Antibiotics for Common Pediatric Infections

**Competency:** Residents should be able to identify the proper antibiotic choices for the common pediatric infections treated in the outpatient setting. They should understand the rationale for choosing antibiotics based upon efficacy, likely pathogens in the region in which they practice, drug dosing and pharmacokinetics, and side effect profiles. Residents should be aware of the common side effects for frequently used antibiotics, and know the best second line therapies for patients with allergies or sensitivities to the first line drugs.

**Case 1:** A previously healthy 9 month old male presents to your office with a two day history of a “boil” in his left inguinal region. He has been febrile to 102°F since this morning, and quite fussy. While in the waiting room, the boil began draining blood tinged, yellowish fluid. The patient has not had any vomiting, diarrhea, URI symptoms, or rash. He was born full term, and has no prior medical history. Immunizations are up to date. His older brother has had several similar boils in the past. On exam, the patient is irritable, with a temperature of 39.2. He has a 2cm x 4cm erythematous, indurated lesion in his left inguinal area. The lesion is quite tender to palpation. There is a central area of fluctuance, with blood tinged, purulent material oozing out. The rest of the exam is normal.

**Case 2:** A 4 yo girl presents to your office with a three day history of cough, sore throat, runny nose, fever, and R ear pain. She has had several ear infections in the past, treated successfully with amoxicillin. Her last ear infection was ~6 months ago. On exam, her right tympanic membrane is erythematous and bulging, with purulent fluid behind it. Her oropharynx is mildly erythematous, with no exudate. She has clear rhinorrhea and shoddy anterior cervical lymphadenopathy. The rest of the exam is unremarkable.

**Questions:**
1. How do you choose the proper antibiotic therapy for common pediatric infections? What factors go into selecting a drug?
2. Which antibiotics should be used for acute otitis media, acute bacterial sinusitis, strep pharyngitis, cellulitis/abscess, and community acquired pneumonia? What are alternatives for patients with PCN allergy?
3. What are the common side effects of the antibiotics commonly used in outpatient pediatric practice?

**Questions:**
1. How do you choose the proper antibiotic therapy for common pediatric infections? What factors go into selecting a drug?

Selection of the proper anti-microbial therapy depends upon knowledge of the most likely causative organism and susceptibility patterns in your particular region. The most narrow spectrum antibiotic that covers the likely organisms is preferred. In addition,
cost, taste, and dosing schedule should be taken into account. It is important to make sure your patient has no allergy or sensitivity to the class of antibiotics you intend to use.

2. Which antibiotics should be used for acute otitis media, acute bacterial sinusitis, strep pharyngitis, cellulites/abscess, and community acquired pneumonia? What are alternatives for patients with PCN allergy?

**Acute otitis media-**

**Likely causative organisms:** Strep. pneumo, non-typable H. influenzae, M. catarrhalis.

**First line therapy:** Based on CDC recommendations, treatment of AOM depends on whether the patient falls into the high or low risk category for resistant otopathogens. The primary risk factors for resistant bacteria are daycare attendance and antibiotic use in the preceding 30 days. For low risk patients, first-line therapy is low dose amoxicillin (40-45 mg/kg/day) or high dose augmentin (80-90/6.4mg/kg/day). For high risk patients (day care or antibiotics within 30 days), first line therapy is high dose augmentin, high dose amoxicillin (80-90 mg/kg/day), or cefuroxime, cefpodoxime, or cefdinir.

AAP/AAFP guidelines advise that if the patient is 6 mo – 2yr and the diagnosis of AOM is uncertain, or > 2 yr with mild symptoms or uncertain diagnosis, it is acceptable to treat symptomatically for 48-72 hours, and begin antibiotic therapy only if symptoms do not improve. If a patient is vomiting and unable to keep down PO meds, a onetime dose of IM CTX, 50 mg/kg, is an acceptable initial therapy.

**Alternative therapies:** For patients with true allergies to penicillin, first line therapy is azithromycin 10 mg/kg x 1 day, followed by 5 mg/kg x 4 days.

For low risk patients who fail initial antibiotic therapy at 72 hours, the next line of therapy is high dose augmentin, cefuroxime, cefpodoxime, cefdinir, or ceftriaxone (IM for 3 days). For high risk patients who fail initial therapy, the next line is clindamycin or 3 days of IM ceftriaxone.

For treatment failures farther out, with recurrent symptoms from 10-28 days after initial treatment, low risk patients can be treated with high dose augmentin, cefuroxime, or IM ceftriaxone. High risk patients can be treated with high dose augmentin, cefuroxime, cefpodoxime, cefdinir, or IM ceftriaxone.

Tymanocentesis should be considered for high risk patients who have either early or late treatment failures.

CDC recommendations are summarized in the table below:

<table>
<thead>
<tr>
<th>TABLE 2 Modified CDC Treatment Recommendations for AOM</th>
<th>Antibiotic Use in Prior Month and/or Day Care Attendance</th>
<th>No Antibiotic Use in Prior Month and No Day Care Attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-line therapy</td>
<td>High-dose amoxicillin/clavulanate potassium (80–90/6.4 mg/kg per d), high-dose amoxicillin (80–90 mg/kg per d), cefuroxime axetil, cefpodoxime proxetil, or</td>
<td>Amoxicillin (40–45 mg/kg per d) or high-dose amoxicillin/clavulanate potassium (80–90/6.4 mg/kg per d)</td>
</tr>
</tbody>
</table>
Acute bacterial sinusitis-
Likely causative organisms: Same as AOM - Strep. pneumo, non-typable H. influenzae, M. catarrhalis.

First line therapy: For mild to moderate symptoms in a child without recent antibiotic therapy and not in daycare, first line therapy is amoxicillin 45-90 mg/kg/day divided bid. For children with severe symptoms (3-4 days of fever of > 102°F and purulent nasal discharge), in daycare, or recently treated with antibiotics, first line therapy is high dose augmentin (90 mg/kg/day amox., 6.4 mg/kg/day clavulanic acid) divided bid.

Alternative therapies: For patients with allergies to penicillin, first line therapy is azithromycin 10 mg/kg x 1 day, followed by 5 mg/kg x 4 day, or clarithromycin 15 mg/kg/day divided bid.

Length of treatment: For patients who fail amoxicillin, high dose augmentin is the next step. If a patient is vomiting, a dose of IM ceftriaxone can be given, 50 mg/kg, and then PO antibiotics started in 24 hr if the patient has improved.

Length of treatment: There are a variety of recommendations for length of treatment for sinusitis, ranging from 10-28 days. Treating for 10-14 days is common, but there is no strong evidence for this.

Group A Strep Pharyngitis-
Likely causative organism: Group A strep.

First line therapy: Penicillin V is the recommended treatment. For children < 27 kg, 400,000 u (250 mg) tid. For children > 27 kg, 800,000 u (500 mg) bid or tid.
**Alternative therapy:** For patients allergic to PCN, erythromycin 20-40 mg/kg divided in 2-4 doses is first line therapy. In patients with whom compliance is an issue, a onetime dose of IM penicillin G can be used, 600,000 u for < 27 kg, 1.2 million u for > 27 kg.

**Length of treatment:** Ten days of treatment are necessary to prevent the development of rheumatic fever.

**Cellulitis/abscess-**

**Likely causative organism:** Group A strep, Staph aureus (likely MRSA in Chicago)

**First line therapy:** Although keflex is often used in other parts of the country to treat cellulitis, given the prevalence of community acquired MRSA infections in our region, clindamycin (30 mg/kg/day divided tid) is first line therapy for cellulitis or abscesses in our patients. An abscess with an area of fluctuance that is not draining spontaneously may require incision and drainage in addition to antibiotic therapy.

**Alternative therapy:** Patients who fail clindamycin therapy for an abscess or cellulitis will likely need admission for drainage or vancomycin.

**Length of treatment:** Standard length of therapy is 5 to 10 days.

**Community acquired pneumonia-**

**Likely causative organism:**

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Likely Organisms</th>
</tr>
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<tbody>
<tr>
<td>0-3 weeks</td>
<td>GBS, Gram – rods, CMV</td>
</tr>
<tr>
<td>3 weeks – 3 months</td>
<td>Chlamydia trachomatis, Strept pneumo, RSV, paraflu</td>
</tr>
<tr>
<td>4 months – 4 yrs</td>
<td>Viruses most common, then strep pneumo, than mycoplasma pneumoniae (in older patients in age range)</td>
</tr>
<tr>
<td>5 yrs – 15 yrs</td>
<td>Mycoplasma pneumoniae, Chlamydia pneumoniae, Strept pneumo</td>
</tr>
</tbody>
</table>

**First line therapy:**

| 0-3 weeks | Patient must be admitted, outpatient treatment not sufficient. |
| 3 weeks – 3 months | Patient admitted if febrile. If afebrile, azithromycin, 10 mg/kg x 1 day, then 5 mg/kg x 4 days, or erythromycin 30-40 mg/kg divided in 4 doses are recommended first line therapies. If the patient has a well defined, lobar infiltrate on CXR, however, amoxicillin should be used, either in combination with a macrolide or alone. |
| 4 months – 4 years | Amoxicillin, 80-90 mg/kg/day divided bid |
| 5 years-15 years | Azithromycin, 10 mg/kg x 1 day, then 5 mg/kg x 4 days, or erythromycin 30-40 mg/kg divided in 4 doses. Again, if the patient has a well defined lobar infiltrate on CXR, amoxicillin should be used. |

**Alternative therapy:** For patients 4 months to 4 years with a penicillin allergy, azithromycin or erythromycin is the preferred therapy.

**Length of treatment:** Azithromycin treatment course is five days. Standard course of amoxicillin or erythromycin is 7-10 days.

### 3. What are the common side effects of the antibiotics commonly used in outpatient pediatric practice?

**Penicillins-** Penicillin allergy is the most common true drug allergy. Allergic reactions can range from maculopapular skin rashes or urticaria to anaphylaxis (incidence 0.01 to 0.02%). Other adverse reactions to penicillins include erythema multiforme, Stevens-
Johnson syndrome, toxic epidermal necrolysis, vasculitis, nausea, vomiting, diarrhea, pseudomembranous colitis, hemolytic anemia, thrombocytopenia, elevated transaminases, and cholestasis. Skin testing is useful with penicillin reactions, and patients with a negative skin test are no more likely to have an immediate reaction to additional doses of penicillin than the general population (~4%). Among the penicillins, augmentin is particularly likely to cause diarrhea, occurring in up to 9% of patients.

Cephalosporins- Common reactions include maculopapular and morbilliform skin eruptions, fever, and positive Coomb’s test. Less common reactions include urticaria, eosinophilia, serum-sickness like reaction, and anaphylaxis (0.0001 to 0.01%). Rare reactions include acute interstitial nephritis and cytopenia. Ceftriaxone in particular in contra-indicated in patients under 1 month due to potential for biliary sludging. The question of cross-reaction with penicillin is complicated. In general, cephalosporins cause anaphylaxis less commonly than penicillins. Overall, a patient with a previous allergic reaction to penicillin is estimated to be 4-8 times more likely to have an allergic reaction to a cephalosporin, although the overall risk is still only 4-8%. There is some evidence that a severe reaction to penicillin increases your risk of a life-threatening reaction to cephalosporins. Evidence suggests that patients with a reaction to penicillin who are skin test negative are not at increased risk of reaction to cephalosporins.

Macrolides- Relatively common reactions to macrolides include diarrhea (6%), nausea (2%), and abdominal pain (2.5%), and maculopapular rash. Less common reactions include headache, dizziness, Stevens-Johnson syndrome, toxic epidermal necrolysis, pseudomembranous colitis, pancreatitis, anemia, leucopenia, thrombocytopenia, elevated transaminases, cholestasis, palpitations, chest pain, and ventricular arrhythmias.

Clindamycin- Clindamycin is one of the antibiotics most associated with pseudomembranous colitis and C. diff infection. Other reactions include diarrhea, rash, urticaria, Stevens-Johnson syndrome, granulocytopenia, eosinophilia, neutropenia, elevated transaminases, esophagitis, and arrhythmia associated with prolonged QT.

References:
Lexi-Comp online.

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