

# **Urologic Surgical Associates of Delaware**

## ***Specializing in Robotic Surgery***

### **Female Urinary Tract Infections**

#### **Overview**

Urinary tract infection (UTI) is a common infection that usually occurs when bacteria enter the opening of the urethra and multiply in the urinary tract. The urinary tract includes the kidneys, ureters (the tubes that carry urine from the kidneys to the bladder), bladder, and the urethra (the tube that empties the urine out of the bladder). The special connection of the ureters at the bladder helps to prevent urine from backing up into the kidneys, and the flow of urine through the urethra helps to eliminate bacteria. Men, women, and children can develop UTIs but they are most commonly seen in adult females after the onset of sexual activity.

#### **Types**

Urinary tract infections usually develop first in the lower urinary tract (urethra, bladder) and, if not treated UTIs can progress to the upper urinary tract (ureters, kidneys). Bladder infection (cystitis) is by far the most common UTI. Infection of the urethra is called urethritis. Kidney infection (pyelonephritis) requires urgent treatment and can lead to reduced kidney function and possibly even death in untreated, severe cases.

#### **Incidence and Prevalence**

Approximately 8 to 10 million people in the United States develop a UTI each year. Women develop the condition much more often than men primarily because of the much shorter female urethra and its proximity to the rectum. The condition is uncommon in boys and young men.

Twenty percent of women in the United States develop a UTI and 20% of those have a recurrence. Urinary tract infections in children are more common in those under the age of two.

#### **Causes and Risk Factors**

*Escherichia coli* (*E. coli*) causes about 80% of urinary tract infections (UTIs) in adults. These bacteria are normally present in the colon and may enter the urethral opening from the skin around the genitals. Women are more susceptible to UTI than men because their urethral opening is near the source of bacteria (e.g. the rectum) and their urethra is shorter, providing bacteria easier access to the bladder.

Other bacteria that cause urinary tract infections include *Staphylococcus saprophyticus* (5 to 15% of cases), *Proteus*, *Klebsiella*, *Enterococci*, and *Pseudomonas*.

Sexual activity can trigger UTI in some women probably due to increased activity in the perineum (the area between the vagina and the rectum). Women who use a diaphragm develop infections more often, and condoms with spermicidal foam may cause the growth of *E. coli* in the vagina, which may enter the urethra.

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Urinary catheterization (i.e., insertion of a small tube into the bladder through the urethra to drain urine) can also cause UTI by introducing bacteria into the urinary tract. Any instrumentation of the urethra can increase the risk of UTI. The risk for developing a UTI increases when long-term catheterization is required.

In infants, bacteria from soiled diapers can enter the urethra and cause UTI. E. coli may also enter the urethral opening when young girls wipe from back to front rather than from front to back after a bowel movement.

Other risk factors include the following:

- Bladder outlet obstructions (e.g., BPH and bladder stones)
- Conditions that cause incomplete bladder emptying (e.g., spinal cord injury, diabetes)
- Congenital (present at birth) abnormalities of the urinary tract (e.g., vesicoureteral reflux)
- Suppressed immune system
- Being uncircumcised

Certain blood types enable bacteria to attach more easily to cells that line the urinary tract, causing recurrent urinary tract infections. Studies have shown that the bladder lining makes it much easier for the bacteria to adhere to the bladder wall in these blood types and this gives the bacteria an advantage to create infection.

Symptoms of lower UTI (e.g., cystitis, urethritis) in adults include the following:

- Back pain
- Blood in the urine (hematuria)
- Cloudy urine
- Inability to urinate despite the urge
- Fever
- Frequent need to urinate, usually with only small quantities of urine
- General discomfort (malaise)
- Painful urination (dysuria)

Symptoms that indicate upper UTI (e.g., pyelonephritis) include the following:

- Chills
- High fever
- Nausea
- Pain below the ribs
- Vomiting

#### Diagnosis of UTI

Diagnosis of a urinary tract infection will often include a history, physical exam, and some testing. The testing usually includes a urinalysis and urine culture.

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A clean-catch urine specimen is obtained to diagnose a urinary tract infection (UTI). This test involves cleansing the area around the urethral opening and collecting a mid-stream urine sample, preventing bacteria in the genital area from contaminating the sample. Urinalysis is performed to determine the level of white blood cells that destroy harmful bacteria (leukocytes) in the urine. A large number of these cells may indicate bacterial infection.

A culture and sensitivity specimen (induced growth of the bacteria) may be done to determine the type of bacteria and how to treat the infection.

#### Complicated UTI

Recurrent UTI's or UTI's that fail to resolve may be complicated by an anatomical or functional problem of the urinary tract. These anatomical and functional problems might include vesicoureteral reflux, kidney or bladder stones, a urethral or bladder diverticulum, incomplete or high pressure voiding, or a foreign body within the urinary tract. Xray studies such as a CT scan and office studies such as cystoscopy and urodynamics can help evaluate the patient for these problems. Sometimes additional x-ray studies such as an MRI for urethral diverticulum or a Voiding Cystourethrogram for urethral diverticulum or vesicoureteral reflux may be used.

MRI (magnetic resonance imaging) can be especially sensitive for detecting urethral diverticulum without the need for a catheter being placed into the urethra. Patients with severe claustrophobia or poor kidney function or metal in their bodies (a pacemaker, metal shavings from industrial work, recent surgery) may not be able to undergo MRI imaging.

VCUG (a voiding cystourethrogram x-ray) requires a urethral catheter for contrast injection into the bladder to evaluate for urethral diverticulum. The catheter used for evaluating for urethral diverticulum is usually a double balloon catheter. A routine foley (single balloon) can be used for VCUG to look for vesicoureteral reflux.

Urodynamics may be used if a patient has significant voiding dysfunction and recurrent UTIs. Assessment of bladder function may be used as a baseline study or to assess other possible bladder problems such as high pressure storage or incomplete bladder emptying that could lead to UTI. Urodynamics involves a small urethral catheter along with a vaginal (or rectal) catheter and some sticky EMG pads on the pelvis to study bladder function. This study takes 30 – 60 minutes in the office.

Cystoscopy and a detailed pelvic exam also help evaluate for other possible anatomic problems causing UTI. These anatomic problems include bladder stones, bladder diverticuli, urethral stricture, foreign body in the bladder, and ureterocele. Cystoscopy and a detailed pelvic exam also can help screen for other problems occurring at the same time as recurrent UTI. Cystoscopy involves placing a telescope with a camera into the bladder through the urethra to inspect the anatomy of the bladder and urethra. This procedure takes just a few minutes in the office.

#### **UTI and Pregnancy**

Hormonal changes and shifts in the urinary tract during pregnancy increase the risk for

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kidney infection. Prenatal care includes regular urine testing because bacteria are often present without causing symptoms and UTI during pregnancy may result in complications (e.g., premature birth, high blood pressure) for the mother and fetus.

### **Treatment**

Bladder infections, kidney infections, and other urinary tract infections are often treated with antibacterial drugs. The type of drug used and the duration of treatment depend on the type of bacteria. Most simple UTIs should probably be treated with macrodantin, trimethoprim-sulfamethoxazole, amoxicillin, or penicillin derivatives. The infection may improve within a couple of days, and usually antibiotic dosing can be 1-5 days in duration. Fluoroquinolones should probably be reserved for complicated UTIs that do not respond to the above antibiotics.

Infections complicated by bladder outlet obstructions (e.g., kidney stone, BPH) and other risk factors (e.g., spinal cord injury, diverticuli, vesicoureteral reflux, kidney or bladder stones) may require surgery to correct the cause of UTI.

Kidney infections may require brief hospitalization and 3-6 weeks of antibiotic treatment.

Over-the-counter pain relievers and a heating pad may be used to relieve discomfort caused by UTI. Drinking plenty of water helps to cleanse bacteria out of the urinary tract. Coffee, alcohol, and smoking should be avoided.

### **Home Self Start Therapy**

Home Self Start Therapy (HSST) is a convenient way to manage recurrent UTIs for patients who have reliable symptoms and who can manage their own antibiotic dosing at home. With HSST the patient is given a large and renewable supply of antibiotics to take at home at the first onset of symptoms. The antibiotics should be taken for 3-5 days and if the symptoms do not resolve the patient should contact the office. This strategy works if the patient has reliable symptoms and is not allergic to the selected antibiotic and the patient can be relied upon to self medicate in this fashion with antibiotics.

### **Suppressive Therapy**

In general no antibiotic should be taken daily for an extended period of time but this type of suppressive antibiotic therapy (long term daily antibiotic dosing to prevent infection) is sometimes used in special cases (such as immune suppressed patients). Daily suppressive therapy is especially problematic with NitroFuartoin (Macrochantin) since daily, long-term dosing with this drug can cause interstitial lung disease.

### **Gastrointestinal Excretion and Bacterial Resistance**

The antibiotics used for HSST are usually Nitrofurantoin, trimethoprim-sulfamethoxazole, or amoxicillin. These antibiotics are used rather than fluoroquinolones because these antibiotics are less likely to cause resistant organisms developing in the rectum than the fluoroquinolones. Some antibiotics such as the fluoroquinolones are heavily excreted into the rectum. The presence of these antibiotics in the rectum will eliminate the bacteria from the rectum that are sensitive to these antibiotics and then resistant organisms will overpopulate the rectum. The rectum is the reservoir for UTIs and so future UTIs after fluoroquinolones dosing will be more likely to be resistant to

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fluoroquinolones. Nitrofurantoin, trimethoprim-sulfamethoxazole, or amoxicillin are not heavily excreted into the rectum (Nitrofurantoin not at all) and so these are much less likely to cause the development of future infections with resistant organisms.

### **Gentamicin Irrigations**

Antibiotic irrigations directly into the bladder can be very beneficial in managing difficult UTIs, especially for patients with functional difficulties of the urinary tract. For example, elderly patients who do not empty their bladder completely can collect debris and bacteria in the bladder leading to infection and because they don't empty their bladder completely they cannot clear the infection even with the proper oral or intravenous antibiotic. Catheterizing the bladder allows for complete emptying and can also facilitate the irrigation of sterile water or saline into the bladder to further eradicate debris and bacteria and finally the catheter can be used to infuse antibiotics directly into the bladder (such as gentamicin). Infusing the antibiotic directly into the bladder prevents the antibiotic from entering the rectum and so decreases the likelihood of developing resistant organisms and is a highly effective means of delivering the antibiotic to directly where it is needed.

### **UTI Symptoms without a UTI**

UTI symptoms can sometime occur in the absence of infection; that is, the patient has typical UTI symptoms such as frequent, painful urinations with only small quantities voided each time but when the urinalysis and urine culture is performed the urinalysis may indicate infection but the urine culture is negative. The strict criterion for a documented UTI is a positive urine culture. Starting antibiotics before the culture is taken may cause a negative culture but otherwise a negative culture probably indicates that there is no significant infection even with a positive urinalysis and classic UTI symptoms. The symptoms of a UTI are caused by the body's own immune system and not by the bacteria. When a patient has UTI symptoms but no UTI it may be that her own immune system is causing these symptoms in the absence of infection. This problem is not well understood but can occur with problems such as interstitial cystitis and endometriosis. Recent studies show that some patients will turn on genes responsible for this immune response and the genes may stay active after the UTI is clear. These patients can suffer lifelong UTI symptoms in the absence of infection. It is not yet clear how best to help these patients.

### **Prevention**

The following measures can reduce the risk for bladder infections and other UTIs:

- Avoid products that may irritate the urethra (e.g., bubble bath, scented feminine products).
- Cleanse the genital area before sexual activity .
- Change soiled diapers in infants and toddlers promptly.
- Drink plenty of water to remove bacteria from the urinary tract.
- Do not routinely resist the urge to urinate.
- Take showers instead of baths.
- Urinate after sexual activity.
- Women and girls should wipe from front to back after voiding to prevent contaminating the urethra with bacteria from the anal area.

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- Stop smoking (nicotine irritates the bladder).

### **Alkalinize the Urine**

Although some controversy remains concerning what pH level is most conducive to bacteria growth in the urinary tract, most evidence indicates alkaline pH (less acidic urine) helps prevent UTIs. The easiest way to alkalinize the urine is with minerals, specifically potassium citrate and sodium citrate. All citrates encourage an alkaline shift; so patients already taking a calcium/magnesium supplement should switch to a calcium citrate/magnesium citrate preparation. Mineral supplements should not be taken before bedtime, as urine that remains in the bladder during sleep may irritate the tissue and promote an infection.

Drinking at least 16 ounces a day of cranberry or blueberry juice (not the sugar-sweetened variety) can have a preventative and therapeutic effect. These juices have antibiotic properties that interfere with the ability of bacteria to adhere to the bladder or urethral tissue.