If suspected pyelonephritis refer to respective guideline for "Acute Pyelonephritis in Adult Patients – Diagnosis and Management".

**Suspected UTI or CAUTI:**
- Clinical sepsis without evident alternative source
- Costovertebral angle or suprapubic pain or tenderness
- Shaking chills/rigors
- New onset of altered mental status without alternative cause
- Urinary urgency and/or frequency*
- Dysuria, suprapubic or flank pain*
- Increased spasticity or autonomic dysreflexia in patients with spinal cord injury
- Fever ≥ 100.4 °F (38 °C) without alternative source

*Patients with indwelling urethral catheters MAY NOT exhibit these classic symptoms; for young females a positive UA may suffice

**Preoperative Surgical Screening**
- Consider only in the instance of high-risk surgery including:
  - Cardiac surgery
  - Neurosurgery
  - Urologic surgery/procedures

**Order & collect appropriate urine testing based on criteria "A" vs "B"**

(See also "How to Collect a Clean Urine Sample" Male or Female)

A. Urinalysis with Reflex to Culture for General Population

- Lab will reflex to culture if urinalysis meets any ONE of the following:
  - ≥ Moderate Leukocyte Esterase
  - WBC > 5/HPF
  - Bacteria present with squamous cells ≤ 2+
  - Nitrile positive with squamous cells ≤ 2+

*Squamous cells are a marker of contamination

Antimicrobial therapy is NOT recommended if:
- Asymptomatic and no indwelling urinary catheter

Antimicrobial therapy is recommended if:
- Symptomatic (any population)
- UA reflexed to culture and culture results are pending or positive AND one of the following:
  - Asymptomatic in high-risk population (See criteria in Box B)
  - If impending urologic, neurosurgery or cardiac surgery procedure

If catheterized, replace indwelling catheter (as above) or perform straight cath if unable to provide clean catch sample

Begin empiric antimicrobial therapy (See Treatment Considerations – Step 1)

- Evaluate prior cultures and susceptibilities when available and tailor antimicrobial therapy
- See Steps 2-3 for antimicrobial options, dosing and treatment guidance

The following should be considered "significant" and should complete a full course of therapy (Step 3).

- "Clean catch" specimens growing ≥100,000 CFU’s
- "Straight cath" specimen growing ≥10,000 CFU’s

Cultures with lesser growth may warrant additional consideration for non-infectious etiologies

**Antimicrobial therapy is NOT recommended if:**
- Asymptomatic and no indwelling urinary catheter

- If indwelling urinary catheter present for ≥ 3 calendar days (or unknown), remove PRIOR to sample collection unless contraindicated.
- Determine clinical need for ongoing indwelling catheter prior to replacement (See CAUTI Guidelines)

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Cultures with lesser growth may warrant additional consideration for non-infectious etiologies
Empiric Treatment Considerations

A. Unless guided by current or prior urine culture results, consider these empiric options in order of preference based on overall susceptibility from OSUWMC antibiograms:

(See Appendix A for recommendations during pregnancy and Appendix B for OSUWMC Emergency Department Antibiogram for E. coli Urine Isolates)

1. Cephalexin (Keflex®) PO
2. Cefazolin (Ancef®) IV if enteral access not available or concern for altered absorption
3. Ceftriaxone (Rocephin®) IV if additional coverage is necessary beyond urinary tract (i.e. pneumonia) or for less frequent dosing if IV access/compatibility is of concern
4. Nitrofurantoin (Macrobid®) - DO NOT USE IF Creatinine Clearance (CrCl) < 50 mL/min
5. Sulfamethoxazole / trimethoprim (Bactrim DS®) PO
6. Ciprofloxacin (Cipro®) or Levofloxacin (Levaquin®) - use PO formulation, if enteral access is available and there is no concern for altered absorption (i.e. high dose pressors or tube feeding)

B. Determine location/severity of UTI – this will determine duration of therapy

<table>
<thead>
<tr>
<th>Severity</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncomplicated</td>
<td>• Patient with a structurally and neurologically normal urinary tract</td>
</tr>
<tr>
<td></td>
<td>o Usually only applicable to premenopausal women</td>
</tr>
<tr>
<td>Complicated</td>
<td>• Patient with a functional or anatomical abnormality of the urinary tract</td>
</tr>
<tr>
<td></td>
<td>o Men</td>
</tr>
<tr>
<td></td>
<td>o Urinary catheter in place</td>
</tr>
<tr>
<td></td>
<td>o Genitourinary tract obstruction</td>
</tr>
<tr>
<td></td>
<td>o Immunosuppressed or Immunocompromised</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>• See Appendix A</td>
</tr>
<tr>
<td></td>
<td>o During pregnancy, mixed gram-positive bacteria, Lactobacilli, and Staphylococcus (other than S. saprophyticus) are typically presumed contaminants.</td>
</tr>
</tbody>
</table>

C. Commonly used antibiotic dosing recommendations based on renal function:

<table>
<thead>
<tr>
<th>Renal Function</th>
<th>Cephalexin (PO)</th>
<th>Cefazolin (IV)</th>
<th>Ceftriaxone (IV)</th>
<th>Nitrofurantoin (PO)</th>
<th>SMX/TMP (PO)</th>
<th>Levofloxacin (PO/IV)</th>
<th>Ciprofloxacin (PO/IV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrCl &gt;50</td>
<td>500 mg PO q12h</td>
<td>1 g IV q8h</td>
<td>1 gm IV q24h</td>
<td>CrCl ≥50: 100 mg q12h</td>
<td>1 DS tab (800/160) q12h</td>
<td>250 mg q24h</td>
<td>PO: 250-500 mg q12h IV: 400 mg q12h</td>
</tr>
<tr>
<td>CrCl 30-50</td>
<td>500 mg PO q12h</td>
<td>1 gm IV q12h</td>
<td>1 gm IV q24h</td>
<td>DO NOT USE</td>
<td>1 DS tab (800/160) q24h</td>
<td>250 mg q48h</td>
<td>PO: 250-500 mg q24h IV: 400 mg q24h</td>
</tr>
<tr>
<td>CrCl 10-29</td>
<td>500 mg PO q24h</td>
<td>1 gm IV q24h</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IHD/CrCl &lt;10²</td>
<td>500 mg PO q24h</td>
<td>1 gm IV q24h</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRRT³</td>
<td>500 mg PO q12h</td>
<td>1 gm IV q12h</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Recommended Duration**

<table>
<thead>
<tr>
<th></th>
<th>Uncomplicated</th>
<th>Complicated</th>
<th>Pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 days</td>
<td>10 days</td>
<td>4-7 days</td>
</tr>
<tr>
<td></td>
<td>3 days</td>
<td>10 days</td>
<td>4-7 days</td>
</tr>
<tr>
<td></td>
<td>3 days</td>
<td>10 days</td>
<td>4-7 days</td>
</tr>
<tr>
<td></td>
<td>5 days</td>
<td>10 days</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>3 days</td>
<td>10 days</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>3 days</td>
<td>10 days</td>
<td>NA</td>
</tr>
</tbody>
</table>

* Duration should be guided by the specific clinical situation and the response to therapy
  
² IHD: Intermittent Hemodialysis
  
³ CRRT: Continuous Renal Replacement Therapy

Clinical Considerations

The following pathogens are not considered common urinary pathogens:

- **Candida species**: In most patients, isolation of Candida represents colonization. When possible, consider the removal of catheter as this may resolve candiduria. Treatment of candiduria should be considered for: symptomatic patients, patients with neutropenia, patients with renal allografts, patients who will undergo a urologic procedure. If treatment is indicated, treat for 7-14 days.

- **Enterococcus**: Often represents colonization or contamination; consider not treating unless patient is symptomatic and corresponding urinalysis shows inflammation OR in high-risk populations. Preferred therapies may include penicillin, ampicillin, amoxicillin, or nitrofurantoin. For VRE, fosfomycin may be indicated and susceptibilities must be requested/released. This agent also may work for ESBL or CRE in the urine.

- **Staphylococcus aureus**: If isolated from urine, unless there are other indicators of contamination MUST consider blood cultures, as often Staphylococcal bacteriuria is secondary to bacteremia.

- **Gardnerella vaginalis**: Gardnerella is the most common cause of bacterial vaginosis (BV), but may cause a UTI. If there are significant CFUs in culture and UA also shows inflammation, treat with metronidazole 500 mg PO/IV BID for 7 days is indicated.
References


Quality Measures

“Appropriate” test utilization and clinical action:
- Within inpatient units and EDs, the following tests should account for >85% of urine tests for UTI/CAUTI workup:
  - Urinalysis total with reflex to culture
  - Urinalysis total AND culture
  - Urine cultures ordered independent of UA

Guidelines, Policies & Protocols

- OSUWMC Urinary Urethral Catheter Removal Protocol
- CAUTI Guideline

Guideline Authors

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- Elizabeth Rozycki, PharmD
- Amy Gewirtz, MD
- Julie Mangino, MD
- CAUTI Task Force

Reviewed through P&T Antibiotic Subcommittee

Guideline Approved

August 30, 2017. 2nd Edition

Disclaimer

Clinical practice guidelines and algorithms at The Ohio State University Wexner Medical Center (OSUWMC) are standards that are intended to provide general guidance to clinicians. Patient choice and clinician judgment must remain central to the selection of diagnostic tests and therapy. OSUWMC’s guidelines and algorithms are reviewed periodically for consistency with new evidence; however, new developments may not be represented.

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Appendix A: Common treatment options for Urinary Tract Infections and Asymptomatic Bacteriuria during Pregnancy

<table>
<thead>
<tr>
<th>Gestational Period</th>
<th>Recommended options (should be tailored to urine culture susceptibilities when possible)</th>
</tr>
</thead>
</table>
| First Trimester    | **First Line therapies:**  
|                    | • Cephalexin 250-500mg PO Q6H (most commonly used)  
|                    | • Amoxicillin 500mg PO q8h or 875mg PO q12h  
|                    | • Amoxicillin-clavulanic acid 875mg PO q12h  
|                    | • Ampicillin 250mg PO q6h  
|                    | *Avoid Nitrofurantoin and Trimethoprim-sulfamethoxazole unless other agents are clinically contraindicated (e.g. severe allergy) or pathogen is not susceptible to other preferred agents* |
| Second or Third Trimester | **First Line therapies:**  
| | • Nitrofurantoin 100mg q12h  
| | • Trimethoprim-sulfamethoxazole 1 DS tablet q12h  
| | *Avoid Trimethoprim-sulfamethoxazole prior to delivery* |

Appendix B: 2016 OSUWMC UH/Main Emergency Department Antibiogram for E. Coli Urine Isolates

<table>
<thead>
<tr>
<th>Organism</th>
<th>Location</th>
<th># of Isolates</th>
<th>Cefazolin</th>
<th>Ceftriaxone</th>
<th>% Susceptible</th>
<th>Nitrofurantoin</th>
<th>TMP/SMX</th>
<th>Ciprofloxacin</th>
<th>Tetracycline</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.coli</td>
<td>All</td>
<td>497</td>
<td>93</td>
<td>99</td>
<td>98</td>
<td>74</td>
<td>77</td>
<td>77</td>
<td>75</td>
</tr>
<tr>
<td>E.coli ESBL</td>
<td>All</td>
<td>28</td>
<td>NA</td>
<td>NA</td>
<td>86</td>
<td>29</td>
<td>21</td>
<td>21</td>
<td>36</td>
</tr>
</tbody>
</table>