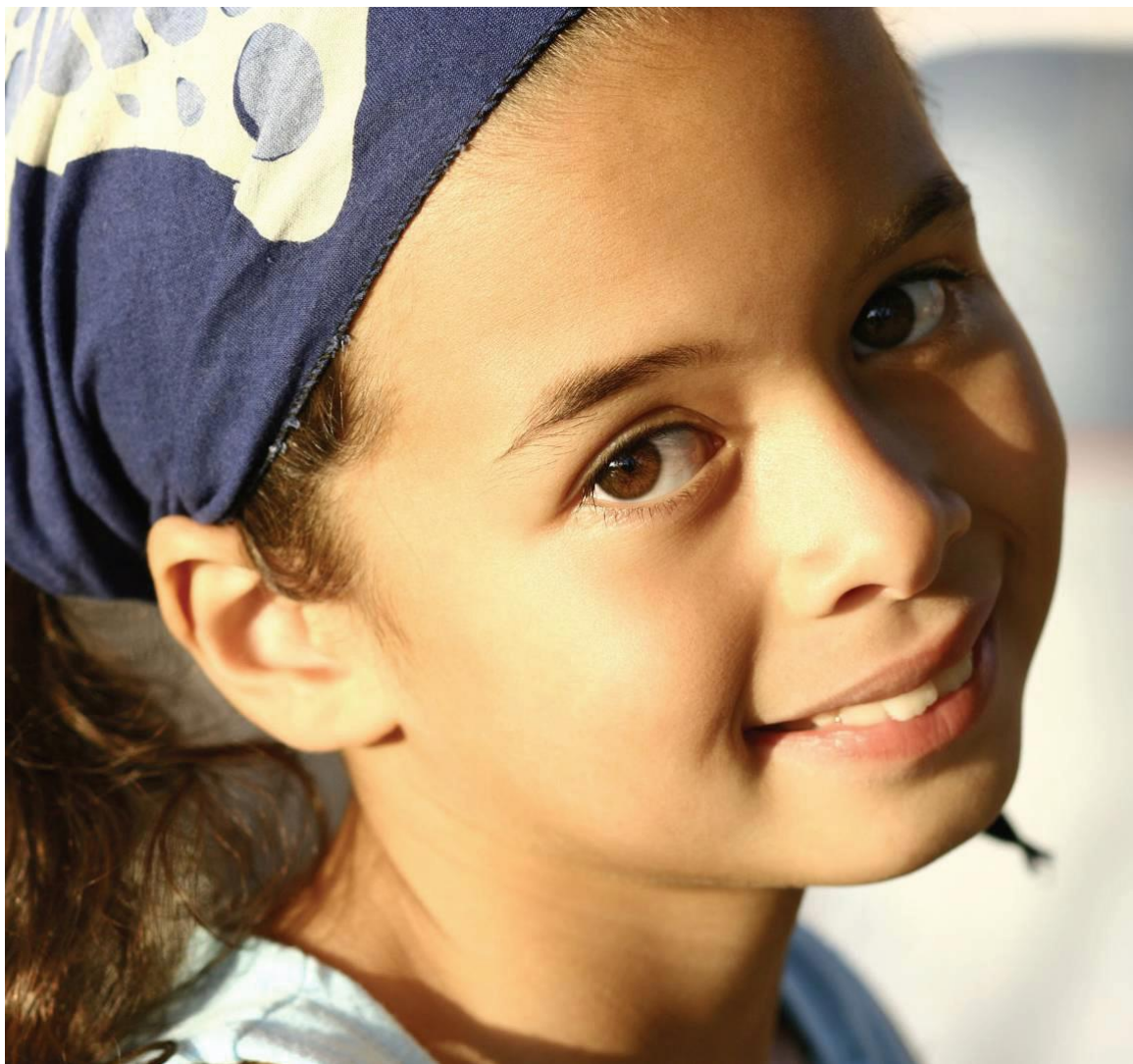


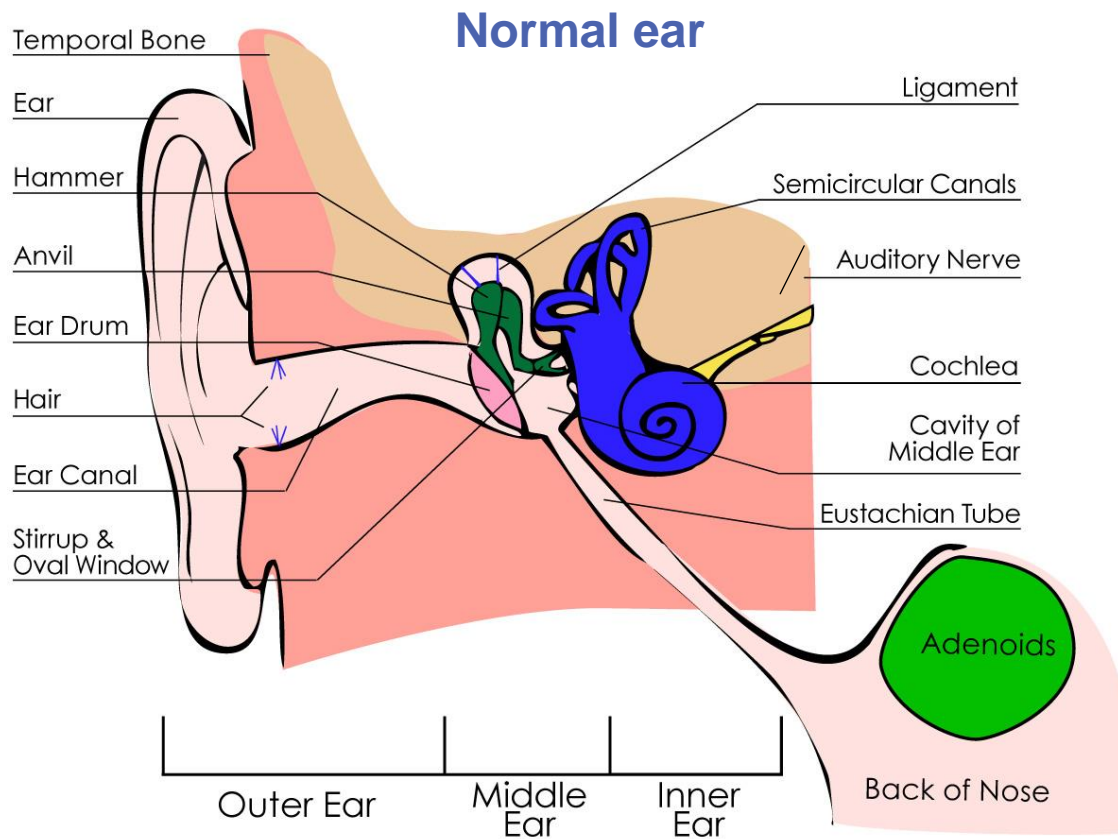


Medical and Surgical Treatments of Middle Ear Disease in Children

**Department of Otolaryngology & Communication Enhancement
Pre-operative Informational Series**



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disease occurs, you must first understand some facts about the normal middle ear.

Introduction

Middle ear disease (otitis media) is very common in children. It affects more than one third of us at some time during our childhood years. **For example, in the City of Boston, more than thirty percent of children have experienced three or more episodes of middle ear disease by their second birthday.** To understand how middle ear

The normal middle ear

The normal middle ear is a cavity surrounded by bone on three sides and by a thin tissue membrane, the *tympanic membrane*, or eardrum on the fourth. Connected to the middle ear by a passageway is an air-filled honeycomb of bone called the mastoid cavity.

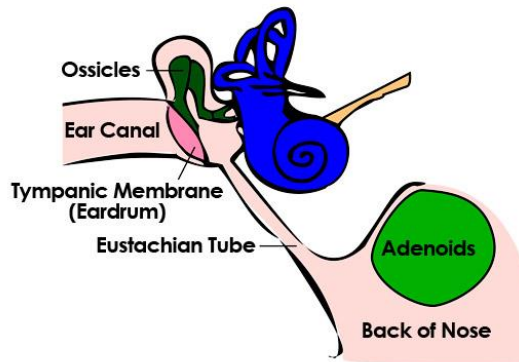
Sound waves enter the outer ear, pass down the ear canal, and strike the eardrum. The eardrum vibrates and transmits the sound waves along a chain of tiny bones (ossicles) into the inner ear, located within the bony wall directly opposite the eardrum. When the vibrations enter the inner ear, they are converted to electrical impulses by the special nerve cells within the cochlea. These impulses are transmitted along the hearing nerve to the brain.

Normally the middle ear cavity is filled only with air. The pressure of this air should be equal to the air pressure outside the eardrum. Equal air pressure on either side of the eardrum permits the eardrum to move freely when stimulated by sound waves. The air within the middle ear space is used to help nourish tissue linings in the middle ear. As the air pressure within the middle ear cavity begins to drop, a slight vacuum forms. As we swallow, a small passageway (the *Eustachian tube*) between the back of the nose and the middle ear cavity opens and allows air to pass from the nose into the middle ear, to eliminate the vacuum. This

passage of air equalizes the air pressure on either side of the eardrum. The Eustachian tube opens into the back of the nose near the

collection of lymph glands called the *adenoids*.

View of right middle ear from the front

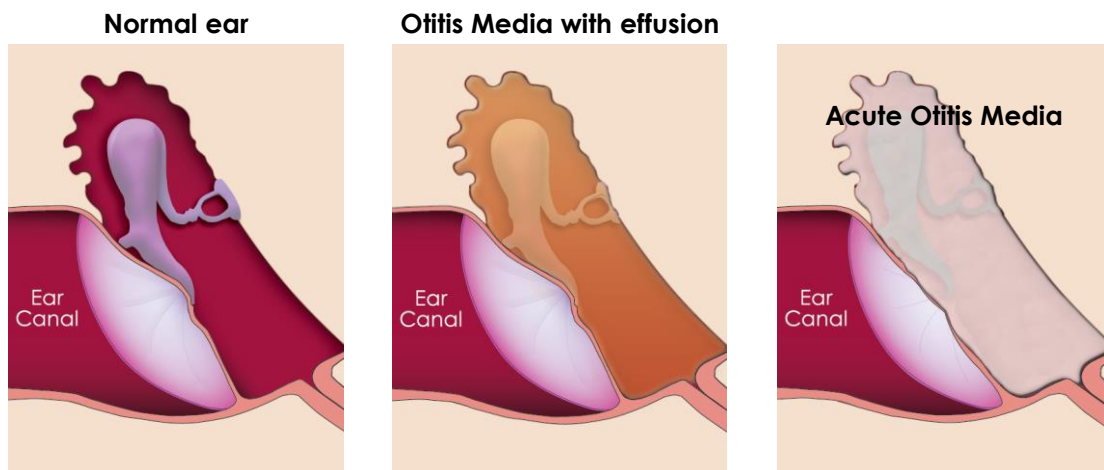


Why is middle ear disease more common in children?

Middle ear disease occurs more often in children than in adults because children

more often experience abnormal functioning of their Eustachian tubes. The two most common types of Eustachian tube problems are: 1) failure of the tube to open during swallowing; and 2) failure of the tube to remain closed at other times.

Eustachian tube blockage may be associated with conditions that cause swelling of the Eustachian tube lining, such as nasal infection, allergies, muscular weakness or abnormality, or large, potentially infected adenoids. A failure of Eustachian tube opening permits a temporary vacuum in the middle ear space to persist. This vacuum, in turn, produces a chain of undesirable effects. The vacuum pulls the eardrum in toward the bony middle ear cavity preventing the eardrum from moving freely and conducting



sounds completely, thereby producing a hearing loss. The stretching of the eardrum may be associated with discomfort and blocked ear sensations familiar to anyone who has descended rapidly in an airplane or elevator. The persistent vacuum also withdraws thin fluid from the tissues lining the middle ear space. This fluid interferes with the vibration of the eardrum and the tiny bones connecting it to the inner ear, adding to the hearing loss.

Often the middle ear fluid becomes infected by bacteria. These bacteria seem to enter the middle ear from the back of the nose through the Eustachian tube. Many of the bacteria cultured from the middle ear may simultaneously be cultured from the adenoids next to the Eustachian tube openings. The infection may not always cause symptoms for the child such as pain, fever, or drainage. It does, however, lead to irritation of the middle ear linings which may produce thick mucus in place of the thin fluid. The swelling of the

middle ear linings will also lead to further Eustachian tube blockage to complete the cycle.

Eustachian tube blockage can occur in any age child and especially in those with certain types of skull, bone, and tissue disorders including cleft palate. In young children, the Eustachian tube in this age group tends to be shorter and straighter. Bacteria and viruses from the nose may readily pass up through it and infect the middle ear space, particularly during upper respiratory infections. Once such infections occur, the Eustachian tube becomes temporarily blocked by the swelling created in the middle ear by the infection. This, in turn, leads to the formation of a middle ear vacuum, a stretched, retracted eardrum, and the formation of middle ear fluid and mucus.

What problems are associated with long-standing or untreated middle ear disease?

The most common complications of chronic middle ear disease include: hearing loss, eardrum changes such as scarring and stretching, creation of eardrum **retraction pockets** which may protrude back into the middle ear and mastoid cavities, erosion of the sound transmission bones in the middle ear, and scar formation in the middle ear space itself.

Eardrum stretching and scarring are caused by the constant vacuum and by the inflammation and middle ear infection which accompany many forms of middle ear disease. The persistent stretch leads to the development of weakened portions of the eardrum, which then become prone to the formation of retraction pockets that can collect debris.

These pockets, lined with skin, which is the outer layer of the eardrum, may continue to enlarge slowly as the vacuum persists. As the pockets increase in size, they may spread into the bony recesses of the middle ear and mastoid and cause destruction of vital structures. Once skin debris begins to collect in such pouches, they are called **cholesteatomas**. The pressure from the pocket and its accompanying infection may cause partial or complete destruction of the

small middle ear bones, which conduct sounds.

Often major ear surgery is required to remove such pockets completely and to repair the consequences of their development. In some cases, the eardrum is so thin or scarred that it must be completely replaced. Scar tissue within the middle ear space may become so extensive that the entire middle ear lining may have to be removed.

What about the hearing loss? Is it reversible?

The hearing loss that accompanies middle ear disease is usually reversible. Timely treatment of such disease may completely restore normal hearing. However, more advanced middle ear disease with deterioration of the eardrum, sound transmission middle ear bones, or middle ear lining may cause a hearing loss more difficult to reverse even with major surgery. Chronic recurrent infections of the middle ear are rarely associated with loss of inner ear function. However, when it occurs, this latter type of loss is permanent and may be helped only by a hearing aid.

Middle ear disease often causes a hearing loss that changes in severity from day to day or week to week. This so-called fluctuating hearing loss may produce confusion for the

patient. It may interfere with the development of normal language and speech in the infant and young child and it may lead to poor school performance by the older child.

What treatment is effective for middle ear disease?

Treatment for middle ear disease may be broken down into two general categories: medical and surgical. Medical treatment is utilized to improve Eustachian tube function and, in other ways, to interrupt the cycle of middle ear disease. The most common drugs used are decongestants and antibiotics.

Unfortunately, multiple clinical studies have failed to demonstrate that the decongestant medications actually help middle ear problems to resolve. These medications are useful for the treatment of nasal congestion and runny noses in older children and adults that frequently accompany colds or allergies and that might cause or make middle ear disease worse.

In contrast, studies have shown that antibiotics taken by mouth for variable periods of time may help eliminate middle ear fluid. These medications eliminate the bacteria associated with middle ear infections, and thereby reduce swelling of the middle ear and Eustachian tube lining. When air is able to pass through the Eustachian tube, middle ear fluid resolves and the cycle

is broken. Long-term or prophylactic antibiotic therapy may also be used to prevent recurrent ear infections and the hearing loss associated with them.

In some cases, it is possible for a patient to learn how to direct air from the nose up through the Eustachian tubes into the middle ear spaces. This type of exercise, called the *Valsalva maneuver* may be helpful in eliminating middle ear fluid and may also help treat certain other types of middle ear disease.

Sometimes middle ear disease will improve or regress completely without active treatment. The body can control and eliminate mild infections. Eustachian tube function may spontaneously improve after the problem that led to its malfunction has resolved.

If we have recommended a medical treatment for middle ear disease, it is important to use the medication or other therapy as directed. It is often necessary to continue the medications over prolonged periods of time. You should always consult us before discontinuing a medication prematurely.

When middle ear disease fails to respond to medications or to resolve spontaneously, surgical therapy is indicated. Surgery for

middle ear disease involves the creation of a small incision in the eardrum called a myringotomy. Through this incision, the fluid within the middle ear space may be removed and any remaining fluid may be allowed to drain spontaneously. Of most importance, air from the ear canal may freely enter the middle ear space. This free entry of air effectively prevents vacuum formation as long as the myringotomy incision remains open.

It may be necessary to maintain an air passage through the eardrum long enough for the middle ear lining to return to normal and for all fluid to resolve. Since myringotomy incisions may heal in a matter of hours after creation, an artificial device must be inserted into the eardrum to hold the incision open. The tubes themselves are small, about the size and shape of a capital letter “O” on this page. Tubes vary in size, shape, and material. Each tube has been designed for particular

clinical situations. All tubes are constructed of materials well tolerated by the body.

The tubes, when properly positioned, will not

protrude from the ear canal. They normally will not be visible except with a special examining instrument. How long the tube remains in your child’s eardrum depends upon many factors, including the thickness of the eardrum, the position of the tube placement, and the amount of eardrum growth during the time that the tube is in place. Tubes usually remain in place in the eardrum for an average of six to twelve months. However, the tubes may fall out

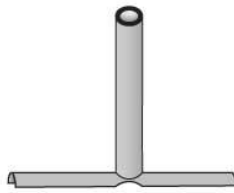
immediately after insertion or remain in place for over two years.

The tube seems to be pulled out of the eardrum by the slow growth of the outer layer of eardrum skin. Eardrum skin tends to grow and seemingly move slowly from a point in

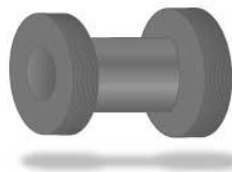
Types of Tympanostomy Tubes



Bobbin-type ventilation tube



T-Tube ventilation tube



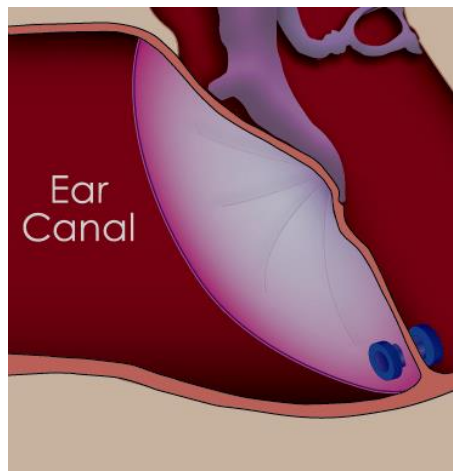
Paparella Tube

the central portion of the eardrum out into the ear canal. The skin tends to carry the tube along as it grows. The tubes may plug with wax or crusts, particularly those that may form if an ear infection occurs while the tube is in place. When plugging occurs, the eardrum may stretch inward and close behind the plugged tympanostomy tube, forcing it into the ear canal.

Once the tube leaves the eardrum, the myringotomy incision usually closes within several days to weeks, depending upon how long the tube was in place. The tube itself may remain within the ear canal for months. Tubes often fall out of the ear canal or are removed from it in an accumulation of ear wax.

Tubes are painless while in the eardrum or after they have fallen out into the ear canal. The only way that you will know that the tube is in place and functioning properly is that your child will hear better and will probably have fewer ear infections and can be seen by the otolaryngologist or pediatrician.

Tympanostomy tube in position in eardrum



What are the possible complications of tubes?

Bleeding or acute middle ear infections with the drainage of infected fluid may immediately follow tube insertion. These problems may be controlled using antibiotic eardrops and/or antibiotics taken by mouth.

Late complications which have been

associated with ventilation tubes include: infection with drainage through the tube, persistent eardrum perforations once the tube falls out, eardrum scarring, and retraction pocket or cholesteatoma formation. It must be stressed that these complications are “associated” with tube insertion and not

caused by the operation or the indwelling tubes themselves. Many of the same complications are commonly seen in ears with recurrent or persistent middle ear infections or fluid. On the other hand, patients who have had repeated and timely tube insertions often have normal appearing eardrums after their middle ear problems have stopped.

In rare instances, tubes have extruded into the middle ear space rather than into the ear canal. In these cases, the tubes remain

behind the eardrum. Since the tubes are constructed of materials well tolerated by the body, the presence of the tube has very little influence on middle ear function. The tube can be removed at a subsequent tube insertion or during a general anesthetic for other reasons.

Why are adenoids also removed as part of treatment for middle ear disease?

Adenoid excision may help eliminate middle ear disease if there is evidence that the adenoids are contributing to the spread of infection up through the Eustachian tube.

Recent studies indicate that the routine inclusion of adenoidectomy along with tube insertion will not guarantee faster or more permanent resolution of middle ear problems, but may help some patients.

Why must tubes be inserted repeatedly?

The insertion of the tube allows air to enter into the middle ear space, permitting the middle ear linings to return to a normal state.

This may help correct those Eustachian tube

functional problems related to blockage at the “ear-end” of the Eustachian tube.

Problems occurring at the “nasal-end” of the Eustachian tube, including Eustachian tube muscle dysfunction and swelling of the nasal end of the tube, will probably not be helped by the tube insertion. Unless problems at both ends of the Eustachian tube resolve during the period while the tubes remain in place, middle ear disease may recur

following tube extrusion.

If middle ear disease recurs after tube extrusion, we may suggest the use of either medical, surgical, or both types of therapy for treatment of the

recurrent disease. It has been our experience that significant, recurrent middle ear disease in a child who has previously had tympanostomy tubes will usually require reinsertion of the tubes. Of course, the time of year as well as the individual circumstances of each patient will also be important.



About the operative procedure to insert tympanostomy tubes

The operative procedure is usually carried out on an outpatient basis in a regular operating room. You and your child should arrive ONE AND A HALF HOURS before the appointed time for the nurses and doctors to review your child's medical history as well as to prepare your child.

If there is concern about potential anesthesia risks (e.g. asthma, cardiac history, seizures, etc.) you may be asked to bring your child in for an anesthesia consultation several days before the procedure. This appointment will be held in the admitting office.

On the day of the surgery, you and your child will meet the anesthesiologist who will administer the anesthesia. We usually induce anesthesia in the operating room by having the child breathe "laughing gas" (nitrous oxide). The effect is prolonged and deepened using other drugs. Particularly anxious patients may be given a sedative for relaxation prior to entering the operating room.

The operation is performed using an operating microscope. The eardrum is incised and the middle ear fluid is removed. The tube is inserted. Antibiotic ear drops are often placed in the ear canal and allowed to enter the middle ear through the tubes. In most cases the entire operation takes approximately 30 minutes.



The patient is then awakened from anesthesia and returned to the recovery room. The family may come in. Once your child is awake, you may be asked to stay with him/her until discharge.

Adenoidectomy

In many cases adenoidectomy may be performed on an outpatient basis along with the tympanostomy tube insertion. The adenoids are removed from the nasopharynx (area behind the nose) to improve the function of the Eustachian tube and to eliminate a source of infection, which may spread up into the middle ear spaces. Surgery is carried out through the mouth without the need for any external incisions.

General anesthesia for an adenoidectomy requires the insertion of a breathing or endotracheal tube into the upper windpipe to prevent the seepage of blood from the throat into the lungs. In contrast, the brief anesthesia for a tympanostomy tube insertion usually requires only a facemask. The passage of the endotracheal tube is a routine part of most general anesthetics, and it requires the insertion of an intravenous line.

The major complication associated with adenoidectomy is bleeding from the operative site. This occurs most frequently either during the first two days, or at six to ten days following the operation. Bleeding generally occurs when a small fragment of the scab or healing tissue dislodges and exposes a blood vessel beneath. Although most persistent bleeding is self-limited, we consider it to be a major complication requiring a doctor's examination and in some cases re-admission to the hospital. To assess your child's clotting ability, blood tests may be recommended by your surgeon prior to the day of surgery. Please inform the doctor if your child bleeds or bruises easily,

or if any family members have had trouble with bleeding during or right after surgery.

Another potential complication involves post-operative infection. This is usually manifested by significant, continuous headache or pain radiating to the ears. If these symptoms occur, you should contact us at once. Some physicians send patients home on antibiotics after adenoidectomy and some do not. If an



infection should occur, it may be necessary to change the antibiotic or increase the dose of the drug that your child is currently taking.

Removal of large adenoids may produce a temporary, or rarely, a permanent change in your child's voice. This may occur because the enlarged adenoid tissue may be aiding the soft palate in closing off the entry of air from the throat into the nasal cavity while speaking. For the same reason, some individuals have temporary or permanent problems with fluids leaking back through the nose. If these problems occur, they usually resolve spontaneously in 4 to 6 weeks. If they do not, an operation may be necessary to partially close the entrance into the back of the nose.

This is more common with cleft palate patients.

The adenoids are multiple accumulations of lymphoid tissue and must be removed piecemeal. For this reason, it is not unusual for adenoid tissue to re-grow, particularly in those patients who have allergies to inhaled materials. Should the adenoid tissue re-grow, it may be removed again. Usually, re-grown adenoid tissue is less abundant than the original adenoid mass.

Scarring of the raw surfaces in the back of the nose occurs rarely after adenoidectomy. If it should, the scar could seal the entry way into the back of the nose. An operation would be required to reopen the nasal passage.



Despite precautions, the instrumentation used in the performance of the operation may produce complications. The gag used to hold the mouth open must place some pressure on the tongue, lips and teeth. Occasionally, these tissues are unusually sensitive to this pressure. The tongue or lips may swell and become uncomfortable. Teeth, particularly first teeth, may loosen. Please tell the anesthesiologist if your child has any loose teeth prior to the surgery.

Pre-operative instructions

For the operation to be performed, your child must be given a general anesthetic. This must be administered on an empty stomach. **It is important that your child have nothing to eat after midnight.** Your child may drink clear liquids such as apple juice or water only up to two hours before the scheduled time of surgery. **Do not** allow your child to have gum, milk, lollipops, or hard candy on the morning of surgery.

Your child should arrive at the hospital 90 minutes before the scheduled time of surgery. **You will need to call the Day Surgery Dept the day before surgery to find out the time of your child's surgery.**

A parent or legal guardian must accompany the child to the hospital in order to give permission for the operation to be carried out.

General anesthesia cannot be given if your child has a fever or symptoms of an upper respiratory tract infection (cold). To do so would increase the risk of a post-operative pneumonia. If you must postpone your child's operation for this or any other reason, please call our office at least twenty-four hours in advance, if possible.



Aspirin or other non-inflammatory medications such as Advil™, Motrin™, ibuprofen, and Bufferin™ interfere with the body’s ability to clot blood. For this reason, it is advised not to administer aspirin-containing medications or other non-inflammatory products to the patient for two weeks prior to surgery.

Post-operative instructions

Children are allowed to swim after their ear tubes.

Children can typically return to school or fly in an airplane the day after tube placement as long as there are no complications.

Be prepared for some drainage of fluid from the ears for the first day or two after surgery. Ear drops have been placed in the ears at the time of surgery and these may continue to drain. A small cotton ball may have been placed in the patient’s ears. This absorbs excess ear drops and may be removed at any time following surgery.



Occasionally there will be blood-tinged fluid draining from the ear. If this persists during the day of surgery or the blood-tinged fluid becomes bloodier, please call us.

We may often ask you to place eardrops in the child’s ears for several days after surgery. Usually one full dropper should be placed in each ear twice per day. Keep the bottle of

drops after this three-day period. They may be used on a one-dose basis should water accidentally enter your child’s ear(s) or if ear drainage recurs.

A post-operative appointment should be scheduled for approximately 6

weeks after surgery. At that time, we will check your child’s ears to be certain that the tubes are working properly. A post-operative hearing test may be performed at this time.

If the patient has had an adenoidectomy, we recommend quiet activity during the first post-operative week. If you should notice slight oozing of blood from the nose over the first several days following surgery, please notify our office.

While the patient has a tube in an eardrum, it is important to keep all follow-up appointments. Follow-up evaluation includes examination of the ear canals to check the position of the tubes. When the tubes fall out of the eardrums, it is necessary to be certain that the drum is healing normally. Even if you notice that the tubes have fallen out of the ears onto the pillow, water precautions should be maintained until the patient has been seen by us to make certain that the eardrum hole no longer exists before resuming water related activities unprotected.

How to reach us

During the day

- Call the ORL Nursing line: 617-355-7147.
- If your issue is not urgent, and you reach voicemail, leave a message and we will usually be able to return your call in 1-2 hours.
- If your issue is urgent, and you reach voicemail, listen to the end of the

message and you will hear instructions as to how to page the nurse on call for immediate attention.

Nights, weekends & holidays

- Call the Children's Hospital Boston paging operator at 617-355-6369. Ask for the ORL doctor on-call and give the operator your name and phone number.
- Set your phone to received blocked caller IDs. Most of our physicians have blocked caller IDs and will not be able to reach you if your phone blocks these calls.
- To schedule an appointment at any of our locations, please call 617-355-6462 from 8:30 a.m. to 5:00 p.m. Monday through Friday.