Pediatric Acute Infectious Otitis Externa

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Grand Rounds Presentation
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Introduction

• Otitis Externa: inflammation or infection of the external ear includes
  • all inflammatory conditions of the auricle
  • external ear canal
  • and outer surface of the TM

• Common childhood disease

• Commonly referred to as “swimmer’s ear” or “tropical ear”

• Can be acute or chronic

• Has multiple etiologies:
  • infectious
  • traumatic
  • allergic

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  • traumatic
  • allergic

• Spectrum from minor ear infection to necrotizing, life-threatening disease
History of Otitis Externa

Historical Treatments

1500 BC

- Red lead
- Resin
- Goose grease

1000 A.D.

- Ear candles

- Red lead = lead tetroxide - used as a red pigment
- Resin = hydrocarbon secretion of plants (like sap)
History of Otitis Externa

Early 20th Century

Ear Potions Containing:
- Camphor
- Sassafras

Camphor is a waxy derivative of evergreen trees

Mid 20th Century

topical astringents and alcohols

menthol
History of Otitis Externa

First formally described in the literature in 1844 by Mayer- presumed to be a fungal infection.

During WWII high incidence in troops stationed in the South Pacific -

50-70% of cases for ENT’s in South Pacific was because of OE

Re-investigated and found to be primarily a bacterial cause

-statistics from Rolland study
- **Pinna**: elastic cartilage framework

- **EAC**: outer cartilaginous portion (outer 1/3rd)
  - contains sebaceous and apocrine glands

- **EAC**: Inner osseous portion (Inner 2/3rd’s)
  - no adnexal structures.
  - Lined by squamous epithelium

- **Cerumen**: combination of gland cretions and desquamated cells

- **Normal Ear flora**: S. epidermidis, Corynbacterium, and alpha hemolytic streptococcus

Cerumen

Contains lysozyme (antimicrobial properties).

Also has acidic pH (6-6.5). Pseudomonas and Staph Aureus grow best in alkaline environment (pH 8-10).

Effective as an anti-microbial? Controversial

- antimicrobial properties vs. nutrient source for microbes
Caused by a breakdown in the skin/cerumen protective barrier

3 stages:

1. **pre-inflammatory**: moisture or trauma to the external ear. Skin becomes edematous, which blocks the glands.

2. **inflammatory**:
   - **mild**: canal is erythematous and edematous - produces clear dorless secretions
   - **moderate**: increased edema and pain. Secretions become seropurulent
   - **severe**: intense pain. Obstructed EAC lumen, purulent drainage, and debris in the canal. Often associated with pre-auricular and adenopathy

3. **chronic**: an episode lasting longer than 4 weeks OR at least 4 episodes in one year
Microbiology of Otitis Externa

- Microbiology (Roaland Study 2002)
  - 53% gram negative: pseudomonas
  - 45% gram positive (Staph Aureus 7.5%, overall stapes sp. 25%)
  - 1.7% yeast/fungus

- Viral causes of EAC inflammation:
  - Herpes virus, varicella-zoster virus
Age Distribution

- peak in ages 7-12, decline age after 50 and relatively constant for all other age groups
- clear increase of cases during the summer months (80.5% of cases occurred during the summer months)
- age-related distribution of organisms isolated
- only 4% of children under age 12 were found to have S. Aureus
- 8% in 13-18 year old age group
- no age related differences noticed for pseudomonas

Clinical Presentation

1. ear pain
can be severe (skin of the canal is closely adherent to the underlying perichondrium/periostium)  Worsened by manipulation of the pinna

2. itching- often precedes pain. (Also associated with fungal infection)

3. Draining ear

4. conductive hearing loss

5. aural fullness

Complications/Sequelae

- stenosis of the ear canal
- cellulitis/chondritis
- Parotiditis
- necrotizing OE - very rare in children and almost never fatal
- kids who are susceptible have immune dysfunction (leukemia, drug-induce leukopenia, immunoglobulin deficiency, and DM)
Clinical Pearls
- otalgia is commonly referred from
teeth, tonsils, TMJ, larynx, neck, sphenoid sinus
- cranial nerves 5, 6, 9, and 10 control sensation to the middle and external ear

* furonculosis - occurs in the lateral (hair bearing) EAC - typically causes localized swelling limited to single quadrant (OE tends to be concentric and the entire length of the EAC)

* Otitis Media - visualize the TM to differentiate (OE can be due to OM if there is a TM perf)

* mastoiditis - post auricular fold will be obliterated (preserved in OE). Will have pain to palpation over the mastoid process (vs. pain with manipulation of the pinna)
Relevant Clinical History

- Relevant HPI
  - pain (severe pain can be due to a furuncle (abscess in the hair bearing skin)
  - history of swimming
  - history of recent ear trauma
    - q tips
    - syringing
    - hearing aids
    - ear plugs
    - foreign body

Relevant PMH to acquire
  - immunosuppression (including DM)
  - contact dermatitis, eczema, psoriasis
  - previous history of ear disease
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Physical Exam

**Observation**

Ear drainage?
- thick/clumpy (OE). Green/foul (pseudomonas)
- Mucoid (OM)

Surrounding cellulitis?
- mark to monitor treatment response

Protruding pinna?
- sign of post-auricular abscess (mastoiditis)

Facial paralysis?
- could signify severe infection

**Palpation**

Bony tenderness over the mastoid?

Palpable/tender lymph nodes in the peri and pre-auricular areas?

Physical Exam

Otoscopy
Classic OE findings: edema/erythema of the ear canal, EAC narrowing, debris in the canal, cerumen, purulence

-Keratosis obturans: cerumen/keratin filling the EAC

fungal hyphae?

Is the TM perforated or intact? Is there a PE tube?
**important for both diagnostic and treatment considerations

Physical Exam

Otoscopy

Vesicles in the canal?
- herpes zoster-oticus

TM itself inflamed?

myringitis (can be bullous or granular)
- primary myringitis: trauma, infection or sudden pressure changes
- secondary as a result of adjacent inflammation of the middle ear or external canal
Diagnostic Tests

When to culture?
   - If empiric treatment fails

Imaging?
   - CT
   - Isotope scan/bone scan
Treatment
Treatment

Goals:

1. Antimicrobial therapy that eradicates the 2 most common bacterial causes: Pseudomonas and Staph aureus

2. Aural toilet - remove as much debris as possible

3. Pain control

4. Dry Ear precautions

5. Patient instructions in proper use of ear drops
   **have child lie on side with affected ear up. Place drops in ear and pump tragus. Continue to lie on side for 5 minutes

6. Ear wick?
   - if canal is significantly narrowed
   - must return to clinic to have it removed 2-3 days later
**Treatment**

Non-Antibiotic Topical Treatment Options

Alcohols/Astringents:

- **Boric Acid (2.75%)**
- **Acetic Acid**
- **Vosol HC=2% acetic acid plus 1% hydrocortisone**
- **Alcohols**
  - 90-95%

Advantages:

1. Cheap
2. Work against bacteria and fungi

**Work by acidifying or providing a toxic environment for microbes**
5. Can be ototoxic if they get into the middle ear cavity

Drawbacks of Astringents/Alcohols:

1. That they don’t usually work if the disease is moderate/severe (later in the disease process)

2. They hurt

3. Require multiple treatments per day

4. Require long treatment period - up to 3 weeks

5. Can be ototoxic if they get into the middle ear cavity
   * cant use with a TM perf or PE tube

(T irritate inflamed skin)
Treatment

Topical Antibiotic Treatment Options

Aminoglycosides
- Used as first-line therapy during 1970’s through late 1990’s
- neomycin is often combined with a second antibiotic (polymixin) and a steroid
- polymixin covers pseudomonas. Polymixin/neomycin have 87-97% cure rates
- gentamicin also sometimes used

Limitations of polymixin/neomycin
- hypersensitivity reactions to neomycin (up to 53%) and thimerisol (up to 18%) (preserving agent)

- aminoglycoside ototoxicity: rare and usually occurs in the setting of a TM perf (treatment is sometimes started without being able to see it)

- requires QID dosing
Treatment

Topical Antibiotic Treatment Options: Quinolones

Became available in topical otic preparations in 1998

Now Considered First-line Therapy

Ciprofloxacin 0.3% and dexamethasone 0.1%

Ofloxacin 0.3% (no steroid)

ciprofloxacin 0.2% and 1% hydrocortisone
Treatment
Topical Antibiotic Treatment Options

- **Advantages:**
  1. Cover both gram positive and gram negative - equivalent efficacy to aminoglycosides
  2. BID dosing
  3. Almost no systemic absorption
  4. No known ototoxicity
  5. Ofloxacin and Ciprodex FDA approved in the setting of a perforated TM - cipro and floxin are considered equal in their efficacy.
  6. Allergies to quinolones have been very rare and reported with oral use

- **Drawbacks:**

$$
Treatment

Quinolones vs. aminoglycosides + oral

Topical Quinolone vs. topical quinolone and oral antibiotics Rolland 2008 Study

- prospective, controlled trial comparing oral vs. topical therapy for treatment of OE.

- Less likelihood of resistance because there is not systemic absorption

- found that they were equivalent
Anti-fungals

1% clotrimazole
tolnaftate

Use if:
- Clinical suspicion of fungal infection upon presentation
- Treatment failure after 48 hours
Prevention

Ear plugs (Silicone Ear Putty by Physicians Choice) or cotton balls with petroleum jelly

- OTC astringents (equal parts vinegar and rubbing alcohol)

- drying the ears after swimming with a hair dryer 1 ft away from ear

- tell patients not to jam Q-tips in their ears
Prevention: Q-Tips

- Q-tips cause AOE (Nussinovitch Study 434))
- 3 year study period of all children diagnosed with OE

Results

- Subjects
  - 87 children. Ages 3.5-12yrs with OE
  - 90 age-matched children without OE
- cleaning habits
  - 70.1% of children diagnosed with OE had cleaned their ears with a cotton-tip applicator within 10 days
  - only 34% used Q-tips during the previous 10 days
  - P<0.001

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<thead>
<tr>
<th>Table 1</th>
<th>Risk factors for otitis externa</th>
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<tbody>
<tr>
<td></td>
<td>OE group (N = 87)</td>
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<tr>
<td>Age (months)</td>
<td>68 ± 6.5</td>
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<tr>
<td>Sex (male)</td>
<td>42 (48%)</td>
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<tr>
<td>Q-tip applicators</td>
<td>61 (70%)</td>
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<tr>
<td>Swimming</td>
<td>30 (34%)</td>
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<tr>
<td>Wax removal (by physician)</td>
<td>5 (5.8%)</td>
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<tr>
<td>Ventilation tube</td>
<td>1 (1.1%)</td>
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NS: not significant.
Controversy / Trends

- paper #5: is fungal otitis externa on the rise because of quinolones? (Martin et al. 2005)

- DISCUSSION
  - are the use of oral and topical antibiotics causing increased fungal infections?
  - topical quinolones
  - they admit they are great drugs because they provide great coverage for pathogens and good side effect profiles

**Conclusion:** fungal otitis externa is on the rise. This study showed an increase in the rate of ear cultures positive for fungus after the introduction of quinolone oto-topical drops
  - oral fluconazole for fungal otitis externa should be further investigated
  - study shows correlation, but not causality between topical oto-quinolones and fungal otitis - a larger, prospective study that controlled for confounding factors is necessary to make that claim
Bibliography


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Wall GM, Stroman DW, Roland PS, Dohar J. Ciprofloxacin 0.3%/Dexamethasone 0.1% Sterile Otic Suspension for the Topical Treatment of Ear Infections. The Pediatric Infectious Disease Journal. 2009;28:141-144.


