The Relationship Between Acute Mastoiditis and Antibiotic Use for Acute Otitis Media in Children

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Objective: To determine the relationship between prior antibiotic use and the development of acute mastoiditis (AM) in children.

Design: Retrospective review.

Setting: Tertiary pediatric center.

Patients: We identified 129 patients with AM who were admitted to our center between 1996 and 2005.

Main Outcome Measure: Proportion of children who developed AM.

Results: A total of only 67 patients (51.9%) had undergone any antimicrobial treatment prior to hospital admission. In 1996, 64% of patients with AM had received antibiotics for acute otitis media (AOM) prior to admission (n=7 of 11), but this percentage had steadily decreased to 27% by 2005 (n=4 of 15). The yearly number of cases of AM treated in our institution has remained stable over this period. A subperiosteal abscess was identified in 45 patients (34.9%), while the remainder (n=84) had postauricular inflammation only (65.1%). Nineteen patients with a subperiosteal abscess (42%) and 48 patients without a subperiosteal abscess (57%) had undergone prehospitalization antimicrobial therapy for suppurative AOM. There was no significant difference in antibiotic use between the numbers of patients with or without a subperiosteal abscess. Regarding the sensitivity of bacteria isolated from patients with a subperiosteal abscess, only 1 patient was infected with an organism that was not sensitive to the prehospitalization antibiotic prescribed.

Conclusion: Use of antibiotics to treat suppurative AOM in children might not influence the subsequent development of AM.


The diagnosis of acute mastoiditis (AM) is based on the presence of acute otitis media (AOM), an acutely protruding ear with postauricular inflammation or subperiosteal abscess, and systemic symptoms. Current publications have noted that prior to the advent of antibiotics, greater than 50% of AOM cases progressed to AM, with or without more severe intracranial problems, and most of these required surgical intervention. However, with the advent of antibiotic use, AOM became for the most part a medical disease rather than a surgical one. Surgery tended to be reserved for treatment of the complications of the disease, and the overall incidence of mastoiditis as a complication of AOM dropped to less than 1%.

Recent clinical evidence indicates that 60% to 80% of uncomplicated AOM cases resolve within 24 to 48 hours without antibiotic therapy. Correspondingly, antibiotic prescription guidelines emerged to recommend that antibiotic treatment of AOM be reserved for cases in children younger than 6 months, unresolving cases, or otherwise complicated cases. All other AOM cases should be treated initially with supportive therapy with discretionary clinical follow-up. The intent of these guidelines is generally to reduce the use of unnecessary antibiotics, which contributes to the development of microbial antibiotic resistance. Interestingly, several recent publications have identified a rise in the incidence of AM, which indicates a possible correlation between decreased antibiotic use and increased frequency of mastoiditis cases.

In an attempt to investigate the relationship between antibiotic use and the incidence of AM we performed a ret-
A retrospective review of children admitted with a diagnosis of AM to our institution. Our intent was both to assess the influence on AM of antibiotics prescribed for AOM immediately prior to hospitalization and to ascertain if the antibiotics prescribed corresponded to the sensitivities of the organisms being grown from cultures obtained at surgery.

A total of 129 patients (81 boys, 48 girls) were identified, mean age, 2.5 years (age range 0.5-12). Each year, different numbers of cases were identified without evidence of a trend toward either increased or decreased incidence (Figure 1).

The relative proportions of patients treated with antibiotics for AOM prior to hospital admission vs the proportions of untreated patients, grouped by year of disease presentation, are shown in Figure 2. Over the study period, a trend is noted toward a steady decrease in the incidence of AM to our institution. Our intent was both to assess the influence on AM of antibiotics prescribed for AOM immediately prior to hospitalization and to ascertain if the antibiotics prescribed corresponded to the sensitivities of the organisms being grown from cultures obtained at surgery.

**RESULTS**

A total of 129 patients (81 boys, 48 girls) were identified, mean age, 2.5 years (age range 0.5-12). Each year, different numbers of cases were identified without evidence of a trend toward either increased or decreased incidence (Figure 1). The relative proportions of patients treated with antibiotics for AOM prior to hospital admission vs the proportions of untreated patients, grouped by year of disease presentation, are shown in Figure 2. Over the study period, a trend is noted toward a steady decrease in the proportion of patients undergoing antibiotic therapy for AOM prior to hospital admission for AM.

Overall, slightly more than half of the study population underwent antimicrobial therapy prior to hospital admission (n=67; 51.9%). The most commonly prescribed prehospitalization antibiotic was amoxicillin (n=24; 42%), followed by amoxicillin–clavulanic acid (n=14; 25%), and cefaclor (n=12; 21%). The mean duration of prehospitalization treatment was 5.6 days. Three patients developed complications prior to admission: 2, facial nerve weakness; 1, sigmoid sinus thrombosis. No patients in our study developed either meningitis or a brain abscess prior to admission.

The in-hospital treatment details of the patient population are summarized in Table 1. Typically, a double-coverage antibiotic regimen was applied, most commonly flucloxacillin (n=96; 74.4%) and cefotaxime (n=77;
The retrospective nature of the present study makes it difficult to draw definitive conclusions regarding the relationship between incidence of AM in children and declining rates of antibiotics use for the treatment of AOM. Our patient population was substantially larger than the populations of the earlier studies and was assessed over a longer continuous period.

The retrospective nature of the present study makes it difficult to draw definitive conclusions regarding the relationship between incidence of AM in children and declining rates of antibiotics use for the treatment of AOM. Our patient population was substantially larger than that of many other studies on this subject, but our study still carries the limitations of a retrospective review. Also, while our institution is the major pediatric tertiary center in the state, our experience may not be representative of the broader community. Furthermore, to assess the rate of development of AM in children only as a complication of AOM (rather than simply the absolute number of AM cases) would require information...
regarding the total number of AOM cases in the community. This information was not readily available during the period of the present study. Factors such as improved public health measures, including antimicrobial vaccinations, may have led to an overall decrease in the number of cases of AOM.

A case-control study is needed to properly assess the effects of antibiotic treatment for AOM as a means of preventing the development of AM. A group of patients with AOM complicated by AM would serve as the cases, while patients with AOM who did not develop AM would serve as controls. The ideal study would be a prospective randomized controlled trial of antibiotic use in AOM to subsequently determine the rate of AM developing in each group. While a worthwhile endeavor, such a study would prove difficult to execute.

Studies have shown that the most common organism cultured from patients with AM is P aeruginosa, with proportions ranging from 24% to 34%.

The authors of those studies indicated that the high numbers of Pseudomonas grown were all from patients who had undergone antibiotic treatment prior to hospitalization. However, in all cases this result might reflect contaminated specimens taken from the middle ear rather than from the abscess cavity. We analyzed cultures grown on samples taken only from the subperiosteal abscess, thus precluding the possibility of commensal outer ear organisms contaminating the data set. Consequently, our most common organism was streptococcal species (42%), with only 1 culture of 45 growing P aeruginosa (2%).

Antibiotic resistance did not seem to be a factor in our study because all organisms grown were sensitive to the antibiotic prescribed to kill them, if an appropriate antibiotic was chosen initially. None of the cultures showed any resistance to penicillin, a result that echoes the findings of other studies. This, along with our stable rate of AM cases, stands in contrast to recent findings of Antonelli et al, which demonstrated that antibiotic-resistant S pneumoniae may be responsible for an increasing rate of AM.

In conclusion, at our institution we have demonstrated a steady rate of admissions of children with AM over the last 10 years despite a decreased use of prehospitalization antibiotics for the treatment of AOM in these children. Antibiotic administration for the treatment of AOM in the prehospitalization setting does not seem to influence the rate of development of AM in children.

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REFERENCES