

Urinary Tract Infections

Overview

A urine culture must ALWAYS be interpreted in the context of the urinalysis and patient symptoms. If a patient has no signs of infection on urinalysis, no symptoms of infection, but a positive urine culture, the patient by definition has **asymptomatic bacteriuria**, or the specimen was contaminated at the time of collection with organisms present on the skin/mucous membranes. Typically, catheterized patients will become colonized within 48 hours of catheterization. Patients with chronically indwelling catheters, urinary stoma, and neobladders will almost universally have positive urine cultures. The only patient populations for which it is recommended to screen for and treat asymptomatic bacteriuria are **pregnant women** and **patients scheduled for a genitourinary surgical procedure**.

NOTES:

- The diagnosis of a UTI in inpatients can be difficult.
- Signs and symptoms, the presence of a urinary catheter, and the quality of specimen collection must be considered before initiation of treatment.
- Collection of cultures in the absence of signs and symptoms should be avoided.
- All recommendations are for empiric treatment; narrow coverage based on susceptibilities.

Management of Patients without a Urinary Catheter

NOTE: Ciprofloxacin is not listed as an empiric treatment recommendation for inpatients with non-catheter associated UTI at UCLA due to the low rate of *E. coli* susceptibility (58%). Use of ciprofloxacin can be considered in patients with known-susceptible isolates or with non-lactose fermenting organisms in the urine.

Category	Definition	Empiric Treatment
Asymptomatic bacteriuria	Positive urine culture with no signs or symptoms. Common in elderly.	<u>No treatment</u> unless patient is: <ul style="list-style-type: none"> • Pregnant • About to undergo a urologic procedure • Post renal transplant • Neutropenic
Acute cystitis	Signs and symptoms (e.g., dysuria, urgency, frequency, suprapubic pain) AND pyuria (>5-10 WBC/hpf) AND positive urine culture ≥ 100,000 colonies	<u>Uncomplicated:</u> female, no urologic abnormalities, no stones, no catheter. <ul style="list-style-type: none"> • TMP/SMX 1 DS PO q12H x 3 days OR <ul style="list-style-type: none"> • Cephalexin 500 mg PO q6H x 7 days OR <ul style="list-style-type: none"> • Nitrofurantoin 100 mg PO q12H x 5 days (do NOT use in patients with CrCl < 40 ml/min) <u>Complicated:</u> male, stones, urologic abnormality, pregnancy. <ul style="list-style-type: none"> • Same regimens as above, except duration is 7-14 days.

Acute pyelonephritis	<p>Signs and symptoms (e.g., fever, flank pain) AND pyuria AND positive urine culture \geq 100,000 colonies.</p> <p>Many patients will have other evidence of upper tract disease (i.e., leukocytosis, WBC casts, or abnormalities on imaging).</p>	<p><u>Patient not severely ill</u></p> <ul style="list-style-type: none"> Ertapenem 1 g IV q24H <p>OR</p> <ul style="list-style-type: none"> Ceftriaxone 1 g IV q24H <p>Duration 7-14 days</p> <p><u>Patient severely ill or hospitalized >48 hours</u></p> <ul style="list-style-type: none"> Meropenem 1 g IV q8H <p>OR</p> <ul style="list-style-type: none"> Cefepime 1 g IV q8H
"Urosepsis"	SIRS due to urinary tract infection	<ul style="list-style-type: none"> Meropenem 1 g IV q8H <p>OR</p> <ul style="list-style-type: none"> Cefepime 1 g IV q8H <p>OR</p> <ul style="list-style-type: none"> PCN allergy: Aztreonam 1 g IV q8H <p>Duration 7-14 days</p>

DIAGNOSIS

Specimen collection: The urethral area should be cleaned with an antiseptic cloth and the urine sample should be collected midstream or obtained by fresh catheterization. Specimens collected using a drainage bag or taken from a collection hat are not reliable and should not be sent.

Interpretation of the urinalysis (U/A) and urine culture

- Urinalysis and urine cultures must be interpreted together in context of symptoms.
- **Urinalysis/microscopy:**
 - Dipstick
 - Nitrites indicate bacteria in the urine indicates the presence of a nitrate-reducing microorganism, such as *Escherichia coli* or any other member of the *Enterobacteriaceae* family.
 - Leukocyte esterase indicates white blood cells in the urine
 - Bacteria: presence of bacteria on urinalysis should be interpreted with caution and is not generally useful
 - Pyuria (more sensitive than leukocyte esterase): $>5-10$ WBC/hpf or >27 WBC/microliter
- **Urine cultures:**
 - If U/A is negative for pyuria, positive cultures are likely contamination.
 - Positive cultures with pyuria are defined as $\geq 100,000$ (10^5) colonies. This cutoff is the most sensitive for a true UTI. Situations in which lower colony counts $<10^5$ may be significant include: patients who are already on antibiotics at the time of culture, symptomatic young women, suprapubic aspiration, and men with pyuria.

TREATMENT NOTES

- Sterile pyuria (positive U/A, but negative culture results) typically requires no treatment, although if the patient has received antibiotics, the patient may still have a UTI. If sterile pyuria persists consider other causes (e.g., interstitial nephritis or cystitis, fastidious organisms such as TB).
- Follow-up urine cultures or U/A are only warranted for ongoing symptoms. They should NOT be acquired routinely to monitor response to therapy.
- See below for discussion of treatment options for VRE and renal concentrations of antibiotics.

Management of Patients WITH a Urinary Catheter

Category	Definition	Empiric Treatment
Asymptomatic bacteriuria	<p>Positive urine culture with no signs or symptoms of infection. Common in the elderly.</p> <p>NOTE: obtaining routine cultures in asymptomatic patients is not recommended</p>	<p>Remove the catheter</p> <p>No treatment unless the patient is:</p> <ul style="list-style-type: none"> • Pregnant • About to undergo a urologic procedure • Post renal transplant • Neutropenic <p>Antibiotics do NOT decrease asymptomatic bacteriuria or prevent subsequent development of UTI</p>
Catheter-associated UTI (CAUTI)	<p>Signs and symptoms (fever with no other source is the most common; patients may also have suprapubic or flank pain) AND pyuria (>5-10 WBC/hpf) AND positive urine culture $\geq 100,000$ colonies (see information below regarding significant colony counts)</p>	<ul style="list-style-type: none"> • Remove (PREFERRED) or replace catheter in all patients <p><u>Patient stable with no evidence of upper tract disease:</u></p> <ul style="list-style-type: none"> • If catheter removed, consider observation alone <p>OR</p> <ul style="list-style-type: none"> • Ertapenem 1 g IV q24H <p>OR</p> <ul style="list-style-type: none"> • Ceftriaxone 1 g IV q24H <p>OR</p> <ul style="list-style-type: none"> • Ciprofloxacin 500 mg PO BID or 400 mg IV q12H (avoid in pregnancy and in patients with prior exposure to quinolones) <p>Duration: see treatment notes</p> <p><u>Patient severely ill, with evidence of upper tract disease, or hospitalized >48 H:</u></p> <ul style="list-style-type: none"> • Meropenem 1 g IV q8H <p>OR</p> <ul style="list-style-type: none"> • Cefepime 1 g IV q8H <p>OR</p> <ul style="list-style-type: none"> • PCN allergy: Aztreonam 1 g IV q8H <p>Duration: 7-14 days</p>

DIAGNOSIS

Specimen collection: urine sample should be drawn in a sterile fashion from a fresh catheter specimen. It should be drawn from either the catheter itself or through the port designed specifically for this purpose, **NOT** from the urine collection bag. Specimen collection is critical since colonization of the Foley bag or actual catheter is common.

Symptoms: Catheterized patients often lack typical symptoms of dysuria, although fever, suprapubic pain, and flank pain may still be present.

Interpretation of the urinalysis and urine culture:

- Pyuria: defined as >5-10 WBC/hpf or >27 WBC/microliter. In the presence of a catheter, pyuria or positive cultures are not always a reliable indicator of infection. Lack of pyuria suggests no active infection.
- Positive urine culture: $\geq 100,000$ colonies is the most specific for true CAUTI. Some experts state that $\geq 1,000$ colonies represents significant bacteriuria; however, if this count is used, there should be a strong clinical suspicion of CAUTI based on symptoms and absence of infection at another site.

TREATMENT NOTES

- The best way to avoid CAUTI is to avoid use of a urinary catheter! Consider intermittent straight cath in patients with short-term needs for catheterization.
- Avoid catheter use solely for convenience.
- Remove catheter whenever possible.
- The duration of treatment has not been well-studied for CAUTI.
- Assess the degree of illness, comorbidities, and clinical response to determine duration of therapy. As a general guide:
 - If the catheter is removed and the patient is not severely ill and has good response to treatment: 5-7 days.
 - If the catheter remains present or the patient is severely ill (e.g. urosepsis) or has pyelonephritis: 7-14 days.

Treatment of UTI due to Enterococci

- Almost all *E. faecalis* isolates are susceptible to Amoxicillin 500 mg PO TID **OR** Ampicillin 1 g IV q6H and should be treated with these agents. For patients with PCN allergy: Nitrofurantoin 100 mg PO BID (do NOT use in patients with CrCl < 40 mL/min).
- *E. faecium* (commonly vancomycin resistant)
 - Nitrofurantoin 100 mg PO BID if susceptible (do NOT use in patients with CrCl < 40 mL/min)
 - Doxycycline 100 mg PO BID if susceptible
 - Fosfomycin 3 g PO once (if female without catheter or catheter is removed; ask the micro lab for susceptibility)
 - Linezolid 600 mg PO BID **OR** fosfomycin 3 g PO every 2-3 days (max 21 days) if complicated UTI or catheter cannot be removed

Treatment of UTI due to extended spectrum beta-lactamase (ESBL)-producing organisms

- ESBLs are enzymes that confer resistance to ALL penicillins, cephalosporins, and aztreonam.
- Risk factors for infection or colonization: recent hospitalization, residence in a long-term care facility, prolonged use of broad spectrum antibiotics.
- Meropenem 1 g IV q8H should be used for all severe urinary infections if the organism is susceptible.
- Ertapenem 1 g IV q24H can be used for uncomplicated UTI.
- Ciprofloxacin or TMP/SMX can be used as alternatives to ertapenem for uncomplicated UTI if the organism is susceptible. Nitrofurantoin or fosfomycin may also be used for uncomplicated UTI if the organism is susceptible.

Renal excretion/concentration of selected antibiotics

- **Good (>60%)**: aminoglycosides, amoxicillin, amoxicillin/clavulanate, fosfomicin, cefazolin, cefepime, cephalexin, ciprofloxacin, colistin, ertapenem, levofloxacin, trimethoprim/sulfamethoxazole, vancomycin, amphotericin B, fluconazole, flucytosine
- **Variable (30-60%)**: cefpodoxime, linezolid (30%), doxycycline (29-55%), ceftriaxone, tetracycline (~60%)
- **Poor (<30%)**: azithromycin, clindamycin, oxacillin, tigecycline, caspofungin, posaconazole, voriconazole

REFERENCES

Pyuria and urinary catheters: Arch Int Med 2000;160(5):673-77.

IDSA Guidelines for treatment of uncomplicated acute bacterial cystitis and pyelonephritis in women: Clin Infect Dis 1999;29:745.

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