Urinary Tract Infection: Causes, Symptoms and Treatment

Urinary tract infection (UTI) is defined as significant bacteriuria in the presence of a constellation of symptoms such as dysuria (painful urination) , increased urinary frequency, urgency, suprapubic discomfort costovertebral angle tenderness.

It is a common cause of infections, particularly among young, sexually active women; an estimated 1 in 3 women will develop a urinary tract infection before the age of 24 years.

Infection may involve either only the lower urinary tract or both the upper and lower tracts.

The term cystitis is used to describe the syndrome involving dysuria, suprapubic tenderness with urinary frequency and urgency. These symptoms may also be related to lower tract inflammation without bacterial infection and can be caused by urethritis (ex. gonorrheal or chlamydial urethritis).

Acute pyelonephritis refers to the syndrome of cystitis accompanied by significant bacteriuria and acute infection in the kidney; it is characterized by clinical symptoms such as flank pain, fever, dysuria, urinary urgency, and frequency.

Definition of terms

1. Lower UTI includes cystitis, urethritis, prostatitis
2. Upper UTI entails pyelonephritis, intra-renal abscess, perinephric abscess (usually late complications of pyelonephritis)
3. Uncomplicated UTI encompasses infection in a structurally and neurologically normal urinary tract. Simple cystitis of short (1-5 day) duration
4. Complicated UTI is the infection in a urinary tract with functional or structural abnormalities (indwelling catheters and renal calculi). Cystitis of long duration or hemorrhagic cystitis.

Groups at increased risk for infection include neonates, prepubertal girls, young women, older men, individuals with structural abnormalities of the urinary tract or immunosuppression (e.g. diabetes).

In neonates, a urinary tract infection occurs more often in males; thereafter they occur more frequently in girls and women.

When infections occur in preschool boys, they are frequently associated with serious congenital abnormalities; it has also been shown that lack of circumcision predisposes young boys and infants to UTIs.

Bacteriuria is rare in men below the age of 50 years, and symptoms of dysuria are more commonly due to a sexually transmitted infection of the urethra or prostate.

Pregnant women have a 4-10% prevalence of bacteriuria which has been shown to increase the risk of premature delivery, fetal mortality, and pyelonephritis in the mother.

Risk factors

- Anatomic or functional urologic abnormalities.
- Congenital abnormalities;
- Uncircumcised penis.
- Vesicoureteral reflux.
- Sexual intercourse, diaphragm use, spermicidal jelly, previous urinary tract infection.
- Insertive rectal intercourse.
- Gynecologic surgery, bladder prolapse. Previous urinary tract infection.
- Prostate hypertrophy, obstruction, catheterization, surgery.
- Estrogen deficiency and loss of vaginal lactobacilli.
- All of the above, incontinence, long –term catheterization, condom catheters.

The most common pathogens are Gram-negative rods. Escherichia coli causes about 80% of acute infections in patients without urinary tract abnormalities.

Other Gram-negative organisms include Proteus mirabilis and Klebsiella pneumoniae, organisms that colonize the enteric tract. Enterobacter, Serratia, and Pseudomonas are infrequent in the outpatient population, but they are more frequent in patients with complicated UTI.

Pathogenesis of urinary tract infection

Hematogenous Route**.**

The infection of the renal parenchyma by blood-borne organisms occurs in humans, albeit less commonly than by the ascending route. The kidney is frequently the site of abscesses in a patient with bacteremia or endocarditis caused by a Gram-positive organism, Staphylococcus aureus; infections of the kidney with Gram-negative bacilli rarely occur by the hematogenous route.

Ascending Route.

Urinary tract infections in women develop when uropathogens from the fecal flora colonize the vaginal introitus and displace the normal flora (diphtheroids, lactobacilli, coagulase-negative staphylococci, and streptococcal species).

Colonization of the vaginal introitus with E.coli seems to be one of the critical initial steps in the pathogenesis of both acute and recurrent UTI. Most uropathogens originate in the rectal flora and enter the bladder via the urethra.
The female urethra is short and proximal to the vulvar and perineal areas, making contamination likely.

Abnormalities of the urinary tract which lead to obstruction of the urinary flow are a major factor in the development of urinary infection.

Extra-renal obstruction due to posterior urethral valves in infant boys or urethral strictures in adult men is uncommon but important to consider. More common is incomplete bladder emptying due to prostatic hyperplasia.

Dysfunction of the bladder due to mechanical (prostate, pelvic floor relaxation) or neurological

causes also contributes to the development of UTI's.

Signs and symptoms of UTI

Symptoms of urinary tract infection vary with the age of the patient and the location of the infection. Neonates and children less than 2 years old do not complain of dysuria: fever, emesis, and failure to gain weight are the usual symptoms.

Children over 3 years will complain of burning on urination and lower abdominal pain; previously toilet-trained children may develop enuresis.

Adult patients with cystitis have dysuria, suprapubic pain, urinary frequency, and urgency.
The urine often is cloudy and malodorous and may be bloody.
Fever and systemic symptoms usually are absent in infection limited to the lower tract.

Acute dysuria in adult women can also be due to acute urethritis (chlamydial, gonococcal, or herpetic) or to vaginitis/vaginosis.

systemic symptoms of fever, nausea, vomiting, and pain in the costovertebral areas, are highly suggestive of upper urinary tract infection (pyelonephritis).

This is frequently accompanied by urinary frequency, urgency, and dysuria. Rigors (shaking chills) may indicate bacteremia.

Flank tenderness is frequent and more intense when there is obstructive disease (renal calculi), and severe pain with radiation to the groin suggests the presence of renal calculus.

The pain from an inflamed kidney may be felt in or near the epigastrium and may radiate to one of the lower quadrants.
Patients with urinary-catheter associated infection often are asymptomatic but may have a fever, chills, leukocytosis, etc.

Diagnostic Investigations

- Urine Culture and Sensitivity (midstream, suprapubic puncture or catheter specimen). Bacterial colony count: Most reliable providing urine has been plated within 1 hour of Interpret results as follows:
    - <10,000: Nonspecific contaminants; significant if suprapubic
    - 10,000–100,000: Doubtful Repeat cultures and evaluate clinical symptoms.
    - 100,000: Diagnostic of UTI
- Urinalysis indicates >10 WBC/cubic3 in uncentrifuged urine midstream or catheter specimen
- Full blood count
- Random blood sugars -It is important to identify diabetic patients who are at risk for recurrent infections, pyelonephritis, and perinephric abscesses.
- Abdominal pelvic Ultrasound-prostate enlargement, Renal Ultrasound
- Micturating cystourethrogram – urethral valves and reflux.
- Radiographic studies (e.g. ultrasound, intravenous pyelography, or a CT scan) are indicated in a

patient in whom an abnormality of the urinary system is highly likely, or if an abscess is suspected, or in a patient with pyelonephritis who does not respond to appropriate therapy within 72 hours.

Treatment of urinary tract infection

The antimicrobial agents selected should inhibit E. coli, since it accounts for 80% of uncomplicated lower urinary tract infections.

Trimethoprim, co-trimoxazole, and fluoroquinolones are ideal agents since they are effective orally, they achieve good urine concentrations, and tend not to disturb the anaerobic flora of the gut and the vagina.

Acute cystitis in adult men (which can be caused by the same organisms that possess virulence factors for pyelonephritis) will respond to 7-10 days of treatment, but acute prostatitis from the same organisms will require 6-12 weeks to eradicate the offending organism, with a 70% cure rate.

Nonbacterial prostatosis is probably caused by chlamydiae or ureaplasmata and will respond to tetracyclines, erythromycins or fluoroquinolones.

In the case of acute pyelonephritis, initial therapy is often given intravenously with completion of therapy orally after the patient is afebrile. The total duration of therapy is 10-14 days.