

Overview of Ear Infections

0.25 CREDIT HOURS



Pete Kreckel, RPh
Director of Clinical Services, Nickman's Drug Store

PHARMACIST OBJECTIVES

1. Differentiate between treatment options for otitis externa and otitis media

PHARMACY TECHNICIAN OBJECTIVES

1. Differentiate between treatment options for otitis externa and otitis media

OVERVIEW

Micro-learning opportunities were created in response to evidence that learning is maximized when delivered in short and focused 'bursts.' In this session, ear infections, otitis externa and media, are explored along with a summary of medications appropriate treatment, and best prescribing practices.

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TARGET AUDIENCE

Pharmacist, Pharmacy Technician

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When my wife Denise worked at a state college's clinic pharmacy, one of the pediatricians was insistent on using only the Amoxicillin/Clavulanate (Augmentin) 600mg/5mL concentration. She would not tolerate prescribing any Augmentin 250mg/5mL or Augmentin 400mg/5mL for her patients. If she read the emergency room reports or listened to any other physician writing for the 250mg/5mL or the 400mg/5mL, she would instruct the parents to dump out the product dispensed and come the pharmacy to get the 600mg/5mL product to decrease nausea, vomiting and of course, diarrhea.

One of my former PA students did the same. She sent me an email begging me to reinforce this concept as well. For otitis media the best option is the 600mg/5mL to decrease clavulanate exposure and its side effects.

All of the amoxicillin/clavulanate products taste horrible and cannot be made palatable with any flavoring agent. I recommend the parent use an oral syringe and have a teaspoon with Hershey chocolate syrup ready. Once the child swallows, stick the spoon of chocolate syrup in their mouth to clear the nasty taste.

Ear Infections

Otitis externa

- Characterized by erythema (redness) and edema of the external auditory ear canal
- Symptoms frequently include otalgia (ear pain), pruritis (itching), purulent discharge, and impaired hearing
- Recent exposure to water or mechanical trauma (Q-tips, scratching, etc.) can precipitate the condition
- The ear canal may become blocked by hair follicles or wax, providing a protective barrier and adequate environment for bacteria and fungi to grow
- Edema commonly associated with external ear infections occurs from a change in normal pH, triggering an inflammatory response
- Manipulation of auricle often causes pain response
- Frequently referred to as "swimmers' ear"
- Infection is usually unilateral only affecting one ear at one time
- Usually caused by gram-negative rods (*Pseudomonas aeruginosa* and *Staphylococcus aureus*) or fungi (*Candida* and *Aspergillus*) which grow well warm, dark, moist environment

Treatment of otitis externa:

- Protection of ear from further moisture and/or mechanical injury are key to treatment
- Avoid placing cotton swabs in the ear
- Oral acetaminophen and nonsteroidal anti-inflammatories
 - Adequate for mild to moderate pain
- Short course of oral opioids may be prescribed for severe pain associated with uncomplicated otitis externa
 - Should resolve within 48 to 72 hours of initiating antibiotic therapy

Primary treatment:

- Neomycin/Polymyxin/Hydrocortisone (Cortisporin® otic) ear drops
 - Dose: 4 drops three to four times daily
 - MAX duration of 10 days
- Ciprofloxacin 0.3%/dexamethasone 0.1% (CiproDex Otic®)
 - Dose: 4 drops into the affected ear(s) twice daily for 7 days
- Ofloxacin otic (Floxin otic®)
 - Dose: 10 drops into affected ear(s) once daily for 7 days
- Ciprofloxacin + hydrocortisone (Cipro-HC®)
 - Dose: 3 drops into affected ear twice daily for 7 days
 - This preparation is not sterile
 - Cannot be used when a patient has a perforated ear drum
- Swim Ear®
 - Contains 95% isopropyl alcohol as a drying agent for “clogged ears”

Fungal infection for otitis externa:

- Nonperforated tympanic membrane: hydrocortisone/acetic acid otic (1%/2%)
- Perforated: Tolnaftate topical drops (1%) (usually found in the foot section)
- Fluconazole 200mg x1 dose then 100mg daily for 3-5 days

Otitis media

- Inflammatory process of the middle ear
- Inflammation of area behind the eardrum
- It is accompanied by the presence of fluid in the middle ear and a rapid onset of signs and symptom of ear infection

Signs/Symptoms:

- Fever, otalgia, otorrhea, changes in balance or hearing, irritability, lethargy, vomiting or diarrhea
- Patients commonly experience upper respiratory infection symptoms as well consisting of rhinorrhea, cough, congestion

Types of otitis media:

- Myringitis: inflammation of tympanic membrane
- Otitis media with effusion
- Acute otitis media
- Chronic suppurative otitis media

Microbial pathogens – overall detection in middle ear fluid:

- Viral: up to 70% of all otitis media cases are of viral etiology
- Bacterial and viral: 66% of cases
- Bacteria: 92%
- No pathogen: 4%

- *Streptococcus pneumoniae*
 - Contributed to 49% of bacterial otitis media
 - Resistance is becoming more of a problem
 - Up to 50% of strains are resistant to macrolides
- *Haemophilus influenzae*
 - Contributed to 29% of the cases
 - Bacterial resistance is due to beta-lactamase production
- *Moraxella catarrhalis*
 - Contributed to 28% of cases
 - Almost all strains are beta-lactamase producing

Benefits and risks of pharmacological therapy:

- A study conducted from 1966 to 1992 concluded that the overall rate of spontaneous resolution of acute otitis media was 81% (<https://www.aafp.org>)
 - According to the new guidelines, watchful waiting is considered an appropriate option for:
 - Children 6-23 months with unilateral infection and non-severe symptoms (presence of mild ear pain for less than 48 hours and a temperature less than 39°C or 102.2°F)
 - Children 2 years or older with unilateral or bilateral infection and non-severe symptoms (presence of mild ear pain for less than 48 hours and a temperature less than 39°C or 102.2°F)
 - Regardless of the use of an antibiotic, an analgesic should be considered within the first 24 hours to relieve (AAP guidelines 2013)
 - Conversely, antibiotic therapy should be prescribed for:
 - All children less than 6 months
 - Children 6 months of age or older with severe symptoms (presence of moderate to severe ear pain for at least 48 hours or a temperature of 39°C or 102.2°F or higher)
 - Children six months to 23 months with bilateral infection and non-severe symptoms (presence of mild ear pain for less than 48 hours and a temperature less than 39°C or 102.2°F for less than 48 hours)
 - All children with acute otitis media with otorrhea
- Treat ear pain with ibuprofen or acetaminophen
- In most patients, symptoms begin improving within 24-72 hours of initiation of therapy. As a result, less than 50% of the children complete the prescribed course of antibiotics.
 - Adherence to antibiotic regimens may be improved by selecting agents that require less frequent dosing (once or twice daily) and by prescribing shorter (five days or less) treatment courses
- Advise parents to bring children with suspected otitis media to the clinic for evaluation however, they should not always expect an antibiotic

Non-pharmacological treatment measures:

- Otitis media:
 - Local heat can help comfort the child
 - American Academy of Otolaryngology recommends tubes being placed in patients who have had 4 episodes of AOM in past 6 months or 6 episodes in past year
 - Myringotomy and insertion of tympanostomy tubes:
 - Incision is made in tympanic membrane; middle ear effusion is aspirated
 - Biflanged tympanostomy (ventilator tube) tube is inserted
 - These tubes decrease episodes by 50%.
 - They usually last 6-12 months
 - After extrusion there is no evidence of ongoing benefit

Risk factors for otitis media:

- Age – peaks between 6 and 12 months of age
- Family history: especially if siblings are prone to ear infections
- Day care: risk ratio is 2.8 to 5 times greater
- Tobacco exposure: risk ratio is 1.66 times greater
- Pacifier use: slight risk increase, with risk ratio of 1.24

Otitis media treatment and prevention

	No antibiotics in the last 30 days	Antibiotics in the last 30 days
First-line (initial empiric) therapy	Amoxicillin HD (high risk patients)	Amoxicillin HD or Amoxicillin/Clavulanate HD or cefuroxime, or cefdinir, or cefpodoxime or cefprozil (Adults--moxifloxacin or levofloxacin)
Failure after 3 days Rx	Amoxicillin/clavulanate HD *or*cefprozil or cefpodoxime or cefuroxime OR ceftriaxone	Ceftriaxone-IM in 3 daily doses. Clindamycin, tympanocentesis
Failure at days 10-28	Same as above, choose different regimen	Amoxicillin/clavulanate HD, cefuroxime, ceftriaxone-IM x3, tympanocentesis.

Prescribing rules:

- Amoxicillin HD (high dose) (80-90mg/kg/day)
 - First-line therapy for otitis media
 - Divided into 2 or 3 doses (every 8 or every 12 hours)
- Amoxicillin/Clavulanate high dose
 - Treatment of choice for first line failure (amoxicillin high dose)
- Amoxicillin-UD (usual dose)
 - **Not** recommended for first line use in otitis media
 - 40mg/kg in 2 or 3 divided doses
- Amoxicillin HD
 - 80-90mg/kg/day in 2 or 3 divided doses (q8h or q12h)

Shortcut for amoxicillin prescribing at 80mg/kg (HD):

- High dose = 80-90mg/kg.
- Using 400mg/5 mL concentration think of it as (80 mg/mL)
 - 80mg/1mL equals 80mg/kg therefore, for every 1 kg a child weighs he/she gets 1mL of amoxicillin 400mg/5 mL per day
- EXAMPLE: Child weights 44lb. 44lb divided by 2.2lb/kg = 20kg
 - The child gets 20mL/day may give 10mL twice daily (1600mg/day)
- Now here is the problem when prescribing Amoxicillin/Clavulanate (Augmentin®), which is dosed based on the component:

Drug	To get 1500mg amoxicillin	You get this much clavulanate daily
Augmentin 125 mg/31.25 mL	12 teaspoon	375 mg
Augmentin 250 mg/62.5 mL	6 teaspoon	375 mg
Augmentin 400 mg/57 mL	3.75 teaspoon	213.75 mg
Augmentin-ES 600 mg/42.9 mL	2.5 teaspoon	107.25 mg
Augmentin 250 mg/125 mL	6 tablets	750 mg
Augmentin 500 mg/125 mL	3 tablets	375 mg
Augmentin 875 mg/125 mL	2 tablets	250 mg

- As you can see from the above chart, a child getting Amoxicillin 1500mg per day (37lb child) would get **107.25mg** of clavulanate, should the prescriber use Augmentin ES 600, versus **375mg** of clavulanate should the prescriber use Augmentin 250/5
- Whenever you are prescribing **Augmentin therapy HD** (high dose), as is recommended for otitis media, it is critical to use **Augmentin ES 600mg/42.9** to minimize clavulanate exposure and decrease incidence of severe GI upset and diarrhea. Maintain daily **clavulanate** dose **<10mg/kg/day**. Amoxicillin/Clavulanate can cause **diarrhea in 3- 34%** of patients, and this percentage varies upon dose and regimen.

Clinical pearls:

- The younger a child is when they develop otitis media, the more likely they are to have a recurrence
- High dose amoxicillin is first line, do not use if child has had antibiotics the previous 30 days, or receiving prophylaxis with amoxicillin
- Standard treatment duration is 10 days, with short course being 1-7 days
 - Use 10 days for all children under 2 years of age, and ALL children with severe disease
 - For children aged 2 years and older, with mild to moderate acute otitis media, a 5-7-day course is appropriate
 - A Cochrane review showed that, in otherwise healthy children, a 5-day course is as effective as the 10-day course supported in AAP/AAFP guidelines
 - Clinical improvement should be evident in 48-72 hours
 - Antihistamines and decongestants are of NO value in the treatment of acute otitis media

Maximum amoxicillin dose:

- The recommended dose of amoxicillin is 80 to 90 mg/kg per day for otitis or respiratory infections due to resistant *S. pneumoniae*
- The manufacturer recommended dose (per package insert) is 1.75g/day. This is exceeded when a kid weighs over 20kg.
- When amoxicillin was approved in 1974, pneumococcal resistance was not a problem. Today, feel comfortable dispensing 3g per day and sometimes up to 4g per day if necessary.

Preventative measures against otitis externa and otitis media

Prevention of otitis externa:

- Turn head to drain water after swimming or showering
- Utilizing earplugs may help prevent water from getting inside the ear, but if water is already present, it may trap water
 - There have been mixed results when looking at use of earplugs

Prevention of otitis media highlights:

- Be sure to emphasize the importance of prevention to all parents of small children
 - **Pneumococcal vaccine** – Use of the vaccine according to the childhood immunizations schedule has been shown to be effective in reducing the incidence of acute otitis media
 - **Influenza vaccine** – many cases of acute otitis media follow a viral upper respiratory tract infection. Reducing viral infections will reduce otitis media.
 - **Breastfeeding** – Breastfeeding for 4-6 months reduces episodes of acute otitis media. American Academy of Pediatrics recommends exclusive breastfeeding for the first 6 months of life and to continue for at least the first year or longer, based on the abilities of the mother and child.
 - **Day care** – Family-provided day care or small group day care helps prevent otitis media
 - **Tobacco smoke** – Avoid exposure of household tobacco smoke
 - **Pacifiers** – Avoid giving your infant a pacifier
 - **Viral infections** – Viral infections, like the common cold, increase the likelihood of otitis media. Wash hands frequently, do not share toys, etc.
 - **Allergies** – Inflammation and mucus caused by allergies can block the eustachian tube and make ear infections more likely

Prophylaxis: antibiotic therapy for otitis media:

- Use of antibiotics to prevent otitis media is a MAJOR contributor to the emergence of antibiotic resistant *S. pneumoniae*
 - Antibiotic prophylaxis for otitis media is NO longer recommended
 - Pneumococcal conjugate vaccine (Prevnar-13) decreases frequency of otitis media in children

--Have a great day on the bench!!

Activity Test

Overview of Ear Infections

Activity tests must be completed online at www.freeCE.com.

A passing grade of 70 or higher and completion of an online activity evaluation are required to earn credit.

- 1. Which of the following statements regarding ear infections is/are TRUE?**
 - A. Inflammation in otitis externa affects the middle ear area behind the ear drum.
 - B. Medications used to treat ear infections are only available as an ear drop.
 - C. Patients may experience symptoms of upper respiratory infection in addition to signs of an ear infection.
 - D. All of the above statements are true.
 - E. None of the above statements are true.

- 2. Which of the following is a risk factor for otitis media?**
 - A. Attending day care
 - B. Sibling has chronic ear infections
 - C. Secondhand smoke exposure
 - D. All of the above
 - E. None of the above