Ear infection or otitis media (OM) is the most frequently diagnosed illness among children in the United States (Zeisel & Roberts, 2003). The prevalence of OM has grown dramatically in the last 30 years. A U.S. Department of Health study in 1996 reported a 150% increase in the number of identified ear infections in preschoolers since 1975 (Feakes, 1996). Frequent ear infections during the first two years of life can have a deleterious effect on a child’s hearing and may lead to impairment of the child’s developing language and speech skills. Problems with developing language and speech skills can subsequently lead to academic problems. It is important that parents and teachers are aware of the features of OM, including prevalence, current treatment, risk factors and role in later language and learning difficulties.

Disease Overview

Otitis media (OM) is the inflammation of the middle ear, which can be accompanied by fluid. OM affects 75% to 95% of the pediatric population. Most episodes occur within the first three years of life with frequency of episodes most likely to peak between 12 to 18 months. Nearly half of all children experiencing an ear infection will have had three or more episodes by their third birthday (Cornell Pediatrics, 2003).

In healthy children the middle space behind the eardrum is filled with air. The middle ear is attached to throat by the Eustachian tube. The Eustachian tube sustains the middle ear airway and protects the middle ear from secretions. However, when a child is experiencing an upper respiratory tract infection, the upper respiratory tract (including nose and throat), Eustachian tube, and middle ear are congested with mucous. When the Eustachian tube is blocked, swollen, irritated or malfunctioning, the child is more likely to retain or accumulate middle ear fluid that would ordinarily drain into the throat. When the middle ear is filled with fluid, the eardrum is not able to vibrate properly, which leads to decreased conduction of sound and reduced hearing. The hearing deficits will persist until the fluid dissipates; often this hearing loss recurs and will vary in degree.

When the middle ear is filled with infected fluid, the child’s condition is known as acute otitis media (AOM), commonly known as an ear infection. Symptoms of AOM include fever, irritability, and pain. Frequently, the fluid in the ear will not become infected, or if the fluid is infected, often the infection will spontaneously resolve. The problem, however, is when the fluid will not dissipate. When this occurs the condition is known as otitis media with effusion (OME). The non-infected fluid may persist for several weeks or even months. If the fluid remains in the child’s ear for more than three months, then the condition is considered to be chronic OME.
**Risk Factors**

Multiple factors increase a child’s chance for developing OM, including environmental, developmental, and biological factors. Environmental risk factors for developing chronic OM include having an episode of otitis media during the first six months of life, exposure to second-hand smoke, infant feeding practices (including bottle feeding and position of the bottle during feeding), socioeconomic status, and group daycare attendance. Regarding the latter, children who participate in group child care are more likely to develop frequent and recurrent upper respiratory tract infections, which are a major contributor to Eustachian tube dysfunction.

One of the greatest risk factors for developing OME is age. Children who are younger than age three are at increased risk for OME because their Eustachian tubes are more horizontally aligned than those of older children. The horizontal position of the tubes makes it more difficult for fluid to drain from the middle ear. Chronic infection is another risk factor, as children who have had their first episode of OM at an early age show greater risk for developing repeated and/or chronic episodes.

Other contributory risk factors include heredity, as mothers who themselves have histories of ear infections are more likely to have children with higher rates of infection. The likelihood of identical twins or triplets having an ear infection simultaneously is about twice the rate for fraternal twins. Several chromosomal disorders cause Eustachian tube dysfunction and concomitant OM, such as Down syndrome, Williams syndrome, Apert syndrome, Fragile X syndrome, Turner syndrome, cleft palate, and autism. Chronic allergies have been also implicated as a potential risk factor. Allergic rhinitis has been associated with OME, most likely due to the inflammation of the mucosa of the middle ear. The rhinitis condition can be attributable to airborne allergens such as pollen, mold, dust, and dander, as well as nonallergic irritants such as fumes, odors, and smoke. In general, any allergic reaction that leads to mucosa inflammation and fluid accumulation in the middle ear may lead to OME. Food allergies have been suggested as a possible contributory source of chronic OM, but this hypothesis has not been supported by rigorous scientific trials using control samples (e.g., differentiating between children with OME who suffer rhinitis versus those who have food allergies). The pathogenic role of food allergies in OM is likely unusual and further research is needed.

In contrast, a promising line of recent research suggests that bacterial biofilms may directly contribute to conditions of chronic ear infections (Hall-Stoodley et al., 2006). Biofilms are colonizations of bacteria that attach to surfaces and serve as a defensive barrier for the bacteria. Bacterial biofilms are also resistant to antibiotics. Children with a history of chronic ear infections, including those who were asymptomatic, have been found to have bacterial biofilms on their middle ear tissue. These results suggest that recurrent OM may not be due to reinfection, but to persistent biofilms that are metabolically resistant to antibiotics. While antibiotic therapy is typically effective for those children with acute OM without the presence of biofilms, those children with chronic OM typically receive little benefit from antibiotic therapy and are better treated by myringotomy (surgery to insert tubes in the ear canal, see below).
Monitoring Hearing, Speech, and Language Development

Otitis media with effusion is the most frequent cause of acquired hearing loss in children. The link between OME and speech and language development is related to fluctuating hearing loss that accompanies OME. In children who have OME, hearing loss can vary from no hearing loss to a loss of up to 50 decibels. The majority of children with OME experience mild to moderate hearing loss, which is an average of 25 db (comparable to putting your hands over your ears). The hearing loss may impair the ability to hear certain speech sounds and subsequently process those sounds. Infants with greater than 20db average hearing loss from 12 to 18 months of age have a 33% probability of developing subclinical (i.e., emergent) and clinical speech disorder by three years of age.

One important consideration is that OM does not always present with specific signs or symptoms. Therefore, when observing a child it is important to consider that the following behaviors may result from hearing loss: difficulty paying attention, or diminished attention from previous observations; failure to respond when spoken to; and sitting closer to audio stimuli such as computer speakers or TV. These behaviors may be indirect symptoms of temporary and fluctuating hearing loss associated with OM. When a child has a diagnosed ear infection, however, signs of illness will be much more acute. The child will have a fever, pull on his or her ear, be irritable, and complain of ear pain.

Children with a history of OM and/or risk factors for OM should have their speech and language development closely monitored, and need a recent hearing assessment. The hearing assessment is in addition to the hearing screening completed in the pediatrician’s office. The hearing assessment includes a complete physical examination of the ear, tests of hearing tone or pure-tone audiometry, tests of middle ear function such as tympanometry and acoustic reflex measurement, and tests of speech audiometry including speech reception threshold and tests of word recognition.

Prevention and Treatment

Antibiotic therapy. Frequently, children with OME will not be treated unless the fluid becomes infected or if hearing loss is observed. When treatment is required, antibiotic therapy is the most common treatment for acute otitis media. In the United States, ten days of antibiotic therapy is the standard prescription for treatment of an acute ear infection. However, the effectiveness of antibiotic therapy in treating OME is not conclusive, as antibiotics have a beneficial but limited effect on treating recurrent otitis media and shortterm OME, but longer-term benefits on OME have not been found (Williams, Chalmers, Stange, Chalmers, & Bowlin, 1993). This finding is particularly alarming given reports that antibiotic-resistant infections are on the rise (CDC, 2006). Research indicates that antibiotic use in treating AOM is not always necessary, except in persistent cases. When parents are counseled about the course of AOM and cautioned against unnecessary use of antibiotics, the majority of parents opt to not treat their children with antibiotics.
Surgery. In persistent cases clinicians may recommend that surgery be performed to alleviate the child’s chronic ear infections. The surgery, known as myringotomy, requires that a pressure equalization tube (i.e., P.E. tubes) be placed in the child’s middle ear. This tube will allow air to enter the middle ear space. The air will help the lining of the middle ear heal and will prevent future infections. Surgical tubes will stay in place for six to twelve months and fall out on their own.

Intervention strategies. Parents and teachers can work together to stress several basic intervention strategies including: 1) promoting a healthy environment, 2) promoting listening, 3) promoting language learning, and 4) promoting early literacy learning. Promoting a healthy environment may include frequent hand and toy washing, and minimizing or eliminating exposure to second-hand cigarette smoke. Promoting listening involves helping children to hear and understand speech and decreasing background noise to minimize distractions for children when they need to listen. Activities to promote language learning may include asking simple questions, listening to what the child has to say, and talking about things that the child is interested in. Finally, promoting literacy learning can be accomplished through interaction with books, songs and games, such as reading stories aloud to children, describing and explaining the pictures, referring to the child’s own experiences, giving children books and magazines to look at on their own, and reading aloud signs and labels encountered daily, such as traffic signs, newspaper headlines, and labels on packages.

References


**Resources**

American Speech-Language-Hearing Association (ASHA): 10801 Rockville Pike, Rockville, MD 20825; (800) 638-8255; [www.asha.org](http://www.asha.org)


National Institute on Deafness and Other Communication Disorders (NIDCD) Information Clearinghouse: 1 Communication Avenue, Bethesda, MD 20892; (800) 241-1044; [www.nih.gov](http://www.nih.gov)