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).

Does your adult patient have any of the following without alternate explanation?
- Fever >38°C or rigors without alternative cause
- Urgency, frequency, dysuria
- Suprapubic pain for tenderness
- Costovertebral pain or tenderness
- New onset mental status changes with leukocytosis, hypotension, or ≥2 SIRS criteria
- Acute hematuria
- Spasticity or autonomic dysreflexia in patients with spinal cord injury

Order “UA with reflex culture if indicated”*
(note: for neutropenic patients, send culture without UA)

Do NOT send a urine culture or urinalysis

*: 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 infection.

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.

<table>
<thead>
<tr>
<th>Asymptomatic Bacteriuria</th>
<th>Uncomplicated Cystitis</th>
<th>Complicated Lower Cystitis w/o sepsis/bacteremia</th>
<th>Uncomplicated Pyelonephritis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complicated UTI w/sepsis/bacteremia</td>
<td>Complicated Pyelonephritis</td>
<td>Pyelonephritis in Pregnancy</td>
<td>Perinephric Abscess</td>
</tr>
<tr>
<td>Prostatitis</td>
<td>Epidydenid</td>
<td>References</td>
<td></td>
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<tr>
<td>Clinical Setting</td>
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<td>Duration</td>
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<tr>
<td><strong>Asymptomatic Bacteriuria</strong></td>
<td>In most circumstances, asymptomatic bacteriuria should not be treated, regardless of pyuria, bacterial density, or isolation of resistant organisms.</td>
<td></td>
<td>• Surgical prophylaxis guidelines provide recommendations on antimicrobial prophylaxis prior to genitourinary operation</td>
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<td></td>
<td>Treatment is recommended in the following circumstances: pregnancy and prior to urologic procedures.</td>
<td></td>
<td>• Available evidence does not support screening for, and treatment of, asymptomatic bacteriuria prior to implantation of prosthetic orthopedic or cardiac devices or neurosurgical procedures.</td>
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<tr>
<td></td>
<td>PREGNANCY</td>
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<td>• Pregnancy:</td>
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<td><strong>Cephalexin</strong>&lt;sup&gt;*&lt;/sup&gt; 500 mg PO QID OR Nitrofurantoin 100 mg PO BID (contraindicated if CrCl &lt;30 mL/min) OR Fosfomycin 3 g PO once (more expensive than cephalexin and nitrofurantoin)</td>
<td></td>
<td>○ Urine culture should be sent and treatment adjusted based on susceptibilities. Follow-up urine cultures should be obtained for test of cure.</td>
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<td></td>
<td>○ <strong>Contraindicated throughout pregnancy:</strong> Fluoroquinolones and doxycycline</td>
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<td></td>
<td>○ <strong>Avoid in first 8 weeks of pregnancy:</strong> TMP-SMX</td>
</tr>
</tbody>
</table>

<sup>1</sup> Possible UTI symptoms include (without alternative explanation):  
- 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  
- Acute hematuria  
- Spasticity or autonomic dysreflexia in patients with spinal cord injury

<sup>2</sup> Available evidence does not support screening for, and treatment of, asymptomatic bacteriuria prior to implantation of prosthetic orthopedic or cardiac devices or neurosurgical procedures.

<sup>*</sup> Adjust dose based on renal function
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<tr>
<td>Uncomplicated Cystitis³</td>
<td>Preferred Nitrofurantoin 100 mg PO BID (contraindicated if CrCl &lt;30 mL/min. Due to the cost of fosfomycin, nitrofurantoin is preferred if not contraindicated)</td>
<td>Nitrofurantoin: 5 days</td>
<td>• Fluoroquinolones are no longer recommended as 1st-line agents due to high rates of <em>E coli</em> resistance and propensity for collateral damage (resistance, <em>C difficile</em> 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 susceptible⁵</td>
</tr>
<tr>
<td>(Non-pregnant female without obstruction, catheters, flank pain, or co-morbid conditions except well-controlled diabetes mellitus)</td>
<td>Alternative TMP-SMX* 1 DS tab PO BID OR Fosfomycin 3 g PO once OR Cephalexin* 500 mg PO BID</td>
<td>Fosfomycin: 1 dose Cephalexin: 7 days TMP-SMX: 3 days</td>
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| Complicated Lower Urinary Tract Infection (Cystitis) Without Sepsis or Bacteremia | Preferred oral regimens: Nitrofurantoin 100 mg PO BID (contraindicated if CrCl <30 mL/min)  
Alternative oral regimens:TMP-SMX* 1 DS tab PO BID (if susceptibility confirmed) OR Cephalexin* 500 mg PO QID OR Fosfomycin 3 g PO x3 doses given every 48 hours  
Preferred IV option if patient cannot take PO medications Cefazolin* 1 g IV q8h  
Alternative IV option in patients with anaphylactic:PCN/Cephalosporin allergy Aztreonam* 1 g IV q8h  
History of resistant Gram-negative bacteria OR Not responding to PO antibiotics: Piperacillin-tazobactam* 4.5 g IV q8h  
Alternative in patients with anaphylactic PCN/Cephalosporin allergy:Aztreonam* 1 g IV q8h | Non-Catheter-associated: Treatment duration depends on patient characteristics and clinical response, 7 days usually appropriate  
Catheter-associated: Prompt resolution of symptoms: 7 days  
Delayed response to therapy: 10-14 days  
Special Populations: Women <65 y/o without upper tract symptoms after catheter removal: 3 days | • 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  
• Definitive antimicrobial choice should be adjusted based on urine culture and susceptibility testing  
• Pregnancy:  
  o Urine culture should be sent and treatment adjusted based on susceptibilities. Follow-up urine cultures should be obtained for test of cure.  
  o Contraindicated throughout pregnancy: Fluoroquinolones and doxycycline  
  o Avoid in first 8 weeks: TMP-SMX  
  o If listed options are not appropriate, aminoglycosides may be acceptable alternatives |

* Adjust dose based on renal function
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<tr>
<td>Uncomplicated Pyelonephritis(^3)</td>
<td>Preferred: Ceftriaxone 1 g IV daily followed by step-down to oral TMP-SMX* 1 DS tab PO BID if susceptible</td>
<td></td>
<td>• Urine culture and susceptibility testing should be obtained</td>
</tr>
<tr>
<td>(healthy non-pregnant female)</td>
<td>Alternative in patients with anaphylactic PCN/Cephalosporin allergy Ciprofloxacin* 500 mg PO BID or 400 mg IV BID + Gentamicin 2 mg/kg IV x1 dose</td>
<td></td>
<td>• Step-down to oral therapy is dependent on the susceptibility of the organism</td>
</tr>
<tr>
<td></td>
<td>*Adjust dose based on renal function</td>
<td></td>
<td>• Fluoroquinolones may cause tendinopathy and tendon rupture especially among patients who are older (&gt;60 yo), malnourished, and on oral glucocorticoids</td>
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<tr>
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<td></td>
<td>• Fluoroquinolones may lead to potentially fatal arrhythmias in patients with QT interval prolongation, electrolyte abnormalities, clinically significant bradycardia, and in patients receiving antiarrhythmic medications</td>
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**Duration:**
- **TMP-SMX:** 7-14 days (7 days may be considered in female patients <65 years old without comorbidities)
- **Ciprofloxacin:** 7 days
- **Oral Beta-lactams:** 10-14 days
- **IV Beta-lactams:** 7 days
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| **Complicated Urinary Tract Infection with Sepsis or Bacteremia, Complicated Pyelonephritis, Pyelonephritis in Pregnancy, or Perinephric Abscess** | **Community-acquired:**  
  Ceftriaxone 2 g IV daily  
  Critically ill, septic shock, healthcare- or hospital-acquired:  
  Piperacillin-tazobactam*  
  4.5 g IV q6h  
  Alternative  
  PCN allergy without anaphylaxis, angioedema, or urticaria  
  Cefepime*  
  2 g IV q8h  
  + Vancomycin IV (see nomogram, AUC goal 400-600)  
  Anaphylactic  
  PCN/Cephalosporin allergy  
  Aztreonam*  
  2 g IV q8h  
  + Vancomycin IV (see nomogram, AUC goal 400-600)  
  PREGNANCY:  
  Follow recommendations as above, but note agents to avoid in comments  
  *Adjust dose based on renal function | **Sepsis w/o bacteremia:**  
  7 days, can step down to oral therapy when stable (see comment)  
  **Sepsis with bacteremia:**  
  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 appropriate in conjunction with ID consultation for patients without urinary diversion, recent urologic surgery, anatomic abnormalities, relapsed infection and:  
  * Transient bacteremia (single day) with rapid clinical improvement within 72 hours  
  * Not polymicrobial or bacteremic with *Pseudomonas*  
  * Not neutropenic, HCST/SOT, HIV with CD4 <200  
  * Remains hemodynamically stable at day 7  
  * Been afebrile ≥48 hours (at day 7)  
  **Complicated Pyelonephritis without bacteremia:**  
  IV beta-lactam or quinolone:  
  7 days if meet the following criteria:  
  * 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  
  If does not meet above criteria or wish to treat with agents other than IV beta-lactam or quinolone:  
  14 days  
  **Perinephric Abscess:**  
  Prolonged duration (see comments) |  
  * Perinephric abscess: recommend ID and urology consult  
  **Pregnancy:**  
  - Urine culture should be sent and treatment adjusted based on susceptibilities. Follow-up urine cultures should be obtained for test of cure.  
  - Contraindicated throughout pregnancy: Fluoroquinolones and doxycycline  
  - Avoid in first 8 weeks of pregnancy: 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. |
### Renal Dosing Recommendations

* 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.

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| **Prostatitis**  | Preferred: **Ciprofloxacin** * 500 mg PO BID OR **TMP-SMX** * 1 DS tab PO BID | 4-6 weeks | • 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 |
|                  | * Adjust dose based on renal function |          |          |
| **Epididymitis** | Preferred: 
  - Men ≤35 years: **Ceftriaxone** 250 mg IM once + **Doxycycline** 100 mg PO BID 
  - Men >35 years and men who practice insertive anal intercourse: **Ceftriaxone** 250 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 *N. gonorrhoeae*) + **Levofloxacin** * 500 mg PO daily (coverage of enteric organisms) 
  * Adjust dose based on renal function | **Doxycycline:** 10 days  
  **Levofloxacin:** 10 days | • Recommended tests: U/A, Urine culture, and NAATs from urine or urethral specimen for *N. gonorrhoeae* and *C. trachomatis*  
  • All men should be empirically treated with antibiotics that cover *C. trachomatis* and *N. gonorrhoeae*. 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 |
References


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P&T Approval: 7/2019
Last Revised: 03/2021

Revision History:
3/21: Updated vancomycin dosing & hyperlinks

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.

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