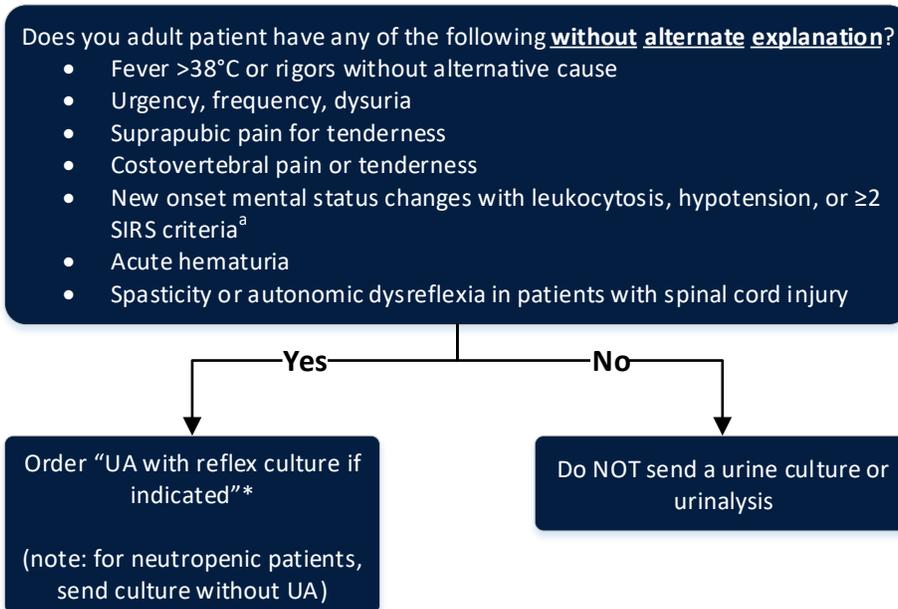




URINARY TRACT INFECTIONS IN ADULTS

When to Order a Urine Culture: Asymptomatic bacteriuria is often treated unnecessarily, and accounts for a substantial burden of unnecessary antimicrobial use. National guidelines recommend against testing for asymptomatic bacteriuria, except in select circumstances. Therefore urine cultures should only be obtained on adult inpatients for appropriate reasons. In the absence of signs or symptoms (see below) attributable to a urinary tract infection, patients with a positive urine culture and/or pyuria should not be treated with antibiotics irrespective of high bacterial colony count, or a multi-drug resistant organism. The following is an effective strategy for how and when to order a urinalysis and/or urine culture. NOTE: this does not apply to patients being screened for asymptomatic bacteriuria (see subsequent page for recommendations in such patients).



*: With this order, a urine culture will only be performed if a urinalysis result indicates infection. This is a strategy to decrease unnecessary antibiotic treatment in samples indicative of colonization and not infection⁶

^a SIRS Criteria: Heart rate greater than 90 bpm, respiratory rate greater than 20 breaths per minute, temperature less than 36°C, white blood count less than 4,000 cells/mm³, temperature greater than 38°C, white blood count greater than 12,000 cells/mm³.

<u>Asymptomatic Bacteriuria</u>	<u>Uncomplicated Cystitis</u>	<u>Complicated Lower Cystitis w/o sepsis/bacteremia</u>	<u>Uncomplicated Pyelonephritis</u>
<u>Complicated UTI w/ sepsis/bacteremia</u>	<u>Complicated Pyelonephritis</u>	<u>Pyelonephritis in Pregnancy</u>	<u>Perinephric Abscess</u>
<u>Prostatitis</u>	<u>Epididymitis</u>		<u>References</u>

Clinical Setting	Empiric Therapy	Duration	Comments
<p>Asymptomatic Bacteriuria¹</p> <p>No symptoms of UTI (listed below)</p> <p>Possible UTI symptoms include (without alternative explanation):</p> <ul style="list-style-type: none"> - Fever >38°C or rigors without alternative cause - Urgency, frequency, dysuria - Suprapubic pain or tenderness - Costovertebral pain or tenderness - New onset mental status changes with leukocytosis, hypotension, or ≥2 SIRS criteria^a - Acute hematuria - Spasticity or autonomic dysreflexia in patients with spinal cord injury 	<p>In most circumstances, asymptomatic bacteriuria <u>should not be treated</u>, regardless of pyuria, bacterial density, or isolation of resistant organisms.</p> <p>Treatment is recommended in the following circumstances: pregnancy and prior to urologic procedures.</p> <p><u>PREGNANCY</u></p> <p>Cephalexin* 500 mg PO QID OR Nitrofurantoin 100 mg PO BID (contraindicated if CrCl <30 mL/min) OR Fosfomycin 3 g PO once (more expensive than cephalexin and nitrofurantoin)</p> <p>*Adjust dose based on renal function</p>	<p>Cephalexin: 7 days</p> <p>Nitrofurantoin: 5 days</p>	<ul style="list-style-type: none"> ● Surgical prophylaxis guidelines provide recommendations on antimicrobial prophylaxis prior to genitourinary operation ● Available evidence does not support screening for, and treatment of, asymptomatic bacteriuria prior to implantation of prosthetic orthopedic² or cardiac devices or neurosurgical procedures. ● <u>Pregnancy:</u> <ul style="list-style-type: none"> ○ Urine culture should be sent and treatment adjusted based on susceptibilities. Follow-up urine cultures should be obtained for test of cure. ○ <u>Contraindicated throughout pregnancy:</u> Fluoroquinolones and doxycycline ○ <u>Avoid in first 8 weeks of pregnancy:</u> TMP-SMX

Clinical Setting	Empiric Therapy (Should take into account recent previous cultures)	Duration	Comments
<p>Uncomplicated Cystitis³</p> <p>(Non-pregnant female without obstruction, catheters, flank pain, or co-morbid conditions except well-controlled diabetes mellitus)</p>	<p><u>Preferred</u></p> <p>Nitrofurantoin 100 mg PO BID (contraindicated if CrCl <30 mL/min. Due to the cost of fosfomycin, nitrofurantoin is preferred if not contraindicated)</p> <p><u>Alternative</u></p> <p>TMP-SMX* 1 DS tab PO BID</p> <p>OR</p> <p>Fosfomycin 3 g PO once</p> <p>OR</p> <p>Cephalexin* 500 mg PO BID</p> <p>*Adjust dose based on renal function</p>	<p>Nitrofurantoin: 5 days</p> <p>Fosfomycin: 1 dose</p> <p>Cephalexin: 7 days</p> <p>TMP-SMX: 3 days</p>	<ul style="list-style-type: none"> • Fluoroquinolones are no longer recommended as 1st-line agents due to high rates of <i>E. coli</i> resistance and propensity for collateral damage (resistance, <i>C. difficile</i> infection). Use should be reserved when other options are not feasible; duration of therapy should be 3 days. • Extended spectrum beta-lactamase positive cases of uncomplicated cystitis can be treated with piperacillin-tazobactam, ampicillin-sulbactam, amoxicillin-clavulanate, cefepime, ceftriaxone or aztreonam when susceptible⁵Beta-lactams and fluoroquinolones concentrate in the urine and may be clinically efficacious for (only) cystitis caused by isolates with intermediate susceptibility, provided preferred/alternative oral susceptible options are not feasible.

Clinical Setting	Empiric Therapy (Should take into account recent previous cultures)	Duration	Comments
<p>Complicated Lower Urinary Tract Infection (Cystitis) Without Sepsis or Bacteremia ⁴</p> <p>(Male, urinary catheter present or removal within the last 48 hours, recent GU instrumentation, anatomic abnormality or obstruction, pregnancy or other significant co-morbid conditions such as uncontrolled diabetes or immunosuppression)</p> <p>*Adjust dose based on renal function</p>	<p><u>Preferred oral regimens:</u> Nitrofurantoin 100 mg PO BID (contraindicated if CrCl <30 mL/min)</p> <p><u>Alternative oral regimens:</u> TMP-SMX* 1 DS tab PO BID (if susceptibility confirmed) OR Cephalexin* 500 mg PO QID or 1000 mg PO TID OR Fosfomycin 3 g PO x3 doses given every 48 hours</p> <p><u>Preferred IV option if patient cannot take PO medications</u> Cefazolin* 1 g IV q8h</p> <p><u>Alternative IV option in patients with anaphylactic:</u> <i>PCN/Cephalosporin allergy</i> Aztreonam* 1 g IV q8h</p> <p><u>History of resistant Gram-negative bacteria OR NOT responding to PO antibiotics:</u> Piperacillin-tazobactam* 4.5 g IV q8h</p> <p><u>Alternative in patients with anaphylactic PCN/Cephalosporin allergy:</u> Aztreonam* 1 g IV q8h</p> <p><u>PREGNANCY:</u> Follow recommendations as above, but note agents to avoid/use with caution in comments. Note that fosfomycin is more expensive than cephalexin and nitrofurantoin</p>	<p><u>Non-Catheter-associated:</u> Treatment duration depends on patient characteristics and clinical response, 7 days usually appropriate</p> <p><u>Catheter-associated:</u> Prompt resolution of symptoms: 7 days</p> <p>Delayed response to therapy: 10-14 days</p> <p><u>Special Populations:</u> Women <65 y/o without upper tract symptoms after catheter removal: 3 days</p>	<ul style="list-style-type: none"> ● Asymptomatic bacteriuria in catheterized patients, even in the presence of pyuria, is NOT an indication for treatment ● Remove urinary catheter whenever possible ● Nitrofurantoin and fosfomycin should be avoided if pyelonephritis is suspected ● Fluoroquinolones are no longer recommended as 1st-line agents due to high rates of <i>E. coli</i> resistance and propensity for collateral damage (resistance, <i>C. difficile</i> infection). Use should be reserved when other options are not feasible. ● Definitive antimicrobial choice should be adjusted based on urine culture and susceptibility testing ● ● Beta-lactams and fluoroquinolones concentrate in the urine and may be clinically efficacious for (only) cystitis caused by isolates with intermediate susceptibility, provided preferred/alternative oral susceptible options are not feasible. ● <u>Pregnancy:</u> <ul style="list-style-type: none"> ○ Urine culture should be sent and treatment adjusted based on susceptibilities. Follow-up urine cultures should be obtained for test of cure. ○ <u>Contraindicated throughout pregnancy:</u> Fluoroquinolones and doxycycline ○ <u>Avoid in first 8 weeks:</u> TMP-SMX ○ If listed options are not appropriate, aminoglycosides may be acceptable alternatives

Clinical Setting	Empiric Therapy (should take into account recent previous cultures)	Duration	Comments
<p>Uncomplicated Pyelonephritis³</p> <p>(healthy non-pregnant female)</p>	<p><u>Preferred:</u> Ceftriaxone 1 g IV daily followed by step-down to oral TMP-SMX* 1 DS tab PO BID if susceptible</p> <p><u>Alternative in patients with anaphylactic PCN/Cephalosporin allergy</u> Ciprofloxacin* 750 mg PO BID or 400 mg IV TID + Gentamicin 2 mg/kg IV x1 dose</p> <p>*Adjust dose based on renal function</p>	<p><u>TMP-SMX:</u> 7- 14 days (7 days may be considered in female patients <65 years old without comorbidities)</p> <p><u>Ciprofloxacin:</u> 7 days</p> <p><u>Oral Beta-lactams:</u> 10-14 days</p> <p><u>IV Beta-lactams:</u> 7 days</p>	<ul style="list-style-type: none"> • Urine culture and susceptibility testing should be obtained • Step-down to oral therapy is dependent on the susceptibility of the organism • Fluoroquinolones may cause tendinopathy and tendon rupture especially among patients who are older (>60 years), malnourished, and on oral glucocorticoids • Fluoroquinolones may lead to potentially fatal arrhythmias in patients with QT interval prolongation, electrolyte abnormalities, clinically significant bradycardia, and in patients receiving antiarrhythmic medications

Clinical Setting	Empiric Therapy (should take into account recent previous cultures)	Duration	Comments
<p>Complicated Urinary Tract Infection with Sepsis or Bacteremia, Complicated Pyelonephritis, Pyelonephritis in Pregnancy, or Perinephric Abscess</p>	<p>Community-acquired: Ceftriaxone 2 g IV daily</p> <p>Critically ill, septic shock, healthcare- or hospital-acquired: Piperacillin-tazobactam* 4.5 g IV q6h</p> <p>Alternative <i>PCN allergy without anaphylaxis, angioedema, or urticaria</i> Cefepime* 2 g IV q8h + Vancomycin IV (see nomogram, AUC goal 400-600)</p> <p>Anaphylactic PCN/Cephalosporin allergy Aztreonam* 2 g IV q8h + Vancomycin IV (see nomogram, AUC goal 400-600)</p> <p>PREGNANCY: Follow recommendations as above, but note agents to avoid in comments</p> <p>*Adjust dose based on renal function</p>	<p><u>Sepsis w/o bacteremia:</u> 7 days, can step down to oral therapy when stable (see comment)</p> <p><u>Sepsis with bacteremia:</u> 7-14 days from first negative blood culture with IV antibiotics or oral quinolone if susceptible gram-negative organism. A 7-day duration may be appropriate⁷ in conjunction with ID consultation for patients <u>without urinary diversion, recent urologic surgery, anatomic abnormalities, relapsed infection</u> and:</p> <ul style="list-style-type: none"> • Transient bacteremia (single day) with rapid clinical improvement within 72 hours • Not polymicrobial or bacteremic with <i>Pseudomonas</i> • Not neutropenic, HCST/SOT, HIV with CD4 <200 • Remains hemodynamically stable at day 7 • Been afebrile ≥48 hours (at day 7) <p><u>Complicated Pyelonephritis without bacteremia:</u> IV beta-lactam or quinolone: 7 days IF meet the following criteria:</p> <ul style="list-style-type: none"> • Not neutropenic, HIV with CD4 <200, or HCST/SOT • Rapid clinical improvement within 72 hours, remains hemodynamically stable at day 7, and been afebrile ≥48 hours (at day 7) • No urinary diversion, recent urologic surgery, anatomic abnormalities, or relapsed infection • Non-pregnant <p>If does not meet above criteria or wish to treat with agents other than IV beta-lactam or quinolone: 14 days</p> <p><u>Perinephric Abscess:</u> Prolonged duration (see comments)</p>	<ul style="list-style-type: none"> • Perinephric abscess: recommend ID and urology consult • Pregnancy: <ul style="list-style-type: none"> ○ Urine culture should be sent and treatment adjusted based on susceptibilities. Follow-up urine cultures should be obtained for test of cure. ○ <u>Contraindicated throughout pregnancy:</u> Fluoroquinolones and doxycycline ○ <u>Avoid in first 8 weeks of pregnancy:</u> TMP-SMX ○ While aminoglycosides in combination with Ampicillin may be used for the treatment of UTIs in pregnancy, due to potential toxicity and appropriate alternatives, they typically are not first line agents. In addition, the combination of ampicillin and an aminoglycoside is not recommended in the setting of sepsis or septic shock.

Clinical Setting	Empiric Therapy (should take into account recent previous cultures)	Duration	Comments
<p>Prostatitis</p> <p>Patients typically present with frequency, urgency, urinary incontinence, poor stream, hesitancy, fever and a tender, edematous prostate on exam.</p>	<p>Preferred: Ciprofloxacin* 750 mg PO BID OR TMP-SMX* 1 DS tab PO BID</p> <p>*Adjust dose based on renal function</p>	<p>4-6 weeks</p>	<ul style="list-style-type: none"> Antimicrobial choice should be adjusted based on urine culture and susceptibility testing Fluoroquinolones may lead to potentially fatal arrhythmias in patients with QT interval prolongation, electrolyte abnormalities, clinically significant bradycardia, and in patients receiving antiarrhythmic medications Fluoroquinolones may cause tendinopathy and tendon rupture especially among patients who are older (>60 years), malnourished, and on oral glucocorticoids
<p>Epididymitis</p> <p>Primary pathogens <i>C. trachomatis</i> or <i>N. gonorrhoeae</i></p> <p>Enteric organisms are more likely in men who practice insertive anal intercourse</p> <p>Enteric organisms in select patients only, such as after prostate biopsy, vasectomy, and other urinary tract instrumentation.</p>	<p>Ceftriaxone 500 mg** IM once + Doxycycline 100 mg PO BID</p> <p><i>Men who practice insertive anal intercourse</i></p> <p>Ceftriaxone 500 mg** IM once (ceftriaxone could be omitted in select cases if there is a low suspicion for gonorrhea or there is a negative NAAT for <i>N. gonorrhoeae</i>) + Levofloxacin* 500 mg PO daily (coverage of enteric organisms)</p> <p>*Adjust dose based on renal function ** If weight \geq 150 kg, ceftriaxone dose should be 1000 mg</p>	<p>Doxycycline: 10 days</p> <p>Levofloxacin: 10 days</p>	<ul style="list-style-type: none"> Recommended tests: U/A, Urine culture, and NAATs from urine or urethral specimen for <i>N. gonorrhoeae</i> and <i>C. trachomatis</i> All men should be empirically treated with antibiotics that cover <i>C. trachomatis</i> and <i>N. gonorrhoeae</i>. Antimicrobial regimens should be re-evaluated based on NAAT and urine culture results. Fluoroquinolones may lead to potentially fatal arrhythmias in patients with QT interval prolongation, electrolyte abnormalities, clinically significant bradycardia, and in patients receiving antiarrhythmic medications Fluoroquinolones may cause tendinopathy and tendon rupture especially among patients who are older (>60 years), malnourished, and on oral glucocorticoids

[*Renal Dosing Recommendations](#)

^a SIRS Criteria: Heart rate greater than 90 bpm, respiratory rate greater than 20 breaths per minute, temperature less than 36°C, white blood count less than 4,000 cells/mm³, temperature greater than 38°C, white blood count greater than 12,000 cells/mm³.

References

- ¹ Nicolle LE, et al. Infectious Diseases Society of America Guidelines for the Diagnosis and Treatment of Asymptomatic Bacteriuria in Adults. [Clin Infect Dis 2005;40:643-654.](#)
- ² Sousa R, et al. Is Asymptomatic Bacteriuria a Risk Factor for Prosthetic Joint Infection? [Clin Infect Dis 2014;59:41-47.](#)
- ³ Gupta K, et al. International Clinical Practice Guidelines for the Treatment of Acute Uncomplicated Cystitis and Pyelonephritis in Women: A 2010 Update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases. [Clin Infect Dis 2011;52:e103-e120.](#)
- ⁴ Hooton TM, et al. Diagnosis, Prevention, and Treatment of Catheter- Associated Urinary Tract Infection in Adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America. [Clin Infect Dis 2010;50:625-663.](#)
- ⁵ Harris PN, et al. β -lactam and β -lactamase inhibitor combinations in the treatment of extended-spectrum β -lactamase producing Enterobacteriaceae: time for a reappraisal in the era of few antibiotic options? [Lancet Infect Dis 2015;15:475-485.](#)
- ⁶ Gandhi T, et al. Importance of urinary tract infection to antibiotic use among hospitalized patients. [Infect Control Hosp Epidemiol 2009;30:193-5.](#)
- ⁷ Yahav D, et al. Seven Versus 14 Days of Antibiotic Therapy for Uncomplicated Gram-negative Bacteremia: A Noninferiority Randomized Controlled Trial. [Clin Infect Dis, 69 \(7\), 1091-1098 2019 Sep 13.](#)

Antimicrobial Subcommittee Approval: 5/19, 06/21	Originated: 12/15
P&T Approval: 7/19, 07/21	Last Revised: 10/22
Revision History: 3/21: Updated vancomycin dosing & hyperlinks 07/21: Updated cystitis section comments 10/22: Updated Epididymitis	

The recommendations in this guide are meant to serve as treatment guidelines for use at Michigan Medicine facilities. If you are an individual experiencing a medical emergency, call 911 immediately. These guidelines should not replace a provider's professional medical advice based on clinical judgment, or be used in lieu of an Infectious Diseases consultation when necessary. As a result of ongoing research, practice guidelines may from time to time change. The authors of these guidelines have made all attempts to ensure the accuracy based on current information, however, due to ongoing research, users of these guidelines are strongly encouraged to confirm the information contained within them through an independent source.

If obtained from a source other than med.umich.edu/asp, please visit the webpage for the most up-to-date document.