The diagnosis of acute otitis media

Paola Marchisio
Department of Pediatric and Maternal Sciences,
University of Milan
Fondazione IRCCS Ospedale Maggiore Cà Granda
Milan, Italy
ACUTE OTITIS MEDIA (AOM)

- Frequent disease
- Difficult diagnosis
- Cause of antibiotic abuse and misuse
Incidence and clinical presentation of acute otitis media in children aged <6 years in European medical practices

Liese JG et al

Clinical diagnoses of otitis media: differences between paediatricians and paediatric otolaryngologists

For a paediatrician the diagnosis of AOM is difficult
DIAGNOSIS : key message
A correct diagnosis of AOM is essential in order to avoid useless, unjustified, costly and potentially harmful therapeutic procedures (I/A)

Examples of certain AOM

Marchisio P et al. Italian guideline on AOM. IJPORL 2010; 74:1209-16
Role of symptoms
Symptoms in children (6 m – 7 y, mean 3.7) with upper respiratory tract infections with or without acute otitis media

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Acute otitis media</th>
<th>URTI</th>
</tr>
</thead>
<tbody>
<tr>
<td>irritability</td>
<td>30</td>
<td>39</td>
</tr>
<tr>
<td>nasal obstruction</td>
<td>35</td>
<td>42</td>
</tr>
<tr>
<td>rhinorrhea</td>
<td>42</td>
<td>50</td>
</tr>
<tr>
<td>fever</td>
<td>28</td>
<td>42</td>
</tr>
<tr>
<td>sore throat</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>earache</td>
<td>15</td>
<td>59</td>
</tr>
</tbody>
</table>

Kontiokari T. PIDJ 1998;17:676-9
Diagnosis of AOM is a challenge for paediatricians and GPs

- The younger the child, the greater the uncertainty\(^1\)
  - 0–12 months 58%
  - 12–30 months 66%
  - >30 months 73%
- Symptoms are often non-specific or absent
- Diagnostic tools are seldom used
- Training is limited

\(^1\)Froom et al. BMJ 1990; 300: 582–6
Symptoms of AOM may be absent in children aged 6 months to 7 years (no single symptom >60%)

Still a problem in 2015

Symptoms or Symptom-Based Scores Cannot Predict Acute Otitis Media at Otitis-Prone Age
Miia K. Laine, Paula A. Tähtinen, Olli Ruuskanen, Pentti Huovinen and Aino Ruohola

*Pediatrics* published online Apr 5, 2010;
DOI: 10.1542/peds.2009-2689

- Children 6–35 months of age
- Parents’ suspicion of AOM
- Individual symptoms did not predict AOM
Occurrence and mean duration of symptoms in 469 children (< 3 yrs) with parental suspicion of acute otitis media

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Occurrence n (%)</th>
<th>P</th>
<th>Mean duration</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AOM (N=237)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child’s verbal expression of ear pain</td>
<td>44 (19)</td>
<td>0.124</td>
<td>1.1</td>
<td>0.427</td>
</tr>
<tr>
<td></td>
<td>Non-AOM (N=232)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ear-rubbing</td>
<td>165 (70)</td>
<td>0.050</td>
<td>2.4</td>
<td>0.318</td>
</tr>
<tr>
<td></td>
<td>180 (78)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fever</td>
<td>102 (43)</td>
<td>0.071</td>
<td>2.1</td>
<td>0.234</td>
</tr>
<tr>
<td></td>
<td>81 (35)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cough</td>
<td>187 (79)</td>
<td>0.223</td>
<td>6.2</td>
<td>0.377</td>
</tr>
<tr>
<td></td>
<td>172 (74)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conjunctivitis</td>
<td>44 (19)</td>
<td>0.204</td>
<td>3.5</td>
<td>0.193</td>
</tr>
<tr>
<td></td>
<td>33 (14)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vomiting</td>
<td>3 (1)</td>
<td>0.500</td>
<td>0.5</td>
<td>0.304</td>
</tr>
<tr>
<td></td>
<td>5 (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>31 (13)</td>
<td>0.219</td>
<td>2.6</td>
<td>0.861</td>
</tr>
<tr>
<td></td>
<td>22 (10)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Symptoms (occurrence 0.5<P<0.945): parentally reported ear pain; irritability; excessive crying; restless sleep; less playful or active; poor appetite; rhinitis; nasal congestion; hoarse voice; mucus vomiting

Symptoms where P≤0.5 for occurrence compared between AOM vs non-AOM; Duration of each symptom among those children who had the symptom

Laine et al. Pediatrics 2010; 125;e1154-61
Severity of parenterally reported ear pain

Child’s verbal expression of ear pain

Ear-rubbing

Irritability

Laine et al. Pediatrics 2010; 125; e1154-61
How Do Parents of Preverbal Children With Acute Otitis Media Determine How Much Ear Pain Their Child Is Having?

### Table 2. Association Between Each Symptom and Assigned Level of Pain on Multivariate Analysis

<table>
<thead>
<tr>
<th>Symptom</th>
<th>$\beta^*$</th>
<th>$se (\beta)^{†}$</th>
<th>$P \text{ Value}$</th>
<th>Pseudo-$R^2^{‡}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ear tugging</td>
<td>.948</td>
<td>.111</td>
<td>&lt;.001</td>
<td>.115</td>
</tr>
<tr>
<td>Fussiness</td>
<td>.879</td>
<td>.113</td>
<td>&lt;.001</td>
<td>.098</td>
</tr>
<tr>
<td>Sleeping difficulty</td>
<td>.767</td>
<td>.115</td>
<td>&lt;.001</td>
<td>.075</td>
</tr>
<tr>
<td>Fever</td>
<td>.749</td>
<td>.115</td>
<td>&lt;.001</td>
<td>.072</td>
</tr>
<tr>
<td>Eating less</td>
<td>.674</td>
<td>.116</td>
<td>&lt;.001</td>
<td>.058</td>
</tr>
<tr>
<td>Playing less</td>
<td>.642</td>
<td>.117</td>
<td>&lt;.001</td>
<td>.053</td>
</tr>
</tbody>
</table>

* $\beta = $ Slope of the regression line, symptoms with higher $\beta$ coefficients have a larger impact on pain levels.

How Do Parents of Preverbal Children With Acute Otitis Media Determine How Much Ear Pain Their Child Is Having?

Our results support the hypothesis that parents of children with AOM use information from the child’s observable behaviors to determine their child’s level of pain. Although no symptom by itself dominated parental assessment, ear tugging and fussiness seem to be the most important symptoms in influencing perception of pain by parents.

**DIAGNOSIS**

1. Acute onset of symptoms
2. Signs of inflammation of the tympanic membrane
3. Presence of middle ear effusion (bulging being the clinical sign considered optimal for detecting middle ear effusion)

Marchisio P et al. Italian guideline on AOM. IJPORL 2010; 74:1209-16
4. Pneumatic otoscope most simple and efficient means
5. Description of all the features of the tympanic membrane
6. Earwax removal

Marchisio P et al. Italian guideline on AOM. IJPORL 2010; 74:1209-16
Methods to detect middle ear effusion have been evaluated

Pneumatic otoscopy
Portable tympanometry
Acoustic reflectometry
Professional tympanometry – flat B curve
Professional tympanometry – flat B or C2 curve

Standard fluid aspirated at myringotomy used as the reference standard

The use of diagnostic tools for AOM is limited among paediatricians in Italy and the USA.

1Marchisio et al. PIDJ 2009;28:1–4; 2Vernacchio et al. PIDJ 2006; 25:385–9
DIAGNOSTIC ACCURACY

The acronym COMPLETES summarizes the importance of examining the ENTIRE surface of the tympanic membrane.

Obstructing cerumen (which needs to be removed to visualize the tympanic membrane) is a problem in up to 57% of children <2 yrs with OM.*

The best method for cerumen removal is undecided, but all methods pose problems for paediatricians.

ELEMENTS for a certain diagnosis COMPLETES

- Color tympanic membrane
- Other condition
- Mobility
- Position
- Lighting
- Entire Surface
- Translucency
- External ear canal
- Seal
OTOSCOPES… one size does not fit all…

1. Only nickel-cadmium or lithium battery-powered otoscopes should be used. Abruptly dims. Replacement every 2-4 years.
2. Standard alkaline batteries provide suboptimal illumination. Subtly discharge.
3. Halogen light bulbs must be replaced every 6 months.
4. Disposable speculum too small!
   - Children 4 to 5 months: 2.5 mm aperture
   - Children 6 to 36 months: 3.0 mm aperture
   - Children > 36 months: 4.0 mm aperture
5. Speculum must be large enough and shiny enough!
The normal eardrum
Look at the eardrum with method COLOR

Look at the eardrum with method COLOR

Shaikh N et al. NEJM 2010;362:e62
Look at the eardrum with method TRANSLUCENCY

Translucent

Opaque

Shaikh N et al. NEJM 2010;362:e62
Look at the eardrum with method POSITION

Neutral  Bulging  Retracted

Shaikh N et al. NEJM 2010;362:e62
Development of an Algorithm for the Diagnosis of Otitis Media

Nader Shaikh, MD, MPH; Alejandro Hoberman, MD; Howard E. Rockette, PhD; Marcia Kurs-Lasky, MS

**Bar Chart: AOM vs. OME**

- Bulging of the TM: 100%
- Marked redness of the TM: 29.1%
- Decreased mobility of the TM: 22.6%
- Irritability: 17.5%
- Ear pain: 14.5%
- Discoloration of the TM: 12.9%
Development of an Algorithm for the Diagnosis of Otitis Media

Nader Shaikh, MD, MPH; Alejandro Hoberman, MD; Howard E. Rockette, PhD; Marcia Kurs-Lasky, MS

Figure 3. Proposed algorithm for the diagnosis of otitis media.
The Diagnosis and Management of Acute Otitis Media
Allan S. Lieberthal, Aaron E. Carroll, Tasnee Chomnaitree, Theodore G. Ganiats, Alejandro Hoberman, Mary Anne Jackson, Mark D. Joffe, Donald T. Miller, Richard M. Rosenfeld, Xavier D. Sevilla, Richard H. Schwartz, Pauline A. Thomas and David E. Tunkel

*Pediatrics*; originally published online February 25, 2013;

Grading of bulging

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*Pediatrics,* originally published online February 25, 2013;

**KEY ACTION STATEMENTS**

**Key Action Statement 1A**

Clinicians should diagnose AOM in children who present with moderate to severe bulging of the TM or new onset of otorrhea not due to acute otitis externa. (Evidence Quality: Grade B, Rec. Strength: Recommendation)

C, TM with moderate bulging. D, TM with severe bulging.
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Allan S. Lieberthal, Aaron E. Carroll, Tasnee Chonmaitree, Theodore G. Ganiats, Alejandro Hoberman, Mary Anne Jackson, Mark D. Joffe, Donald T. Miller, Richard M. Rosenfeld, Xavier D. Sevilla, Richard H. Schwartz, Pauline A. Thomas and David E. Tunkel
Pediatrics; originally published online February 25, 2013;

**Key Action Statement 1B**

Clinicians should diagnose AOM in children who present with mild bulging of the TM and recent (less than 48 hours) onset of ear pain (holding, tugging, rubbing of the ear in a nonverbal child) or intense erythema of the TM. (Evidence Quality: Grade C, Rec. Strength: Recommendation)

![Image of TM with mild bulging](image_url)
The Diagnosis and Management of Acute Otitis Media

Allan S. Lieberthal, Aaron E. Carroll, Tasnee Chonmaitree, Theodore G. Ganiats, Alejandro Hoberman, Mary Anne Jackson, Mark D. Joffe, Donald T. Miller, Richard M. Rosenfeld, Xavier D. Sevilla, Richard H. Schwartz, Pauline A. Thomas and David E. Tunkel

*Pediatrics*; originally published online February 25, 2013;

<table>
<thead>
<tr>
<th>Aggregate evidence quality</th>
<th>Grade C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefits</td>
<td>Identify AOM in children when the diagnosis is not highly certain.</td>
</tr>
<tr>
<td>Risks, harms, cost</td>
<td>Overdiagnosis of AOM. Reduced precision in diagnosis.</td>
</tr>
<tr>
<td>Benefits-harms assessment</td>
<td>Benefits greater than harms.</td>
</tr>
</tbody>
</table>

B, TM with mild bulging.
Pneumatic otoscopy is not always necessary

…. pneumatic otoscopy is not necessary to diagnose every case of AOM given that:

1. This adjuvant is helpful only in determining whether or not fluid is present and

2. Is superfluous in the case of a visibly full or bulging TM.

RODDEY OF Jr. PIDJ 2003; 22: 673
Pneumatic otoscopy is not painful
How to grade the severity of symptoms of acute otitis media?

Still no definite answer but various options

Severe illness:

moderate or severe otalgia

or fever $\geq 39.0$ C
Development of a Practical Tool for Assessing the Severity of Acute Otitis Media

Norman R. Friedman, MD,*† David P. McCormick, MD,‡ Carmen Pittman, BA,‡
Tasnee Chonmaitree, MD,‡§ Davis C. Teichgraeber, MD,‡ Tatsuo Uchida, MS,‖
Constance D. Baldwin, PhD,‡ and Kokab A. Saeed, MD‡

Design/Methods: The components of the pocket card consisted of a faces scale, to assess parent perception of severity, and a standard set of tympanic membrane photographs, with which the pediatrician can grade the severity of tympanic membrane inflammation. The components of the pocket card were tested for validity, reliability and responsiveness with the use of data from parents, pediatricians and pediatric otolaryngologists.

Results: The components of the pocket AOM card demonstrated excellent sequence validity, concurrent correlation and reliability ($r = 0.58–0.99$). Total AOM card severity, consisting of the sum of the 2 scales, demonstrated better responsiveness to change than any of the scales taken individually.

FIGURE 1. AOM-faces scale.

Friedman NR, PIDJ 2006;25:101
### TABLE 4. AOM-SOS (Version 3.0)*

We are interested in finding out how your child has been doing. For each question, please place a check mark in the box corresponding to your child’s symptoms. Please answer all questions.

<table>
<thead>
<tr>
<th>Question</th>
<th>No</th>
<th>A Little</th>
<th>A Lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over the past 12 h, has your child been tugging, rubbing, or holding the ear(s) more than usual?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over the past 12 h, has your child been crying more than usual?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over the past 12 h, has your child been more irritable or fussy than usual?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over the past 12 h, has your child been having more difficulty sleeping than usual?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over the past 12 h, has your child been less playful or active than usual?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over the past 12 h, has your child been eating less than usual?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over the past 12 h, has your child been having fever or feeling warm to touch?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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TRAINING AND SHARING
Acute otitis media: use of diagnostic modalities by Italian pediatricians and ENTs

Mastering Diagnostic Skills: Enhancing Proficiency in Otitis Media, a Model for Diagnostic Skills Training
Phillip H. Kaleida, Dianna L. Ploof, Marcia Kurs-Lasky, Nader Shaikh, D. Kathleen Colborn, Mary Ann Haralam, Sean Ray, Diana Kearney, Jack L. Paradise and Alejandro Hoberman

*Pediatrics* 2009;124:e714-e720; originally published online Sep 28, 2009;

![Graph showing the proportion of TMs correctly diagnosed for different groups and conditions]

- **PGY2 standard teaching (84 residents)**
- **PGY1 intervention group pre-ePROM (102 residents)**
- **PGY1 intervention group post-ePROM (90 residents)**
“The key to the optimal management of acute otitis media remains the accuracy of the diagnosis”

Klein JO. NEJM 2011; 364:2
“Never look for the extraordinary, but, on the contrary, concentrate on the more prevalent and common diseases, and try to cure them; these are the diseases you will most frequently encounter in your practice”

Emile Ménière
Deuxième Congrès Otologique Internationale