The “-itis-es”:
Updates on Pediatric Otolaryngologic Infections and Management for the Pediatrician

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Objectives

• To diagnose and treat pediatric patients with acute, chronic and recurrent upper respiratory tract infections using the up-to-date guidelines and recommendations

• Identify when to consult a specialist for further care including surgical intervention

• Be able to use tympanometry in a meaningful way
Outline

- Tonsillitis
- Rhinosinusitis
- Otitis externa
- Otitis media
  - The use of tympanometry for the pediatrician
Disclosures

• I have no relevant financial relationships with the manufacturer(s) of any commercial product(s) and/or provider(s) of commercial services discussed in this CME activity.

• I do sit on the commercial advisory board for ALK Pharmaceuticals for their product Odactra, which is not relevant and unrelated to the contents of this educational presentation.
Tonsillitis
Among school-aged children:

- Incidence of pharyngitis and tonsillitis is quite high
- Not all sore throats are strep though!

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Incidence (per 100 child years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute sore throat</td>
<td>33</td>
</tr>
<tr>
<td>Swab positive GABHS</td>
<td>13</td>
</tr>
<tr>
<td>Serologically confirmed GABHS</td>
<td>8</td>
</tr>
</tbody>
</table>

*Danchin et al, (2007)*
• GABHS
  • Sudden onset of sore throat
  • Age 5–15 years
  • Fever >100.5°F
  • Headache
  • Nausea, vomiting, abdominal pain
  • Tonsilopharyngeal inflammation/erythema
  • Patchy tonsilopharyngeal exudates
  • Palatal petechiae
  • Anterior cervical adenitis (tender nodes)
  • Winter and early spring presentation
  • History of exposure to strep pharyngitis
  • Scarlatiniform rash

• Viral
  • Conjunctivitis
  • Coryza
  • Cough
  • Diarrhea
  • Hoarseness
  • Discrete ulcerative stomatitis
  • Viral exanthema

(Danchin et al, 2007)
Clinical Practice Guideline for the Diagnosis and Management of Group A Streptococcal Pharyngitis: 2012 Update by the Infectious Diseases Society of America

The guideline is intended for use by healthcare providers who care for adult and pediatric patients with group A streptococcal pharyngitis. The guideline updates the 2002 Infectious Diseases Society of America guideline and discusses diagnosis and management, and recommendations are provided regarding antibiotic
Diagnosis

- Rule out Group A Beta-hemolytic Streptococcal (GABHS)
  - Clinical features alone do not reliably discriminate between GABHS infections and viral pharyngitis so we empirically treat them as such
    - "Except when overt viral features like rhinorrhea, cough, oral ulcers, and/or hoarseness are present"
  - In children and adolescents, negative RADT tests should be backed up by a throat culture (strong, high recommendation).
  - Positive RADTs do not necessitate a back-up culture because they are highly specific
  - Anti-streptococcal antibody titers are not recommended in the routine diagnosis of acute pharyngitis as they reflect past but not current events
  - Diagnostic studies for GABHS pharyngitis are not indicated for children <3 years old
    - Rheumatic fever is rare in children <3 years old and the incidence of streptococcal pharyngitis and the classic presentation of streptococcal pharyngitis are uncommon in this age group.
    - Selected children <3 years old who have other risk factors, such as an older sibling with GABHS infection, may be considered for testing
    - Diagnostic testing or empiric treatment of asymptomatic household contacts of patients with acute streptococcal pharyngitis is not routinely recommended

- However again, it is important to realize not all sore throats are strep
  - Only 20-30% of tonsillar and pharyngeal infections in children are GABHS

<table>
<thead>
<tr>
<th><strong>Bacterial</strong></th>
<th><strong>Viral</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A streptococcus</td>
<td>Adenovirus</td>
</tr>
<tr>
<td>Group C and group G streptococcus</td>
<td>Pharyngotonsillitis</td>
</tr>
<tr>
<td>Arcanobacterium haemolyticum</td>
<td>Herpes simplex virus 1 and 2</td>
</tr>
<tr>
<td>Neisseria gonorrhoeae</td>
<td>Coxsackievirus</td>
</tr>
<tr>
<td>Corynebacterium diphtheriae</td>
<td>Rhinovirus</td>
</tr>
<tr>
<td>Mixed anaerobes</td>
<td>Coronavirus</td>
</tr>
<tr>
<td>Fusobacterium necrophorum</td>
<td>Influenza A and B</td>
</tr>
<tr>
<td>Francisella tularensis</td>
<td>Parainfluenza</td>
</tr>
<tr>
<td>Yersinia pestis</td>
<td>EBV</td>
</tr>
<tr>
<td>Yersinia enterocolitica</td>
<td>Cytomegalovirus</td>
</tr>
<tr>
<td>Mycoplasma pneumoniae</td>
<td>HIV</td>
</tr>
<tr>
<td>Chlamydophila pneumoniae</td>
<td>Pharyngoconjunctival fever</td>
</tr>
<tr>
<td>Chlamydophila psittaci</td>
<td>Gingivostomatitis</td>
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<tr>
<td></td>
<td>Herpangina</td>
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<tr>
<td></td>
<td>Common cold</td>
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<tr>
<td></td>
<td>Influenza</td>
</tr>
<tr>
<td></td>
<td>Cold, croup</td>
</tr>
<tr>
<td></td>
<td>Infectious mononucleosis</td>
</tr>
<tr>
<td></td>
<td>CMV mononucleosis</td>
</tr>
<tr>
<td></td>
<td>Primary acute HIV Infection</td>
</tr>
</tbody>
</table>

*Shulman, et al (2012)*
Diagnosis

• It is important to treat acute illness seriously as it may lead to chronic or recurrent disease!

• Important diagnostic considerations
  • Recurrent episodes of pharyngitis associated with laboratory evidence of GABHS pharyngitis consider that the patient may be experiencing >1 episode of bona fide streptococcal pharyngitis at close intervals
  • More commonly however is the possibility that the patient may actually be a chronic pharyngeal GABHS carrier who is experiencing repeated viral infections

Recurrent and chronic tonsillitis is important to understand as a distinct disease from acute tonsillitis

- Palatine tonsils are a concentration of lymphoepithelial tissue that serve a secondary lymphoid organ, initiated immune responses against antigens
  - Greatest function occurs between 3-10 years of age
  - Tissue is found throughout Waldeyer’s Ring and the upper aerodigestive tract
  - Immunocomplexes present antigens to helper T lymphocytes which then proliferate follicular B lymphocytes which create memory B lymphocytes and plasma cells which release antibodies
  - All 5 immunoglobulin types are produced by this process in the tonsil
- In recurrent tonsillitis this system becomes hijacked!

In recurrent tonsillitis:

- The process of antigen transport and presentation is altered
  - M Cells are shed from the tonsil
  - Direct flux of antigens disproportionately expands the population of mature B cells, decreasing immunoglobulin production
- The cells become overwhelmed with antigens
- This becomes worse and worse with each episode of tonsillitis
  - Tonsil hypertrophy occurs
  - A bacterial colony altering the mucoepithelial layer permanently forms protecting and promoting a new biom of antigens (a biofilm)
  - This colony matures and creates resilience and eventually resistance to the immune system as well as to antibiotics
  - This colony can then seed other areas of the airway

Tonsillitis
Biofilms have characteristics that create antimicrobial resistance
  • These characteristics protect the microbes from the host's immune system in nature but also create antimicrobial protection
    • Restricted antimicrobial transmission
    • Alteration of the environment
      • Anoxia
      • pH changes
    • Alteration to flora
      • Polymicrobial
      • Latent and active stages of bacterium exist simultaneously
  • In the presence of even high concentrations of bactericidal antimicrobials, bacteria in biofilms persist
    • This is despite the same bacteria being abundantly sensitive to those antimicrobials in culture plates under planktonic (diffuse) conditions.
      • Microorganisms found in biofilms can be up to 500–1,000 times more tolerant to antibacterial compounds than their planktonic counterparts.

BEFORE WE TALK ANTIBIOTICS:

- Antimicrobial therapy is of no proven benefit as treatment for acute pharyngitis due to organisms other than GABHS
- Exceptions include:
  - Cases of *Corynebacterium diphtheriae* and *Neisseria gonorrhoeae*
  - Abscess formation (normally representative of mixed anaerobic flora)
# CDC Recommendations for antibiotics against GABHS

<table>
<thead>
<tr>
<th>Drug, Route</th>
<th>Dose or Dosage</th>
<th>Duration or Quantity</th>
<th>Recommendation Strength, Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>For individuals without penicillin allergy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penicillin V, oral</td>
<td>Children: 250 mg twice daily or 3 times daily; adolescents and adults: 250 mg 4 times daily or 500 mg twice daily</td>
<td>10 d</td>
<td>Strong, high</td>
</tr>
<tr>
<td>Amoxicillin, oral</td>
<td>50 mg/kg once daily (max = 1000 mg); alternate: 25 mg/kg (max = 500 mg) twice daily</td>
<td>10 d</td>
<td>Strong, high</td>
</tr>
<tr>
<td>Benzathine penicillin G, intramuscular</td>
<td>&lt;27 kg: 600 000 U; ≥27 kg: 1 200 000 U</td>
<td>1 dose</td>
<td>Strong, high</td>
</tr>
<tr>
<td><strong>For individuals with penicillin allergy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cephalexin, oral</td>
<td>20 mg/kg/dose twice daily (max = 500 mg/dose)</td>
<td>10 d</td>
<td>Strong, high</td>
</tr>
<tr>
<td>Cefadroxil, oral</td>
<td>30 mg/kg once daily (max = 1 g)</td>
<td>10 d</td>
<td>Strong, high</td>
</tr>
<tr>
<td>Clindamycin, oral</td>
<td>7 mg/kg/dose 3 times daily (max = 300 mg/dose)</td>
<td>10 d</td>
<td>Strong, moderate</td>
</tr>
<tr>
<td>Azithromycin, oral</td>
<td>12 mg/kg once daily (max = 500 mg)</td>
<td>5 d</td>
<td>Strong, moderate</td>
</tr>
<tr>
<td>Clarithromycin, oral</td>
<td>7.5 mg/kg/dose twice daily (max = 250 mg/dose)</td>
<td>10 d</td>
<td>Strong, moderate</td>
</tr>
</tbody>
</table>

• Amoxicillin has a much better compliance rate than both penicillin and clindamycin
  • Tastes better
  • Dosing schedule is easier
    • Although not FDA approved once a day dosing is as effective as three times a day dosing and with the same efficacy AND failure rate as twice a day dosing

• Resistance
  • In cases where a child fails to respond the therapy, alternative therapy should be considered

• Recurrence
  • In cases where multiple acute episodes occur WITH clearance of symptoms between the encounters one MAY consider the use of the second line therapy
    • Often one or two episodes in the same season can reasonably be treated with the same agent

Brook (2017)
• Macrolides have demonstrated up to a 60% resistance in GABHS in some studies

• Cephalosporins offer reasonable coverage against GABHS
  • HOWEVER... first generation cephalosporins also demonstrate resistance especially against beta-lactamase producing bacteria (BLPB)

<table>
<thead>
<tr>
<th>BLPB</th>
<th>First generation (cephalothin)</th>
<th>Second generation (cefuroxime)</th>
<th>Extended spectrum (cefdinir, cefpodoxime)</th>
<th>Third generation (cefixime, ceftibuten)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>S. aureus</em></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><em>H. influenzae</em></td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><em>M. catarrhalis</em></td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Brook (2017)
Treatment

- Antibiotic recommendations therefore change when treating recurrent and chronic conditions
- There is no good literature on WHEN exactly to change during recurrent tonsillitis
  - How many recurrences and how frequently are they occurring
- The antibiotic choices are CLEAR

<table>
<thead>
<tr>
<th>Acute</th>
<th>Recurrent/Chronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillins (amoxicillin)</td>
<td>Clindamycin, amoxicillin-clavulanate</td>
</tr>
<tr>
<td>Cephalosporins</td>
<td>Metronidazole plus macrolide</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>Penicillin plus rifampin</td>
</tr>
<tr>
<td>Amoxicillin-clavulanate</td>
<td>–</td>
</tr>
<tr>
<td>Macrolides</td>
<td>–</td>
</tr>
</tbody>
</table>

Brook (2017)
In 2019 the AAOHNS published an update to their “Clinical Practice Guideline: Tonsillectomy in Children”.
What is considered a throat infection?

- How the American Academy of Otolaryngology and Head and Neck Surgery (AAO-HNS) defines a throat infection
  - Recorded episode of sore throat with 1 or more of the following:
    - Temperature >38.3°C (101°F)
    - Cervical adenopathy
    - Tonsillar exudate
    - Positive Group A beta-hemolytic streptococcus
  - Be aware:
    - It can be pharyngitis with or without tonsillitis
    - It can be viral or bacterial
    - It DOES NOT have to be streptococcus associated!
  - This is exceedingly important as it is the MAIN criteria for a tonsillectomy in both children AND adults!

When do you send a patient to an otolaryngologist for recurrent tonsillitis?
- How many infections do you need?
  - At least 7 episodes of infection/year for one year
  - At least 5 episodes of infection/year each year for two years
  - At least 3 episodes of infection/year each year for three years
- AKA Paradise Criteria
- Watchful waiting can be an option if recurrent tonsillitis is present however only when the criteria for a tonsillectomy is not met
  - The risks OUTWEIGH the benefits once the Paradise Criteria is met
  - This is NOT a change from previous recommendations
The AAO-HNS identified several modifying factors which qualify a child for a tonsillectomy even if the criteria based on episodes alone are not met:

- Multiple antibiotic allergies or intolerance WITH recurrent tonsillitis
- Periodic Fever, Aphthous stomatitis, Pharyngitis and Adenitis (PFAPA)
- History of >1 peritonsillar abscess
- Recurrent infections requiring hospitalization
- Numerous repeated infections in a single household (so called “ping pong spread”)
- Obstructive sleep-disordered breathing (oSDB)

  - Note that the term Obstructive Sleep Apnea is only used by the AAO-HNS as well as the American Academy of Pediatrics (AAP) and the American Academy of Sleep Medicine when oSDB is accompanied by an abnormal polysomnogram
  - Polysomnography is NOT NECESSARILY needed prior to a tonsillectomy in a child with oSDB

• Obstructive Sleep Disorder Breathing Recommendations

• Polysomnography should be PERFORMED before tonsillectomy if:
  • Child <2 years of age
  • Obese
  • Down’s Syndrome
  • Craniofacial abnormalities
  • Neuromuscular Disorders
  • Sickle Cell Disease
  • Mucopolysaccharidoses

• Polysomnography should be ADVOCATED before tonsillectomy if:
  • OSDB suspect without the above criteria but the need for a tonsillectomy is uncertain
  • OSDB is suspect but there is disconcordence between the physical examination and the reported severity of the disease

• Sleep medicine for children is changing!
  • This is a hot topic in pediatric otolaryngology!
  • It is not just tonsils and adenoids any more!
  • It’s not just family assessment and sleep studies!

Modern pediatric sleep medicine should include:

- Highly directed surgery for children in certain populations
- Drug induced sleep endoscopy (DISE) in SELECT patients
  - Infants with OSA
  - DISE does change treatment decisions in otherwise healthy children and infants with OSA. *Boudewyns, et al (2018)*
    - DISE altered the therapeutic decision-making in up to 1/3 to 1/4 who did not undergo adenotonsillectomy
    - DISE resulted in comparable treatment outcomes when compared to standard treatment with adenotonsillectomy

HOWEVER the role of DISE is in cases without hypertrophied tonsils or adenoids, in the cases where the OSA is refractory to adenotonsillectomy... including infants
• Side notes on perioperative medications that you might want to know!
  • The use of perioperative antibiotics is not recommended
  • Pain control
    • Clinicians should recommend ibuprofen, acetaminophen OR BOTH for pain control after a tonsillectomy
    • CODEINE SHOULD NEVER BE PRESCRIBED after a tonsillectomy for children <12
      • Risks clearly outweigh the benefits in all populations and studies
Rhinosinusitis
Differential

- Acute infectious rhinosinusitis
- Allergic rhinosinusitis
- Recurrent infectious rhinosinusitis
- Chronic rhinosinusitis
  - With or without polyposis
Clinical Practice Guideline for the Diagnosis and Management of Acute Bacterial Sinusitis in Children Aged 1 to 18 Years

abstract

OBJECTIVE: To update the American Academy of Pediatrics clinical practice guideline regarding the diagnosis and management of acute bacterial sinusitis in children and adolescents.

METHODS: Analysis of the medical literature published since the last version of the guideline (2001).

RESULTS: The diagnosis of acute bacterial sinusitis is made when a child with an acute upper respiratory tract infection (URI) presents with (1) persistent illness (nasal discharge [of any quality] or daytime cough or both lasting more than 10 days without improvement), (2) a worsening course (worsening or new onset of nasal discharge, daytime cough, or fever after initial improvement), or (3) severe onset (concurrent fever [temperature $\geq 39^\circ$C/102.2$^\circ$F] and purulent nasal discharge for at least 3 consecutive days). Clinicians should not obtain imaging studies of any kind to distinguish acute bacterial sinusitis from viral URI because they
Signs and symptoms: acute rhinosinusitis

- Acute rhinosinusitis ALWAYS begins as either viral or allergic in nature
  - Acute bacterial rhinosinusitis can be thought of as a complication of a viral infection or allergic condition in most cases

- What does the viral infection of the nose and sinuses in children look like?
  - Duration is typically 5-7 days with
  - Early fever, headache and myalgia (first 24-48 hours)
  - Clear nasal discharge, congestion and obstruction
  - Cough (productive or non-productive)
  - The nasal discharge often goes from clear to more mucoid or even purulent then improves WITHOUT antibiotics
  - Some respiratory symptoms often tend to linger up to 10-12 days

Signs and symptoms: acute rhinosinusitis

- Symptoms of acute bacterial rhinosinusitis and viral rhinosinusitis or even severe acute allergic rhinosinusitis often overlap
  - Allergic rhinosinusitis patients are often more susceptible and in some studies overlap in demographic (more likely to be in daycare, live in urban settings) as infectious rhinosinusitis patients
  - For this reason we use PERSISTENCE of symptoms or WORSENING of symptoms as the hallmark for diagnosis in bacterial infection

- Often physical findings are also not helpful
  - Erythema or enlargement of turbinates is not specific
  - Percussion of the sinuses is not specific
  - Transillumination is unpredictable and difficult in children
  - Nasal cultures are unreliable and poor indicators of causative pathogen or to target therapy

- So diagnosis is tricky

Diagnosis: acute rhinosinusitis

- How to distinguish BACTERIAL rhinosinusitis in children
  - Persistent illness OR daytime cough OR both lasting >10 days without improvement
  - A worsening course of disease
    - Increase in symptoms (discharge, cough, fever) after initial improvement
  - Severe onset of disease
    - Temperature >39C (102.2F) and purulent nasal discharge for >3 consecutive days
    - Remember in viral disease
      - Fever, constitutional symptoms PRECEDE severe respiratory symptoms
      - Be suspicious of a bacterial component if there is early on congruence of symptoms

Diagnosis: acute rhinosinusitis

Images

- There is no efficacy in obtaining images of any kind with uncomplicated acute rhinosinusitis \textit{Wald, et al (2013)}
- Computerized tomographic imaging should be obtained if:
  - Child is suspected of having orbital, bony or central nervous system involvement in ACUTE sinusitis
    - Proptosis/decreased extraocular eye movement
    - Orbital or frontal cellulitis (with or without mass, ie: Pott’s Puffy Tumor)
    - Photo/phonophobia
    - Debilitating headache
    - Focal neurologic findings \textit{Wald, et al (2013)}
  - OR Child has a diagnosis of CHRONIC rhinosinusitis with or without polyps \textit{Briezke, et al 2013}
Treatment: acute rhinosinusitis

- Initial treatment should be the same FOR ALL FORMS OF ACUTE RHINOSINUSITIS
  - Nasal corticosteroids
    - Data on this for children is not as rich as in adults however there is strong evidence that support the use of the drug class for rhinitis
Treatment: acute rhinosinusitis

- Antihistamines and decongestants have no benefit *(Shaikh, 2014)*
  - While often used in infectious rhinosinusitis in children, the resolution of disease tends to be no different in duration or complication
  - Multiple harmful side effects exist

- Lavage or not to lavage?
  - In the same meta-analysis demonstrating that antihistamines and decongestants have no benefit, nasal lavage was also included *(Shaikh, 2014)*
    - There was no improvement in resolution of disease or complication rate
    - Unlike antihistamine and decongestant use however there are no harmful side effects
  - Multiple studies demonstrate that there is a clear benefit with nasal lavage
    - Studies using quality of life parameters have demonstrated great symptomatic relief in both infectious and allergic rhinosinusitis pediatric patients with improvement in:
      - Rhinorrhea
      - Nasal congestion
      - Throat discomfort
      - Cough
      - Sleep quality

Treatment: acute rhinosinusitis

- Antibiotic therapy for 10 days for ARS (and possibly CRS?)
  - Amoxicillin (90mg/kg/day)
  - Amoxicillin with clavulanate (90mg/kg/day)
- Antibiotics should be offered to any child with a:
  - Severe onset of disease (Fever >39C, purulent discharge >3 days)
  - Worsening course of disease (>3 days)
  - Persistent disease (>10 days)

Treatment: acute rhinosinusitis

- Augmenting therapy after reassessing
  - Offer symptomatic relief initially THEN antibiotic therapy after 3 days after 3 days of the initial therapy
  - Offer first line antibiotic therapy THEN second line if no improvement after 3 days of the initial therapy

- Any child with systemic illness, complications of sinusitis or who is not tolerating oral antibiotics should be admitted for parenteral antibiotics.

The American Academy of Otolaryngology guidelines of Allergic Rhinitis include pediatric patients above the age of 2.
Signs and symptoms: allergic rhinosinusitis

- Acute allergic rhinosinusitis in children
  - Often also have general signs or other conditions of atopy
    - Asthma or lower respiratory symptoms
    - Eczema/atopic dermatitis
    - Allergic conjunctivitis
    - Triggers, family history
- Lingering, subtle symptoms
  - Persistent clear nasal discharge (thin or thick, but clear)
  - Nasal obstruction
  - Sneezing
  - Allergic salute/itchy nose
  - Venous congestion
  - Adenoid hypertrophy
  - Recurrent middle ear effusions
  - Chronic cough, often dry
  - Pallor of the turbinates
- Generally these are not “sick” kids
  - No fevers, myalgias, constitutional symptoms

Schuler and Montejo (2019)
Treatment:

allergic rhinosinusitis

• Treatment
  • Nasal corticosteroids can be used as first line therapy, first as monotherapies then as combination with second generation antihistamines
    • Chosen first when rhinosinusitis is the ONLY atopic system affected
  • Second generation oral antihistamines can be used as first line therapy, first as monotherapies then as combination with nasal corticosteroids
    • Chosen first when more than one system is involved
  • Nasal antihistamines can also be offered as first line therapy or in combination with nasal steroids for children older than 6 years of age
    • No benefit used concurrently with oral antihistamines
    • Lack systemic affect of oral antihistamines
  • Leukotriene inhibitors should be used as a second line or combination agent for allergic rhinitis
    • SHOULD NOT be used as first line agents
  • Immunotherapy should be offered once combination therapies fail to control symptoms
  • Inferior turbinate reductions can be performed for patients not responsive to combination therapy if nasal obstruction is a symptom

More Diagnosis: allergic rhinosinusitis

Clinicians should perform and interpret (or refer to a clinician who can) specific IgE (skin or blood) allergy testing for patients with a clinical diagnosis of allergic rhinitis who:

- Do not respond to empiric treatment
- When the diagnosis is uncertain
- When knowledge of the specific causative allergen is needed to target therapy

Chronic Rhinosinusitis

Clinical Consensus Statement: Pediatric Chronic Rhinosinusitis

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Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

Abstract

Objective. To develop a clinical consensus statement on the optimal diagnosis and management of pediatric chronic rhinosinusitis (PCRS).

Methods. A representative 9-member panel of otolaryngologists with no relevant conflicts of interest was assembled to consider opportunities to optimize the diagnosis and management of PCRS. A working definition of PCRS and the scope of pertinent otolaryngologic practice were first established. Patients of ages 6 months to 18 years without craniofacial syndromes or immunodeficiency were

percent to 13% of childhood viral upper respiratory tract infections may progress to acute rhinosinusitis\(^1,4\) with a proportion of these progressing to a chronic condition. PCRS may also coexist and/or be exacerbated by other widespread conditions such as allergic rhinitis and adenoid disease\(^3,9\) and some suggest the incidence of PCRS may be rising\(^10\). In addition, PCRS has a meaningful impact on quality of life\(^11\) with its related adverse effects potentially exceeding that of chronic respiratory and arthritis disease.\(^12\) PCRS also has the potential to exacerbate asthma\(^13,14\), a condition that negatively affects 2% to 20% of children.

In spite of its prevalence and impact on affected families, many aspects of PCRS remain ill-defined. At the most basic level, even the diagnostic definition of PCRS has not been concretely elucidated among our specialty societies, creating
Chronic Rhinosinusitis

- Definition and distinction of pediatric chronic rhinosinusitis (CRS):
  - 90 days of two or more of the following symptoms:
    - nasal congestion
    - nasal discharge
    - facial pressure/pain
    - cough
  - Accompanied either by clinical evidence of:
    - nasal polyps
    - mucosal edema
    - discharge
    - relevant findings on sinus CT scan

- Why is this different than ARS or Allergic rhinosinusitis
  - Biofilms
  - Polyposis
    - Distinct disease state from other rhinosinusitis (similar to adults)
    - Must assess for underlying disorders and comorbid conditions
  - Associated with life-long upper airway problems if not properly addressed

Briezke, et al 2013
Treatment: CRS

- Chronic rhinosinusitis should be treated with nasal corticosteroids as a first line therapy
- Again unless there is atopy antihistamines should not be used
- Decongestants should never be used for CRS in children

Briezke, et al 2013)
When should you refer to an otolaryngologist?
- Recurrent sinusitis
  - >4 episodes in 1 calendar year
  - Patient should go >10 days asymptomatic between episodes
- Chronic sinusitis
  - >90 of continuous symptoms
  - Must be evaluated for underlying condition
    - Allergic rhinitis
    - Nasal polyposis
    - Immunologic deficit
    - Ciliary dysmotile disorder
- In either case:
  - Allergy testing maybe useful
  - Nasal endoscopy maybe useful
  - CT of sinuses maybe useful

Treatment: CRS

- Surgery is never the first option!
  - Adenoidectomy for chronic rhinosinusitis
    - This is an indication recommended by the AAO-HNS!
      - Largely having to do with biofilms
      - Tonsillectomy does not have ANY benefit in isolated rhinosinusitis
  - Sinus surgery in children
    - Acute sinusitis patients with ocular or neurologic findings
    - Chronic sinusitis patients who fail medical management of adenoidectomy or BOTH
  - Rhinologic surgery in children
    - Turbinectomies are highly effective in improving nasal obstruction especially for sleep apnea
    - Not necessarily beneficial for rhinosinusitis although often done

*Briezke, et al 2013*
Otitis Externa
Clinical Practice Guideline: Acute Otitis Externa

Richard M. Rosenfeld, MD, MPH, Seth R. Schwartz, MD, MPH, C. Ron Cannon, MD, Peter S. Roland, MD, Geoffrey R. Simon, MD, Kaparaboyna Ashok Kumar, MD, FRCS, William W. Huang, MD, MPH, Helen W. Haskell, MA, and Peter J. Robertson, MPA

AOE from other causes of otalgia, ototrahea, and inflammation of the external ear canal; (2) clinicians should assess the patient with diffuse AOE for factors that modify management (nonintact tympanic membrane, tympanostomy tube, diabetes, immunocompromised state, prior radiotherapy); (3) clinicians should prescribe topical preparations for initial therapy of diffuse, uncomplicated AOE; (4) clinicians should enhance the delivery of topical drops by informing the patient how to administer topical drops and by performing aural toilet, placing a wick, or both, when the ear canal is obstructed; (5) clinicians should prescribe a non-ocotoxic preparation when the

Abstract

Objective. This clinical practice guideline is an update and replacement for an earlier guideline published in 2006 by the American Academy of Otolaryngology—Head and Neck Surgery Foundation. This update provides evidence-based recommendations to manage acute otitis externa (AOE), defined as diffuse inflammation...
• Symptoms of acute otitis externa (AOE) include:
  • Rapid onset in the past 3 weeks
  • AND… symptoms of inflammation of the external auditory canal (ECA)
    • Otalgia, jaw pain (70%)
    • Itchiness (60%)
    • Fullness (22%)
    • Hearing loss
  • AND… signs of inflammation of the ECA
    • Tenderness of tragus/pinna
    • Diffuse ECA edema/erythema
    • WITH OR WITHOUT otorrhea, lymphadenopathy, cellulitis of the outer ear

• Very important to distinguish AOE from other diseases
  • Acute otitis media (AOM)
    • Good pneumatic otoscopy or tympanometry generally rules out the middle ear
    • If there is otorrhea WITH AOM and without a tympanostomy tube, there may or may not be inflammation of the ECA and may or may not be AOE too
  • Cholesteatoma
  • Chronic otitis externa or malignant otitis externa

• It is also important to recognize factors that would change the management and course of the disease
  • Diabetic or immunocompromised patients
  • Perforated tympanic membrane
  • Tympanostomy tube
Acute otitis externa

- Pathophysiology
  - Predisposing factors are well-known
    - Humidity and prolonged water exposure
    - Dermatologic conditions (eczema, seborhea, psoriasis)
    - Anatomy (narrow or tortuous canals)
    - Occlusion in the EAC (severe cerumen, exostoses, foreign bodies)
    - Trauma (cerumen removal, inserting ear plugs or buds)
    - Otorhea CAUSED by middle ear disease
  - 98% of AOE in the US is bacterial and it is often polymicrobial
    - 20-60% prevalence of Pseudomonas aeruginosa
    - 10-70% prevalence of Staphylococcus aureus
  - In immunocompromised patients, those with skin conditions and in chronic cases biofilms often lend to coinfection with fungus
    - Fungus is exceedingly rare in isolated AOE however if it is found:
      - Asperigillus spp (60-90%)
      - Candida spp (10-40%)

Rosenfeld, et al (2014)
Treatment

- Prevention does help!
  - Dermatoses
    - Topical corticosteroids
    - Gentle skin care
    - Control underlying condition
  - Proper ear cleaning
    - Ears are self cleaning organs
    - Over debridement is common in AOE patients
    - Keep ear buds and plus clean with peroxide or alcohol
  - Avoid dirty water contact
  - Keep ears dry!

Rosenfeld, et al (2014)
Topical antibiotics are THE drug of choice
   Clinicians SHOULD NOT prescribe systemic antibiotics as a primary treatment modality
      Unfortunately 20-40% of patients with AOE receive oral antibiotics (with or without topical therapy) as a primary treatment modality!
   Exceptions to the use of topical only therapy include:
      - Extension outside of ear canal
      - Presence of specific host factors
      - Otorhea DUE TO AOM without a tympanosotomy tube
Topical antibiotics have a VERY low resistance
   High local concentration of the drug in the ear canal eradicates all susceptible organisms
   ANY FDA approved agent is acceptable with or without corticosteroid for 7-10 days
      - Ofloxacin
      - Ciprofloxacin
      - Neomycin-Polymyxin-Hydrocortisone

Rosenfeld, et al (2014)
Treatment

- Non-quinolone versus quinolone-containing otic drops
  - Cure rates
    - Some studies do show that 87% versus 95% of patients with AOE have a bacteriologic cure after therapy complete with non-quinolone versus quinolone containing drops
    - There is NO fundamental advantage to one drop over another

- Be cognizant of pricing and dosing
  - Some quinolone preparations can cost hundreds of dollars for a single treatment course
  - Neomycin-Polymyxin-Hydrocortisone should be dosed four times daily versus quinolones which are generally twice daily
• First cause no harm!
  • If there is a tympanostomy tube or a perforation is suspect do not prescribe ototoxic drugs (aminoglycocides, acidic or alcohol based drugs)
  • Topical QUINOLONES are THE antimicrobials of choice (and the ONLY ones FDA approved) for AOM with a tympanostomy tube or perforation or placement in the middle ear
Treatment

- Assess for pain and treat accordingly
  - Acetaminophen or non-steroidal anti-inflammatory drugs are the recommendation
  - Topical analgesics are NOT recommended
    - They may mask the progression of disease
    - Should NEVER be used with a tympanic membrane perforation or when a tympanostomy tube is present
• Make sure topical medications WILL work
  • Aural toilet and wicks
    • Removal of the canal contents by the healthcare practioner can be important in management of the disease is there is an obstruction
    • Placement of a wick should occur if the healthcare practioner CANNOT see a tympanic membrane or there is severe canal edema
  • Patient education
    • Best practices for administration
    • Keep ear dry
      • Refrain from submersion in water for 7-10 days
      • May use clean well fitting ear plugs for competitive swimmers
      • Use of cotton balls and clean well fitting ear plugs are useful for bathing
    • Do not remove wick
Table 9. Instructions for patients.

- If possible, get someone to put the drops in the ear canal for you.
- Lie down with the affected ear up. Put enough drops in the ear canal to fill it up.
- Once the drops are in place, stay in this position for 3 to 5 minutes. Use a timer to help measure the time. It is important to allow adequate time for the drops to penetrate into the ear canal.
- A gentle to-and-fro movement of the ear will sometimes help in getting the drops to their intended destination. An alternate method is to press with an in/out movement on the small piece of cartilage (tragus) in front of the ear.
- You may then get up and resume your normal activities. Wipe off any excess drops.
- Keeping the ear dry is generally a good idea while using ear drops.
- Try not to clean the ear yourself as the ear is very tender and you could possibly damage the ear canal or even the eardrum.
- If the drops do not easily run into the ear canal, you may need to have the ear canal cleaned by your clinician or have a wick placed in the ear canal to help in getting the drops into the ear canal.
- If you do have a wick placed, it may fall out on its own. This is a good sign as it means the inflammation is clearing and the infection subsiding.
- Do not remove the wick yourself unless instructed to do so.
Treatment

- Reassess patient 48-72 hours if symptoms fail to improve
- When to send to an otolaryngologist?
  - Persistent disease not responding to topical antibiotics when properly given
  - Identification of a disease causing otorrhea OTHER than AOE

Rosenfeld, et al (2014)
Otitis Media
Differential

- Acute Otitis Media (AOM)
  - “Ear infection”
    - 60% of children under the age of 3 years have experienced the disease at least once
    - Approximately 24% display 3 or more episodes (Marchisio, et al. 2019)

- Otitis Media with Effusion (OME)
  - “Fluid in the ear”
    - This is the “occupational hazard” of early childhood
      - 90% of children will have OME prior to beginning school
      - The average child will have 4 episodes of OME each year (Rosenfeld, et al. 2016)
The two disorders beget each other
- Child is more likely to have OME if they have had AOM
- Child is more likely to have AOM if they have OME
- Both are diseases rooted in dysfunction the eustachian tube

But the two need to be distinguished and are not managed the same
- Even the guidelines are confusing!
More recently the Italian Society of Pediatrics updated their recommendations *Marchisio, et al. 2019*
Clinical Practice Guideline: Otitis Media with Effusion (Update)

Richard M. Rosenfeld, MD, MPH, Jennifer J. Shin, MD, SM, Seth R. Schwartz, MD, MPH, Robyn Coggins, MFA, Lisa Gagnon, MSN, CPNP, Jesse M. Hackell, MD, David Hoelting, MD, Lisa L. Hunter, PhD, Ann W. Kummer, PhD, CCC-SLP, Spencer C. Payne, MD, Dennis S. Poe, MD, PhD, Maria Veling, MD, Peter M. Vila, MD, MSPH, Sandra A. Walsh, and Maureen D. Corrigan

Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

Abstract

Objective. This update of a 2004 guideline co-developed by the American Academy of Otolaryngology—Head and Neck Surgery Foundation, the American Academy of Pediatrics, and the American Academy of Family Physicians, provides evidence-based recommendations to assist clinicians and it applies to any setting in which OME would be identified, monitored, or managed. This guideline, however, does not apply to patients <2 months or >12 years old.

Action Statements. The update group made strong recommendations that clinicians (1) should document the presence of middle ear effusion with pneumatic otoscopy when diagnosing OME in a child; (2) should perform pneumatic otoscopy to assess for OME in a child with otalgia, hearing loss, or both; (3) should obtain tympanometry in children with suspected OME for...
• Target of both these guidelines was about the same
  • AOM: children 6 months to 12 years, OME: children 2 months to 12 years
  • With or without developmental disabilities
  • With or without underlying conditions that predispose children to disease
Pathophysiology: AOM

- Pathogenesis is well known however often misunderstood!
  - Viruses are present in the vast majority of AOM
    - This does not mean that there is NO bacterial component however
    - The vast majority of viral AOM have bacterial coinfection
  - Pathologic bacteria has not changed!
    - *Streptococcus pneumoniae*
    - *Haemophilus influenzae*
    - *Moraxella catarrhalis*
    - *Streptococcus pyogenes*
  - Luckily REGARDLESS of whether treated with an antibiotic or not most AOM with pathogenic bacteria resolve on their own
    - This is something we have understood for a VERY long time

Bacteria isolated | Resolution without antibiotics 2-7 days later
--- | ---
*S. pneumoniae* | 19%
*H. influenzae* | 48%
*M. catarrhalis* | 75%

Howie and Ploussard (1972)
Diagnosis: AOM

- Many investigators have attempted to create scoring systems and criteria for diagnosis of AOM
  - Most of them are poor and the AAP does NOT recommend their use

- The hallmark symptoms from the otolaryngologic literature is:
  - Acute onset of otalgia with bulging, cloudy, tympanic membrane with impaired movement, with or without a fever
  - This is not FAR from the truth
    - 50-60% of children have otalgia with AOM
    - The combination of “cloudy” “bulging” and “decreased mobility” has been found to be the single most predictive set of findings for the presence of bacteria in AOM!
      - Interestingly enough, erythema was a poor prognostic indicator when described as “slight” and only modestly better when described as “hemorrhagic”, “strongly red”, or “moderately red”

<table>
<thead>
<tr>
<th>Finding</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloudy+Bulging+Decreased mobility</td>
<td>95%</td>
<td>85%</td>
</tr>
<tr>
<td>Cloudy</td>
<td>74%</td>
<td>93%</td>
</tr>
<tr>
<td>Bulging</td>
<td>97%</td>
<td>51%</td>
</tr>
</tbody>
</table>

Diagnosis: AOM

- Findings from multiple studies do demonstrate that BULGING alone is highly indicative of a middle ear infection!
    - A single otolaryngologist at Tampere, Finland and a single pediatrician at Oulu, Finland examined subjects
    - Color, position and motility were recorded
    - Myringotomy and aspiration were performed if MEE was suspected.
    - The study is NOT perfect
  - Bulging is important to recognize!


Diagnosis: OME

- Symptoms
  - Hearing Loss
  - Speech language or learning delay
    - Assess and interview patient and family understand baseline language, sensory, physical, cognitive, or behavioral factors
  - Otalgia
    - So are all children with otalgia AND effusion to be treated as AOM or should be assumed to have OME?

- Signs
  - USE PNEUMATIC OTOSCOPY
    - Presence of middle ear effusion with the lack of movement is highly diagnostic
    - All children should be evaluated with pneumatic otoscopy if there is the complaint of HEARING LOSS and/or OTALGIA

Rosenfeld, et al (2016)
Diagnosis: OME

• USE TYMPANOMETRY
  • All children who have a QUESTIONABLE diagnosis of middle ear effusion after pneumatic otoscopy is performed or attempted

• USE AGE APPROPRIATE AUDIOGRAPHY
  • If OME persists longer than 3 months
  • For any at-risk children

• LOOK FOR THAT CLOUDY BULGE!!!
• Measures the “admittance” or “compliance” of the tympanic membrane over different applied pressures

• How this works:
  • In order to provide these pressure a seal is important
    • The probe has different size “plugs” that provide a seal at the entrance to the external ear canal.
    • The tip of the probe has a pressure transducer that changes the pressure in the external ear canal from negative, through atmospheric pressure, to positive pressure.
  • While the pressure is changing, a sound transmitter sends a sound wave to the tympanic membrane.
  • The wave that is reflected from the TM is then picked up by a microphone in the probe.
  • The tympanometer measures the energy of the reflected sound.
Tympanometry

• ECV: external canal volume (0.5-1.2cc)
  - Large volume may indicate perforation
  - Small volume may indicate obstruction

• PEAK: peak compliance of the tympanic membrane

• GR: gradient measures the width of the tracing

• X-axis: middle ear pressure
• Y-axis: compliance
Tympanometry
• Type A
  • Peak compliance > 0.2 ml, < 1.4 ml near 0 daPa middle ear pressure
  • Normal middle ear function

• Type As
  • Peak compliance < 0.2 ml near 0 daPa middle ear pressure
  • “Stiff middle ear”

• Type Ad
  • Peak compliance > 1.4 ml near 0 daPa middle ear pressure
  • Highly mobile middle ear
Tympanometry

• Type B
  • No peak anywhere on tracing
  • Fluid in middle ear place
    • A gradient greater than 150 daPa is often associated with a collection of fluid in the middle ear space.
    • The combination of a large gradient (>150 daPa) and low compliance (<0.2 cc) is associated with a 95% or greater likelihood of a middle ear effusion.
  • Perforation OR poor seal
    • Very large volume but little compliance
    • PAY ATTENTION TO THE EVC!
Tympanometry
Tympanometry

- Type C
  - Regardless of Peak middle ear pressure of -100 daPa or less
  - Intimately associated with retraction of the tympanic membrane and eustachian tube dysfunction

Photos from Alper and Olszewska, 2017
Treatment: AOM

- Treatment for AOM without otorrhea depends on three key points
  - Severe versus not severe
    - New onset moderate or severe otalgia
    - Temperature 39°C [102.2°F]
    - Otalgia >48 hours
  - Age
    - Younger (6-23 months)
    - Older (>23 months)
  - Bilateral versus unilateral disease

\[ \text{this is the hallmark of AOM!} \]
\[ \text{this is confusing} \]
<table>
<thead>
<tr>
<th>Age</th>
<th>Young children (6-23m)</th>
<th>Older children (&gt;23m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Otorrhea with AOM</td>
<td>Otorrhea present</td>
<td>AOM only</td>
</tr>
<tr>
<td>Severity</td>
<td>Severe</td>
<td>Not severe</td>
</tr>
<tr>
<td>Laterality</td>
<td>Bilateral</td>
<td>Unilateral</td>
</tr>
<tr>
<td>Antibiotic or not?</td>
<td>Yes</td>
<td>Maybe</td>
</tr>
</tbody>
</table>

- **Antibiotic use for AOM**

  - **Maybe?**:
  - AAP guidelines offer two options:
    - Observation
    - Antibiotics

Treatment: AOM

- How not to over prescribe antibiotics?
  - USE other clinical signs and symptoms to distinguish between AOM and OME!
    - Temperature can be VERY useful
    - Make sure the child does not have dental or temporomandibular joint issues
  - Educate family
  - Agreed observation
    - “When observation is used, a mechanism must be in place to ensure follow-up and begin antibiotic therapy if the child worsens or fails to improve within 48 to 72 hours of onset of symptoms” (Key Action Statement 3C; Lieberthal, et al 2013)
  - There are multiple PROVEN ways to do this
• “Wait and see prescriptions” or “WASP” Spiro, et al (2006)
  • Give the patient’s family a prescription for antibiotics to be used only if the symptoms became worse
  • Initial studies on this technique demonstrated:
    • Equivocal resolution of symptoms and recurrence rates between antibiotic and WASP groups”
    • WASP parents began the prescription for:
      • Fever (60%)
      • Ear pain (34%)
      • Fussy behavior (6%).
    • 62% of children in the WASP group DID NOT receive the antibiotic

• “Safety net antibiotic prescriptions” or “SNAP”
  • The script can be dated 48-72 hours from when symptoms started
  • The script should only be used for persistent or worsening symptoms
  • Similar outcome to “WASP”

• Many physicians simply just make it easy to contact them for an antibiotic if fever begins, otalgia becomes severe or there is persistence of disease

• Close follow up
• Non-penicillin allergic children:
  • High dose Amoxicillin for 7 days UNLESS:
    • Child has received amoxicillin in the last 30 days
    • Child has concurrent purulent conjunctivitis
    • Child has a history of recurrent AOM unresponsive to amoxicillin within 72 hours of beginning the antibiotic for a documented ear infection
    • Some studies show 5 days are adequate for children 6 and older
  • For all other cases an antibiotic with beta-lactamase coverage should be used

TABLE 5: Recommended Antibiotics for (Initial or Delayed) Treatment and for Patients Who Have Failed Initial Antibiotic Treatment

<table>
<thead>
<tr>
<th>Initial Immediate or Delayed Antibiotic</th>
<th>Recommended First-line Treatment</th>
<th>Alternative Treatment of Penicillin Allergy</th>
<th>Recommended</th>
<th>Alternative Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin (80-90 mg/kg per day in 2 divided doses)</td>
<td>Cefuroxime (600 mg/kg per day in 2 divided doses)</td>
<td>Amoxicillin-clavulanate&lt;sup&gt;a&lt;/sup&gt; (90 mg/kg per day of amoxicillin, with 6.4 mg/kg per day of clavulanate (amoxicillin to clavulanate ratio, 14:1) in 2 divided doses)</td>
<td>Ceftriaxone (50 mg IM or IV for 3 d)</td>
<td>Ceftriaxone (50 mg IM or IV for 3 d)</td>
</tr>
<tr>
<td>or</td>
<td>Cefuroxime (600 mg/kg per day in 2 divided doses)</td>
<td>or</td>
<td>Ceftriaxone (50 mg IM or IV for 3 d)</td>
<td>or</td>
</tr>
</tbody>
</table>

<sup>a</sup> May be considered in patients who have received amoxicillin in the previous 50 d or who have the otitis-conjunctivitis syndrome.

Treatment: AOM

- Analgesia for AOM:
  - Recommendation is NSAIDS and/or Tylenol

- Preventative medicine
  - Vaccinations reduce AOM prevalence
    - 30% to 55% efficacy of influenza vaccine in prevention of AOM during the respiratory illness season
    - Pneumococcal vaccine is more controversial in reducing AOM
  - Breastfeeding reduces AOM prevalence
  - Italian guidelines do explore MANY other preventative measures
    - Passive smoking
    - Environmental pollutants
    - Nasal irrigation

- Other medications for AOM:
  - Mixed data on the use of xylitol, corticosteroids, decongestants and antihistamines in the absence of rhinorhea or other symptoms

_Lieberthal, et al (2013)_
Treatment: AOM

- When conservative management fails refer to an otolaryngologist for tympanostomy tube placement
- The threshold for tympanostomy tube placement for AOM:
  - 3 AOM episodes in 6 months
  - 4 AOM episodes in 12 months, with one episode in the preceding 6 months
  - Persistent OME for 3 months with hearing loss or speech delay
  - At risk children with recurrent AOM or OME

Treatment: OME

- Effusions without overt infection for less than 3 months
  - Children NOT at risk without other conditions
    - Watchful waiting \textbf{without} the use of the following:
      - Antihistamines or decongestants
      - Antibiotics
      - Intranasal or systemic steroids
    - Should reevaluate, at 3- to 6-month intervals until:
      - The effusion is no longer present
      - Significant hearing loss is identified
      - Structural abnormalities of the eardrum or middle ear are suspected
  - Children NOT at risk with underlying condition
    - Address the underlying medical condition (allergies, etc)
    - Continue to observe the child every 3 months
  - Children at risk
    - Hearing loss is identified
      - Audiogram and/or tympanostomy tube placement
    - Structural abnormalities of the eardrum or middle ear are suspected
      - Further work-up and evaluation by otolaryngologist

\textit{Rosenfeld, et al (2016)}
• Indications for tympanometry tube placement
  • Children <4 years of age with OME alone
    • Tympanostomy tubes only
    • UNLESS a distinct indication exists (nasal obstruction, chronic adenoiditis) for adenoidectomy
  • Children >4 years of age with OME or AOM alone
    • Tympanostomy tubes, adenoidectomy, or both

• Multiple metanalyses delineated in the guidelines demonstrate
  • Children <4 years old showed no clinically important benefits for adenoidectomy for middle ear disease alone
  • Children >4 years old:
    • Spent 50 fewer days with OME over the next 12 months
    • Had lower failure rates (51% vs 70%)
      • In the metanalyses failure:
        • Failure at 12 months was defined as additional surgery
        • Recurrent AOM
        • Middle ear effusion at least 50% of the time
        • Average hearing improvement <10-dB HL.
    • Lower rate of future surgery (2% vs 19%)

Rosenfeld, et al (2016)
So when do we do an adenoidectomy in children?

- Chronic or recurrent adenoiditis
- Sleep-disordered breathing
  - Despite recommendations from both the AAP and AAOHNS, in non-obese patients with moderate OSA and small tonsils multiple studies have shown comparable benefits with adenoidectomy alone with less complications
  - DISE helps delineate these children!
- Nasal airway obstruction
- Chronic rhinosinusitis
- Recurrent AOM or OME >3 months in patients over the age of 4

_Schupper, et al (2018)_
Clinical Practice Guideline: Tympanostomy Tubes in Children

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Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

Abstract

Several randomized controlled trials (RCTs) have found that tympanostomy tube insertion in children with a single episode of otitis media with effusion (OME) of less than 3 months' duration does not reduce the risk of recurrent acute OME or improve hearing. However, these trials did not address the role of tympanostomy tubes in children with recurrent acute OME or OME with complications such as cholesteatoma. Therefore, the aim of this guideline is to provide evidence-based recommendations for the use of tympanostomy tubes in children with acute OME.

The panel made recommendations that (1) clinicians should not perform tympanostomy tube insertion in children with a single episode of OME with effusion (OME) of less than 3 months' duration; (2) clinicians should obtain an age-appropriate hearing test if OME persists for 2 weeks or longer (chronic OME); (3) clinicians should consider tympanostomy tube insertion in children with recurrent acute OME; and (4) clinicians should consider tympanostomy tube insertion in children with OME with complications such as cholesteatoma.
Another well discussed statement in the guideline is KAS 7:

- “Clinicians should not perform tympanostomy tube insertion in children with recurrent acute otitis media who do not have middle ear effusion in either ear at the time of assessment for tube candidacy.”

Exceptions to this include:

- Children with histories of severe or persistent AOM
- Immunosuppression
- Prior complication of otitis media

The 2013 Guidelines reviewed multiple sources showing that in children without effusion on surgical evaluation:

- An average of 41% of children had no additional episodes of AOM while on placebo for a median duration of 6 months
- An average of 83% had only 2 or fewer episodes
- THIS ESSENTIALLY STRATIFIES OUT recurrent AOM with OME versus recurrent AOM alone

Clinicians should obtain an age-appropriate hearing test if:
- OME persists for 3 months or longer
- Prior to surgery when a child becomes a candidate for tympanostomy tube insertion.
- Only if the results are unreliable or unattainable should history be used
  - History by parents is not reliable in this case
  - 2 out of 3 failed answers of the validated questions is indicative of hearing loss

---

**Table 7.** Validated questions for assessing hearing difficulty by caregiver report.*

<table>
<thead>
<tr>
<th>Question</th>
<th>Responses</th>
<th>Pass</th>
<th>Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td>How would you describe your child’s hearing?</td>
<td>Normal, slightly below normal, poor, very poor</td>
<td>Normal</td>
<td>Slightly below normal, poor, or very poor</td>
</tr>
<tr>
<td>Has he/she mishand words when not looking at you?</td>
<td>No, rarely, often, always</td>
<td>No or rarely</td>
<td>Often or always</td>
</tr>
<tr>
<td>Has he/she had difficulty hearing when with a group of people</td>
<td>No, rarely, often, always</td>
<td>No or rarely</td>
<td>Often or always</td>
</tr>
<tr>
<td>(i.e. not one-to-one)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*A hearing difficulty is present when there is a fail response for 2 or more questions.

---

Tympanostomy

- Treatment in any patient with otorrhea with a tympanostomy
  - Non-ototoxic topical antibiotic
  - ONLY IN PATIENTS WITH COMPLICATIONS SHOULD AN ORAL ANTIBIOTIC BE USED
    - Cellulitis of the pinna
    - Concurrent bacterial infection
    - Signs of severe infection exist (high fever, severe otalgia, toxic appearance)
    - Acute otorrhea persists, or worsens, despite topical antibiotic therapy
    - Administration of eardrops is not possible because of local discomfort or lack of tolerance by the child
    - A patient has an immune-compromised state
    - Cost considerations prevent access to non-ototoxic topical antibiotic drops

Ear Tubes and Ear Infections

Your child may still get an ear infection (acute otitis media) with a tube. If an infection occurs, you will usually notice drainage or a bad smell from the ear canal.

If your child gets an ear infection with visible drainage or discharge from the ear canal:

1. Do not worry: the drainage indicates that the tube is working to drain infection from the middle ear space. Most children do not have pain or fever with an infection when the tube is in place and working.
2. Ear drainage can be clear, cloudy, or even bloody. There is no danger to hearing.
3. The best treatment is antibiotic ear drops alone (cefuroxime or ciprofloxacin-dexamethasone). Place the drops in the ear canal two times a day for up to 10 days. “Pump” the flap of skin in front of the ear canal (tragus) a few times after placing the drops. This will help the drops enter the ear tube.
4. Ear drainage may build up or dry at the opening of the ear canal. Remove the drainage with a cotton-tipped swab dipped in hydrogen peroxide or warm water, a cotton ball to absorb drainage, or gently suction with an infant nasal aspirator.
5. Prevent water entry into the ear canal during bathing or hair washing by using a piece of cotton saturated with Vaseline to cover the opening; do not allow swimming until the drainage stops.
6. To avoid yeast infections of the ear canal, do not use antibiotic eardrops frequently or more than 10 days at a time.
7. Oral antibiotics are unnecessary for most ear infections with tubes unless your child is very ill, has another reason to be on an antibiotic, or the infection does not go away after using ear drops.

If your child gets an ear infection without visible drainage from the ear canal:

1. Ask your primary doctor if the tube is open (functioning); if it is, the infection should resolve without a need for oral antibiotics or antibiotic ear drops.
2. If your doctor gives you an antibiotic or ear drop prescription anyway, ask if you can wait a few days before filling it; chances are high you will not need the medication. Use acetaminophen or ibuprofen to relieve pain, if necessary, during the first few days.
3. If the tube is not open, the ear infection is treated as if the tube was not there; the blocked tube does not do any harm (and will not cause a problem), but it also does not do any good.

When to Call the Ear Doctor (Otolaryngologist)

Call the ear doctor if any of the following occur:

1. Your child’s regular doctor can’t see the tube in the ear
2. Your child has hearing loss, continued ear infections or continued ear pain/discomfort
3. Ear drainage continues for more than 7 days
4. Drainage from the ears occurs frequently
5. There is excessive wax build-up in the ear canal

How to Care for Your Child’s Ear Tubes

Ear tubes help protect your child from ear infections, middle-ear fluid (liquid behind the eardrum), and the hearing problems that go along with them. Most tubes last about 6 to 18 months, allowing many children time to outgrow their ear problems. Most tubes fall out by themselves. The chance of a tube falling in, instead of out, is very rare. Tubes that do not come out after 3 or more years may need to be removed by your doctor.

Possible Complications of Ear Tubes

Complications of ear tubes are usually minor. Some children develop a white mark or patch on the eardrum which is called scarring. It does not affect your child’s hearing or future chance of ear infections. Some children develop a small depression or pocket in the eardrum at the tube site after it falls out. Again, this does not affect hearing and rarely requires treatment. About 1-2 out of every 100 children will develop a small hole (perforation) of the eardrum after the tube falls out. The hole will often close on its own over time, but if it does not, it can be patched in the operating room.

Ear Tubes and Water Precautions

Some children with ear tubes wear ear plugs when swimming. The ear plugs keep water out of the ear canal and out of the ear tube. However, water does not usually go through the tube during swimming. As a result, ear plugs are not necessary for most children.

Although most children with tubes do not need ear plugs, they may be necessary in the following situations:

- Pain or discomfort when water enters the ear canal
- Discharge or drainage is observed coming out of the ear canal
- Frequent or prolonged episodes of ear discharge

Other times when ear plugs may be needed on an individual basis are:

- Swimming more than 6 feet under water
- Swimming in lakes or non-chlorinated pools
- Dunking head in the bathtub (soapy water has a lower surface tension than plain water)

A variety of soft, fitted ear plugs are available, if needed, as are special neoprene headbands to cover the ears. Never use Playdoh or silly putty as an earplug, because it can become trapped in the ear canal and require surgical removal. Once the tube becomes blocked or comes out, ear plugs are not needed if there is no hole in the eardrum.

Ear Tube Follow-Up and Aftercare

Routine follow-up with your doctor every 4 to 6 months is important to make sure that your child’s tubes are in place and to check for any possible problems. All children need follow-up no matter how well they are doing. Children often feel well even when there is a problem with the tube. Once the tubes fall out, your child should return for a final re-check after 6-12 months so your doctor can check the ears and be sure that fluid has not built up again.


It is important that everyone is on the same page after a child has tubes.
• Summery
  • Tonsillitis
    • Understanding biofilms in recurrent infection explains the importance of tonsillectomy
    • Tonsillectomies ARE NOT for just strep patients!
  • Rhinosinusitis
    • Distinguish between viral, allergic and bacterial rhinitis as well as chronic
    • Step-wise approach following symptoms carefully is during acute rhinitis is key in minimizing antibiotic use
  • Otitis Externa
    • DROPS are the drug of choice
    • Patient education is key
  • Otitis Media
    • Distinguish between AOM and OME
    • Do not use medications unless there is another diagnoses when managing OME
    • Adenoidectomy is not strictly indicated in OME any more


