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 demonstrates pyuria or bacteriuria. In the absence of clinical suspicion for urinary tract infection based on the criteria listed above, pyuria and/or bacteriuria should not be treated. The presence of pyuria or bacteriuria is expected in patients with catheterization or suprapubic catheters and should not alter clinical decision making on whether a urinary tract infection is present. 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>
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<tr>
<td>Prostatitis</td>
<td>Epididymitis</td>
<td>References</td>
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<tr>
<td>Clinical Setting</td>
<td>Therapy</td>
<td>Duration</td>
<td>Comments</td>
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<tr>
<td>Asymptomatic Bacteriuria&lt;sup&gt;1&lt;/sup&gt;</td>
<td>In most circumstances, asymptomatic bacteriuria should not be treated, regardless of pyuria, bacterial density, or isolation of resistant organisms. Treatment is recommended in the following circumstances: pregnancy and prior to urologic procedures. Preferred: 1&lt;sup&gt;st&lt;/sup&gt; line: <strong>Nitrofurantoin</strong> 100 mg PO BID (contraindicated if CrCl &lt; 30 mL/min) Alternative: <strong>Cephalexin</strong>* 500 mg PO BID OR <strong>Fosfomycin</strong> 3 g PO once</td>
<td>Cephalexin: 7 days (pregnancy only) Nitrofurantoin: 5 days (pregnancy only)</td>
<td>• Surgical prophylaxis guidelines provide recommendations on antimicrobial prophylaxis prior to genitourinary operation • Screening for and treatment of asymptomatic bacteriuria prior to implantation of prosthetic orthopedic or cardiac devices or neurosurgical procedures should not be treated. • Pregnancy: ○ Urine culture should be sent and treatment adjusted based on susceptibilities. Follow-up urine cultures should be obtained for test of cure. ○ Relatively contraindicated throughout pregnancy: Fluoroquinolones and ○ Avoid in first 8 weeks of pregnancy: TMP-SMX</td>
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<sup>1</sup> Adjust dose based on renal function
<table>
<thead>
<tr>
<th>Clinical Setting</th>
<th>Therapy (Should take into account recent previous cultures)</th>
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| **Uncomplicated Cystitis**³ | Preferred  
Nitrofurantoin 100 mg PO BID (contraindicated if CrCl < 30 mL/min).  
1st Alternative  
TMP-SMX* 1 DS tab PO BID  
2nd Alternative  
Cephalexin* 500 mg PO BID (avoid if anaphylaxis to penicillin)  
3rd Alternative  
Fosfomycin 3 g PO once OR  
Ciprofloxacin 500 mg PO BID OR  
Levofloxacin 750 mg PO daily  
4th Alternative:  
Gentamicin* 5 mg/kg IV x1 OR  
Tobramycin* 5 mg/kg IV x1 OR  
Amikacin* 15 mg/kg IV x1 | Nitrofurantoin:  
5 days  
Ciprofloxacin / levofloxacin:  
3 days  
Fosfomycin:  
1 dose  
Cephalexin:  
7 days  
TMP-SMX:  
3 days | • Fosfomycin should only be used to treat *E. coli*. Fosfomycin is less effective than nitrofurantoin and should only be used if a contraindication to nitrofurantoin exists.  
• Fluoroquinolones are no longer recommended as 1st-line agents due to high rates of *E. coli* resistance and propensity for collateral damage (resistance, *C. difficile* infection). Use should be reserved when 1st and 2nd line options are not feasible |
<table>
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</table>
| **Complicated Lower Urinary Tract Infection (Cystitis) Without Sepsis or Bacteremia** | Preferred  
Nitrofurantoin 100 mg PO BID  
(contraindicated if CrCl < 30 mL/min).  
1st Alternative  
TMP-SMX* 1 DS tab PO BID  
2nd Alternative  
Cephalexin 1000 mg PO TID  
(avoid if anaphylaxis to penicillin)  
3rd Alternative  
Fosfomycin 3 g PO once  
OR  
Ciprofloxacin 500 mg PO q12h  
OR  
Levofloxacin 500 mg PO q24h | Based on clinical response, 7 days usually appropriate  
Delayed response to therapy:  
10-14 days | • Empiric therapy should take prior antimicrobial susceptibility into account  
• Nitrofurantoin and fosfomycin should be avoided if any upper-tract or parenchymal involvement is suspected or confirmed. No data are available to support repeat dosing of fosfomycin for complicated lower urinary tract infection.  
• Asymptomatic bacteriuria with or without pyuria in catheterized patients are NOT an indication for treatment  
• Remove urinary catheter whenever possible  
• If catheter removed and instigating symptoms have resolved, likely no infection was present and no treatment is needed  
• Antimicrobial choice should be adjusted based on urine culture and susceptibility testing  
• **Pregnancy:**  
  o Follow-up urine cultures should be obtained for test of cure.  
  o Relatively contraindicated throughout pregnancy:  
    o Fluoroquinolones  
  o Avoid in first 8 weeks:  
    o TMP-SMX |
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</tr>
</thead>
<tbody>
<tr>
<td>Uncomplicated Pyelonephritis³</td>
<td>Preferred: Ceftriaxone 2 g IV daily followed by oral therapy if possible (safe in patients with anaphylaxis to penicillin)*</td>
<td>TMP-SMX: 7 days</td>
<td>• Urine culture and susceptibility testing should be obtained</td>
</tr>
<tr>
<td></td>
<td>Alternative in patients with ceftriaxone allergy: Meropenem 1g IV q8h followed by oral therapy if possible*</td>
<td>Ciprofloxacin or levofloxacin: 5 days</td>
<td>• Use of oral therapy is dependent on the susceptibility of the organism</td>
</tr>
<tr>
<td></td>
<td>Alternative in patients with history of ESBL-producing organisms: Meropenem 1 – 2g IV q8h followed by oral therapy if possible*</td>
<td>Oral Beta-lactams: 10-14 days</td>
<td>• Oral therapy appropriate for patients with bacteremia</td>
</tr>
<tr>
<td></td>
<td>*See appendix</td>
<td>IV Beta-lactams: 7 days</td>
<td></td>
</tr>
<tr>
<td>Clinical Setting</td>
<td>Empiric Therapy (should take into account recent previous cultures)</td>
<td>Duration</td>
<td>Comments</td>
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<tr>
<td><strong>Complicated Urinary Tract Infection with Sepsis or Bacteremia, Complicated Pyelonephritis, Pyelonephritis in Pregnancy, or Perinephric Abscess</strong></td>
<td><strong>Community-acquired:</strong> Ceftriaxone 2 g IV daily (safe even with penicillin anaphylaxis)</td>
<td><strong>Complicated pyelonephritis with or without bacteremia:</strong> 7-14 days from first negative blood culture 7-day duration recommended for patients without urinary diversion, recent urologic surgery, anatomic abnormalities, relapsed infection, or other complicating factors and:</td>
<td>• Perinephric abscess: recommend ID and urology consult</td>
</tr>
</tbody>
</table>
|                                                                                 | **Critically ill, septic shock, healthcare- or hospital-acquired:** Cefepime* 2g IV q8h + Vancomycin IV (see nomogram) followed by oral therapy if possible (safe even with penicillin anaphylaxis)* |                                                                                              | **Pregnancy:**  
  ○ Urine culture should be sent and treatment adjusted based on susceptibilities. Follow-up urine cultures should be obtained for test of cure.  
  ○ Relatively contraindicated throughout pregnancy:  
    ○ Fluoroquinolones  
    ○ Avoid in first 8 weeks of pregnancy:  
      ○ TMP-SMX |
<p>| Alternative in patients with history of ESBL-producing organisms: Cefepine* 1–2 g IV q8h with or without vancomycin as above followed by oral therapy if possible* |                                                                                              |                                                                                              |                                                                                                                                           |
| <strong>PREGNANCY:</strong> Follow recommendations as above, but note agents to avoid in comments |                                                                                              |                                                                                              |                                                                                                                                           |
|                                                                                 | *See appendix                                                                                                   |                                                                                              |                                                                                                                                           |</p>
<table>
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| **Prostatitis**  | Preferred: Ciprofloxacin 750 mg PO BID OR Levofloxacin 750 mg PO daily OR TMP-SMX 2 DS tab PO BID | 4-6 weeks | • Antimicrobial choice should be adjusted based on urine culture and susceptibility testing  
• Insurance coverage and access should be verified for fosfomycin prior to initiation of therapy |
|                  | Alternative for patients with *E. coli* or *E. faecalis*, in consultation with ID: Fosfomycin 3g PO daily x 1 week followed by 3g PO q48h x6-12 weeks |          |          |
| **Epididymitis** | Ceftriaxone 500 mg** IM once (safe even with penicillin anaphylaxis) + Doxycycline 100 mg PO BID  
*Men who practice insertive anal intercourse*  
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 *N. gonorrhoeae*; (safe even with penicillin anaphylaxis)) + Levofloxacin* 750 mg PO daily (coverage of enteric organisms)  
*Adjust dose based on renal function*  
** If weight ≥150 kg, ceftriaxone dose should be 1000 mg  
Doxycycline: 10 days  
Levofloxacin: 10 days | 4-6 weeks | • 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. |

*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.*
Appendix 1. Preferred oral antibiotic dosing for bacteremia, pyelonephritis, and other non-cystitis urinary tract infections

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Bioavailability</th>
<th>Dosing (normal renal function)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin¥</td>
<td>70 – 80%</td>
<td>1000mg PO q6h</td>
</tr>
<tr>
<td>Ciprofloxacin*,€</td>
<td>70%</td>
<td>750mg PO q12h</td>
</tr>
<tr>
<td>Levofloxacin*, €</td>
<td>99%</td>
<td>750mg PO q24h</td>
</tr>
<tr>
<td>Trimethoprim-sulfamethoxazole, €</td>
<td>~100%</td>
<td>2 DS PO q12h</td>
</tr>
</tbody>
</table>

*Administer at least 2 hours before and 6 hours after divalent cations (calcium, magnesium, aluminum, dairy). Administration of continuous tube feeds may reduce efficacy
€ - Preferred
¥ - Enterococcus only

1 – Antibiotics not listed in this chart are not routinely recommended for use for patients with bacteremia or upper urinary tract infections. Considerations for other oral β-lactams are provided in Appendix 2

2 – Oral antibiotic therapy should preferentially be used in patients meeting the following criteria, assuming in vitro susceptibility:
   - Ability to take oral medications reliably
   - Clinical stability
   - No concerns for diminished absorption (e.g., short-gut syndrome, unavoidable drug-drug interactions)
Appendix 2. Oral β-lactam dosing for bacteremia, pyelonephritis, and other non-cystitis urinary tract infections for when fluoroquinolones and trimethoprim-sulfamethoxazole cannot be used

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Bioavailability</th>
<th>Dosing (normal renal function)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin-clavulanate</td>
<td>70 – 80% (amoxicillin)</td>
<td>875mg PO q8h</td>
</tr>
<tr>
<td>Cefpodoxime</td>
<td>50%</td>
<td>400mg PO BID</td>
</tr>
<tr>
<td>Cephalexin</td>
<td>95%</td>
<td>1000mg PO q6h</td>
</tr>
</tbody>
</table>

Should only be used in patients with definitive source control when applicable, resolution of clinical signs and symptoms of infection, and at least 3 days of prior intravenous therapy. Should be used ONLY in consultation with ID and when fluoroquinolones and trimethoprim-sulfamethoxazole are not options. Available pharmacokinetic / pharmacodynamic (PK/PD) data, using contemporary PK/PD targets, do not support the use of oral β-lactam agents as definitive therapy for non-cystitis urinary tract infections, with or without bacteremia. However, published clinical data and experience on the use of oral β-lactams as definitive therapy do suggest that they have a role in many patients although the risk of recurrence and treatment is likely marginally higher in comparison to fluoroquinolones and trimethoprim-sulfamethoxazole. Additionally, the role of prior active therapy, definitive source control, and other patient-specific factors must be considered.

Thus, the use of oral β-lactams for non-cystitis urinary tract infections with or without bacteremia must be evaluated with patient-specific risk-benefit considerations in mind, including the potential harms of central intravenous line placement, treatment failure / recurrence, or alternative oral therapies.
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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