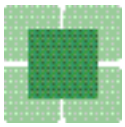

From principles to practice: Case-based applications of the acute otitis media guidelines

CASE 1

A 4-year-old boy presents with a 24-hour history of fever and right-sided ear pain following 2 to 3 days of rhinorrhea and congestion. The boy is not toxic-appearing, and physical examination is normal except for bulging and impaired mobility of his right tympanic membrane.

Diagnosis starts with careful distinctions

Dr. Camille Sabella—Dr. Francy, one of the goals of the new guidelines for the management of acute otitis media (AOM)[1] is to help the clinician achieve better diagnostic accuracy. What are the diagnostic findings that help distinguish AOM from otitis media with effusion?

Dr. Scott Francy—Definitive diagnosis requires careful examination of the tympanic membrane and the use of a pneumatic otoscope. Pneumatic otoscopy allows us to examine the mobility of the tympanic membrane, which improves diagnostic sensitivity. The otoscope should have sufficient bulb brightness as well as the correct speculum size so that an airtight seal can be achieved. Cerumen that obstructs visualization of the tympanic membrane must be removed.

It is important to differentiate clinically between AOM and otitis media with effusion because the management of these two entities is different. However, one study has shown that general pediatricians in the United States can accurately differentiate between these two entities only 50% of the time.[2]

The diagnosis of otitis media with effusion is made accurately when bubbles or an air–fluid interface are seen and there is decreased or absent mobility of the tympanic membrane. Also, the tympanic membrane often takes on an abnormal color, such as white, yellow, or amber.

The diagnosis of AOM is made clinically by detection of the presence of middle ear effusion together with the acute onset of middle ear inflammation. This typically is done by use of pneumatic otoscopy, although tympanography, acoustic reflectometry, or tympanocentesis may also be used. The diagnosis of AOM cannot be made without the presence of middle ear effusion. Signs of middle ear inflammation include purulent drainage or a bulging or full tympanic membrane with hemorrhagic, white, or yellow discoloration of the membrane. It is important to remember that redness of the tympanic membrane is a nonspecific finding and may be caused by crying alone, without infection. Thus, the child who has erythema without fullness or bulging of the tympanic membrane should not be diagnosed with AOM.

Older children, such as the boy in this case, often will complain of pain and, less often, of hearing loss. In this setting, with a history of rapid onset of fever and especially after an upper respiratory tract infection, AOM should be suspected. Ear-pulling, irritability, fever, and, in older children, hearing loss are nonspecific symptoms and do not correlate well with infection.

In cases in which pneumatic otoscopy is difficult, tympanography or acoustic reflectometry may be available in the physi-

cian's office and can be helpful in identifying middle ear effusion.

Dr. Sabella—How would the new guidelines help you in managing this patient with AOM?

Dr. Francy— First of all, the child should be assessed for the degree of pain that he is having and treated with analgesics accordingly. I have not found analgesic drops helpful, given their short duration of action. Over-the-counter analgesics such as acetaminophen and ibuprofen are effective. I have not had to resort to the use of codeine for pain control.

In terms of antimicrobial therapy for this child, the new guidelines offer the option of observation without antibiotics for a child 2 years of age or older who has nonsevere illness. However, since this child has a fever and has significant otalgia, I would treat with antibiotics if I were certain of the diagnosis.

Observation alone: How realistic is it?

Dr. Johanna Goldfarb— Would you ever not treat this child?

Dr. Francy— If the child had these findings on physical examination but was afebrile (< 38 °C), was in minimal or no discomfort, and had no previous history of otitis media, I think 2 to 3 days of observation would be an option, after educating the parents about why I was choosing to not treat.

Dr. Goldfarb— The practical question is whether a practicing pediatrician in the United States in 2004 can follow this guideline and not treat this patient. In Europe, physicians have a long tradition of not treating older children with otitis media. However, it seems to me that if the diagnosis of AOM were clear-cut, it would be difficult to not treat the child with antibiotics. Also, there are many practical problems with the observation option, from the child being able to return to school to the parents being able to go back to work, as well as the follow-up needed in 2 to 3 days.

Dr. Michael Marcy— The observation option for selected children with AOM is based on data showing spontaneous resolution 70% to 90% of the time.[3] Because much of the data is from studies limited to children 2 years of age or older, in some cases based upon uncertain diagnostic methods, and because children younger than 2 years of age, particularly those with severe disease, do not appear to do well without antibiotic therapy, the observation option is applicable only for those children 2 years of age or older who have nonsevere illness, or in whom the diagnosis is not clear-cut.

In terms of follow-up, the guidelines state that the observation option is valid only for those children in whom follow-up is assured. It must also be emphasized that the decision whether to observe a child with AOM should take into consideration the fact that antimicrobial therapy results in adverse events in 5% to 15% of children.[4] This results in discomfort, increased phone calls, and another office visit. All of these factors, as well as findings that there does not appear to be an increased incidence of mastoiditis in children with AOM who undergo observation alone, have led to the guidelines' inclusion of the observation option.

Dr. Sabella—What would you say to the parents of a child for whom you had made the diagnosis of AOM but chosen not to treat?

Dr. Francy— I think you talk to the parents and you educate them about the reasons not to treat: the fact that most cases of AOM resolve spontaneously and that anytime we treat with any medicine, antibiotics included, there can be adverse effects. Certainly otitis media with effusion does not require antibiotic therapy, and I mention that even when I have a case of AOM. I then talk about the fact that overuse of antibiotics can lead to antibiotic resistance, and I explain what that means in lay terms and how it eventually can lead to decreased drug effectiveness and a larger problem for all of us. This is probably the most important point of all, and most parents will understand it.

Dr. Marcy— To explain otitis media with effusion, I tell parents that the ear hurts

The practical question is whether a US pediatrician in 2004 can follow this guideline and not treat this patient.
—Dr. Johanna Goldfarb

because the eustachian tube is blocked, like what happens in the mountains or up in an airplane. But I explain that what I see does not give me evidence of infection in the middle ear, and I add that although in some cases these effusions will become infected, the overwhelming majority resolve by themselves, and that using antibiotics will neither prevent nor alter the course of a subsequent infection.

Dr. Goldfarb—And it may select more resistant bacteria in that child and in the community.

Factors to weigh in initial antibiotic choice

Dr. Sabella—What would be your choice of antimicrobial agent for the child in this case once you had made a decision to treat?

Dr. Francy—My first-line choice would be amoxicillin.

The observation option is valid only for those children in whom follow-up is assured.

—Dr. Michael Marcy

Dr. Marcy—Yes, according to the guidelines, amoxicillin continues to be first-line therapy. However, if the child is severely ill, another option is to start with amoxicillin-clavulanate. In other words, if the child has a high fever and severe pain on presentation, you want to assure coverage of *Haemophilus influenzae* and *Moraxella catarrhalis*, which have 30% to 50% resistance and virtually 100% resistance, respectively, to amoxicillin.[3]

Dr. Goldfarb—So amoxicillin-clavulanate is an option in such circumstances regardless of patient age?

Dr. Marcy—Yes.

Dr. Francy—I think this is a clinical decision. A child with a fever to 39.2 °C who is running around the room and relatively playful is different from a child with a high fever who is ill.

Dr. Goldfarb—When would you use amoxicillin-clavulanate in the older child with AOM?

Dr. Francy—I would use it very rarely as my initial agent. The factors to consider include recent antibiotic use, whether there is a history of recurrent otitis media, and overall previous medical history. If this child doesn't have recurrent otitis media and doesn't have a toxic appearance, and if I can assure phone follow-up or a return trip to my office, then I would choose amoxicillin.

Dr. Sabella—It is important to point out that, given the natural history of AOM, an infection with *H influenzae* or *M catarrhalis* is more likely to resolve spontaneously than an infection caused by *Streptococcus pneumoniae*. Because of this, I believe that the use of amoxicillin-clavulanate as first-line therapy for AOM should be discouraged.

Duration of illness: Important but often elusive

Dr. Sabella—One more question about this case: Would your management of this child be different if he presented with a 48-hour history of fever rather than a 24-hour history?

Dr. Marcy—Yes, the guidelines indicate that the observation option is valid for 48 to 72 hours. If a child presents after already having 48 hours of discomfort and pain, and if we find by examination that this is truly AOM, then in fact that child already has undergone an observation period, and I would treat the child immediately. It is interesting to speculate that as clinicians utilize observation of AOM with increasing frequency, parents may also begin to incorporate a 48-hour delay in seeking care for their child with mild to moderate illness.

Dr. Francy—From a practical standpoint, it is not always possible to know the exact duration of the illness because of differing parental reports. Also, a frequent scenario is the child who is seen late in the afternoon after a 36-hour history of illness. The point to stress here is that these are guidelines and not every clinical situation will be clear-cut.

CASE 2

A 9-month-old girl presents with a 24-hour history of fever and irritability. On physical examination, she is febrile to 38.9 °C as measured rec-

tally. She is irritable but consolable and is not toxic-appearing in her mother's arms. Physical examination is normal except for mild upper respiratory symptoms and a bulging, erythematous left tympanic membrane.

Dr. Goldfarb— How would you manage this infant, Dr. Francy?

Dr. Francy— Observation would not really be an option, given the child's age and the fact that there is a documented fever of 38.9 °C and irritability, although she is not toxic-appearing. Again, after having made an appropriate and correct diagnosis of AOM, which I think is very important to state again, I would treat with amoxicillin 80 to 90 mg/kg/day, in two divided doses.

The microbiology behind dosing decisions

Dr. Sabella—What is the rationale behind using high-dose amoxicillin, specifically in regard to *S pneumoniae* resistance?

Dr. Jennifer Long— There are two key factors to keep in mind with regard to high-dose amoxicillin: the mechanism of resistance of *S pneumoniae*, and the pharmacodynamics of the beta-lactams.

In regard to the mechanism of resistance, it actually is mediated not by beta-lactamase but by a change in the penicillin-binding protein, which is a graded resistance. This type of resistance can be overcome by increasing the dose of amoxicillin (Table 1).

The pharmacodynamics of beta-lactams are such that the duration for which the serum level of the antibiotic is above the minimum inhibitory concentration (MIC) is probably the critical factor in bacterial killing. There are many in vitro and animal studies, as well as studies looking at levels in children,[5–8] showing that as the amoxicillin dose is increased to the range of 80 to 90 mg/kg/day, the time above the MIC in both the plasma and the middle ear fluid is indeed increased as well.

Dr. Goldfarb— Does twice-daily (BID) dosing, as compared with three-times-daily (TID) dosing, significantly affect the duration of time that the drug level is above the MIC, given the short half-life of the beta-lactams?

TABLE 1

Mechanisms of antimicrobial resistance among organisms that cause acute otitis media

MECHANISM OF RESISTANCE	ORGANISMS	CAN RESISTANCE BE OVERCOME BY RAISING DOSE OF ANTIMICROBIAL?
Beta-lactamase production	Haemophilus influenzae Moraxella catarrhalis	No
Alteration of penicillin-binding proteins	Streptococcus pneumoniae	Yes

Dr. Long— Because amoxicillin has linear pharmacokinetics, doubling its dose results in a doubling of the peak level achieved. The half-life will stay the same, which for amoxicillin is roughly 1 hour. This results in serum levels above 1 µg/mL for anywhere from 40% to 50% of the dosing interval, depending on whether 80 or 90 mg/kg/day is given. The optimal time above the MIC that is needed for efficacy is debated, but it is generally thought to range from 30% to 40%, although some experts advocate that 60% to 70% is ideal.[7]

Dr. Sabella—And this can be achieved with BID dosing as well as TID dosing?

Dr. Long— Yes. The area under the curve, which translates to the duration above the MIC for the whole 24-hour period, is roughly the same with 8-hour dose intervals as with 12-hour dose intervals.

Dr. Marcy— The other thing to remember about BID dosing is that it improves compliance. TID dosing simply doesn't work for a child in a day care center.

Dr. Francy— Right—there's no question that compliance is better with BID dosing.

Dr. Sabella—Will high-dose amoxicillin be

If it's explained in lay terms, most parents understand how resistance leads to decreased drug effectiveness and a larger problem for us all.
—Dr. Scott Francy

TABLE 2

Risk factors for acquisition and carriage of resistant S pneumoniae

Age younger than 2 years
Previous treatment with a beta-lactam antibiotic
Group day care attendance
Underlying medical illness
Recent hospitalization

effective if you are dealing with a fully resistant strain of *S pneumoniae*—for instance, one for which the MIC is 2 µg/mL?

Dr. Long—Because of the high peak serum levels that are achievable with high-dose amoxicillin—15 to 22 µg/mL[6–9]—it should be effective.

Three-times-daily dosing simply doesn't work for a child in a day care center.
—Dr. Michael Marcy

Dr. Marcy—Yes, it has been shown that with dosing of 90 mg/kg/day, peak levels in middle ear fluid will be significantly higher than 2 µg/mL.[6] Fortunately, even most highly resistant strains of *S pneumoniae* are not resistant to concentrations above 8 µg/mL. Those that are may present a problem.

Dr. Sabella—This point is especially important for children who are at increased risk of infection with resistant *S pneumoniae* (Table 2).

Dr. Long—It should be noted that dosages also increase the time above the MIC. For example, studies have shown that the time above the MIC, assuming an MIC of 4 µg/mL, is 38% for high-dose amoxicillin-clavulanate (90/6.4 mg/kg/day given in two divided doses) compared with 23% for the standard dose (45/6.4 mg/kg/day given in two divided doses). In addition, high-dose amoxicillin achieves middle ear fluid concentrations between 3 and 8 µg/mL for at least 3 hours after the dose.[10–12]

Duration of therapy: Age matters, but err on the long side

Dr. Sabella—What about duration of therapy, Dr. Marcy? In the child with AOM who is 6 years of age or older, would you think about a shorter duration of therapy?

Dr. Marcy—The formal recommendation remains 10 days for children younger than 6 years of age. A shorter duration of therapy—5 to 7 days—may be appropriate for children 6 years of age or older. This applies not only to amoxicillin and amoxicillin-clavulanate but also to the cephalosporins and to the third-line drugs that are not FDA-approved for short-course therapy.

Personally, I treat children up to 2 years of age with amoxicillin or amoxicillin-clavulanate for 10 days, those between 2 years and 4 years of age for 7 days, and those 4 years of age or older for 5 days. In truth, I would guess that a large proportion of parents stop therapy within a day or two of their child's improvement and that it makes little difference what we recommend.

CASE 3

The 9-month-old infant from Case 2 is treated with high-dose amoxicillin and returns in 48 hours with continued fever and irritability. The examination remains normal except for continued erythema and bulging of the left tympanic membrane.

Reassessment by phone vs face-to-face

Dr. Marcy—Any child who does not respond to primary therapy warrants reassessment, either by direct physical examination or by telephone assessment, depending on the reliability of the parent or caregiver who is observing the child. The clinician has to decide whether or not to accept telephone assessment. Many parents and caregivers simply will be unable to come in for an office visit, so then it must be decided whether the child is well enough to warrant treatment over the phone alone. Whatever decision is made, a telephone conversation should be thoroughly documented in the chart.

The question of giving a prescription "on call," or a contingency prescription, to parents also has been raised. That decision also rests with the physician, but there are risks. Parents and caregivers cannot always be relied upon to accurately judge how ill their child is. They may well fill the "on call" prescription to treat

what they think is simply unresolved AOM when, in fact, their child is sicker with an underlying condition, such as pneumonia, empyema, or meningitis, that would require parenteral antibiotic treatment. The responsibility for the decision to proceed with a course of inadequate oral therapy in those situations rests not only with the parent or caregiver but also with the physician if there was no medical reassessment before starting antibiotics.

Dr. Sabella—What are the microbiologic considerations for the child in whom high-dose amoxicillin therapy has failed?

Dr. Marcy—Well, a child who does not respond to high-dose amoxicillin has a residual microbiology that may involve one of several organisms. A significant percentage of these children have been shown to actually suffer from a viral illness,[3] and the persistent fever is caused by the underlying viral illness—not necessarily a viral AOM but simply an underlying viral upper respiratory tract infection. Assuming that this is bacteriologic failure, the high-dose amoxicillin will have killed 50% to 70% of the *H influenzae* organisms, 75% to 90% of the pneumococci, and none of the *M catarrhalis* organisms.[3]

Alternative therapies: Recommendations and rationale

Dr. Sabella—Given the possibility of bacteriologic failure, what are the second-line agents to be considered at this point?

Dr. Marcy—These would include the use of amoxicillin-clavulanate, which will eliminate the remaining 30% of *H influenzae* organisms and all of the *M catarrhalis*. High-dose amoxicillin-clavulanate may also eliminate some pneumococci that were not fully eradicated in the first 48 hours, but that is a lesser consideration at this time.

Other alternative therapies after amoxicillin failure include the oral cephalosporins cefuroxime, cefpodoxime, and cefdinir for children with non–type I allergies to beta-lactams.

Additionally, the use of ceftriaxone, given intramuscularly once daily for 3 days, can be considered.

TABLE 3

Eradication of S pneumoniae in children with acute otitis media treated with high-dose amoxicillin-clavulan

SUSCEPTIBILITY OF S PNEUMONIAE TO PENICILLIN AT BASELINE	ERADICATION RATE, DAGAN ET AL[18]	ERADICATION RATE, PACKAGE INSERT[9]
MIC ≤ 0.25 mg/L (penicillin-susceptible or -intermediate)	83/83 (100%)	—
MIC 0.5–1.0 mg/L (penicillin-intermediate)	5/5 (100%)	—
MIC 2 mg/L (penicillin-resistant)	19/20 (95%)	19/19 (100%)
MIC 4 mg/L (penicillin-resistant)	12/14 (86%)	12/14 (86%)
All S pneumoniae	122/125 (98%)	121/123 (98%)

MIC = minimum inhibitory concentration

Dr. Sabella—Dr. Long, what is relevant for physicians to know about the pharmacology of high-dose amoxicillin-clavulanate?

Dr. Long—Clavulanate is a suicide beta-lactamase inhibitor, so it covalently binds to and inactivates beta-lactamases. Across the various amoxicillin-clavulanate preparations, the amount of amoxicillin increases while the amount of clavulanate remains the same. Thus, these formulations are designed to deliver higher doses of amoxicillin without increasing the concentration of clavulanate. My concern with these formulations is that with BID dosing, there is a theoretical chance that not enough clavulanate will be present for the entire dosing interval, whereas this is less of a risk with TID dosing.

Dr. Marcy—Clinically, this does not appear to be a problem (Table 3).

Dr. Long—Yes. In fact, a report published a

few years ago compared clavulanate levels with BID vs TID dosing and showed that higher levels of clavulanate actually were achieved with BID dosing.[8] I cannot find a suitable pharmacologic or pharmacodynamic explanation for this phenomenon.

Dr. Marcy— We should point out that it's the clavulanate, and not the high-dose amoxicillin, that is responsible for these preparations' gastrointestinal side effects—the vomiting, the diarrhea, and the abdominal pain.

Dr. Goldfarb— Let's turn to the cephalosporin second-line agents. Dr. Long, what should physicians know about these agents' antimicrobial spectrum and pharmacodynamics?

Dr. Long— The oral cephalosporins that are included in the guidelines—cefuroxime, cefpodoxime, and cefdinir—have good activity against penicillin-susceptible strains of *S pneumoniae*. However, it is important to note that they are inferior to amoxicillin in activity against pneumococcal strains that are intermediately or fully resistant to penicillin. Because these agents are stable against beta-lactamases, they have excellent activity against *H influenzae* and *M catarrhalis*.

All three of these oral cephalosporins are given twice daily, although cefdinir can also be given as a once-daily, 14-mg/kg dose. Cefdinir is the most palatable of the three agents, as shown in the only comparative palatability study of antimicrobial suspensions, which was conducted in adults because of its impracticality in infants and young children.[13]

Ceftriaxone, which is given intramuscularly, has excellent antimicrobial activity against all of the potential pathogens discussed and is clinically effective against even resistant strains of *S pneumoniae*. Its long half-life allows once-daily administration.

Testing the activity of cephalosporins against beta-lactamase-producing strains of H influenzae can be unreliable.
—Dr. Camille Sabella

Dr. Goldfarb— Dr. Marcy, given your role as a consultant to the American Academy of Pediatrics for the development of these guidelines, what was the rationale behind the selection of these particular cephalosporins for recommendation in the guidelines?

Dr. Marcy— Cefuroxime was chosen because it was recommended by the Centers for Disease Control and Prevention's Drug-resistant *Streptococcus pneumoniae* Therapeutic Working Group in consensus recommendations published in 1999.[12] Cefpodoxime was added because of its activity against *H influenzae* and *M catarrhalis* as well as against some drug-resistant strains of *S pneumoniae*, as noted in those same consensus recommendations. Cefdinir was chosen because of its increased palatability over cefuroxime and cefpodoxime.[13]

Dr. Goldfarb— Was consideration given to recommending macrolides as second-line agents?

Dr. Marcy— It was felt that the macrolides have limited efficacy against all the etiologies of AOM. Thus, the macrolides, along with trimethoprim-sulfamethoxazole and erythromycin-sulfisoxazole, are listed in the guidelines only as alternatives for patients who have a history of anaphylaxis or severe allergy to beta-lactam agents.

Dr. Goldfarb— What about consideration for other cephalosporins, such as cefprozil, as second-line agents?

Dr. Marcy— In regard to cefprozil, there was a concern that it was inferior to the recommended agents in its in vitro activity against *H influenzae*.

Dr. Goldfarb— It is important to note, however, that clinical trials have not demonstrated that cefprozil has inferior activity against beta-lactamase–producing *H influenzae*.

Dr. Sabella—I understand that, from a microbiologic standpoint, testing the activity of these agents against beta-lactamase–producing strains of *H influenzae* is problematic and often unreliable. This may explain the discrepancy between in vitro susceptibility and the fact that this agent seems to work well clinically.

Dr. Goldfarb— Yes, I believe that cefprozil should be added to the list of oral cephalosporins that can be used as second-line agents.

Dr. Sabella—Dr. Francy, what is your choice of second-line agent for the child in whom high-dose amoxicillin has failed?

Dr. Francy—I typically use amoxicillin as a first-line agent and then use amoxicillin-clavulanate as the second-line agent.

Fallbacks after further failure: Tympanocentesis, ceftriaxone, clindamycin

Dr. Goldfarb—Is the ceftriaxone alternative something you find useful in your practice, and when would you use it?

Dr. Francy—If amoxicillin-clavulanate fails, I first think about having the otolaryngologists at our institution perform a tympanocentesis. In cases when this has not happened, I have used ceftriaxone.

Dr. Goldfarb—What dosage schedule do you use?

Dr. Francy—I typically use 50 mg/kg for three daily doses.

Dr. Marcy—With this regimen, it appears that about 75% of patients are cured after the first dose and 98% are cured with three doses.[14]

Dr. Sabella—Dr. Marcy, are there times when you may consider a single dose of ceftriaxone for the treatment of AOM?

Dr. Marcy—There is evidence from two outpatient clinical trials that a single dose of ceftriaxone is adequate primary therapy for AOM.[15,16] One of these studies compared a single dose of ceftriaxone with trimethoprim-sulfamethoxazole, to which at least 90% of pneumococcal strains were susceptible at the time, and showed that a single dose is sufficient.[15] In the guidelines, the option for use of single-dose ceftriaxone is restricted to primary therapy for a child who is vomiting or refusing oral antibiotics, or a child for whom compliance with an oral regimen is in question. It is important to stress that when ceftriaxone is given as a second- or third-line agent following treatment failure, the recommendation is for three daily doses.

Dr. Sabella—The guidelines mention clindamycin as an alternative for the child who has not responded to a second-line agent. When would you use clindamycin?

Dr. Marcy—The guidelines offer this option in situations where tympanocentesis is not available and second-line therapy has failed. The usual progression would be amoxicillin to amoxicillin-clavulanate to ceftriaxone. Clindamycin would be an alternative to ceftriaxone because nationwide about 95% of strains of pneumococci that are highly resistant to penicillin remain susceptible to clindamycin.[17]

Dr. Long—There is concern that with the increasing use of both clindamycin and the macrolides for AOM, the percentage of pneumococcal strains that are susceptible to clindamycin will decrease. We have already seen this here in Cleveland, where only 89% of strains of pneumococci are susceptible to clindamycin.

Dr. Marcy—Resistance to clindamycin and resistance to erythromycin very frequently go hand in hand.

Dr. Sabella—I think it is inevitable that with the increasing incidence of macrolide-resistant pneumococci, we are going to be seeing clindamycin resistance as well. In fact, I believe that clindamycin should be used for AOM only if there is a documented positive culture indicating that the organism is penicillin-resistant but clindamycin-susceptible.

Dr. Marcy—From a practical standpoint, if you have a child who has not responded to a second-line therapy, such as amoxicillin-clavulanate or an oral cephalosporin or ceftriaxone, then that child has been ill for 96 hours, and at that point you are doing a tympanocentesis. But you won't have your culture and susceptibility results for another 48 hours. In that case, you may contemplate using clindamycin pending the results of the tympanocentesis.

Dr. Goldfarb—I think that we would treat the child with ceftriaxone, not clindamycin. But if there were confirmation from tympa-

Here in Cleveland, already only 89% of pneumococcal strains are susceptible to clindamycin.
—Dr. Jennifer Long

nocentesis that the organism was a penicillin-resistant pneumococcus that was susceptible to clindamycin, then oral clindamycin would be a good alternative.

Dr. Long—We would stress that clindamycin should be used only when there is documentation or a likelihood that you are dealing with a resistant strain of *S pneumoniae*, given that clindamycin has no activity against the other common causes of AOM—namely, *H influenzae* and *M catarrhalis*.

REFERENCES

1. **Subcommittee on Management of Acute Otitis Media, American Academy of Pediatrics and American Academy of Family Physicians.** Clinical practice guideline: diagnosis and management of acute otitis media. Pediatrics 2004; 113:1451–1465.
2. **Pichichero ME, Poole MD.** Assessing diagnostic accuracy and tympanocentesis skills in the management of otitis media. Arch Pediatr Adolesc Med 2001; 155:1137–1142.
3. **Rovers MM, Schilder AGM, Zielhuis GA, Rosenfeld RM.** Otitis media. Lancet 2004; 363:465–473.
4. 2004 Physicians' Desk Reference. 58th ed. Montvale, N.J.: Thomson Healthcare; 2003.
5. **Canafax DM, Yaun Z, Chonmaitree T, Deka K, Russlie HQ, Giebink GS.** Amoxicillin middle ear fluid penetration and pharmacokinetics in children with acute otitis media. Pediatr Infect Dis J 1998; 17:149–156.
6. **Seikel K, Shelton S, McCracken GH.** Middle ear fluid concentrations of amoxicillin after large dosages in children with acute otitis media. Pediatr Infect Dis J 1997; 16:710–711.
7. **Craig WA, Andes D.** Pharmacokinetics and pharmacodynamics of antibiotics in otitis media. Pediatr Infect Dis J 1996; 15:944–948.
8. **Reed MD.** The clinical pharmacology of amoxicillin and clavulanic acid. Pediatr Infect Dis J 1998; 17:957–962.
9. Augmentin ES-600 [package insert]. Research Triangle Park, N.C.: GlaxoSmithKline; 2004.
10. **Kaye CM, Allen A, Perry S, et al.** The clinical pharmacokinetics of a new pharmacokinetically enhanced formulation of amoxicillin/clavulanate. Clin Ther 2001; 23: 578–584.
11. **Easton J, Noble S, Perry CM.** Amoxicillin/clavulanic acid: a review of its use in the management of paediatric patients with acute otitis media. Drugs 2003; 63:311–340.
12. **Dowell SF, Butler JC, Giebink GS, et al.** Acute otitis media: management and surveillance in an era of pneumococcal resistance—a report from the Drug-resistant Streptococcus pneumoniae Therapeutic Working Group. Pediatr Infect Dis J 1999; 18:1–9.
13. **Steele RW, Thomas MP, Begue RE.** Compliance issues related to the selection of antibiotic suspensions for children. Pediatr Infect Dis J 2001; 20:1–5.
14. **Leibovitz E, Piglansky L, Raiz S, Press J, Leiberman A, Dagan R.** Bacteriologic and clinical efficacy of one day vs. three day intramuscular ceftriaxone for treatment of nonresponsive acute otitis media in children. Pediatr Infect Dis J 2000; 19:1040–1045.
15. **Green SM, Rothrock SG.** Single-dose intramuscular ceftriaxone for acute otitis media in children. Pediatrics 1993; 91:23–30.
16. **Barnett ED, Teele DW, Klein JO, Cabral HJ, Kharasch SJ.** Comparison of ceftriaxone and trimethoprim–sulfamethoxazole for acute otitis media. Greater Boston Otitis Media Study Group. Pediatrics 1997; 99:23–28.
17. **Jacobs MR, Felmingham D, Appelbaum PC, Gruneberg RN; The Alexander Project Group.** The Alexander Project 1998–2000: susceptibility of pathogens isolated from community-acquired respiratory tract infection to commonly used antimicrobial agents. J Antimicrob Chemother 2003; 52:229–246.
18. **Dagan R, Hoberman A, Johnson C, et al.** Bacteriologic and clinical efficacy of high dose amoxicillin/clavulanate in children with acute otitis media. Pediatr Infect Dis J 2001; 20:829–837.