URINARY TRACT INFECTIONS IN CHILDREN

In children, Urinary Tract Infection (UTI) is defined by the presence of a single pathogen in urine culture accompanied by clinical findings in the history, physical examination and diagnostic evaluation. The following recommended antimicrobial treatments for selected pathogen-specific conditions are based on evidence of clinical effectiveness, cost effectiveness and local patterns of drug resistance reported the past two years. Once the sensitivity pattern of a specific pathogen has been obtained from the urine culture requested, antibiotic therapy may be adjusted accordingly.

Acute Uncomplicated UTI

- **Acute pyelonephritis:** Condition that indicates renal parenchymal involvement where infants and children may present with fever with any or all of the following symptoms: abdominal, back, or flank pain; malaise; nausea; vomiting; and, occasionally, diarrhea. Infants and children who have bacteriuria and fever > 38°C OR those presenting with fever <38°C with loin pain/tenderness and bacteriuria should be worked up for acute pyelonephritis.

- **Acute cystitis:** condition that indicates urinary bladder involvement where infants and children may present with any or all of the following symptoms of dysuria, urgency, frequency, suprapubic pain, incontinence, and malodorous urine. Patients usually have no systemic signs or symptoms.

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Preferred regimen</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. coli, Klebsiella, Enterobacter, Enterococcus, Group B Strep</em></td>
<td><strong>Infants &lt; 2 months:</strong> Cefotaxime</td>
<td>If there are signs of sepsis, treat as neonatal sepsis.</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>Weight</td>
</tr>
<tr>
<td></td>
<td>&lt;7 days</td>
<td>&lt;1200 g</td>
</tr>
<tr>
<td></td>
<td>&gt;7 days</td>
<td>1200 g</td>
</tr>
</tbody>
</table>
**E. coli, Klebsiella, Enterobacter, Citrobacter**

<table>
<thead>
<tr>
<th>Age</th>
<th>Weight</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4 weeks</td>
<td>&lt;1200 g</td>
<td>7.5 mg/kg od</td>
</tr>
<tr>
<td>≤7 days</td>
<td>1200 - 2000 g</td>
<td>7.5 mg/kg od</td>
</tr>
<tr>
<td>≤7 days</td>
<td>&gt; 2000 g</td>
<td>7.5-10 mg/kg od</td>
</tr>
<tr>
<td>&gt;7 days</td>
<td>1200 - 2000 g</td>
<td>7.5 mg/kg od</td>
</tr>
<tr>
<td>&gt; 7 days</td>
<td>&gt; 2000 g</td>
<td>10 mg/kg od</td>
</tr>
</tbody>
</table>

Duration of Treatment: 10-14 days

**>2 months to 18 years**

**Oral options**
**Amoxicillin-clavulanate:**

- <40 kg: 20-40 mg (amoxicillin)/kg/d q8h or 25-45 mg/kg/d q12h using the 20 mg/5mL or 400 mg/5mL
- >40 kg: 500-875 mg q8h; maximum dose: 2g/d

Oral therapy is equally effective to IV therapy.

IV therapy is preferred for seriously ill children and for those who cannot take oral therapy.
<table>
<thead>
<tr>
<th></th>
<th>Early antibiotic therapy is necessary to prevent renal damage. Switch to oral therapy once patient has been afebrile for 24h and able to take oral medications. Obtain renal ultrasound within 6 weeks for 1st UTI in children &lt;6 months old. Cephalosporins are not useful if Enterococcus is suspected. Nitrofurantoin should <strong>NOT</strong> be used for pyelonephritis and renal sepsis due to poor serum concentrations. Clinical response is expected in 24-48 hours. Antibiotic coverage should be re-assessed if still unwell in 24-48h Request for a kidney and urinary bladder ultrasound and if abnormal, refer to a pediatric nephrologist for further work-up.</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR</td>
<td>Cefuroxime 250-500 mg PO q12h OR Nitrofurantoin (only for cystitis) 5-7 mg/kg/d q6h; maximum dose: 400 mg/d IV options Ampicillin-Sulbactam 100-200 mg/kg/d of ampicillin q6h IM or IV infusion over 10-15 min OR</td>
</tr>
</tbody>
</table>
### Cefuroxime
75-150 mg/kg/d q8h; max dose: 6 g/d. For those >40 kg, use adult dose.

**Duration of therapy (IV/PO):** 7-14d

According to a Cochrane review on antibiotics for lower urinary tract infection in children (August 2012), “there are insufficient data to answer the question on which type of antibiotic and which duration is most effective to treat symptomatic lower UTI. This review found that 10-day antibiotic treatment is more likely to eliminate bacteria from the urine than single-dose treatments.”

---

### UTI, recurrent catheter related or with other co-morbids
These patients require a referral to a pediatric infectious disease specialist, pediatric nephrologist and pediatric urologist.

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Preferred regimen</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Enterobacteriaceae, Pseudomonas aeruginosa, Enterococcus</em></td>
<td><strong>Ceftriaxone</strong></td>
<td>Use Cefotaxime instead of Ceftriaxone in jaundiced patients. If <em>Pseudomonas</em> is suspected, use Ceftazidime instead if Cefotaxime. Adjust antibiotics depending on results of culture.</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td><strong>Weight</strong></td>
<td><strong>Dose</strong></td>
</tr>
<tr>
<td>&lt;7 days</td>
<td>&lt; 2000 g</td>
<td>50 mg/kg/dose q24h</td>
</tr>
<tr>
<td>&gt;7 days</td>
<td>&lt; 2000 g</td>
<td>50 mg/kg/dose q24h</td>
</tr>
</tbody>
</table>
Urinary Tract Infections

National Antibiotic Guidelines

Cephalosporins are not active against *Enterococcus*.

<table>
<thead>
<tr>
<th>Age</th>
<th>Weight</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;7 days</td>
<td>&gt; 2000 g</td>
<td>50-75 mg/kg/dose q24h</td>
</tr>
</tbody>
</table>

Infants & children: 50-100 mg/kg/dose q24h

AND/OR

Amikacin

<table>
<thead>
<tr>
<th>Age</th>
<th>Weight</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4 weeks</td>
<td>&lt;1200 g</td>
<td>7.5 mg/kg od</td>
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</tr>
<tr>
<td>&gt; 7 days</td>
<td>&gt; 2000 g</td>
<td>10 mg/kg od</td>
</tr>
</tbody>
</table>

Infants and children: 15-22.5 mg/kg/d as single daily dose or q8h; max dose: 24 g/d

Treat for 7-14 days depending on response.
### Perinephric abscess

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Preferred regimen</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Enterobacteriaceae, S. aureus</em></td>
<td><strong>Oxacillin</strong> 100-200 mg/kg/d q6h PLUS <strong>Amikacin</strong> 15-22.5 mg/kg/d as single daily dose or q8h; max dose: 24 g/d</td>
<td>Use Vancomycin if MRSA is suspected Refer to specialist for drainage.</td>
</tr>
</tbody>
</table>

### Hospital acquired UTI

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Preferred regimen</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Ceftazidime</strong> 30-50 mg/kg IV q8h; max dose 6 g/d OR <strong>Amikacin</strong> 15mg/kg IV q24h; max dose</td>
<td>Choice should be based on current antimicrobial susceptibility pattern in the institution</td>
</tr>
</tbody>
</table>

### Prophylaxis for Recurrent UTI

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Preferred regimen</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Nitrofurantoin</strong> 1 to 2 mg/kg/d (up to 100 mg/d) orally in 1 to 2 divided doses</td>
<td>Refer to an infectious disease specialist or nephrologist</td>
</tr>
</tbody>
</table>
**URINARY TRACT INFECTIONS (UTI) IN ADULTS**

**UNCOMPLICATED UTI**

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Preferred regimen</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E. coli (75-90%)</strong></td>
<td><strong>1st line:</strong> Nitrofurantoin macrocrystals 100 mg qid x 5d OR Fosfomycin 3 g single-dose sachet in 3-4 oz (or 90-120 ml) water</td>
<td>Empiric treatment is the most cost-effective approach; urinalysis and urine culture not pre-requisites.</td>
</tr>
<tr>
<td><strong>Staphylococcus saprophyticus (5-15%)</strong></td>
<td><strong>2nd line:</strong> Cefuroxime 250 mg bid x 7d OR Cefixime 200 mg bid x 7d OR Amoxicillin-clavulanate 625 mg bid x 7d</td>
<td>Nitrofurantoin monohydrate/macrocrystals (100 mg bid) are not locally available. Amoxicillin/ampicillin and cotrimoxazole are not recommended for empiric treatment given the high prevalence of resistance to these agents. Fluoroquinolones are considered as reserved drugs because of propensity for collateral damage (i.e., selection for drug-resistant bacteria); but are efficacious in 3-day regimens. The treatment is the same for otherwise healthy elderly women with AUC.</td>
</tr>
</tbody>
</table>
# Acute uncomplicated pyelonephritis
- Fever, flank pain, costovertebral angle tenderness, nausea/vomiting, with or without signs or symptoms of cystitis in an otherwise healthy premenopausal female

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Preferred regimen</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>As for AUC, <em>E. coli</em> is predominant, as well as other Enterobacteriaciae</td>
<td><strong>Oral</strong>&lt;br&gt;1st line:&lt;br&gt;<em>Ciprofloxacin</em> 500 mg bid x 7-10d OR&lt;br&gt;<em>Levofloxacin</em> 750 mg od x 5d&lt;br&gt;2nd line:&lt;br&gt;<em>Cefuroxime</em> 500 mg bid x 14d OR&lt;br&gt;<em>Cefixime</em> 400 mg od x 14d OR&lt;br&gt;<em>Amoxicillin-clavulanate</em> 625 mg tid x 14d (when GS shows Gram+ cocci)</td>
<td>Urine analysis, Gram stain, culture and susceptibility tests should be done. Blood cultures are not routinely done unless septic. Consider giving initial IV/IM dose of antibiotic followed by oral regimen in patients not requiring hospitalization.</td>
</tr>
<tr>
<td><strong>Parenteral</strong>&lt;br&gt;1st line:&lt;br&gt;<em>Ceftriaxone</em> 1-2 g q24h&lt;br&gt;<em>Ciprofloxacin</em> 400 mg q12h&lt;br&gt;<em>Levofloxacin</em> 250-750 mg q24h&lt;br&gt;<em>Amikacin</em> 15 mg/kg q24h&lt;br&gt;<em>Gentamicin</em> 3-5 mg/kg q24 h +/- ampicillin</td>
<td>Indications for hospitalization/parenteral regimen:&lt;br&gt;1. signs of sepsis&lt;br&gt;2. inability to take oral medications/hydration&lt;br&gt;3. concern re compliance&lt;br&gt;4. presence of possible complicating conditions</td>
<td></td>
</tr>
<tr>
<td>2nd line:&lt;br&gt;<em>Ampicillin-sulbactam</em> (when GS shows g+ cocci) 1.5 g q6h</td>
<td>Switch to oral regimen once afebrile for 24-48 hr and able to take oral medicines. Tailor antibiotic regimen once culture result available.</td>
<td></td>
</tr>
</tbody>
</table>
### Asymptomatic bacteriuria (ASB) - presence of bacteria in the urine without signs and symptoms of UTI

**Diagnosis:**
- In women: 2 consecutive voided urine specimens with the same organism in quantitative counts ≥100,000 cfu/mL
- In men: single, clean-catch voided urine with one bacterial species in a quantitative count ≥100,000 cfu/mL
- In both men and women: a single catheterized urine specimen with one bacterial species in a quantitative count ≥100 cfu/mL; pyuria, odor and color of urine not relevant to decision to treat

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Preferred regimen</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Similar to acute uncomplicated cystitis | No screening and treatment recommended except in: | Antibiotics do not decrease asymptomatic bacteriuria or prevent subsequent development of UTI.  
The optimal screening test is a urine culture. |

**DO NOT TREAT ASB in:**
- healthy adults  
- non-pregnant women  
- patients with diabetes mellitus  
- elderly patients  
- persons with spinal cord injury  
- persons with indwelling urinary catheter  
- persons with HIV

- Routine urologic evaluation and imaging not recommended unless still febrile after 72 hr.  
Post-treatment urine culture not recommended if clinically responding to treatment.
- persons with urologic abnormalities should be culture-guided. A 7-day regimen is recommended.

**RECURRENT UTI IN WOMEN**

- ≥3 episodes of acute uncomplicated cystitis documented by urine culture in 1 year or ≥ 2 episodes in a 6-mo. period

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Preferred regimen</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar to cystitis</td>
<td>Treat as acute episode for uncomplicated UTI</td>
<td>Radiologic or imaging studies not routinely indicated.</td>
</tr>
<tr>
<td></td>
<td><strong>Prophylaxis:</strong></td>
<td>Screen for urologic abnormalities in the ff:</td>
</tr>
<tr>
<td></td>
<td><strong>TMP-SMX</strong> 40/200 mg or <strong>nitrofurantoin</strong> 50-100 mg at bedtime for 6-12 mos (continuous prophylaxis)</td>
<td>- No response to treatment</td>
</tr>
<tr>
<td></td>
<td><strong>OR</strong> <strong>TMP-SMX</strong> 40-80/200-400 mg or <strong>nitrofurantoin</strong> 50-100 mg as single dose (post-coital)</td>
<td>- Gross hematuria/persistent microscopic hematuria</td>
</tr>
<tr>
<td></td>
<td><strong>OR</strong> <strong>TMP-SMX</strong> 320/1600 mg as single dose at symptom onset</td>
<td>- Obstructive symptoms</td>
</tr>
<tr>
<td>Other:</td>
<td>Lactobacilli is not recommended.</td>
<td>- History of acute pyelonephritis</td>
</tr>
<tr>
<td></td>
<td>Cranberry juice and products can be used.</td>
<td>- History of or symptoms suggestive of urolithiasis</td>
</tr>
<tr>
<td></td>
<td>For post-menopausal women, intra-vaginal estriol nightly x2 weeks then twice-weekly for at least 8 months.</td>
<td>- History of childhood UTI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Elevated serum creatinine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Infection with urea-splitting bacteria (<em>Proteus, Morganella, Providencia</em>)</td>
</tr>
</tbody>
</table>
# UTI IN PREGNANCY

## Acute uncomplicated cystitis in pregnancy

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Preferred regimen</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli (70%)</td>
<td>Cefalexin 500 mg qid x 7d</td>
<td>Start empiric antibiotic immediately, but pre-treatment urine must be submitted for culture and susceptibility; adjust treatment accordingly.</td>
</tr>
<tr>
<td>Other enterobacteriaceae</td>
<td>Cefuroxime 500 mg bid x 7d</td>
<td>Document clearance of bacteriuria with a repeat urine culture 1-2 wks post-treatment.</td>
</tr>
<tr>
<td>Group B Streptococcus</td>
<td>Cefixime 200 mg bid x 7d</td>
<td>Avoid amoxicillin-clavulanate in those at risk of pre-term labor because of potential for neonatal necrotizing enterocolitis.</td>
</tr>
<tr>
<td></td>
<td>Nitrofurantoin macrocrystals 100 mg qid x 7d</td>
<td>Use nitrofurantoin from the 2nd trimester to 32 wks only, if possible, because of potential for birth defects and hemolytic anemia.</td>
</tr>
<tr>
<td></td>
<td>Fosfomycin 3 g single-dose sachet</td>
<td>Avoid cotrimoxazole especially during the first and third trimesters because of risk of teratogenicity and kernicterus. Fluoroquinolones are contraindicated.</td>
</tr>
<tr>
<td></td>
<td>Amoxicillin-clavulanate 625 mg bid x 7d</td>
<td></td>
</tr>
<tr>
<td>Etiology</td>
<td>Preferred regimen</td>
<td>Comments</td>
</tr>
<tr>
<td>--------------------------------------</td>
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<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Acute pyelonephritis in pregnancy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Similar to acute cystitis in pregnancy</td>
<td>Parenteral: 1st line: Ceftriaxone 1-2 g q24 h</td>
<td>Urinalysis, gram stain and culture/susceptibility tests should be done. Blood culture not routine unless septic. Ultrasound of KUB reserved for failure to respond to treatment.</td>
</tr>
<tr>
<td></td>
<td>Ceftazidime 2 g q8 h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2nd line: Ampicillin-sulbactam (when GS shows gram+ cocci) 1.5 g q6 h</td>
<td>Indications for admission: pre-term labor and other indications as listed above for acute uncomplicated pyelonephritis.</td>
</tr>
<tr>
<td>Oral:</td>
<td>Cefalexin 500 mg to complete 14d</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cefuroxime 500 mg bid to complete 14d</td>
<td>Switch to oral regimen when afebrile x 48 hrs and based on culture/susceptibility result.</td>
</tr>
<tr>
<td></td>
<td>Cefixime 200 mg bid to complete 14d</td>
<td>Recommended duration of treatment is 14d.</td>
</tr>
<tr>
<td></td>
<td>Amoxicillin-clavulanate 625 mg bid to complete 14d</td>
<td>Test of cure with a urine culture post-treatment is essential.</td>
</tr>
<tr>
<td>Asymptomatic bacteriuria (ASB) in pregnancy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Similar to acute cystitis in pregnancy</td>
<td>Cefalexin 500 mg qid x 7d</td>
<td>Treat ASB to reduce the risks of symptomatic UTI and low birth weight neonates and preterm infants.</td>
</tr>
<tr>
<td></td>
<td>Cefuroxime 500 mg bid x 7d</td>
<td></td>
</tr>
</tbody>
</table>
### Urinary Tract Infections National Antibiotic Guidelines

- **Nitrofurantoin** macrocrystals 100 mg qid x 7d
- **Fosfomycin** 3 g single-dose sachet
- **Amoxicillin-clavulanate** 625 mg bid x 7d

Choice of regimen is based on culture/susceptibility test result. Note caveats for use of nitrofurantoin and amoxicillin-clavulanate.

Screen all pregnant women for ASB once between the 9th and 17th week, preferably during the 16th week. The standard urine culture/susceptibility is the test of choice. Urinalysis is inadequate for ASB screening.

Do follow-up urine culture 1 week post-treatment and monitor every trimester till delivery.

### COMPLICATED UTI (CUTI)

- Significant bacteriuria plus clinical symptoms occurring in the setting of:
  - functional or anatomic abnormalities of the urinary tract,
  - presence of an underlying disease that interferes with host defense mechanisms
  - any condition that increases the risk of acquiring [persistent] infection and/or treatment failure.
- Cut-off for significant bacteriuria in cUTI is 100,000 cfu/mL; may be lower in certain clinical situations, such as in catheterized patients.

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Preferred regimen</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Etiologic agents more varied and may include drug – resistant organisms (eg., ESBL-producing <em>E. coli</em>, <em>Pseudomonas aeruginosa</em> and <em>P. aeruginosa</em>)</td>
<td><strong>Parenteral</strong>&lt;br&gt;<strong>Amikacin</strong> 15 mg/kg q24h&lt;br&gt;<strong>Gentamicin</strong> 3-5 mg/kg q24h</td>
<td>Always obtain urine for gram stain, culture and susceptibility prior to start of treatment, and...</td>
</tr>
</tbody>
</table>
| enterococci | **Piperacillin-tazobactam** 2.25-4.5g q6-8h | adjust regimen as needed based on culture result.  
Ancillary diagnostic tests such as imaging of the urinary tract (CT or ultrasound) are often warranted.  
Start with parenteral broad-spectrum antibiotic for severely ill patients, and then switch to an oral regimen/de-escalate when there is clinical improvement.  
treatment duration: 7-14 days  
Repeat urine culture 1-2 weeks post-treatment.  
Referral to a specialist often warranted |
| **Ertapenem** 1g q24h |  |
| **Meropenem** 1 g q8h |  |
| **Oral**  
**Ciprofloxacin** 500-750 mg bid |  |
| **Levofloxacin** 500-750 mg OD |  |
| **Amoxicillin-clavulanate** 625 mg tid or 1 g bid |  |

**CATHETER-ASSOCIATED UTI (CAUTI)**

Diagnosed when  
- Signs or symptoms compatible with UTI are present with no other identified source of infection, AND ≥10^3 colony forming units (CFU)/ml of ≥ 1 bacterial species are present in a single catheterized urine or in a midstream voided urine within 48 hr after catheter (urethral, suprapubic or condom) removal  
- Often a healthcare-associated infection

| **Etiology** | **Preferred regimen** | **Comments** |
| Etiologic agents more varied and may include drug – resistant | **Amikacin** 15 mg/kg IV q24h | Pyuria, odorous or cloudy urine alone is not an indication for |
organisms (e.g., ESBL-producing *E. coli*), *P. aeruginosa* and enterococci

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>Dosage</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ertapenem</td>
<td>1 g IV q24h</td>
<td>Initiating antibiotics</td>
</tr>
<tr>
<td>Meropenem</td>
<td>1 g IV q24h</td>
<td>Whenever possible, remove indwelling catheter; if still needed, replace with a new catheter and obtain urine for gram stain and culture/susceptibility test prior to initiating treatment.</td>
</tr>
<tr>
<td>Cefepime</td>
<td>1-2 g IV q8-12h</td>
<td></td>
</tr>
<tr>
<td>Ceftazidime</td>
<td>1-2 g IV q8h</td>
<td></td>
</tr>
<tr>
<td>Piperacillin-tazobactam</td>
<td>4.5 g iv q8h</td>
<td></td>
</tr>
<tr>
<td>Ampicillin</td>
<td>1-2 g IV q6h</td>
<td></td>
</tr>
<tr>
<td>Levofloxacin</td>
<td>750 mg po or IV q24h</td>
<td></td>
</tr>
</tbody>
</table>

**CANDIDURIA**

**Asymptomatic candiduria**

<table>
<thead>
<tr>
<th>Candida sp. in urine almost always represents colonization; more often in the elderly, female, diabetic, w/ indwelling urinary device, w/ prior surgical procedure, and taking</th>
<th>Preferred regimen</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>No treatment indicated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exceptions: When undergoing urologic procedure, treat with oral fluconazole 400 mg (6 mg/kg) pre-</td>
<td></td>
<td></td>
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</tbody>
</table>

**Duration:** 7 days w/ prompt resolution of signs and symptoms; 10-14 days of antibiotic treatment for patients with delayed response
antibiotics; colony count and presence of pyuria not helpful in differentiating colonization from infection. and post-procedure. Treat also those at risk for dissemination (e.g., neutropenic patients).

| Symptomatic cystitis | | | |
|---|---|---|
| **Etiology** | **Preferred regimen** | **Comments** |
| Most common etiologic agent: *C. albicans* | **Fluconazole** 200-400mg po od x 2 weeks | Do ultrasound or CT of kidneys if candiduria persists in immunocompromised patients. |
| | For fluconazole-resistant *Candida* (*C. krusei* or *C. glabrata*): **AmB deoxycholate** 0.3-0.6 mg/kg x 1-7d | |

| Pyelonephritis | | | |
|---|---|---|
| **Etiology** | **Preferred regimen** | **Comments** |
| Most common etiologic agent: *C. albicans* | **Fluconazole** 400 mg po od x 2 weeks | Consider surgical intervention to relieve obstruction if any (e.g., fungus ball). |
| | For fluconazole-resistant *Candida* (*C. krusei* or *C. glabrata*): **AmB deoxycholate** 0.3-0.6 mg/kg x 1-7d | If disseminated disease suspected, treat as if bloodstream infection is present. |

**BACTERIAL PROSTATITIS**

- Most cases of bacterial prostatitis are preceded by a urinary tract infection.
- Risk factors: urinary tract instrumentation, urethral stricture, or urethritis (usually due to sexually transmitted pathogens)

**Acute bacterial prostatitis (ABP) without risk of STD**
<table>
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<tr>
<th>Etiology</th>
<th>Preferred regimen</th>
<th>Comments</th>
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</table>
| Enterobacteriaceae, enterococcus, *Pseudomonas aeruginosa* | 1<sup>st</sup> line:  
   **Ciprofloxacin** 500 mg PO or 400 mg IV bid  
   OR  
   **Levofloxacin** 500-750 mg IV/po OD  
   If enterococcus is suspected/ documented:  
   **Ampicillin** 1-2 g IV q4h;  
   vancomycin 15 mg/kg q12 h  
   **Alternative:**  
   **TMP-SMX** DS bid  
   **Piperacillin-tazobactam** 4.5 g IV q6-8h | Do CBC, blood cultures, urinalysis and urine culture.  
   Treatment duration: 2 weeks; extend to 4 weeks if patient still symptomatic.  
   **Caveat:** *E. coli* resistance to TMP-SMX is high so TMP-SMX cannot be 1<sup>st</sup> line empiric treatment despite its high prostatic concentration. |

**ABP with risk of STD**

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<th>Etiology</th>
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</table>
| *Neisseria gonorrhoeae* and *Chlamydia trachomatis* | **Ceftriaxone** 250 mg IM x 1 dose  
   PLUS  
   **Doxycycline** 100 mg bid or azithromycin 500 mg po od | Fluoroquinolones not recommended for gonococcal infection. Treat for 2 weeks. |

**ABP with risk of antibiotic-resistant pathogens**

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<tr>
<th>Etiology</th>
<th>Preferred regimen</th>
<th>Comments</th>
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</table>
| Fluoroquinolone-resistant  
   Enterobacteriaceae and *Pseudomonas*  
   ESBL or AmpC beta lactamase-producing Enterobacteriaceae | **Ertapenem** 1g IV od  
   OR  
   **Meropenem** 1 g IV q8h (for *Pseudomonas*)  
   **Alternative:**  
   **Cefepime** 2g IV q12h | Consider a 4-week regimen. |
### Complicated ABP
**Eg., bacteremia or suspected prostatic abscess**

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<tr>
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<th>Preferred regimen</th>
<th>Comments</th>
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</table>
| Enterobacteriaceae, enterococcus, *P. aeruginosa* | **Ciprofloxacin** 400 mg IV q12h OR **Levofloxacin** 750 mg IV q24h OR **Ceftriaxone** 1-2 g IV q24h PLUS **Levofloxacin** 750 mg IV q24h OR **Ertapenem** 1 g IV q24h OR **Piperacillin-tazobactam** 4.5 g IV q8 h | Obtain blood cultures.  
Treat for 4 weeks.  
Consider genitourinary imaging.  
Drain abscess.  
Switch to oral regimen once bacteremia has cleared and abscess is drained. |

### Chronic bacterial prostatitis (CBP)
- Prolonged urogenital symptoms (ie.,>3 mos.)
- Hallmark: relapsing UTI

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<tr>
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<th>Preferred regimen</th>
<th>Comments</th>
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</table>
| Enterobacteriaceae, enterococci, *P. aeruginosa* | **Ciprofloxacin** 400 mg IV q12h OR **Levofloxacin** 750 mg IV q24h OR **TMP-SMX** DS bid | Treat for 4-6 weeks.  
If refractory, options are:  
• treat intermittently for symptomatic episodes;  
• suppressive treatment; or  
• prostatectomy if all other options have failed. |
REFERENCES:


• Bay AG, Anacleto F. Clinical and Laboratory Profile of Urinary Tract Infection Among Children at the Outpatient Clinic of a Tertiary Hospital. PIDSP Journal 2010; 50:164-171.


• Lipsky BA, Byrn J, Hoey CT. Treatment of Bacterial Prostatitis. Clinical Infectious Diseases 2010; 50:1641.


