

MIDDLE EAR INFECTIONS (Otitis Media)

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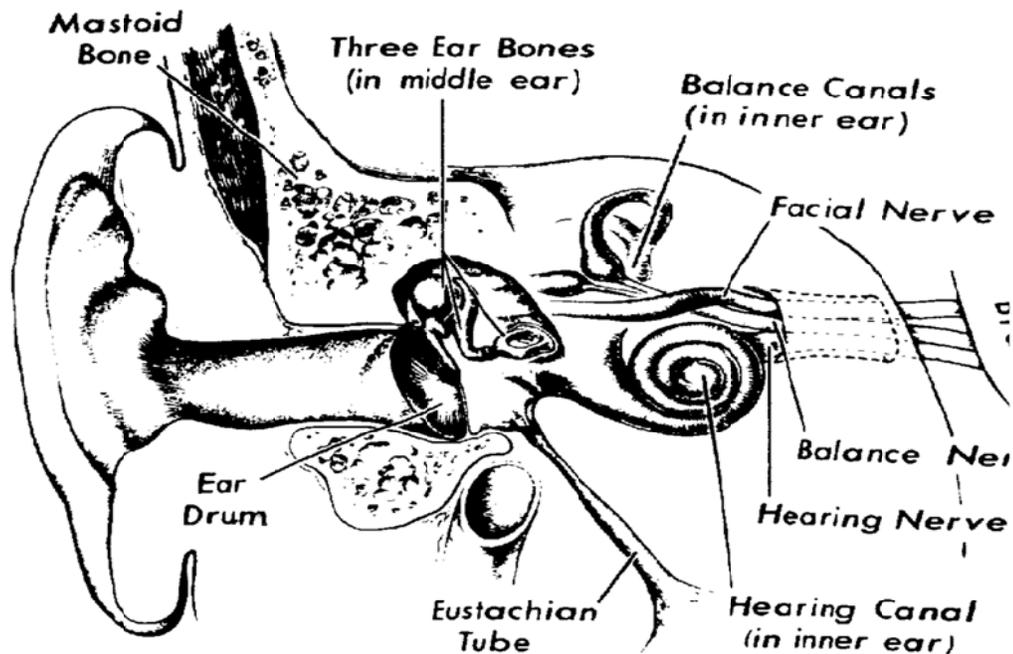
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ATTENTION!

This material is provided as a supplemental service to our patients. It is **not** intended to be a **substitute for a thorough evaluation** and counseling by your otolaryngologist (ear, nose, and throat physician) and other health care professionals.

ANATOMY OF THE EAR

The ear is divided into three parts: the external ear, the middle ear, and the inner ear. The auricle (the part of the ear that sits on the outside of the head) and ear canal are the external ear. The eardrum separates the external from the middle ear. The middle ear includes all of the structures between the eardrum and the inner ear, notably, the three small hearing bones (hammer or malleus, anvil or incus, and stirrup or stapes) and the mastoid bone.



The middle ear chamber is lined by a membrane similar to the lining of the nose and contains secreting glands and blood vessels. This chamber is connected to the back of the nose by a small channel called the Eustachian tube. The Eustachian tube serves to ventilate the middle ear while protecting it from bacteria and nasal mucus.

DEFINITION

Otitis media is *infection or inflammation* of the **middle** ear. In other words, the ear need not be infected to have otitis media. Rather, the ear may simply be inflamed. The common middle ear infection is known as “acute” otitis media. This develops suddenly and typically has severe symptoms, like ear pain and fever. Acute otitis media usually improves with time and / or medical treatment. “Chronic” otitis media, by definition, persists or recurs despite standard medical treatment. Without more aggressive intervention, chronic otitis media can persist indefinitely. Symptoms depend upon whether the condition is active or inactive, whether or not there is involvement of the mastoid bone and whether or not there is a hole in the eardrum. There may be drainage from the ear, hearing impairment, tinnitus (head noise), dizziness, pain or, rarely, weakness of the face.

DEVELOPMENT OF OTITIS MEDIA

A number of factors may contribute to the development of ear infections. Most experts consider Eustachian tube dysfunction to be the primary cause for both acute and chronic ear infections. If the Eustachian tube cannot open properly, air that has been absorbed in the middle ear space cannot be replaced. The Eustachian tube may be adversely affected by immunologic problems, environmental problems, and birth defects.

All children are born with resistance to many bacterial infections, because they carry their mother’s antibodies. These antibodies may be passed through breast milk. This is one reason why children that are breast-fed may have fewer ear infections than children raised on formula. As mother’s antibodies are lost, children will be vulnerable to certain bacteria that cause ear infections. These bacteria are most likely to cause acute ear infections after a child develops a viral upper respiratory tract infection (which causes the Eustachian tube to remain congested). Young children that are in daycare, specifically those with play groups > 6 children, are at an increased risk of developing viral upper respiratory tract infections, as well as acute ear infections. With time, most children will develop a resistance to both the viruses that cause upper respiratory tract infections and the bacteria that cause acute ear infections. If repeated acute ear infections develop or a severe ear infection damages the middle ear, these infections may become recurrent or persistent. For example, an acute ear infection may cause the eardrum to rupture. Though most of these ruptures will heal on their own, some will remain open.

Environmental problems can contribute to the development of ear infections. Environmental and food allergies and tobacco smoke exposure (even if the smoking occurs in another room) can increase congestion in the Eustachian tube.

Children are born with relatively poorer functioning Eustachian tubes than adults. The infant Eustachian tube is relatively more horizontal, narrow, and “S” shaped, leading to be more vulnerable to congestion. The anatomy of the Eustachian tube, like height or eye color, is determined by the genetic composition, so some people will have better tubes than others. Some children are born with more severe problems affecting the Eustachian tube. Trouble with the Eustachian tube usually gets better with age.

Some problems, such as cleft palate, may lead to life-long Eustachian tube problems. The tensor veli palatini muscle, which is responsible for opening the Eustachian tube during swallowing and yawning, is attached to the palate. If the palate has a cleft, contraction of this muscle will not open the Eustachian tube. Even after surgical repair of the cleft palate, the Eustachian tube commonly remains problematic.

If the Eustachian tube cannot open adequately, air cannot enter the middle ear space and a negative pressure is formed. This negative pressure feels like “stuffiness” when it occurs slowly and is not severe. If it occurs rapidly or to greater degrees (eg, when diving under water), it will often cause pain. If the negative pressure continues for longer periods of time, the Eustachian tube will be less effective at clearing bacteria that enter from the back of the nose. If bacteria cannot be cleared from the Eustachian tube they may cause an infection.

Furthermore, the negative pressure may irreversibly damage the eardrum. The negative middle ear pressure leads to a process, known as atelectasis, which is the progressive collapse of the eardrum against the middle ear bones and the inner ear. Skin that is normally shed from the skin of the eardrum can no longer be expelled out the ear canal. This dead skin debris then builds up in small pockets, known as **cholesteatoma**. As the debris accumulates, the pockets expand, destroying surrounding bone. The skin debris, along with moisture and body heat, provide for excellent growth material for bacteria and fungus; hence, chronic ear infections are common with cholesteatoma. These skin pockets can become extensive, growing into small spaces throughout the bone that houses the ear, potentially involving surrounding structures (eg, the brain and the nerve that controls facial movements). If surrounding structures become involved, **more serious complications may develop**. Extension of the skin pockets into small spaces also makes the risk of **residual disease** considerable, even with the most expert of treatment.

HEARING IMPAIRMENT WITH OTITIS MEDIA

Any disease affecting the ear canal, eardrum, or the three small ear bones may cause a **conductive** hearing loss by interfering with transmission of sound to the inner ear. Conductive hearing impairment is commonly encountered in otitis media as a result of fluid accumulation in the middle ear space. Less commonly, conductive hearing loss may result from the development of a perforation (hole) in the eardrum, partial or total destruction of one or all of the three little ear bones, or scar tissue.

If the trouble lies in the inner ear, a **sensorineural** or nerve hearing loss is the result. When there is difficulty in both the middle and inner ear, a combination of conductive and sensorineural impairment exists (mixed hearing loss). The hearing loss associated with chronic ear infection may also be sensorineural, and deafness may occur. Conductive hearing loss is more likely to be treatable. Sensorineural hearing loss is generally permanent.

EVALUATION

In many cases, an ear specialist can determine the cause and treatment needed by simple inspection of the ear. Frequently, the ear will need to be cleaned and examined with a microscope. As hearing loss is a nearly universal problem with chronic otitis media, hearing

tests and middle ear pressure tests are routinely performed before treatment is started. X-rays (usually CT scans) may be needed to determine the extent of the problem. The need for such studies is dependent on symptoms, findings from the ear exam, the hearing test, and prior treatment to the ear.

CONSERVATIVE TREATMENT

The frequency or duration of otitis media may be reduced by a number of conservative measures. As breast milk carries antibodies that help to prevent ear infections, nursing is recommended over the use of formula. Second, efforts should be made to keep childrens' play groups small, less than 6 children, such as in daycare. Third, environmental and food allergies, if any are suspected, should be controlled by reducing exposure to the offending material (eg, dust and pollen). Fourth, tobacco smoke should be avoided in the home, not just moved to another room.

The frequency of recurrent ear infections may be reduced with some dietary supplements, such as xylitol. Xylitol is a naturally occurring sweetener that is found in strawberries and raspberries. It's used to sweeten some sugar-free gums and lozenges. Products with xylitol may be purchased through certain retail outlets and over the web (eg, www.spry dental.com).

If a hole in the eardrum or a cholesteatoma is present additional precautions are necessary. First, you should not allow water to get into the ear canal. This may be avoided when showering or washing the hair by placing cotton or lambs wool in the external ear canal and covering it with a layer of vaseline. Swimming may be permissible with use of an ear plug (ask your ear surgeon). Second, nose-blowing should be avoided to prevent spread of bacteria and mucus from the nose up the Eustachian tube. If it is necessary to blow your nose, do not occlude or compress one nostril while blowing the other.

MEDICAL TREATMENT

Medical treatment may help to reduce the duration of symptoms with acute otitis media and to minimize the risk of more serious complications. Medical treatment may include the use of vaccines, oral antibiotics, careful cleaning of the ear, and application of antibiotic ear drops or powders. Treatment with intravenous antibiotics may be necessary in certain individuals.

In the event of ear drainage, cotton may be placed in the outer ear to catch any discharge but should not be allowed to block the ear canal. Medication, typically in the form of ear drops, should be used as prescribed.

If allergies are contributing to ear infections and minimizing exposure to the offending material isn't sufficient, nasal steroid sprays, antihistamines, or other allergy-control medications may be necessary.

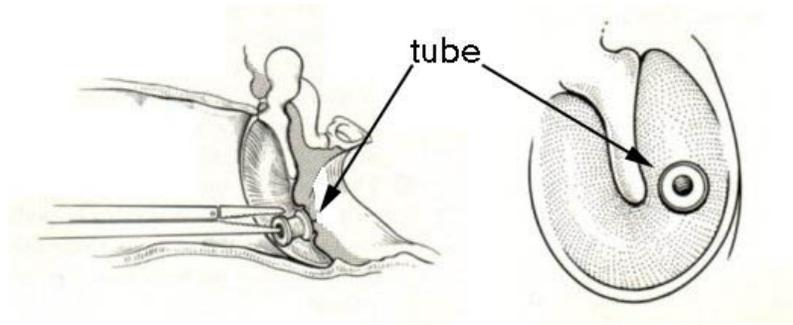
SURGICAL TREATMENT

As a rule, chronic otitis media is a surgically-treated disease. For many years surgical treatment was instituted in **primarily to control infection and prevent serious complications**. These

remain the primary goals of surgery. **Improvement of the hearing is a secondary goal of surgery.**

Tympanostomy Tubes

This procedure bypasses the Eustachian tube to artificially ventilate the middle ear through a temporary hole in the eardrum. These are also commonly known as “PE” or pressure equalization tubes. They may reduce the frequency or symptoms of acute ear infections and may maximize the time that one spends with improved hearing. This can be performed in the office on cooperative patients (ie, adults), but most commonly are done in the operating room under general anesthesia (ie, in children).



Adenoidectomy

The Eustachian tube starts at the junction of the nose and the throat. Just behind the Eustachian tube is a patch of lymph tissue, like the tonsils, which is the body’s first line of defense against respiratory tract bacteria and viruses. If the adenoids become chronically infected, they can actually work against the body, by holding on to infection which can cause ear infections. Removing the bulk of the adenoid tissue can significantly reduce the frequency of ear infections and can reduce the time that children hold on to middle ear fluid. This needs to be done in the operating room under general anesthesia, but it is usually done as an out-patient.

Tympanoplasty

Repair of the eardrum may be necessary to cure some chronic ear infections. This procedure seals the middle ear and improves the hearing in many cases. Tissue grafts may be used to replace or repair the ear drum. These include a covering of muscle from above the ear (fascia) and a covering of ear cartilage (perichondrium). A diseased ear bone may be replaced by an artificial bone (prosthesis). Bone or cartilage from other parts of the ear may be repositioned to rebuild the hearing mechanism. When the ear is filled with scar tissue, or when all ear bones have been destroyed, **it may be necessary to perform the operation in two stages.** At the first stage disease is removed and the ear drum is reconstructed. At the second operation, the ear is explored to minimize the risk of residual disease and to attempt hearing restoration. A decision in regard to staging the operation is often made at the time of the first surgery.

Mastoidectomy

Treatment of chronic ear infection may require removal of part or all of the mastoid bone. This is commonly done at the same time that the ear drum is repaired (tympanoplasty). If

complications of acute otitis media develop (eg, acute mastoiditis), mastoidectomy may be necessary to prevent even more severe complications.

LINKS AND RESOURCES

American Academy of Otolaryngology Head and Neck Surgery
1 Prince St
Alexandria, VA 22314
(703) 519-1585
www.entnet.org

National Institute on Deafness and Other Communication Disorders (NIDCD)
1 Communication Ave
Bethesda, MD 20892-3456
(301) 241-1044
www.nidcd.nih.gov/
www.nidcd.nih.gov/health/hearing/otitismedia.asp

Centers for Disease Control and Prevention
1600 Clifton Rd.
Atlanta, GA 30333
(404) 639-3311
800-311-3435
www.cdc.gov/ncidod/hip/abc/facts12.htm

The American Academy of Pediatrics
141 Northwest Point Boulevard
Elk Grove Village, IL 60007-1098
847-434-4000
www.aap.org/policy/otitis.htm

Agency for Healthcare Research and
Quality Publications Clearinghouse
2101 E. Jefferson Street, Suite 501
Rockville, MD 20852
Voice: (301) 594-1364
Toll-free: (800) 358-9295
www.ahrq.gov