Acute Otitis Media

Introduction

1. AOM is the most common reason for outpatient antibiotic treatment in the United States.[1]
2. Risk factors for AOM development[2]
    a. Upper viral respiratory infection
    b. Tobacco smoke exposure
    c. Day care attendance
    d. Family history of AOM
    e. Atopy (eczema, asthma, and seasonal allergies)
3. Signs and symptoms of AOM[3]
    a. Tugging/rubbing/holding the ear
    b. Excessive crying
    c. Fever
    d. Changes in child's sleep or heavier pattern
4. Most common pathogens[1]
    a. Streptococcus pneumoniae
    b. Nonencapsulated Haemophilus influenzae
    c. Moraxella catarrhalis
    d. Staphylococcus aureus
    e. Viruses account for ~ 16% of cases
        i. Rhinovirus
        ii. Influenza virus
        iii. Adenovirus
5. Diagnosis[3]
    a. Bulging of the TM AND recent onset (< 48 hours) of otalgia or intense TM erythema

Initial Management of Acute Otitis Media (AOM)[3]

Age	Otorrhea with AOM	Unilateral or Bilateral AOM with severe symptoms*	Bilateral AOM without otorrhea	Unilateral AOM without otorrhea	Duration of Antibiotic therapy	First-line Treatment
6-24 months	Antibiotics recommended	Antibiotics recommended	Antibiotics recommended	Observation with close follow up OR antibiotic therapy	10 days	1.Amoxicillin 2.Augmentin Alternative in penicillin-allergic patients: third generation cephalosporin
≥ 2 years	Antibiotics recommended	Antibiotics recommended	Observation with close follow up OR antibiotic therapy	Observation with close follow up OR antibiotic therapy	Severe symptoms: 10 days 2-5 years: 7 days ≥ 6 years: 5-7 days	

*Severe signs or symptoms: moderate or severe otalgia or otalgia for at least 48 hours or temperature 102.2 or higher

First-Line Treatment for Initial Management of Acute Otitis Media

Agent	Dose	Frequency	Administration	Adverse effects	Storage and stability	Flavor	Additional flavoring available with FlavorRx (listed in order of preference)
Amoxicillin	80-90 mg/kg/**day** Max daily dose: 4000 mg/day	BID	May be mixed with: formula, milk, cold drink, juice Shake well before each use	Diarrhea 13.8% Rash (6.5%) generally appears 3-14 days after start of therapy.	Reconstituted oral suspension remains stable for 14 days at room temp or refrigeration. (refrigeration preferred)	Bubble-gum	Mango, watermelon, bubblegum, grape
Amoxicillin-clavulanate	90 mg/kg/day amoxicillin with 6.4 mg/kg/day of clavulanate (14:1 formulation)	BID	May be mixed with: formula, milk, or juice; shake suspension well before use. Administer at the start of a meal to reduce frequency or severity of GI side effects	Diarrhea (18.9%) Rash (4.9%)	Reconstituted oral suspension should be kept in the refrigerator. Any unused suspension should be discarded after 10 days.	orange	Mango, grape, bubblegum, apple
Third Generation Cephalosporins (PO)							
Cefdinir	14 mg/kg/day Max daily dose: 600 mg/day	BID	Administer with food if stomach upset occurs; administer ≥ 2 hours before antacids or iron supplements	Diarrhea (8-15%) Rash (< 3%)	Reconstituted suspension is good for 10 days at room temperature.	Strawb erry-cream/ strawb erry	Mango, apple, grape, grape-bubblegum
Cefpodoxime	10 mg/kg/day Max daily dose: 400 mg/day	BID	Administer without regard to meals	Diarrhea (15%)* Diaper rash (12%) Skin rash (1%)	Reconstituted suspension may be stored in the refrigerator for 14 days	Lemon-crème/ vanilla	Mango, grape-bubblegum, bubblegum, grape

*in infants and toddlers; older children and adults have less frequent reported events of diarrhea (7%)

Formulations of Augmentin

Dosing is based on amoxicillin component
Dose and frequency are product-specific
Using a product with the incorrect amoxicillin: clavulanate ratio could result in subtherapeutic clavulanic acid concentrations or severe diarrhea

Amoxicillin: Clavulanate ratio	Available products	Dosing	Frequency	Standard preparations available
4:1 formulation	125 mg/ 31.25 mg 250 mg/ 62.5 mg 500 mg/ 125 mg	20-40 mg/kg/day Max daily dose: 1500 mg/day	TID	125 mg/31.25 mg/5 mL: 75, 100, 150 mL 250 mg/62.5 mg/5 mL: 75, 100, 150 mL
7:1 formulation	200 mg/ 28.5 mg 400 mg/ 57 mg 875 mg/ 125 mg	25-45 mg/kg/day Max daily dose: 1750 mg/day	BID	200 mg/28.5mg/5mL: 50,75,100 mL 400 mg/57 mg/5mL: 50,

				75,100 mL
14:1 formulation (Augmentin ES)	600 mg/ 42.9 mg	90 mg/kg/day Max daily dose: 4000 mg/day	BID	600 mg/42.9mg/5mL: 75,125, 200 mL
16:1 formulation	1000 mg/ 62.5 mg	2000 mg every 12 hours	BID (extended release)	XR tablets

Topical antibiotics for AOM			
Can only be used if tympanostomy tubes present or if a perforated ear drum is present **Always check insurance/local pricing before recommending** **Ophthalmic drops are safe for use in the ear (and are often less expensive than the otic formulations)** **Ciprodex has gone generic, but don't go crazy just yet. The cost for the new generic on good rx is $82.45-170.34**			
Agent	**Dosing**	**Administration**	**GoodRx cost**
Ofloxacin 0.3% ophthalmic solution	5 drops in the affected ear(s) BID x 10 days	Press the tragus 4 times in a pumping motion to allow drops to pass through the hole or tube into the middle ear	$12.50 per bottle

Overview of Evidence			
Author, year	Design/ sample size	Intervention & Comparison	Outcome
Hum, 2019[4]	Meta-analysis of children receiving antibiotics for AOM	High-dose amoxicillin Low-dose amoxicillin High-dose Augmentin Azithromycin Cefdinir	High-dose Augmentin was associated with highest risk of diarrhea (18.9%) High-dose amoxicillin was associated with highest risk of rash (6.5%)
Hoberman, 2016[5]	RCT children 6-23 months	229 children received 10 day course of Augmentin 238 children received 5 day course of Augmentin	Children treated for 5 days were more likely than those treated for 10 days to experience treatment failure. The rate of adverse effects was not lower in the shorter duration group either.
Tahitnen, 2011[6]	RCT DB children 6-35 months	161 children received Augmentin (40 mg/kg/day 5.7 mg clavulanate/day) 158 children received placebo	Augmentin reduced risk of treatment failure by 62% vs. placebo, but still had a treatment failure rate of 18.6% (due to the low dose of Augmentin used)
Hoberman, 2011[7]	RCT DB children 6-23 months	144 children received Augmentin ES (90 mg/kg/day 6.4 mg clavulanate/day) and 147 received placebo	Augmentin reduced risk of treatment failure by 35% vs placebo, but still had a treatment failure rate of 16% (treatment failure was more common in children that presented with severe infections)

Conclusions

1. Unless, a perforated eardrum or tympanostomy tubes are present, topical antibiotics should be avoided as they do not reach the middle ear without these conditions present.
2. When recommending topical antibiotics for AOM, avoid aminoglycoside-containing agents and non-sterile agents due to risks > benefits. And skip the steroids in favor of Tylenol or ibuprofen to save costs.
3. Anyone under the age of 2 presenting with AOM should receive antibiotic therapy for 10 days.
4. Anyone presenting with AOM with severe symptoms should receive antibiotic therapy for 10 days regardless of age.
5. Always double check dosing and formulation of Augmentin to ensure we are sending people home with the proper ratio of amoxicillin to clavulanate and in a volume that the child can tolerate.

References

1. Rayala BZ. Otitis Media: Acute Otitis and Otitis Media with Effusion. In: Usatine RP, Smith MA, Mayeaux E.J. J, Chumley HS, eds. *The Color Atlas and Synopsis of Family Medicine, 3e*. New York, NY: McGraw-Hill Education; 2019.
2. Paul CR, Moreno MA. Acute Otitis Media. *JAMA Pediatr*. 2020;174(3):308. doi:10.1001/jamapediatrics.2019.5664
3. Lieberthal AS, Carroll AE, Chonmaitree T, et al. *The Diagnosis and Management of Acute Otitis Media*. Vol 131.; 2013.
4. Hum SW, Shaikh KJ, Musa SS, Shaikh N. Adverse Events of Antibiotics Used to Treat Acute Otitis Media in Children: A Systematic Meta-Analysis. *J Pediatr*. 2019;215:139-143.e7. doi:10.1016/j.jpeds.2019.08.043
5. Hoberman A, Paradise JL, Rockette HE, et al. Shortened Antimicrobial Treatment for Acute Otitis Media in Young Children. *N Engl J Med*. 2016;375(25):2446-2456. doi:10.1056/NEJMoa1606043
6. Tähtinen PA, Laine MK, Huovinen P, Jalava J, Ruuskanen O, Ruohola A. A Placebo-Controlled Trial of Antimicrobial Treatment for Acute Otitis Media. *N Engl J Med*. 2011;364(2):116-126. doi:10.1056/nejmoa1007174
7. A H, JL P, HE R, et al. Treatment of acute otitis media in children under 2 years of age. *N Engl J Med*. 2011;364(2).

doi:10.1056/NEJMOA0912254
8. Lexicomp Online, Pediatric and Neonatal Lexi-Drugs Online, Hudson, Ohio: UpToDate, Inc.; 2021; January 23, 2021