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Photos from various internet sources.

## Introduction

Urinary tract infection (UTI) is a bacterial infection that affects any part of the urinary tract. It is the second most common clinical indication for empirical antimicrobial treatment in primary and secondary care, and urine samples constitute the largest single category of specimens examined in most medical microbiology laboratories. Symptoms include frequency of urination, pain or burning during urination, and cloudy urine. The main causal agent is *Escherichia coli*. Although urine contains a variety of fluids, salts, and waste products, it does not usually have bacteria in it. When bacteria get into the bladder or kidney and multiply in the urine, they may cause a UTI. The most common type of UTI is acute cystitis. An infection of the upper urinary tract or kidney is known as pyelonephritis, and is potentially more serious. Although they cause discomfort, urinary tract infections are often easily treated with a short course of antibiotics.

## Signs and symptoms

The most common symptoms of a bladder infection are burning with urination (dysuria), frequency of urination, and an urge to urinate. Lower urinary tract infections in adults may manifest with symptoms including hematuria, inability to urinate despite the urge, and malaise. Other signs of urinary tract infections include foul-smelling urine and urine that appears cloudy. An upper urinary tract infection or pyelonephritis may also present with flank pain and a fever with rigors. The symptoms of urinary tract infections may vary with age and the part of the urinary system that is affected. In newborns



the condition may cause jaundice and hypothermia. In young children, urinary tract infection symptoms may include diarrhea, loss of appetite, nausea and vomiting, fever, and excessive crying that cannot be resolved by typical measures. Older children on the other hand may experience abdominal pain, or incontinence. In the elderly, symptoms of urinary tract infections may include lethargy and a change in the mental status, signs that are otherwise nonspecific.

## Risk factors

### • Intercourse

In young sexually active women, sexual intercourse is the cause of 75.90% of bladder infections, with the risk of infection related to the frequency of intercourse. The term "honeymoon cystitis" has been applied to this phenomenon of frequent UTIs during early marriage. In postmenopausal women sexual activity does not affect the risk of developing a UTI. Spermicide use, independent of sexual frequency, increases the risk of UTIs.

### • Sex

Women are more prone to UTIs than men because, in females, the urethra is much closer to the anus than in males, and women lack the bacteriostatic properties of prostatic secretions. UTIs also more

commonly progress to bladder infections in females due to the much shorter length of the female urethra. Among the elderly, UTI frequency occurs roughly in equal proportions in women and men. This is due, in part, to an enlarged prostate in older men. As the gland grows, it obstructs the urethra, leading to increased difficulty in micturition. Because there is less urine flushing of the urethra, there is a higher incidence of colonization.

### • Urinary catheters

Urinary catheters are a risk factor for urinary tract infections because the catheter provides a focus for bacterial biofilm formation. Duration of catheterisation is strongly associated with the risk of infection. The longer the catheter is in place the greater the likelihood of infection. The risk of an associated infection can be decreased by only catheterizing when necessary, using aseptic technique for insertion, and maintaining unobstructed closed drainage of the catheter.

### • Genetics

A predisposition for bladder infections may run in families.

### • Others

Other risk factors include diabetes, sickle-cell disease, or anatomical malformations of the urinary tract such as prostate enlargement. While ascending infections are, in general, the

rule for lower urinary tract infections and cystitis, the same is not necessarily true for upper urinary tract infections like pyelonephritis, which may originate from a blood-born infection.

## Pathogenesis

The most common organism implicated in UTIs (8085%) is E. Coli, while Staphylococcus saprophyticus is the cause in 510%. The bladder wall is coated with various mannose proteins, such as Tamm-Horsfall proteins (THP), which interfere with the binding of bacteria to the uroepithelium.

As binding is an important factor in establishing pathogenicity for microorganisms, the proteins result in reduced capacity for invasion of the tissues. The unbound bacteria are also more easily removed when voiding. The use of urinary catheters (or other physical trauma) may physically disturb this protective lining, thereby allowing bacteria to invade the exposed epithelium. During cystitis, uropathogenic Escherichia coli subvert innate defenses by invading superficial umbrella cells and rapidly increasing in numbers to form intracellular bacterial communities. By working together, bacteria in biofilms build themselves into structures that are more firmly anchored in infected cells and are more resistant to immune-system assaults and antibiotic treatments. This is often the cause of chronic urinary tract infections.

## Prevention

The following are measures that studies suggest may reduce the incidence of recurrent urinary tract infections.

- A prolonged course (six months to a year) of low-dose antibiotics (usually nitrofurantoin or TMP/SMX) is effective in reducing the frequency of UTIs in those with recurrent UTIs.
- Cranberry (juice or capsules) may decrease the incidence of UTI in those with frequent infections.
- For post-menopausal women intravaginal application of topical estrogen cream can prevent recurrent cystitis. This however is not

as useful as low dose antibiotics.

- Studies have shown that breastfeeding can reduce the risk of UTIs in infants.

## Diagnosis

Multiple bacilli shown between white cells at urine microscopy. This is called bacteriuria and pyuria, respectively. These changes are indicative of a urinary tract infection. In straight-forward cases, a diagnosis may be made and treatment given based on symptoms alone without further laboratory confirmation. In complicated or questionable cases, confirmation via urinalysis, looking for the presence of nitrites, leukocytes, or leukocyte esterase, or via urine microscopy, looking for the presence of red blood cells, white blood cells, and bacteria, is often useful. Urine culture showing a quantitative count of greater than or equal to 10<sup>3</sup> colony-forming units (CFU) per mL of a typical urinary tract organism along with antibiotic sensitivities is useful to guide antibiotic choice. Most cases of lower urinary tract infections in females are benign and do not need exhaustive laboratory work-ups. However, UTI in young infants may require some imaging study, typically a retrograde urethrogram, to ascertain the presence/absence of congenital urinary tract anomalies.

## Differential

If the urine culture is negative:

- Symptoms of urethritis may point to Chlamydia trachomatis or Neisseria gonorrhoeae infection.
- Symptoms of cystitis may point to interstitial cystitis.
- In men, prostatitis may present with dysuria.

The presence of bacteria in the urinary tract of older adults, without symptoms or signs of infection, is a well-recognized phenomenon that may not require antibiotics. This is usually referred to as asymptomatic bacteriuria.

## Treatment

- Oral therapy with an antibiotic effective against gram-negative aerobic coliform bacteria, such as

E coli, is the principal treatment intervention in patients with UTI. The patient with an uncomplicated presumed lower UTI or simple cystitis who has symptoms of less than 48 hours' duration may be treated with one of the following agents for a total of 3 days:

- Ciprofloxacin or similar fluoroquinolone: Ciprofloxacin is first-line therapy. Though the Department of Health guidelines on UTI recommend TMP/SMX as first-line therapy, because of concerns of resistance, treatment failure, and adverse side effect profile, TMP/SMX is not commonly prescribed. Fluoroquinolones must be avoided in pregnancy.
- Co-trimoxazole DS (eg, Bactrim,): Bactrim as first-line therapy in patients without an allergy and in areas where resistance is not high (>15%). Co-trimoxazole should be used with caution in any patient receiving warfarin sodium. Current recommendations are to avoid TMP/SMX in patients with risk factors, including diabetes, recent hospitalization, current use of antibiotics, and recent use of TMP/SMX, and in areas where TMP/SMX resistance to E coli is at or higher than 20% (In Johannesburg TMP/SMX resistance are +/- 60%).
- Nitrofurantoin macrocrystals (eg, Macrochantin)
- Amoxicillin/clavulanate (eg, Augmentin)
- Pregnant, otherwise healthy women with no evidence of an upper UTI should be treated with a 14-day course of a cephalosporin, as most obstetrics authorities prefer prolonged treatment even in the absence of signs of upper tract disease. Pregnant patients should be treated for all episodes of pyuria or bacteriuria, regardless of whether they have symptoms. A urine culture should be performed in all pregnant patients.

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