every 8hr	Vestibular and hearing damage, nephrotoxicity
Ciprofloxacin	200mg i.v every 12hr	Nausea ,vomiting, dizziness, headache, convulsions, hallucination, hepatitis, photosensitivity, blood disorder
Imipenem	500mg i.v.every 8hr	Nausea, vomiting, diarrhoea, allergic reactions, convulsions, confusion

Table.2. Traditional Indian herbs used to treat urinary tract infection

Herbs	Applications in treating UTI
Agrimony, Couch grass, Elder flowers, Plantain, Yarrow, Juniper (not with inflammation), Horsetail, Lady's mantle, Saw palmetto	General healing support for the urinary system.
Juniper berry	Juniper relieves pain and is antiseptic, diuretic, and stimulant
Couch grass.	Diuretic with a soothing, anti-inflammatory healing effect on the lining of the bladder. Useful when there is mucus discharge from the bladder with painful and frequent urination
Yarrow	Anti-inflammatory, Antipyretic, Spasmolytic, Diaphoretic, Astringent, tonic. It regulates many urination problems and soothes and heals mucous membranes. It clears heat and congestion by aiding elimination via the kidneys through its diuretic effect
Nettles, Red clover, Super blue-green algae, Astragalus, The ginsengs, Acidophilus, Aurdock	Overall nutritional and adaptogenic support.
Marshmallow root	Increases the acidity of the urine thus inhibiting bacterial growth. It helps to strengthen and cleanse the bladder. It is a Demulcent, Emollient, and Diuretic. Marshmallow is the best source of easily digested vegetable mucilage which lubricates the body, protecting it against irritation and dryness. It soothes the urinary system and is usually combined with other diuretic herbs to treat kidney and bladder inflammations, difficult or painful urination and kidney stones or gravel. It stops bleeding in the urine.
Marshmallow, Comfrey, Plantain, Violet, Mullein, Cornsilk	Help soothe and coat irritated, inflamed tissue.
Marshmallow, Hops, Red raspberry, Scullcap, Chamomile	Helping the body reduce muscular spasms along the urinary tract.
sarsaparilla, peppermint, marshmallow, comfrey root., plantain, ginger	Alkalize the urine
Echinacea, Goldenseal, Myrrh, Burdock, Garlic, Bilberry, Uva ursi, Feverfew, Honeysuckle, Barberry.	Destroy pathogenic bacteria and strengthen the immune responses.

Uva ursi.	For irritable bladder or an atonic boggy bladder, bacterial vaginosis and ulcerative cystitis Uva ursi is a strong, non-irritating diuretic and urinary antiseptic for bladder and kidney infections. When combined with marshmallow it helps to eliminate stones from the kidney and bladder. It strengthens and tones the urinary passages and is effective to treat blood in the urine.
Buchu.	Urinary antiseptic, diuretic, urinary disinfectant. Its volatile oil stimulates urination and is excreted virtually unchanged by the kidneys, rendering the urine slightly antiseptic.
Goldenseal.	Good for bladder infections if there is bleeding. It is an effective antimicrobial and choleric.
Dandelion, Cornsilk, Sassafras, Juniper berry, Fennel, Cleavers, Uva ursi, Horsetail, Goldenrod, Meadowsweet, Pipsissewa, Plantain, Shepherd's purse.	Stimulate the kidney and bladder and increase the flow of urine.
Plantain	It has cooling diuretic properties that make it beneficial for kidney and urinary bladder infections.
Dandelion root	It increases the flow of urine and has a laxative effect. Herbal diuretics help to cleanse the system. By promoting the release of fluids from the tissues it helps to relieve the false sensations of urgency characteristic of cystitis.
Cleavers	Soothing diuretic which is useful for acute or chronic cystitis with swollen lymph nodes and uterine inflammation.
Goldenrod	A mildly antiseptic and stimulating diuretic which is good to use if there is pain in the kidneys and scanty, dark urine
Ginger, Echinacea, Yellow dock, Licorice, Gotu kola, Comfrey, Chamomile, Marshmallow	Assist in lessening the pain and discomfort
Chamomile flowers	Chamomile flowers reduce muscle spasms and pains, reduce inflammation and are antiseptic. These compounds have a sedative and relaxing effect
Beth root, Horsetail, Hydrangea, Corn silk, Barberry, Black haw	For cystitis with weakness and exhaustion
Hydrangea	Good for stimulating the kidneys and flushing them clean
Barberry	It kills microorganisms (<i>E. coli</i> , <i>staphylococci</i>) that cause urinary tract infections
Gravel root, Marshmallow leaf, Couch grass, Barberry, Stone root, Hydrangea, Corn silk,	For kidney involvement including kidney stones
Corn silk	Soothing, Anti-inflammatory Diuretic that directly reduces painful symptoms and swelling due to inflammation. It is a Diuretic and urinary demulcent.
Shepherd's Purse	Bleeding
Cinnamon	Suppresses completely' the cause of most urinary tract infections (<i>E. coli</i>) and the fungus (<i>Candida albicans</i>) responsible for vaginal yeast infections
Burdock	Contains chemicals (polyacetylenes) that kill disease causing bacteria and fungi. It has been used traditionally for urinary tract infections

Prevention: Lifestyle changes may help prevent some UTIs. After menopause, a woman may use estrogen cream in the vagina area to reduce the chance of further infections.

Bathing and hygiene:

- Choose sanitary pads instead of tampons, which some doctors believe make infections more likely. Change the pad each time you use the bathroom.
- Do not douche or use feminine hygiene sprays or powders. As a general rule, do not use any product containing perfumes in the genital area.
- Take showers instead of baths. Avoid bath oils.
- Keep your genital area clean. Clean your genital and anal areas before and after sexual activity.
- Urinate before and after sexual activity.
- Wipe from front to back after using the bathroom.

Clothing:

- Avoid tight-fitting pants.
- Wear cotton-cloth underwear and pantyhose, and change both at least once a day.

Diet:

- Drink plenty of fluids (2 to 4 quarts each day).
- Drink cranberry juice or use cranberry tablets, but NOT if you have a personal or family history of kidney stones.
- Do NOT drink fluids that irritate the bladder, such as alcohol and caffeine.

2. CONCLUSION

A urinary tract infection (UTI) is caused by bacteria that get inside your urinary tract. Most bacteria that enter your urinary tract are expelled when you urinate. If the bacteria stay in your urinary tract, you may get an infection. Your urinary tract includes your kidneys, ureters, bladder, and urethra. Urine is made in your kidneys, and it flows from the ureters to the bladder. Urine leaves the bladder through the urethra. A UTI is more common in your lower urinary tract, which includes your bladder and urethra.

REFERENCES:

Craig JC, Simpson JM, Williams GJ, Antibiotic prophylaxis and recurrent urinary tract infection in children. *N Engl J Med*, 361, 2009, 1748-1759.

Gupta K, Hooton TM, Naber KG, International clinical practice guidelines for the treatment of acute uncomplicated cystitis and pyelonephritis in women: A 2010 update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases, *Clin Infect Dis*, 2011, 52(5), 103-120.

Hooton TM, Bradley SF, Cardenas DD, Diagnosis, prevention, and treatment of catheter-associated urinary tract infection in adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America, *Clin Infect Dis*. 2010, 50(5), 625-663.

Lin K, Fajardo K, U.S. Preventive Services Task Force, Screening for asymptomatic bacteriuria in adults: evidence for the U.S. Preventive Services Task Force reaffirmation recommendation statement, *Ann Intern Med*. 2008, 149(1), 20-24.

Little P, Moore MV, Turner S, Effectiveness of five different approaches in management of urinary tract infection: randomised controlled trial, *BMJ*. 2010, 340.

Shaikh N, Morone NE, Lopez J, Chianese J, Sangvai S, D'Amico F, Hoberman A, Wald ER. Does this child have a urinary tract infection? *JAMA*, 2007, 298, 2895-2904.

Skoog SJ, Peters CA, Arant BS Jr, Pediatric Vesicoureteral Reflux Guidelines Panel summary report: clinical practice guidelines for screening siblings of children with vesicoureteral reflux and neonates/infants with prenatal hydronephrosis. *J Urol*, 184, 2010, 1145-1151.

White B, Diagnosis and treatment of urinary tract infection in children. *Am Fam Physician*, 2011, 83, 409-415.

Williams G, Craig JC, Long-term antibiotics for preventing recurrent urinary tract infection in children. *Cochrane Database Syst Rev*, 2011, (3), CD001534.