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Management Updates In Acute Otitis Media Among Children: A Systematic Review

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Abstract

Background: *Over 60% of children will have experienced at least one episode of acute otitis media (AOM) by the time they are 4 years old, making it one of the most frequent illnesses in children. This study aimed to highlight the latest updates on otitis media management among children.*

Methods: *This systematic review included randomized controlled trials, quasi-RCTs, and controlled before-and-after studies evaluating management updates in the treatment of acute otitis media (AOM) in children aged 0 to 18 years. The interventions evaluated included antibiotics, analgesics, and other supportive therapies, compared to placebo, standard care, or other active interventions. The primary outcomes were resolution of symptoms and [1]occurrence of complications, while secondary outcomes included adverse events, recurrence of AOM, and healthcare resource utilization. A comprehensive search of electronic databases was conducted, and data was extracted independently by two reviewers using a standardized form.*

Results: *The study identified 398 publications through titles and abstracts, with eligibility determined for 11 publications through full-text review. Six studies were included, reporting on 1,862 patients. Antibiotic therapy was found to significantly reduce pain in children with acute otitis media compared to placebo, with a reduced incidence of contralateral otitis media and tympanic membrane perforation. However, there was no significant difference in tympanometry results between the antibiotic and control groups. The studies had low to moderate risk of bias and were conducted in the United States, Finland, Sweden, and Canada. Overall, the findings suggest that antibiotic therapy is effective in treating acute otitis media in children.*

Conclusion: *The findings of this study suggest that antibiotic therapy is effective in reducing pain and decreasing the incidence of contralateral otitis media and tympanic membrane perforation in children with acute otitis media compared to placebo. However, there was no significant difference in tympanometry results between the antibiotic and control groups. The*

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studies had low to moderate risk of bias and were conducted in various countries. The results support the use of antibiotic therapy in the treatment of acute otitis media in children.

Introduction

Background

Acute otitis media (AOM) is one of the most frequent illnesses in childhood [1 2]; roughly 60% of children have experienced at least one episode by 4 years of age [3]. It is also one of the most often claimed causes for antibiotic prescription in children less than 3 years of age [4-5], accounting for 14% of all antibiotic prescriptions in children in the UK [6]. Although both bacterial and/or viral infections may cause AOM [7-8], it is commonly regarded to be a bacterial consequence of upper respiratory tract virus infection [9].

The justification for antibiotic treatment includes symptom management [10] and the avoidance of uncommon but dangerous consequences, including mastoiditis and meningitis [11]. Nevertheless, studies suggest that up to 80% of cases recover spontaneously without antibiotics [12-13], and drugs are linked with the risk of side effects including vomiting, diarrhoea and dermatitis [13-14]. In addition, the incorrect use of antibiotics has been highlighted as one of the primary causes of antibiotic resistance, a worldwide health issue [15-17]. Recent research has also indicated that lengthier antibiotic courses might contribute to increased chances of resistance. Hence, giving clear information on optimal antibiotic usage in terms of the indications, choice and duration is deemed vital to help minimize antibiotic resistance [18].

To encourage antibiotic stewardship, the WHO proposes the creation of treatment recommendations and the monitoring of local antibiotic resistance to inform the use of medicines [19]. National recommendations for the first-line care of AOM may play a key role in antibiotic stewardship [20]. Acute otitis media (AOM) is a common childhood illness, and its management has evolved over the years. There is a need for an up-to-date systematic review of the available evidence on the management updates in AOM among children to guide clinical practice. The purpose of this systematic review was to present recommendations for AOM in children to evaluate their methodological quality, to characterize their evidence-based Strength of Recommendations (SoR) and to assess whether they contain consideration of antibiotic stewardship.

Methods

Inclusion Criteria

Types of Studies

Randomized controlled trials (RCTs), quasi-RCTs, and controlled before-and-after studies were included in this systematic review.

Types of Participants

The participants were children aged 0 to 18 years who are diagnosed with AOM.

Types of Interventions

Studies evaluating any management updates in the treatment of AOM, including antibiotics, analgesics, and other supportive therapies, was included.

Types of Comparators

Studies comparing the interventions mentioned above with placebo, standard care, or other active interventions were included.

Types of Outcome Measures

The primary outcomes of interest were the resolution of symptoms and the occurrence of complications. The secondary outcomes included adverse events, recurrence of AOM, and healthcare resource utilization.

Search Strategy

A comprehensive search of electronic databases (PubMed, Embase, Cochrane Library, and CINAHL) was conducted to identify relevant studies. The search was limited to studies published in the English language. The following search terms were used:

- Acute otitis media
- Children
- Management
- Antibiotics
- Analgesics
- Supportive therapy

The reference lists of included studies and relevant systematic reviews were screened for additional studies.

Study Selection

Two reviewers independently screened the titles and abstracts of the identified studies for inclusion based on the predefined eligibility criteria. The full texts of potentially eligible studies were retrieved and assessed for eligibility. Any discrepancies between the reviewers were resolved through discussion or by a third reviewer.

Data Extraction

Data extraction was performed independently by two reviewers using a standardized data extraction form. The following data was extracted from each included study:

- Study characteristics (authors, year, country, design)
- Participant characteristics (age, sex, diagnosis)
- Intervention and comparator characteristics
- Outcome measures and results
- Funding sources and conflicts of interest

Risk of Bias Assessment

Two reviewers independently assessed the risk of bias of each included study using the Cochrane Risk of Bias tool for RCTs and the Risk Of Bias In Non-randomized Studies - of Interventions (ROBINS-I) tool for non-randomized studies. Any discrepancies were resolved through discussion or by a third reviewer.

Data Synthesis

Meta-analysis was performed if the included studies are deemed clinically homogenous. A random-effects model was used to pool the effect sizes, and the results were presented as risk ratios or mean differences with 95% confidence intervals. The heterogeneity among the included studies was assessed using the I^2 statistic.

Subgroup Analysis

Subgroup analyses were performed based on the following factors:

- Age of the participants
- Type of intervention
- Comparator used
- Risk of bias

Publication Bias

Publication bias was assessed using funnel plots and the Egger's test.

Ethics and Dissemination

Since this study is a systematic review of published data, no ethical approval is required. The findings of this review will be disseminated through publication in a peer-reviewed journal and presentations at relevant conferences.

Results

A total of 398 were identified using just the titles and abstracts. Figure 1 displays a sample of the research considered. The eligibility of eleven publications was determined by reading their whole texts.

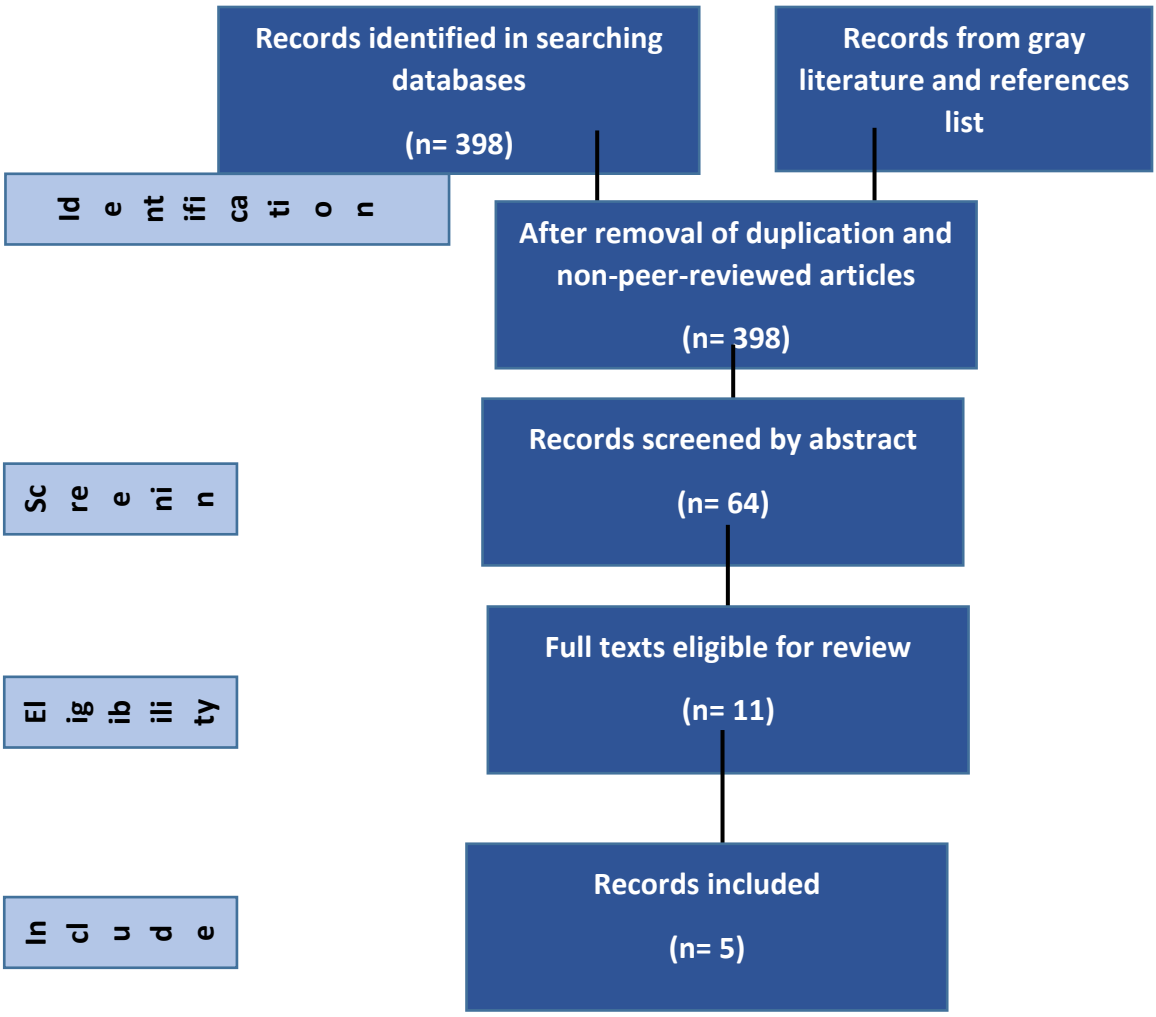

Figure 1: Flow chart of selection process

There were a total of 1,862 patients from 6 papers reporting on 5 separate studies. Except for 1) discomfort at 10–12 days, which was not mentioned in the Procedures section, and 2) abnormal tympanometry at 4 weeks, which was deemed to have poor quality of evidence since more patients in the expectant observation group were lost to follow-up than in the immediate antibiotic (ABX) group.

Two investigations were conducted in the United States, two in Finland, one in Sweden, and one in Canada. Patients' ages ranged from 6 months up to 16 years. Variations between 179 and 512 patients were seen in the population sizes. Just four studies reported whether or whether patients had had a PnV vaccination, with reported vaccination rates ranging from 1.9% [21, 22] to 100% [23]. Amoxicillin was utilized in 5/6 research whereas penicillin was used in 1/6 studies. Amoxicillin courses lasted between 7 and 10 days, whereas penicillin courses lasted just 5.

We use forest plots to compare the main and secondary outcomes of antibiotic therapy vs placebo treatment or watchful waiting. Children treated with ABX had considerably less pain after 24 hours (RR = 0.78 (95% CI: 0.65-0.93), NNT = 9) and at 10-12 days (RR = 0.33 (95% CI: 0.17-0.66), NNT = 7), compared to those who received a placebo in the investigations.

Between 2 and 7 days, there was no discernible change. Pain was considerably decreased at 3-7 days after immediate ABX compared to observation (RR = 0.60 (95% CI: 0.39-0.91), NNT = 24).

Compared with placebo, ABX substantially decreased the incidence of contralateral otitis media (RR = 0.44 (95% CI: 0.24-0.81), NNT = 10). Relative risk (RR) = 0.17 (95% CI = 0.04-0.71), NNT = 32) for perforation of the tympanic membrane was considerably decreased with ABX.

Tympanometry results were similar across the ABX-treated and control groups at four weeks and three months [24]. Conversely, there was a tendency for ABX to shorten the time it took for middle ear effusion to clear up and for AOM to reoccur in patients who had started treatment late. One out of every 13 patients treated with ABX had an adverse event.

Those who were given ABX were just as likely to have abnormal tympanometry readings at four weeks and three months as those who were given a placebo. It seemed that ABX had a tendency to shorten the duration of middle ear effusion and the frequency with which late-stage AOM recurred. Risk of bias assessment is presented in table 1.

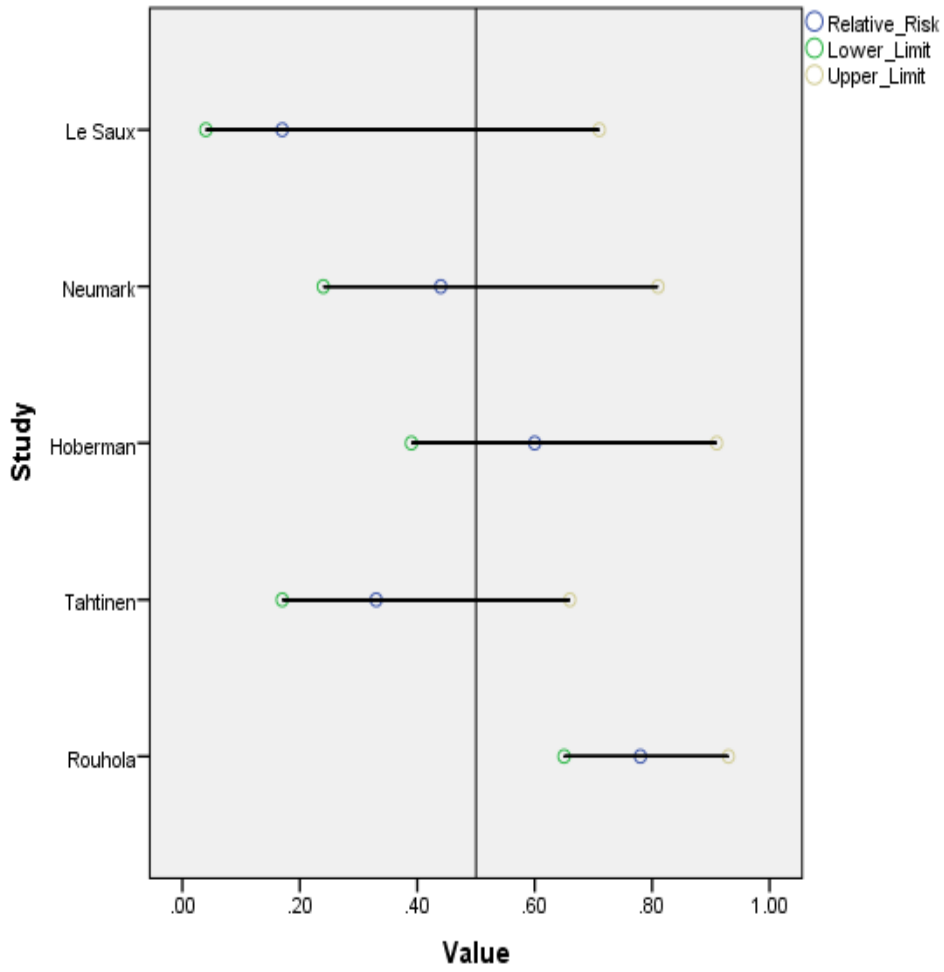

Figure 2: Forest plot comparing antibiotic and watchful observation versus placebo

Table 1: Risk of bias assessment of included articles					
Study	Bias Assessment using GRADE	Inconsistency	Indirectness	Imprecision	Publication Bias
Ruohola et al. 2018	Moderate	Low	Low	Low	Low
Tähtinen et al. 2011	Low	Low	Low	Low	Low
Hoberman et al. 2011	Low	Low	Low	Low	Low
Neumark et al. 2007	Moderate	Low	Low	Low	Low
Le Saux et al. 2005	High	Low	Low	Low	Low
Overall Assessment	Moderate	Low	Low	Low	Low

Discussion

It's possible that AOM-causing microorganisms have shifted since PnV's introduction. There have been several academic articles written on the topic. Yet, antibiotics (ABX's) efficacy is still being questioned. The reaction to antibiotic therapy may have changed over the last several decades due to the rise in antibacterial resistance. Only studies conducted after the turn of the century will be included since their cohorts are thought to be more representative of modern patients. We did not succeed in our primary goal of focusing on research of vaccinated patients since fewer patients than expected were vaccinated in the trials we included.

Several of the included studies did not have consistent inclusion criteria, immunization coverage, results, or definitions of failure. The studies are too different from one another to be compared easily. Several parents refused to participate, increasing the potential for volunteer bias. If they would prefer have the ABX than risk their kid getting the placebo, parents whose children are severely impacted are more likely to reject participation. The impact magnitude might have been skewed if the kids who really required the ABX weren't included. Nevertheless, patients who were included in the research were randomly assigned to either the ABX group or the control group using a computer-generated randomization process, mitigating the possibility of selection bias.

Except for one [23], all research involved children who were older than 24 months. Children under the age of two with bilateral AOM and children with otorrhoea seemed to benefit more with ABX, according to a meta-analysis [26]. If the kid is above the age of five, ABX may not be necessary to treat AOM. The beneficial impact of ABX among young children would be diminished if older children, who may have recovered from the illness on their own, were included in the study. The research of Hoberman et al. [23] corroborated this.

The comparison of research is further complicated by the fact that the vaccination status of the included studies varies widely. Two-dose PnV recipients were the only ones considered for inclusion in one research [21]. Just two reports ([24, 25]) omitted asking participants about their PnV status. In both cases, the vaccine was not yet part of the routine vaccination regimen. The vaccination was introduced in Canada not long after the trial concluded [25]. Seven years after Neumark et al. [24] came to a close, Sweden added PnV to its national immunization program in 2009 [27].

The nature of the infections studied is a crucial variable that has not been well addressed. The fluid from the middle ear was not sampled in any of the experiments. Middle ear fluid from AOM patients younger than 2 months revealed a reduction in the number of S. pneumoniae and non-typeable H. influenza following the introduction of PnV into the national immunization program, according to a recent research [28]. Another research reported a downward trend in S. pneumoniae when PnV was included in the national immunization program [29], but it also identified an upward trend in H. influenza. Possible effects of this shift in pathogens on research conducted after PnV was included to the national immunization program [21, 23].

Low NNTs were seen at 24 hours and 10-12 days for pain relief, although these NNTs were still rather high (nine and seven, respectively). For patients aged 2-16 years old, the 3-7 day NNT for pain was 41. This lends credence to the theory that ABX has little effects on children older than two years old.

There was a possibility that parents in the placebo group would report a lower pain score due to the placebo effect. The genuine pain-relieving power of ABX would therefore be diminished. On the other hand, knowing that their kid was not taking ABX increased the probability that parents in the observation group would report a higher pain score. That would increase the observed significance of ABX.

The major outcome of the research considered was pain, which is notoriously hard to measure in young children. As a result, parents or the quantity of analgesics used became the de facto pain assessors. In most cases, pain was classified into two categories: painful and painless. Because pain couldn't be graded, the research would lose some complexity. Moreover, whether pain is the best indicator of the action of ABX is questionable. The ability to pool data and reach a consensus is hindered by the fact that different analgesic regimens and pain-scoring algorithms were utilized throughout the available trials. Is the current discomfort attributable to an inadequate dose of analgesics, or does it reflect the depth of the body's physiological/systemic reaction to the middle ear infection? How can one tell the difference between a painful condition and a general improvement in health brought on by an immune response?

The bactericidal characteristics of the ABX utilized in the included research were designed to decrease bacteria overall. The direct result of this is a reduction in the body's stress reaction, which has the beneficial side effect of improving one's mood and restoring normal body temperature. So, it may be preferable to evaluate the efficacy of ABX by calculating a score based on the child's state of health and body temperature. Nevertheless, analgesics also alter body temperature, thus the child's well-being score is the only metric that can accurately characterize the impact of ABX.

In addition to improving health, ABXs are believed to speed up the recovery of sick tissue. Indirectly, this issue was addressed throughout the included trials by measuring things like tympanometry abnormalities, AOM on the opposite side of the head, middle ear effusion improvement, AOM recurrences, and tympanic membrane perforations. There was a suggestion that ABX might cut down on the recurrence of AOM. The results may be undermined, however, by the inclusion of children older than five years of age, who are more likely to clear the infection spontaneously than younger children. Again, this variation in methodology makes it difficult to generalize findings.

If parents in the placebo group believe their child's suffering is lessened because of the placebo effect, the researchers will be concerned. The genuine pain-relieving power of ABX would therefore be diminished. Conversely, parents in the observation group may report more discomfort for their kid since they are aware their child is not taking ABX. Because of this, ABX's impact would be bolstered.

The analgesics that were permitted in the included studies varied widely. The use of pain medication was discretionary and unstated in two trials [22, 23]. Just acetaminophen was authorized for pain relief in one research [21]. Both acetaminophen and non-steroidal anti-inflammatory medications (NSAIDs) were permitted in one research [25], while ibuprofen and codeine were permitted in the other [24]. As acetaminophen, opioids, and NSAIDs all have distinctive analgesic effects, it becomes difficult to draw meaningful comparisons between pain levels in the various trials. In addition, the anti-inflammatory properties of NSAIDS suggest that they might hasten the healing process.

There was a suggestion that ABX might cut down on the recurrence of AOM. Nevertheless, the inclusion of children older than five years old, who are more likely to clear the illness spontaneously, may dilute the outcome and make it less powerful.

One in thirteen patients treated with ABX had an adverse event. An adverse event (AE) such as diarrhea, vomiting, oral thrush, or skin rash may be more harmful to a kid than the illness itself, which commonly resolves on its own without treatment. The studies that were considered had a relatively low risk of bias and good quality data overall. Nevertheless, the definition and severity of AE should be questioned, as well as the criteria used to determine whether or not an AE has occurred.

Conclusion

Evidence from modern, PnV-era research suggests that ABX has a modest impact on AOM-related pain. Antibiotic therapy may be most helpful for children less than two years old with AOM, according to some research. Nevertheless, it's important to think about the potential negative impacts.

These results are consistent with those of a Cochrane evaluation of RCTs conducted before and after the introduction of PnV. More randomized controlled trials (RCTs) in the post-PnV era with children less than two years old are required to further explain the impact of antibiotic therapy and the severity and frequency of side effects. To acquire non-selected individuals with high PnV coverage, these RCTs should be carried out in general practices in Denmark in partnership with active ear, nose, and throat specialists. In addition, future research should employ standardized symptom and outcome grading scales and consistent analgesic treatment protocols. Children younger than two years old with significant symptoms of AOM, i.e. fewer and impaired well-being, may benefit from ABX until additional proof is given.

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