

# NATIONAL ANTIBIOTIC GUIDELINES 2016



**DH**

Department of Health

# NATIONAL ANTIBIOTIC GUIDELINES

*(Urinary Tract Infections)*

## 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.

<b>Acute Uncomplicated UTI</b>																																			
<ul style="list-style-type: none"> <li>• <b>Acute pyelonephritis:</b> 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 <math>\geq 38^{\circ}\text{C}</math> OR those presenting with fever <math>&lt; 38^{\circ}\text{C}</math> with loin pain/tenderness and bacteriuria should be worked up for acute pyelonephritis.</li> <li>• <b>Acute cystitis:</b> 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.</li> </ul>																																			
<b>Etiology</b>	<b>Preferred regimen</b>	<b>Comments</b>																																	
<p><i>E. coli, Klebsiella, Enterobacter, Enterococcus, Group B Strep</i></p>	<p><b>Infants &lt; 2 months:</b></p> <p><b>Cefotaxime</b></p> <table border="1"> <thead> <tr> <th>Age</th> <th>Weight</th> <th>Dose</th> </tr> </thead> <tbody> <tr> <td>&lt;7 days</td> <td></td> <td>50 mg/kg/dose q12h</td> </tr> <tr> <td>&gt;7 days</td> <td>&lt; 1200 g</td> <td>50 mg/kg/dose q12h</td> </tr> <tr> <td>&gt;7 days</td> <td>&gt;1200 g</td> <td>50 mg/kg/dose 8h</td> </tr> <tr> <td>&gt;1 month</td> <td></td> <td>100-200 mg/kg/d div q6h</td> </tr> </tbody> </table> <p>PLUS</p> <p><b>Amikacin</b></p> <table border="1"> <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>&lt;7 days</td> <td>1200-2000 g</td> <td>7.5 mg/kg od</td> </tr> <tr> <td>&lt;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> <p>Duration of Treatment: 10-14 days</p>	Age	Weight	Dose	<7 days		50 mg/kg/dose q12h	>7 days	< 1200 g	50 mg/kg/dose q12h	>7 days	>1200 g	50 mg/kg/dose 8h	>1 month		100-200 mg/kg/d div q6h	Age	Weight	Dose	0-4 weeks	<1200 g	7.5 mg/kg od	<7 days	1200-2000 g	7.5 mg/kg od	<7 days	> 2000 g	7.5-10 mg/kg od	>7 days	1200-2000 g	7.5 mg/kg od	> 7 days	> 2000 g	10 mg/kg od	<p>If there are signs of sepsis, treat as neonatal sepsis.</p> <p>Adjust therapy based on culture.</p> <p>Early onset is usually due to maternal transmission.</p> <p>Use ceftriaxone if cefotaxime is not available and the neonate is not jaundiced.</p>
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<p><i>E. coli, Klebsiella, Enterobacter, Citrobacter</i></p>	<p><b>&gt;2 months to 18 years</b></p> <p><u>Oral options</u></p> <p><b>Amoxicillin-clavulanate:</b></p> <p>&lt;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</p> <p>&gt;40 kg: 500-875 mg q8h; maximum dose: 2g/d</p> <p>OR</p>	<p>Oral therapy is equally effective to IV therapy.</p> <p>IV therapy is preferred for seriously ill children and for those who cannot take oral therapy.</p> <p>Early antibiotic therapy is necessary to prevent renal damage.</p>																																	

	<p><b>Cefuroxime</b> &gt;3 mos - 12 yrs: 20 - 30 mg/kg/d q12h PO</p> <p><b>Adolescents:</b> <b>Cefuroxime</b> 250-500 mg q12h PO OR <b>Nitrofurantoin</b> (only for cystitis) 5-7 mg/kg/d q6h; maximum dose: 400 mg/d</p> <p><u>IV options</u></p> <p><b>Ampicillin-Sulbactam</b> 100-200 mg/kg/d of ampicillin q6h IM or IV infusion over 10-15 min</p> <p>OR</p> <p><b>Cefuroxime</b> 75-150 mg/kg/d q8h; max dose: 6 g/d. For those &gt;40 kg, use adult dose.</p> <p><b>Duration of therapy (IV/PO):</b> 7-14 days</p>	<p>Switch to oral therapy once patient has been afebrile for 24h and able to take oral medications.</p> <p>Obtain renal ultrasound within 6 weeks for 1<sup>st</sup> UTI in children &lt;6 months old.</p> <p>Cephalosporins are not useful if <i>Enterococcus</i> is suspected.</p> <p><b>Nitrofurantoin should <u>NOT</u> be used for pyelonephritis and renal sepsis due to poor serum concentrations.</b></p> <p>Clinical response is expected in 24-48 hours. Antibiotic coverage should be re-assessed if still unwell in 24-48h</p> <p>Request for a kidney and urinary bladder ultrasound and if abnormal, refer to a pediatric nephrologist for further work-up.</p> <p>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.”</p>
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**UTI, recurrent catheter related or with other co-morbid**

These patients require a referral to a pediatric infectious disease specialist, pediatric nephrologist and pediatric urologist.

Etiology	Preferred regimen	Comments																														
<p><i>Enterobacteriaceae, Pseudomonas aeruginosa, Enterococcus</i></p>	<p><b>Ceftriaxone</b></p> <table border="1" data-bbox="651 296 1420 424"> <thead> <tr> <th>Age</th> <th>Weight</th> <th>Dose</th> </tr> </thead> <tbody> <tr> <td>&lt;7 days</td> <td></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> <tr> <td>&gt;7 days</td> <td>&gt; 2000 g</td> <td>50-75 mg/kg/dose q24h</td> </tr> </tbody> </table> <p><b>Infants &amp; children:</b> 50-100 mg/kg/dose q24h</p> <p>AND/OR</p> <p><b>Amikacin</b></p> <table border="1" data-bbox="651 635 1420 826"> <thead> <tr> <th>Age</th> <th>Weight</th> <th>Dose</th> </tr> </thead> <tbody> <tr> <td><b>0-4 weeks</b></td> <td>&lt;1200 g</td> <td>7.5 mg/kg od</td> </tr> <tr> <td><b>&lt;7 days</b></td> <td>1200-2000 g</td> <td>7.5 mg/kg od</td> </tr> <tr> <td><b>&lt;7 days</b></td> <td>&gt; 2000 g</td> <td>7.5-10 mg/kg od</td> </tr> <tr> <td><b>&gt;7 days</b></td> <td>1200-2000 g</td> <td>7.5 mg/kg od</td> </tr> <tr> <td><b>&gt; 7 days</b></td> <td>&gt; 2000 g</td> <td>10 mg/kg od</td> </tr> </tbody> </table> <p><b>Infants and children:</b> 15-22.5 mg/kg/d as single daily dose or q8h; max dose: 24 g/d</p> <p>Treat for 7-14 days depending on response.</p>	Age	Weight	Dose	<7 days		50 mg/kg/dose q24h	>7 days	< 2000 g	50 mg/kg/dose q24h	>7 days	> 2000 g	50-75 mg/kg/dose q24h	Age	Weight	Dose	<b>0-4 weeks</b>	<1200 g	7.5 mg/kg od	<b>&lt;7 days</b>	1200-2000 g	7.5 mg/kg od	<b>&lt;7 days</b>	> 2000 g	7.5-10 mg/kg od	<b>&gt;7 days</b>	1200-2000 g	7.5 mg/kg od	<b>&gt; 7 days</b>	> 2000 g	10 mg/kg od	<p>Use Cefotaxime instead of Ceftriaxone in jaundiced patients. If <i>Pseudomonas</i> is suspected, use Ceftazidime instead if Cefotaxime. Adjust antibiotics depending on results of culture.</p> <p>Cephalosporins are not active against <i>Enterococcus</i>.</p>
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**Perinephric abscess**

Etiology	Preferred regimen	Comments
<p><i>Enterobacteriaceae, S. aureus</i></p>	<p><b>Oxacillin</b> 100-200 mg/kg/d div q6h</p> <p>PLUS</p> <p><b>Amikacin</b> 15-22.5 mg/kg/d as single daily dose or q8h; max dose: 24 g/d</p>	<p>Use Vancomycin if MRSA is suspected</p> <p>Refer to specialist for drainage.</p>

Hospital acquired UTI		
Etiology	Preferred regimen	Comments
	<b>Ceftazidime</b> 30-50 mg/kg IV q8h; max dose 6 g/d OR <b>Amikacin</b> 15mg/kg IV q24h; max dose	Choice should be based on current antimicrobial susceptibility pattern in the institution

Prophylaxis for Recurrent UTI		
	<b>Nitrofurantoin</b> 1 to 2 mg/kg/d (up to 100 mg/d) orally in 1 to 2 divided doses	Refer to an infectious disease specialist or nephrologist

## URINARY TRACT INFECTIONS (UTI) IN ADULTS

### UNCOMPLICATED UTI

Acute uncomplicated cystitis (AUC)		
<ul style="list-style-type: none"> <li>Acute dysuria, frequency, urgency in a non-pregnant, otherwise healthy premenopausal female</li> </ul>		
Etiology	Preferred regimen	Comments
<p><i>E. coli</i> (75-90%)</p> <p><i>Staphylococcus saprophyticus</i> (5-15%)</p>	<p><u>1st line:</u>  <b>Nitrofurantoin</b> macrocrystals 100 mg qid x 5d                      OR  <b>Fosfomycin</b> 3 g single-dose sachet in 3-4 oz (or 90-120 ml) water</p> <p><u>2nd line:</u>  <b>Cefuroxime</b> 250 mg bid x 7d                      OR  <b>Cefixime</b> 200 mg bid x 7d                      OR  <b>Amoxicillin-clavulanate</b> 625 mg bid x 7d</p>	<p>Empiric treatment is the most cost-effective approach; urinalysis and urine culture not pre-requisites.</p> <p>Nitrofurantoin monohydrate/ macrocrystals (100 mg bid) are not locally available.</p> <p>Amoxicillin/ampicillin and cotrimoxazole are not recommended for empiric treatment given the high prevalence of resistance to these agents.</p> <p>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.</p> <p>The treatment is the same for otherwise healthy elderly women with AUC.</p>

Acute uncomplicated pyelonephritis		
<ul style="list-style-type: none"> <li>Fever, flank pain, costovertebral angle tenderness, nausea/vomiting, with or without signs or symptoms of cystitis in an otherwise healthy premenopausal female</li> </ul>		
Etiology	Preferred regimen	Comments
<p>As for AUC, <i>E. coli</i> is predominant, as well as other Enterobacteriaceae</p>	<p><u>Oral</u>  <u>1st line:</u>  <b>Ciprofloxacin</b> 500 mg bid x 7-10d                      OR  <b>Levofloxacin</b> 750 mg od x 5d</p> <p><u>2nd line:</u>  <b>Cefuroxime</b> 500 mg bid x 14d                      OR  <b>Cefixime</b> 400 mg od x 14d                      OR  <b>Amoxicillin-clavulanate</b> 625 mg tid x 14d (when GS shows Gram+ cocci)</p>	<p>Urine analysis, Gram stain, culture and susceptibility tests should be done. Blood cultures are not routinely done unless septic.</p> <p>Consider giving initial IV/IM dose of antibiotic followed by oral regimen in patients not requiring hospitalization.</p> <p>Indications for hospitalization/parenteral regimen:</p> <ol style="list-style-type: none"> <li>signs of sepsis</li> <li>inability to take oral medications/hydration</li> <li>concern re compliance</li> <li>presence of possible complicating conditions</li> </ol>

	<p><b>Parenteral</b>  <u>1<sup>st</sup> line:</u>  <b>Ceftriaxone</b> 1-2 g q24h  <b>Ciprofloxacin</b> 400 mg q12h  <b>Levofloxacin</b> 250-750 mg q24h  <b>Amikacin</b> 15 mg/kg q24h  <b>Gentamicin</b> 3-5 mg/kg q24 h +/- ampicillin</p> <p><u>2nd line:</u>  <b>Ampicillin-sulbactam</b> (when GS shows g+ cocci) 1.5 g q6h</p> <p><b>Reserved for multidrug-resistant organisms:</b>  <b>Ertapenem</b> (if ESBL rate &gt;10%) 1 g q24h  <b>Piperacillin-tazobactam</b> 2.25 - 4.5g q6-8h</p>	<p>Switch to oral regimen once afebrile for 24-48 hr and able to take oral medicines.</p> <p>Tailor antibiotic regimen once culture result available.</p> <p>Routine urologic evaluation and imaging not recommended unless still febrile after 72 hr. Post-treatment urine culture not recommended if clinically responding to treatment.</p>
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<p><b>Asymptomatic bacteriuria (ASB)</b> - presence of bacteria in the urine <b>without signs and symptoms of UTI</b></p> <p><b>Diagnosis:</b></p> <ul style="list-style-type: none"> <li>In women: 2 consecutive voided urine specimens with the same organism in quantitative counts <math>\geq 100,000</math> cfu/mL</li> <li>In men: single, clean-catch voided urine with one bacterial species in a quantitative count <math>\geq 100,000</math> cfu/mL</li> <li>In both men and women: a single catheterized urine specimen with one bacterial species in a quantitative count <math>\geq 100</math> cfu/mL; pyuria, odor and color of urine not relevant to decision to treat</li> </ul>		
<b>Etiology</b>	<b>Preferred regimen</b>	<b>Comments</b>
Similar to acute uncomplicated cystitis	<p><b>No screening and treatment recommended <u>except</u> in:</b></p> <ul style="list-style-type: none"> <li>pregnant women</li> <li>persons undergoing invasive genitourinary tract procedures (likely to cause mucosal bleeding)</li> </ul> <p><b>DO NOT TREAT ASB in:</b></p> <ul style="list-style-type: none"> <li>healthy adults</li> <li>non-pregnant women</li> <li>patients with diabetes mellitus</li> <li>elderly patients</li> <li>persons with spinal cord injury</li> <li>persons with indwelling urinary catheter</li> <li>persons with HIV</li> <li>persons with urologic abnormalities</li> </ul>	<p>Antibiotics do not decrease asymptomatic bacteriuria or prevent subsequent development of UTI .</p> <p>The optimal screening test is a urine culture.</p> <p>If urine culture not possible, significant pyuria (&gt;10 wbc/hpf) or a positive gram stain of unspun urine (&gt;2 microorganisms/oif) in two consecutive midstream urine samples may be used to screen for ASB.</p> <p>When indicated, treatment should be culture-guided. A 7-day regimen is recommended.</p>

## RECURRENT UTI IN WOMEN

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

Etiology	Preferred regimen	Comments
Similar to cystitis	<p>Treat as acute episode for uncomplicated UTI</p> <p><b>Prophylaxis:</b>  <b>TMP-SMX</b> 40/200 mg or <b>nitrofurantoin</b> 50-100 mg at bedtime for 6- 12 mos (continuous prophylaxis)  <b>OR</b>  <b>TMP-SMX</b> 40-80/200-400 mg or <b>nitrofurantoin</b> 50-100 mg as single dose (post-coital)  <b>OR</b>  <b>TMP-SMX</b> 320/1600 mg as single dose at symptom onset</p> <p><b>Other:</b>  Lactobacilli is not recommended.</p> <p>Cranberry juice and products can be used.</p> <p>For post-menopausal women, intra-vaginal estriol nightly x2 weeks then twice-weekly for at least 8 months.</p>	<p>Radiologic or imaging studies not routinely indicated.</p> <p>Screen for urologic abnormalities in the ff:</p> <ul style="list-style-type: none"> <li>• No response to treatment</li> <li>• Gross hematuria/persistent microscopic hematuria</li> <li>• Obstructive symptoms</li> <li>• History of acute pyelonephritis</li> <li>• History of or symptoms suggestive of urolithiasis</li> <li>• History of childhood UTI</li> <li>• Elevated serum creatinine</li> <li>• Infection with urea-splitting bacteria (<i>Proteus</i>, <i>Morganella</i>, <i>Providencia</i>)</li> </ul>

## UTI IN PREGNANCY

### Acute uncomplicated cystitis in pregnancy

Etiology	Preferred regimen	Comments
<p><i>E. coli</i> (70%)</p> <p>Other enterobacteriaceae</p> <p>Group B <i>Streptococcus</i></p>	<p><b>Cefalexin</b> 500 mg qid x 7d</p> <p><b>Cefuroxime</b> 500 mg bid x 7d</p> <p><b>Cefixime</b> 200 mg bid x 7d</p> <p><b>Nitrofurantoin</b> macrocrystals 100 mg qid x 7d</p> <p><b>Fosfomycin</b> 3 g single-dose sachet</p> <p><b>Amoxicillin-clavulanate</b> 625 mg bid x 7d</p>	<p>Start empiric antibiotic immediately, but pre- treatment urine must be submitted for culture and susceptibility; adjust treatment accordingly.</p> <p>Document clearance of bacteriuria with a repeat urine culture 1-2 wks post-treatment.</p> <p>Avoid amoxicillin-clavulanate in those at risk of pre-term labor because of potential for neonatal necrotizing enterocolitis.</p> <p>Use nitrofurantoin from the 2<sup>nd</sup> trimester to 32 wks only, if possible, because of potential for birth defects and hemolytic anemia.</p> <p>Avoid cotrimoxazole especially during the first and third trimesters because of risk of teratogenicity and kernicterus.</p> <p>Fluoroquinolones are contraindicated.</p>

Acute pyelonephritis in pregnancy		
Etiology	Preferred regimen	Comments
<i>Similar to acute cystitis in pregnancy</i>	<p><b>Parenteral:</b>  <i>1st line:</i>  <b>Ceftriaxone</b> 1-2 g q24 h</p> <p><b>Ceftazidime</b> 2 g q8 h</p> <p><i>2<sup>nd</sup> line:</i>  <b>Ampicillin-sulbactam</b> (when GS shows gram+ cocci) 1.5 g q6 h</p> <p><b>Oral:</b>  <b>Cefalexin</b> 500 mg to complete 14d</p> <p><b>Cefuroxime</b> 500 mg bid to complete 14d</p> <p><b>Cefixime</b> 200 mg bid to complete 14d</p> <p><b>Amoxicillin-clavulanate</b> 625 mg bid to complete 14d</p>	<p>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</p> <p>Indications for admission: pre-term labor and other indications as listed above for acute uncomplicated pyelonephritis.</p> <p>Switch to oral regimen when afebrile x 48 hrs and based on culture/susceptibility result.</p> <p>Recommended duration of treatment is 14d.</p> <p>Test of cure with a urine culture post-treatment is essential.</p> <p>Follow up with monthly urine culture until delivery.</p>
Asymptomatic bacteriuria (ASB) in pregnancy		
Etiology	Preferred regimen	Comments
<i>Similar to acute cystitis in pregnancy</i>	<p><b>Cefalexin</b> 500 mg qid x 7d</p> <p><b>Cefuroxime</b> 500 mg bid x 7d</p> <p><b>Nitrofurantoin</b> macrocrystals 100 mg qid x 7d</p> <p><b>Fosfomycin</b> 3 g single-dose sachet</p> <p><b>Amoxicillin-clavulanate</b> 625 mg bid x 7d</p>	<p>Treat ASB to reduce the risks of symptomatic UTI and low birth weight neonates and preterm infants.</p> <p>Choice of regimen is based on culture/susceptibility test result. Note caveats for use of nitrofurantoin and amoxicillin-clavulanate.</p> <p>Screen all pregnant women for ASB once between the 9<sup>th</sup> and 17<sup>th</sup> week, preferably during the 16<sup>th</sup> week. The standard urine culture/susceptibility is the test of choice. Urinalysis is inadequate for ASB screening.</p> <p>Do follow-up urine culture 1 week post-treatment and monitor every trimester till delivery.</p>

### 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.

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

### CATHETER-ASSOCIATED UTI (CAUTI)

- Diagnosed when
- Signs or symptoms compatible with UTI are present with no other identified source of infection, AND  $\geq 10^3$  colony forming units (CFU)/ml of  $\geq 1$  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 organisms (eg., ESBL-producing <i>E. coli</i> ), <i>P. aeruginosa</i> and enterococci	<p><b>Amikacin</b> 15 mg/kg iv q24h</p> <p><b>Ertapenem</b> 1 g iv q24h</p> <p><b>Meropenem</b> 1 g iv q24h</p> <p><b>Cefepime</b> 1-2 g iv q8-12h</p> <p><b>Ceftazidime</b> 1-2 g iv q8h</p>	<p>Pyuria, odorous or cloudy urine alone is not an indication for initiating antibiotics</p> <p>Whenever possible, <b>remove indwelling catheter</b>; if still needed, replace with a new catheter and obtain urine for gram stain and culture/susceptibility test prior to initiating treatment.</p> <p><b>DO NOT obtain urine for culture if asymptomatic.</b></p>

	<p><b>Piperacillin-tazobactam</b> 4.5 g iv q8h</p> <p><b>Ampicillin</b> 1-2 g iv q6h (for susceptible enterococcal infections)</p> <p><b>Levofloxacin</b> 750 mg po or iv q24h (for mild infections with no previous 3<sup>rd</sup> gen. cephalosporin or fluoroquinolone use)</p>	<p>Choice of empiric antibiotics is institution-specific depending on the local susceptibility patterns and severity of illness.</p> <p><b>Duration:</b> 7 days w/ prompt resolution of signs and symptoms; 10-14 days of antibiotic treatment for patients with delayed response</p>
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## CANDIDURIA

Asymptomatic candiduria		
	Preferred regimen	Comments
<p><i>Candida</i> sp. in urine almost always represents colonization; more often in the elderly, female, diabetic, w/ indwelling urinary device, w/ prior surgical procedure, and taking antibiotics; colony count and presence of pyuria not helpful in differentiating colonization from infection.</p>	<p>No treatment indicated</p> <p><u>Exceptions:</u> When undergoing urologic procedure, treat with oral fluconazole 400 mg (6 mg/kg) pre- and post-procedure. Treat also those at risk for dissemination (eg., neutropenic patients).</p>	<p>Elimination of risk factors (ex. indwelling urinary catheter) usually adequate to clear candiduria.</p>
Symptomatic cystitis		
Etiology	Preferred regimen	Comments
<p>Most common etiologic agent: <i>C. albicans</i></p>	<p><b>Fluconazole</b> 200-400mg po od x 2 wks</p> <p><u>For fluconazole-resistant <i>Candida</i> (<i>C. krusei</i> or <i>glabrata</i>):</u> <b>AmB deoxycholate</b> 0.3-0.6 mg/kg x 1-7days</p>	<p>Do ultrasound or CT of kidneys if candiduria persists in immunocompromised patients.</p>
Pyelonephritis		
Etiology	Preferred regimen	Comments
<p>Most common etiologic agent: <i>C. albicans</i></p>	<p><b>Fluconazole</b> 400 mg po od x 2 wks</p> <p><u>For fluconazole-resistant <i>Candida</i> (<i>C. krusei</i> or <i>C. glabrata</i>):</u> <b>AmB deoxycholate</b> 0.3-0.6 mg/kg x 1-7 days</p>	<p>Consider surgical intervention to relieve obstruction if any (e.g., fungus ball).</p> <p>If disseminated disease suspected, treat as if bloodstream infection is present.</p>

## 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

Etiology	Preferred regimen	Comments
Enterobacteriaceae, enterococcus, <i>Pseudomonas aeruginosa</i>	<p><u>1<sup>st</sup> line:</u>  <b>Ciprofloxacin</b> 500 mg po or 400 mg iv bid                      OR  <b>Levofloxacin</b> 500-750 mg iv/po OD</p> <p><u>If enterococcus is suspected/documentated:</u>  <b>Ampicillin</b> 1-2 g iv q4h; vancomycin 15 mg/kg q12 h</p> <p><u>Alternative:</u>  <b>TMP-SMX</b> DS bid  <b>Piperacillin-tazobactam</b> 4.5 g IV q6-8h</p>	<p>Do CBC, blood cultures, urinalysis and urine culture.</p> <p>Treatment duration: 2 weeks; extend to 4 weeks if patient still symptomatic.</p> <p><b>Caveat:</b> <i>E. coli</i> resistance to TMP-SMX is high so TMP-SMX cannot be 1<sup>st</sup> line empiric treatment despite its high prostatic concentration.</p>

### ABP with risk of STD

Etiology	Preferred regimen	Comments
<i>Neisseria gonorrhoeae</i> and <i>Chlamydia trachomatis</i>	<p><b>Ceftriaxone</b> 250 mg IM x 1 dose                      PLUS  <b>Doxycycline</b> 100 mg bid or azithromycin 500 mg po od</p>	Fluoroquinolones not recommended for gonococcal infection. Treat for 2 weeks.

### ABP with risk of antibiotic-resistant pathogens

Etiology	Preferred regimen	Comments
Fluoroquinolone-resistant Enterobacteriaceae and <i>Pseudomonas</i>  ESBL or AmpC beta lactamase-producing Enterobacteriaceae	<p><b>Ertapenem</b> 1g IV od                      OR  <b>Meropenem</b> 1 g IV q8h (for <i>Pseudomonas</i>)</p> <p><u>Alternative:</u>  <b>Cefepime</b> 2g IV q12h</p>	Consider a 4-week regimen.

### Complicated ABP

- Eg., bacteremia or suspected prostatic abscess

Etiology	Preferred regimen	Comments
Enterobacteriaceae, enterococcus, <i>Pseudomonas aeruginosa</i>	<p><b>Ciprofloxacin</b> 400 mg iv q12h                      OR  <b>Levofloxacin</b> 750 mg iv q24h</p> <p><u>Alternative:</u>  <b>Ceftriaxone</b> 1-2 g iv q24h PLUS <b>Levofloxacin</b> 750 mg IV q24h                      OR  <b>Ertapenem</b> 1 g IV q24h                      OR  <b>Piperacillin-tazobactam</b> 4.5 g IV q8 h</p>	<p>Obtain blood cultures.</p> <p>Treat for 4 weeks.</p> <p>Consider genitourinary imaging.</p> <p>Drain abscess.</p> <p>Switch to oral regimen once bacteremia has cleared and abscess is drained.</p>

<b>Chronic bacterial prostatitis (CBP)</b>		
<ul style="list-style-type: none"> <li>• Prolonged urogenital symptoms (ie., &gt;3 mos.)</li> <li>• Hallmark: relapsing UTI</li> </ul>		
<b>Etiology</b>	<b>Preferred regimen</b>	<b>Comments</b>
Enterobacteriaceae, enterococci, <i>P. aeruginosa</i>	<b>Ciprofloxacin</b> 400 mg iv q12h OR <b>Levofloxacin</b> 750 mg iv q24h  <u>Alternative:</u> <b>TMP-SMX</b> DS bid	Treat for 4-6 weeks.  If refractory, options are: 1. treat intermittently for symptomatic episodes; 2. suppressive treatment; or 3. prostatectomy if all other options have failed.

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