
Clinical Review

Otitis Media

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The spectrum of otitis media includes acute and chronic forms, each of which can be either suppurative or nonsuppurative. In the usual clinical setting distinctions between these several forms can be difficult. Determination of accurate incidence figures is impeded by the unavailability of universally accepted diagnostic criteria. Risk factors include season of the year, genetic factors, race, preceding respiratory tract infections, cleft palate, and others. The effect of household size and allergy are uncertain. The most common infecting organisms are *Streptococcus pneumoniae* and *Haemophilus influenzae*, although in a significant number of cases either the fluid is non-pathogenic or no organisms can be isolated. The effects of several therapies are reviewed, including antibiotics, myringotomy, steroids, and middle-ear ventilating tubes.

Otitis media is one of the most frequent conditions treated by family physicians and pediatricians. Yet there are no standard criteria for diagnosis, and several issues regarding therapy are controversial. The use of antihistamines, decongestants, myringotomy, and even antibiotics are matters of contention, and the current roles of tympanometry and tympanostomy tubes need clarification. The purpose of this paper is to provide recommendations for diagnosis and management based on reports in the literature, tempered by the author's personal experience and judgment.

Incidence

Otitis media ranks as the ninth most frequently made diagnosis for all ambulatory patient visits. In 1977 it accounted for approximately 11 million visits to physicians in the United States.¹ For approximately one half of these visits the problem was new. Although these data give some indication of the ubiquitous nature of the problem, they do not permit calculation of annual incidence by age and sex. The several studies that do report incidence, unfortunately, are not comparable because the diagnostic criteria used either are not defined or differ among the several investigators. Often the patient population at risk is unknown. Nevertheless, a review of these publications permits an estimate of incidence.

The annual incidence of otitis media varies with age, with some investigators reporting peaks in the 0- to 1-year-old group^{2,3} and others in the 5- to 6-year-old group.^{4,5} In the 0- to 1-year-old group

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attack rates vary between 13.7 percent⁵ and 47 percent,⁶ and in the 6-year-old group an annual incidence of up to 20.8 percent⁵ has been reported. Although patients aged 15 years and over have a much lower annual incidence (0.6 percent⁵ to 1.1 percent⁷), the age distribution of patients in most family practices is such that about 20 percent of all cases seen will be from this age group.⁷

Boys are affected more often than are girls in the younger age groups,^{7,8} but women predominate among adults.⁷ Multiple episodes during a one-year period are frequent, affecting from 14 percent⁵ to 47 percent⁸ of children who have had at least one attack and 2.1 percent⁵ to 4 percent⁷ of adult cases. Initial attacks prior to age 12 to 13 months predispose children to subsequent attacks.^{2,3}

Studies from the United Kingdom^{4,5} report both a lower incidence and a lower recurrence rate than do United States investigators.^{2,7-9} In addition, between 20 percent⁴ and 30 percent⁵ of patients in English practices have purulent drainage from the ears when first seen, as opposed to 6 percent⁷ in practices in the United States. Data to explain these differences are lacking. It is possible, however, that there are differences in patient behaviors concerning physician visits or in treatments given to the two patient populations. Antibiotics may be used more liberally by American physicians than by their English colleagues (Fry recommends against their routine use⁴), and it may be that English patients wait longer from the onset of ear pain to make a visit to their physician than do their American counterparts. Delay prior to therapy and infrequent use of antibiotics could result in an increased frequency of ruptured tympanic membranes.

Risk Factors

Several risk factors have been identified, but the contribution each makes to producing an infection is uncertain. Some reports implicate season of year, household size, genetic factors, race, allergy, position while feeding, preceding respiratory tract infections, cleft palate, and others.

The frequency of otitis media attacks is highest during the winter months and lowest in the sum-

mer.^{2,5,9} There are two conflicting reports on the effect of household size in relation to attack rate, with one study showing a higher frequency in large households as opposed to smaller ones,⁶ and the other reporting the opposite.⁷ The relative risk in relation to household size is therefore uncertain. Both studies, however, found an increased risk in siblings or other family members of affected children. The paucity of investigations on the relationship between household size and family factors to otitis media indicates a need for additional studies of these variables.

There is some evidence that race may be a factor. Teele and colleagues⁶ report a higher incidence in Hispanics than in whites, with the lowest incidence among blacks. Suppurative otitis media is a major problem in native American Indians and Alaskan and Canadian Eskimos.¹⁰⁻¹² Whether variations in attack rates relate to racial differences in the anatomical structure of the middle ear or are primarily a manifestation of associated socioeconomic, environmental, and cultural factors is unknown.

Rhinitis appears to be a frequent preceding event. Almost 50 percent of attacks follow an upper respiratory tract infection.⁵ The effect of allergy, however, is uncertain. Dees and Lefkowitz¹³ studied 130 children with recurrent secretory otitis media and found that 55.5 percent had allergic rhinitis, 23 percent had asthma, and 6 percent had other allergic manifestations. In contrast, two recent studies failed to demonstrate a relationship between allergies and secretory otitis media.^{14,15}

Breast feeding may protect against otitis media. When compared with bottle-fed infants, breast-fed babies had significantly fewer episodes of all infectious illnesses, including otitis media.¹⁶ In a study of 536 adult Eskimos, an inverse relationship between a history of prolonged breast feeding for more than 12 months and chronic middle ear disease was demonstrated.¹¹ The mechanism by which breast feeding protects children from otitis media is not entirely clear. There are several possible factors. One is the effect of bottle feeding in the horizontal position as opposed to the more upright position maintained during breast feeding. Duncan¹⁷ coined the term *positional otitis media*, and studies by him and later by Beauregard¹⁸ demonstrated a relationship between otitis media and

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feeding in the supine position. Swallowing while horizontal presumably facilitates the reflux of milk into the middle ear. An angled-neck bottle has been proposed to encourage the upright position during feeding.¹⁹ Breast feeding may also be protective by the transmission of antibodies. Finally, feeding cow's milk may contribute to infection by the production of milk allergy in the infant.

Additional, but less common, risk factors are cleft palate, in which condition otitis media virtually always occurs,²⁰ and Down's syndrome, in which 60 percent of children studied were found to have middle ear effusions.²¹

Pathogenesis

Eustachian tube malfunction is believed to be the principle mechanism in the production of middle ear effusions. Although the obstruction may be either functional or mechanical, functional causes appear to be more important.²²⁻²⁴ Functional obstruction can result from either structural abnormalities of the tube or abnormal tensor tympanic muscle function, which produces increased compliance or a "floppy tube."²² Mechanical obstruction may be either intrinsic, as from inflammation, or extrinsic, as from hypertrophic adenoid tissue.

The viscosity of the effusion is an additional important factor. There may be an optimal viscosity for clearance by the mucociliary transport system, with mucous of both very low or very high viscosity causing difficulties.²⁵

Senturia²⁶ suggests a classification of otitis media based on the character of the middle ear effusion. *Serous* otitis media is accompanied by amber, cell-free, low-viscosity fluid; *seropurulent* otitis media has amber fluid with some neutrophils and bacteria; *acute purulent* otitis media contains fluid loaded with neutrophils, medium levels of protein, and low levels of glycoprotein; *mucopurulent* otitis media has fluid containing mucoid elements and purulent components; and *mucoid* otitis media has viscous glue-like secretions. The etiological factors responsible for these several forms may be different. In experimental animals the acute purulent type followed introduction of bacteria into the middle ear, whereas both serous and mucoid otitis followed induced tubal obstruction.

In addition, differences in secretory cells, immunoglobulins, and chemical indicators of inflammation were noted between these several groups.²⁷

The utility of Senturia's classification has not been demonstrated in clinical settings. Most physicians make the distinction only between acute purulent otitis media and secretory otitis media. Acute purulent otitis media is thought to be caused by bacteria and precede the development of secretory otitis. Even these distinctions are not without problems because ear fluid from purulent otitis may be sterile and secretions from some cases of secretory otitis can contain bacteria. In addition, secretory otitis media can occur without a documented preceding episode of purulent middle ear infection.

Infecting Organisms

Klein²⁸ compiled several reports of organisms isolated from middle ear fluid from a total of 3,583 children with acute otitis media from the United States, Finland, and Sweden. The distribution of infecting organisms is given in Table 1.

Although *Streptococcus pneumoniae* continues to be the most frequently isolated organism, *Hemophilus influenzae*, formerly thought to be mostly limited to children under the age of five years, appears to be increasing in frequency in the older age groups.²⁹ The etiologic role of *Neisseria catarrhalis* and *Staphylococcus aureus* is uncertain because these organisms are part of the normal flora of the external ear canal.^{28,30} Infections with gram-negative enteric bacilli occur mostly in neonates, accounting for between 18 percent³¹ and 40 percent³² of cases. Otitis media caused by *Streptococcus pneumoniae* is more likely to cause severe pain and fever compared with cases due to *Hemophilus influenzae*, which tend to have less pain and fever but are more likely to be bilateral.³³

In a study of 122 children with symptomatic bilateral acute otitis media, 42 percent had either nonpathogenic organisms or sterile middle ear fluid, 33 percent had the same pathogen in both ears, and 20 percent had a pathogen in one ear, and either sterile fluid or nonpathogenic bacteria in the other. In a few children different pathogens were demonstrated in each of the ears.³⁴ Most

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Organisms	Percent
Streptococcus pneumoniae	35
Hemophilus influenzae	20
Streptococcus, group A	8
Neisseria catarrhalis	3
Staphylococcus aureus	2
Gram-negative enteric bacteria	1
Mixed organisms	2
None or nonpathogenic	29

From Klein²⁸

nonresponders (57 percent) to antimicrobial therapy had sterile ear fluid 36 hours after therapy was begun.³⁵ Anaerobic bacteria are more frequently isolated from patients with chronic otitis media than from those with acute illness. In cultures of ear fluid from 50 patients with chronic otitis media, 3 had only anaerobes, and 25 had both aerobes and anaerobes.³⁶ Cultures taken from the nasopharynx correlate poorly with those obtained by tympanocentesis, with concordance demonstrated in 27 percent³⁰ to 69 percent of cases.³⁷ Culture from the ear canal of purulent drainage following spontaneous rupture of the tympanic membrane leads to recovery of the infecting organisms in about two thirds of cases.³⁸

Attempts to isolate viruses and mycoplasma from middle ear fluid have generally failed. Success for virus isolation was achieved in only 29 of 633 cases. Most were respiratory syncytial viruses.³⁹ Nor could viruses be isolated from fragments of mucosa taken from the promontories of middle ears in a study of 50 children with otitis media effusions.⁴⁰ The demonstration of mycoplasma has been equally unsuccessful.³⁹ Failure to isolate viruses is somewhat surprising because of the relationship of viral respiratory tract infections to acute otitis media.⁵

Diagnosis

Both acute and chronic otitis media can be either suppurative or nonsuppurative. The nonsuppurative forms can be further subdivided into

several types depending on the characteristics of the middle ear effusion. In most clinical settings, however, distinguishing among these several forms can be difficult. In a cooperative patient with a recent onset of ear pain and fever, clean external ear canals, and bulging, red, immobile tympanic membranes, the diagnosis of acute purulent otitis media is not difficult. Often, however, the patient is an irritable, struggling infant, whose eardrums are obscured by cerumen. Adequate help to restrain the infant may be unavailable, and the examination equipment inadequate. In such cases an accurate diagnosis may not be possible. Even when a clear view of the tympanic membrane is obtained, accurate diagnosis is impeded by lack of diagnostic criteria of general acceptance.⁴¹ The routine use of tympanocentesis to prove the diagnosis is neither practical nor in the best interests of the patient.

A bulging red or yellow tympanic membrane or pus in the external ear canal following eardrum rupture is the most reliable criteria for the diagnosis of acute purulent otitis media.⁴² Redness of the eardrum without bulging is unreliable because when tympanocentesis is performed in these cases, effusion is rarely present and cultures are usually sterile.⁴³ Whether these nonbulging red eardrums will evolve to purulent effusions is unknown. In the absence of objective signs, fever, pain, tugging of the ear, and irritability are unreliable indicators of infection.⁴⁴

Demonstration of mobility of the eardrum can be a useful aid to diagnosis of middle ear effusion. Using an otoscope equipped with a rubber bulb and airtight fittings, application of negative pressure causes an outward displacement of the eardrum, whereas positive pressure produces an opposite effect. Lack of movement is most often indicative of a middle ear effusion that can occur in both purulent or secretory otitis media. The finding is not pathognomonic, however, because the application of vigorous pressure with a bulb can cause movement of even a bulging membrane.⁴⁴ In addition, movement of some normal eardrums may be difficult to detect.

Tympanometry is another method of evaluating middle ear function. With this technique the degree of compliance of the eardrum in response to sound delivered by an electroacoustic impedance

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bridge is measured. Absorption of sound by the eardrum varies inversely with the stiffness of the tympanic membrane. Changes in the air pressure within the external ear canal are monitored and displayed graphically. Several typical tympanogram tracings have been described; in general, a tall peaked response is normal, whereas a flat curve is indicative of effusion. As with the pneumatic otoscope, a tight air seal is necessary.

There are several features of tympanometry that are attractive. The test is painless and under ideal conditions can be performed in approximately 45 seconds for each ear.⁴⁵ Although maintenance of an airtight seal is difficult in a crying or moving infant, sucking a bottle does not appreciably change the results and permits a successful examination in a significant number of infants.⁴⁵ Removal of earwax is unnecessary, and objective, quantifiable information can be obtained. Clinical correlations with some of the available instruments have been good, although the utility of the tympanogram in children under the age of seven months is a matter of controversy.^{45,46}

Tympanometry is not without problems. Several models are currently available, but not all have had sufficient clinical testing.⁴⁷ Their cost is high and their reliability has yet to be determined.

Last, in special cases tympanocentesis will be necessary. In very ill children, particularly neonates and those with complications, identification of the pathogenic organism can permit appropriate antibiotic therapy in addition to decompression of the middle ear. Kaplan and Feigin⁴⁸ have recently described a simplified technique using pipette tubing, a tuberculin syringe, and a 21-gauge, short, beveled needle for direct vision tympanocentesis.

Treatment

Most clinical studies of the efficacy of antibiotics for the treatment of acute purulent otitis media reported in the late 1960s and early 1970s generally found little differences among and good results from several antibiotics used, either singly or in combination.⁴⁹ Some of these therapies included penicillin, penicillin plus sulfathiazole, erythro-

mycin, erythromycin plus trisulfapyrimidine, oxytetracycline, and ampicillin. Staining of teeth in infants and increased relapses with oxytetracycline therapy⁵⁰ make the choice of this drug unattractive. When cases due to H influenzae were identified by tympanocentesis and culture, penicillin or erythromycin used alone were less effective than the other treatments.⁵¹⁻⁵³

With an increased awareness of the large percentage of cases caused by H influenzae in both infants and older children, recent studies have focused on therapies directed against that organism. Trimethoprim-sulfamethoxazole, ampicillin,⁵⁴ and cefaclor in either twice daily or thrice daily dose schedules⁵⁵ are all suitable agents. The increasing incidence of ampicillin-resistant organisms⁵⁶ which can reach up to 40 percent in some areas,⁵⁷ make the choice of ampicillin or amoxicillin less appealing than previously. Although both cefaclor and trimethoprim-sulfamethoxazole are effective against both ampicillin-resistant and ampicillin-sensitive organisms, cefaclor can cause serum sickness reactions, and resistance of some organisms to trimethoprim-sulfamethoxazole has already been reported.^{58,59}

There are few studies that compare antibiotics with placebo. In one report four different antibiotic treatment regimens were judged to be more effective than placebo.⁶⁰ In another, both ampicillin and penicillin were found superior to symptomatic therapy.⁶¹ Perhaps the most interesting of all is a recent report by van Buchem and associates.⁶² They studied 171 children and compared antibiotics (amoxicillin) only, myringotomy only, both antibiotics and myringotomy, and neither antibiotics nor myringotomy in a double-blind manner (including sham myringotomies). No significant differences were observed at one and two months in duration of symptoms or in findings by audiography or physical examination. Nor were there differences in recurrences during the first six months. The study did, however, exclude seriously ill children as well as those under the age of two years. A significantly greater number of spontaneous ruptures of eardrums were noted in the no treatment group compared with those treated with antibiotics alone. The lack of benefit from myringotomy suggested by this investigation is confirmed by a study by Roddey and colleagues,⁶³ who found that the only advantage was relief of pain in a small

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group of patients with severe initial earache. Others, however, have found that a combination of myringotomy and antibiotics gave results superior to those with antibiotics alone.^{64,65}

Although the effectiveness of decongestants and antihistamines in the treatment of both acute purulent otitis media and secretory otitis media has never been conclusively demonstrated, one half of the patients treated by family physicians-general practitioners receive these medications.^{7,66} In a recent review of these drugs, Grundfast⁶⁷ reported that some investigators found a favorable effect on eustachian tube function and an improved resolution of both acute and persistent otitis media with effusion. Other studies quoted, however, failed to demonstrate beneficial effects for either antihistamines or decongestants, or both. The author concluded that it was difficult to design a properly controlled study because of the numerous risk factors, including age, sex, race, season, climate, allergy, anatomical features, adenoid hypertrophy, and heredity. Patients selected for some of these variables may benefit from therapy, while those with other variables may not. Regardless of whether treatment is given, 50 percent of patients will be free of effusion within four weeks of diagnosis.⁶⁸ Another drug reported to hasten the resolution of middle ear effusion is prednisone,⁶⁹ but there are few well-controlled studies, and the risks may outweigh any potential benefits. Grote and Kuijpers⁷⁰ report the association of maxillary sinusitis in 60 percent of 307 children treated for middle ear effusion. Ninety percent of those with infected sinuses had resolution of their effusions following lavage of infected sinuses without additional therapy.

Middle Ear Ventilating Tubes

It is estimated that 1 million children receive tympanostomy tubes each year and that for most patients the procedure is bilateral.⁷¹ The purpose of the tubes is to remove the effusion, prevent its recurrence, and to improve hearing. Naunton⁷² detailed several problems associated with the use of the tubes. The underlying disease is unchanged by the treatment in that eustachian tube function is

not affected. The ears of children with tubes must be kept out of water, scarring of drums is a frequent sequela, otorrhea following insertion of tubes occurs in 5 percent to 68 percent of cases, and eardrum holes may not close following extrusion, which usually occurs spontaneously after 5.5 to 7 months.^{73,74} Less frequently reported complications are cholesteatoma, ossicular disruption, and sensorineural impairment.⁷² Placement of tubes is usually performed with general anesthesia, and premature extrusion and replacement requires a second anesthesia. In a report of 108 children five to eight years after placement of grommets, only 67 percent were considered cured judged by tympanometry, 1.6 percent had recurrent accumulation of secretion, 3.3 percent had adhesive otitis, 1.7 percent had perforation, and 1 percent had cholesteatoma. The eardrum was normal in 44 percent, but diffusely atrophic, lax, or retracted in 25 percent.⁷⁵ Infectious complications usually required treatment with antibiotics, but 27 percent of the infections did not respond to a single course, and in a few cases "an extensive and complicated therapeutic regime (was) necessary to achieve healing."⁷⁶

A controlled study comparing tympanostomy tubes with medical therapy could not be located, but in a survey of 500 otolaryngologists, 91 percent believed that prophylactic tubes were more effective than prophylactic antibiotics. Most of these otolaryngologists, however, abandon medical treatment after one to two months (average 1.8 months) in favor of tympanostomy tubes.⁷⁷ Thirty-two percent of the respondents insert tubes in one month or less, although one half of these patients may have cleared their effusions without the use of grommets.⁶⁸ Forty percent of surveyed otolaryngologists felt that tubes were used too frequently.⁷⁷

Complications and Sequelae

Serious complications, such as mastoiditis, meningitis, intracranial abscess, suppurative labyrinthitis, and sinus thrombophlebitis, can occur but fortunately are very infrequent. More common but troublesome is loss of hearing. The incidence of residual deafness following otitis media has been reported with varying frequency. The Medi-

cal Research Councils (MRC) report of 1957⁵ noted that 3 percent of children had diminished hearing 6 months after an acute attack. In a report to the MRC 10 years later, Fry and colleagues⁷⁸ noted a rate of 17 percent in children followed for 5 to 10 years after an initial attack of otitis media. Diminished hearing was more likely in female patients than in male patients, in those with a family history of otitis media, and in patients whose tympanic membrane ruptured during an attack. Other reports confirm the persistence of middle ear effusion and hearing loss for extended periods of time.^{79,80} Additional risk factors for persistent effusions are an age of less than 24 months at time of attack compared with those older than 24 months and an increased risk for white children compared with those who are black.⁸¹

That persistent hearing loss in children with unresolved middle ear effusions can impair language and speech development has been amply documented.⁸²⁻⁸⁵ However, differences in the ability to process sound at 7 years of age between children with persistent middle ear effusion for a nine-month period and a control group had disappeared by the age of 9 years.⁸⁶ Furthermore, in a critical review of literature that related developmental impairments to early otitis media, Paradise⁸⁷ has serious questions about the validity of the relationship. There appear to be important method and design problems with the several studies. Low socioeconomic status, poor parental behavior (such as bottle propping, poor hygiene, and insensitivity to children's symptoms), and unrecognized minimal central nervous system disorders could have accounted for both an increased incidence of otitis media and impaired educational achievement. He cites a body of evidence that suggests that developmental impairments tend to disappear shortly after normal hearing is restored. He cautions against premature use of tympanostomy tubes in children prior to the period in which the spontaneous disappearance of middle ear effusions can be expected.

Prophylaxis, Prevention, and Screening

As noted above, breast feeding^{11,16} and avoidance of the horizontal position while feeding^{17,18} may prevent attacks of otitis media. For children with recurrent attacks, chemoprophylaxis and sul-

fadoxazole⁸⁸ or ampicillin¹⁰ has reduced rates of recurrence. Another approach has been the use of pneumococcal vaccine. Although the immune response to pneumococcal otitis is variable and appears to increase with age,⁸⁹ a trial of pneumococcal vaccine in children over the age of six months demonstrated a significant reduction in attacks caused by pneumococcal organism types contained in the vaccine.^{90,91} The currently available vaccine, however, is not recommended to prevent otitis media or for use in children under the age of two years. The role of tonsillectomy or adenoidectomy is unclear, with a lack of firm evidence that these surgical procedures are useful to reduce recurrent infections.⁹² The use of tympanometry to screen children for middle ear effusions has been recommended and implemented in some locations, but a report by a national task force composed of experts from the fields of audiology, otolaryngology, pediatrics, and epidemiology recently concluded that "the Task Force does not endorse universal (mass) impedance screening at this time" (1978).⁹³ The task force, however, did emphasize the need for research to further clarify the epidemiology, natural history, and optimal management of middle ear disease.

Recommendations

The following recommendations are derived from information contained in the quoted references and the author's personal practice experience. It is clear that data required to answer many questions about natural history, epidemiology, and clinical management are lacking. Nevertheless, the family physician sees patients with otitis media daily and must make clinical decisions using a confusing, voluminous, and conflicting literature in the light of personal experience.

Prevention

Breast feeding should be encouraged, especially for those children with multiple risk factors, such as having siblings with recurrent otitis media, having allergy in the family, belonging to the white race, and others detailed above. Failing this, feed-

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ings should be given in a semivertical position and propping of the bottle should be voided.

Diagnosis

The most reliable diagnostic criteria relate to the appearance of the tympanic membrane or the presence of pus discharging from the eardrum.⁴² A pneumatic otoscope with good illumination, a tight air seal, and facilities for adequate restraint of the infant are essential. Bulging and immobility with redness of the eardrum are reliable indicators of infection, though redness alone is not.⁴³ At this time, tympanometry cannot be recommended either for screening or for purchase by all physicians.⁹³ If available, however, the additional information in questionable cases could help in the diagnostic evaluation. Frequently it will not be possible to make a diagnosis with certainty because the eardrum cannot be adequately visualized or because changes in morphology of the tympanic membrane suggest infection but do not meet all of the necessary criteria. Therapeutic decisions in these cases should be made using all other available information, including a past history of infection and response to therapy, the degree of toxicity of the patient, fever, irritability, and other signs and symptoms. Since most infections are self-limited, in a patient who is not very ill, re-examination after 24 hours during which symptomatic therapy is given may help clarify the situation. For follow-up examinations an audiometer is a useful instrument.

Therapy

Antibiotics are recommended for all cases in which a diagnosis of acute purulent otitis media is made. Spontaneous perforation and perhaps residual hearing loss may be prevented.^{62,78} In all age groups, the antibiotic chosen should be effective against H influenzae. Either ampicillin (100 mg/kg/d in four doses at least one hour before and two hours after meals for 10 days) or amoxicillin (40 mg/kg/d in three doses for 10 days) is suggested as the drug of choice,⁵⁷ unless a significant degree of H influenzae resistance has been demonstrated in

the geographic area. In those cases, either trimethoprim-sulfamethoxazole⁵⁴ (8 mg/kg/d of trimethoprim and 40 mg/kg/d of sulfamethoxazole in two doses for 10 days) or cefaclor⁵⁵ (40 mg/kg/d in two doses for 10 days) should be used. Decongestants or antihistamines can be used in all cases, although their efficacy has not been definitely proven.⁶⁷ Nevertheless, they may be helpful for some patients. The medications are neither costly nor particularly dangerous and can be discontinued if ineffective or if unacceptable side effects develop. Cases should be rechecked at 10 days and monthly thereafter if middle ear effusion persists. Patients with persistent effusions might benefit from a second course of an antibiotic with a somewhat different spectrum of activity from the first one employed. If tolerated, antihistamines and decongestants can be continued for the patients with persistent effusions. Hearing acuity should be checked at monthly intervals. At this time there is insufficient evidence to recommend the use of either steroids⁶⁹ or sinus lavage.⁷⁰ Myringotomy can be reserved for patients with persistent and severe pain.⁶³

For frequent recurrent infections, chemoprophylaxis with either sulfasoxazole⁸⁸ (500 mg two times daily for 6 to 12 months) or ampicillin¹⁰ (125 mg daily up to age 30 months and 250 mg daily for older children as a single daily dose for 6 to 12 months) is recommended. Pneumococcal vaccine is not approved for this purpose at this time, and adenoidectomy with or without tonsillectomy has not yet been shown to be useful.⁹²

The question of referral to an otolaryngologist can be a problem for the family physician. Early referral could result in the premature use of ventilating tubes in cases that may have cleared spontaneously.⁷⁷ Referral for persistent middle ear effusion should be delayed for six months and be requested only if hearing loss is persistent. Hearing acuity should be monitored monthly, and temporary losses compensated for with appropriate educational adjustments. As noted, temporary hearing loss rarely results in lasting educational deficits.⁸⁷

All of these recommendations, of course, are subject to revision with the discovery of new information. The family physician is ideally suited to make some of these discoveries. With access to whole families and older patients, the effect of household size, family factors, and the course of

illness in adults can be investigated. The natural history and effect of antibiotics on the red, non-bulging eardrum needs elucidation. Although some longitudinal studies have been done in the past, treatment methods and perhaps the disease itself may have changed in recent years. Good randomized studies that compare adenoidectomy or ventilating tubes with medical therapy are needed. The use of decongestants, antihistamines, steroids, and prophylactic antibiotics for recurrent infections, all require additional studies. Since the current state of the art is far from satisfactory, it is hoped these discoveries will be soon forthcoming.

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