

# Urinary Tract Infections

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## DEFINITION AND DIAGNOSIS

The term *urinary tract infection* (UTI) refers to significant bacteriuria in a patient with symptoms or signs attributable to the urinary tract and no alternative diagnosis. UTI includes asymptomatic bacteriuria, urethritis, cystitis, pyelonephritis, catheter-associated UTI, prostatitis, and urosepsis. This chapter focuses primarily on the two major forms of UTI, cystitis and pyelonephritis.

A practical classification divides these infections into uncomplicated and complicated UTI. Uncomplicated UTIs are episodes of cystitis and mild pyelonephritis occurring in healthy, premenopausal, sexually active, nonpregnant women with no history suggestive of abnormalities in the urinary tract. All other episodes of UTI are deemed to be potentially complicated and deserving of further evaluation.

The presence of dysuria, increased frequency of urination, suprapubic tenderness, and hematuria associated with bacteriuria or pyuria on urinalysis is unequivocally consistent with the diagnosis of cystitis. Back or flank pain, nausea, vomiting, and the presence of fever or rigors suggest infection of the upper urinary tract, although it is not easy to distinguish cystitis from pyelonephritis on clinical grounds alone. The diagnosis of UTI gets more difficult when patients cannot ascribe symptoms to the urinary tract (e.g., patients with paraplegia or neurogenic bladder, confused elderly or sedated patients) or when they have atypical symptoms, such as changes in mental status, agitation, or hypotension. Sometimes patients have urinary symptoms without bacteriuria (the pyuria-dysuria or “urethral syndrome” commonly caused by *Chlamydia trachomatis* or other difficult-to-culture genitourinary pathogens).

Bacteriuria is the hallmark of UTI. In women, *asymptomatic bacteriuria* is defined as two consecutive voided midstream urine specimens with isolation of the same bacterial strain at levels of at least  $10^5$  colony-forming units (CFU) per milliliter from patients without genitourinary symptoms. In men, a single clean-catch, midstream voided urine specimen with one bacterial species at a concentration greater than  $10^5$  CFU/mL defines asymptomatic bacteriuria. The diagnosis of asymptomatic bacteriuria is also established in both women and men from a single catheterized urine specimen (not an indwelling catheter) with one bacterial species isolated at concentrations greater than  $10^2$  CFU/mL.

To increase the sensitivity of the tests, *significant bacteriuria* is defined as greater than  $10^2$  CFU/mL of urine in a woman with symptoms of uncomplicated cystitis and pyuria ( $\geq 5$  white blood

cells per milliliter of urine per high-power field). Among women with symptoms of uncomplicated pyelonephritis and men with UTI, significant bacteriuria is defined as greater than  $10^4$  CFU/mL plus pyuria. In patients with complicated UTI, a concentration of  $10^5$  CFU/mL or higher is required for the definition of significant bacteriuria independently of pyuria.

In order for these definitions to be valid, the urine must remain in the bladder for at least 2 hours, and after urine collection the sample should be incubated immediately. If urine is not incubated immediately, it can be refrigerated for up to 8 hours before proper incubation.

The presence of asymptomatic bacteriuria is not equivalent to UTI except for pregnant women, neutropenic patients, and individuals with anatomic or functional defects in the urinary tract. The presence of white blood cell casts indicates pyelonephritis, and this finding suggests a complicated UTI with obstructive lesions of the kidney or collecting system (e.g., papillary necrosis). It is difficult to define asymptomatic bacteriuria in the patient who has undergone renal transplantation, and bacteriuria in such patients often indicates the need to treat for UTI.

## LABORATORY FINDINGS

Young, sexually active women with typical symptoms of UTI have a high pretest probability for UTI. Therefore, no laboratory test is indicated. In this population, pretreatment urine analysis and culture are indicated only if the diagnosis is not straightforward or if an antibiotic-resistant organism is suspected. Urine analysis and culture are indicated in all cases of suspected complicated UTI. Blood cultures are mandatory for patients with suspected pyelonephritis. Imaging studies are indicated if kidney stones, malignancy, obstructive uropathy, and urologic malformations are suspected.

## EPIDEMIOLOGY

At the extremes of age, men are more prone to UTI than women. In young boys, urethral malformation is commonly the cause, and in older men, UTI is usually caused by bladder neck obstruction secondary to prostatic hypertrophy. Homosexual men are at increased risk for acquiring UTIs. Teenage girls and sexually active women have more UTIs than their male counterparts. A higher than expected incidence of UTI among young girls might suggest sexual abuse. Sexually active women have the highest rate of UTI. Postmenopausal women have increased prevalence of UTI due to estrogen deficiency and age-related pelvic relaxation with poor bladder emptying.