Does this child have acute otitis media?

Rothman R, Owens T, Simel D L

CRD summary
This review assessed history taking and physical examination in the diagnosis of acute otitis media in children. The authors concluded that although many studies had methodological limitations, a cloudy, bulging or clearly immobile tympanic membrane is highly suggestive of acute otitis media. The conclusions were based on poor-quality studies and may not be reliable.

Authors' objectives
To assess the precision and accuracy of history taking and physical examination in the diagnosis of acute otitis media (AOM) in children.

Searching
MEDLINE was searched from inception to May 2002 for studies published in English. The bibliographies of selected studies and general and specialist textbooks were also checked.

Study selection
Study designs of evaluations included in the review
Studies that used a nonindependent comparison of symptoms with a standard of uncertain validity were excluded.

Specific interventions included in the review
Studies of signs and symptoms of AOM were eligible for inclusion. The specific tests used in the included studies were: ear pain, ear rubbing, cough, rhinitis, excessive crying, poor appetite, vomiting, sore throat, headache, restless sleep, upper respiratory tract infection, and colour, position and mobility of the ear drum.

Reference standard test against which the new test was compared
The reviewers considered tympanocentesis to be the criterion standard, but only one study compared physical signs with this standard. Therefore, the review also included studies that compared symptoms with a standardised clinical definition of AOM.

Participants included in the review
Studies of children were eligible for inclusion. The children in the included studies were aged from 0 to 15 years. Studies of children with persistent otitis media with effusion were generally excluded. In one of the included studies, a high percentage of children had recurrent AOM.

Outcomes assessed in the review
The inclusion criteria were not specified in terms of outcomes. The outcomes in the review were the sensitivity, specificity and likelihood ratio (LR) of signs and symptoms.

How were decisions on the relevance of primary studies made?
One reviewer conducted the search and two reviewers selected the studies.

Assessment of study quality
The studies were graded using a hierarchy of study design that ranged from level 1 (best quality) to level 5. The studies in the review were level 3 (independent, blind comparison of symptoms to standard with nonconsecutive patients suspected of having AOM) or level 4 (nonindependent comparison of symptoms with standard and convenience sample of patients with AOM plus some healthy children). Two reviewers independently assessed validity.

Data extraction
Two reviewers independently extracted the data. The extracted data included sample size, age of children, reference standard and methodological limitations. Where possible, raw data were extracted and used to calculate the sensitivity.
specificity, positive and negative LRs, and 95% confidence intervals (CIs) for each study. Data from patients for all groups combined were extracted. In one study in which selective tympanocentesis was performed, data from children with perforations who did not undergo tympanocentesis were excluded. For this study, the LRs were adjusted for verification bias assuming children not undergoing tympanocentesis had ears that appeared normal. The diagnostic accuracy of tympanic membrane colour (classified on an ordinal scale as cloudy, distinctly red, slightly red, or normal) was assessed using the area under the receiver operating characteristic curve.

**Methods of synthesis**

How were the studies combined?
The studies were combined in a narrative.

How were differences between studies investigated?
Differences were discussed in the paper.

**Results of the review**

Six studies (3,919 children) were included.

Precision of signs and symptoms (1 study, 43 children with complete examination).

Agreement on the diagnosis of AOM between paediatric residents and otolaryngologists was fair (kappa 0.30).
Agreement on specific tympanic membrane features was fair to slight (kappa ranged from 0.4 for erythema to 0.16 for position).

Accuracy of symptoms (4 studies).

Methodological problems included spectrum bias (2 studies) and use of clinical diagnosis as the reference standard (4 studies). The highest positive LR was for ear pain (positive LR ranged from 3.0 to 7.3), but ear pain was only present in 50 to 60% of children with AOM. The results for fever were mixed: one study showed a slight increase in the likelihood of AOM, while two studies found no effect. Other symptoms were listed in the paper.

Accuracy of signs (1 study, 2,911 children).

Methodological problems included spectrum bias. The results showed that a cloudy, bulging or clearly immobile tympanic membrane was highly suggestive of AOM. Positive LRs, adjusted for verification bias, were 34 (95% CI: 28, 42) for cloudy, 51 (95% CI: 36, 73) for bulging, and 31 (95% CI: 26, 37) for immobile. A distinctly red tympanic membrane suggested AOM (positive LR 8.4, 95% CI: 6.7, 11), while a normal colour made AOM unlikely (positive LR 0.2, 95% CI: 0.19, 0.21).

**Authors’ conclusions**

Although many studies had methodological limitations, a cloudy, bulging or clearly immobile tympanic membrane is highly suggestive of AOM. A distinctly red membrane is also suggestive of AOM, while a normal coloured membrane makes AOM unlikely. Ear pain may be an important symptom.

**CRD commentary**

The review question was broadly defined in terms of the study design, intervention and participants. The inclusion criteria were not defined in terms of outcomes, and were widened for the reference standard after surveying the literature. Only one database was searched and this might have resulted in the omission of relevant studies. In addition, no attempts to minimise language or publication bias were made. Two reviewers independently selected the studies, assessed validity and extracted the data, thus reducing the potential for bias and errors. The validity assessment was limited to a hierarchy of study design and was not adequate.

The narrative synthesis was appropriate given the small number of diverse studies. Evidence for the diagnostic accuracy of tympanic membrane features came from only one study in which only one observer examined each patient. The conclusions were based on studies limited by bias.
Implications of the review for practice and research
Practice: The authors stated that pneumatic otoscopy should be used to examine drum colour, appearance and mobility in cases of suspected AOM. They recommended that standard guidelines, such as those of the Agency for Health Care Research should be considered and that methods should be used to improve performance of physical examination techniques (see Other Publications of Related Interest). The authors also noted that the American Academy of Pediatrics provides a website to help clinicians improve their skills in the diagnosis and treatment of AOM (http://www.aap.org/en-us/about-the-aap/Committees-Councils-Sections/Section-on-infectious-diseases/Pages/VideoHighlights.aspx accessed 24/07/2014).

Research: The authors stated that future studies should be conducted in general populations of at-risk children using standardised diagnostic criteria, and with outcomes assessed using independent examinations by blinded examiners. They also stated that physical findings should be classified on ordinal scales, and that the relative importance of colour, position and mobility should be assessed.

Bibliographic details
Rothman R, Owens T, Simel D L. Does this child have acute otitis media? JAMA 2003; 290(12): 1633-1640

PubMedID
14506123

DOI
10.1001/jama.290.12.1633

Original Paper URL
http://jama.ama-assn.org/

Other publications of related interest

This additional published commentary may also be of interest. Uhari M. Review: ear pain and a cloudy, bulging, or distinctly immobile tympanic membrane appear to help diagnose acute otitis media in children. Evid Based Med 2004;9:58.

Indexing Status
Subject indexing assigned by NLM

MeSH
Acute Disease; Child, Preschool; Humans; Infant; Medical History Taking; Otitis Media /diagnosis; Physical Examination; Sensitivity and Specificity

AccessionNumber
12003008593

Date bibliographic record published
31/07/2005

Date abstract record published
31/07/2005

Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.