

Tampa Bay Hearing and Balance Center

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Treatment Options for Ménière's Disease

Generally speaking, Ménière's disease is typified by a high fluid pressure problem in the inner ear. The inner ear has two fluid filled compartments. It is similar to a water balloon sitting within a water balloon. Both compartments are separated by a membrane that has microscopic sodium-potassium exchange pumps to shift salt (sodium) from one chamber to the other. This causes one

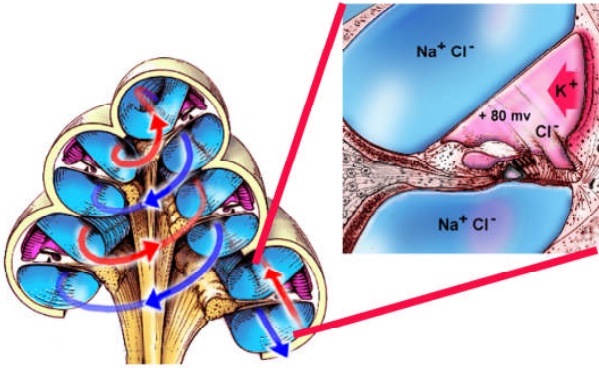


Figure 1

chamber to have a high potassium/low sodium concentration and the other chamber to have a comparatively high sodium/low potassium concentration. This difference in sodium and potassium salt concentrations between the two chambers is responsible for an electrical potential between the two chambers, acting like a small battery in the inner ear. (see Figure 1) This electrical potential is the energy that upon stimulation of the hearing and balance organs, drives stimulation of both hearing and balance nerve endings, enabling you to hear and maintain balance.

In Ménière's disease, the inner compartment which is comparatively high in potassium and low in sodium, has been shown to swell (see Figure 2). The reason for swelling is not definitively known, but some believe that dysfunction of the sodium/potassium control systems plays a role. A variety of symptoms accompany inner compartment swelling. Hearing loss, imbalance, ear noise, ear pressure or fullness, sound distortion, and increased sensitivity to loud noises are among the many sensations caused by swelling in the inner ear. Rapid swelling of the inner chamber may rupture the thin separating membrane between the two compartments. With a rupture, salt (sodium chloride) leaks from the outer chamber of high concentration to the inner chamber with low salt concentration. With sodium intoxication of the sensory cells, hearing declines and a violent vertigo attack starts that may last for minutes to hours. Some attacks are associated with nausea and vomiting. Variably, the delicate hearing and balance sensory cells suffer some degree of reversible and irreversible damage. With each successive attack, injury to the inner ear accumulates.

The main course of treatment is to try to lower the sodium concentration in the inner ear, hoping to lower inner ear fluid pressure levels. Anything that will cause fluid retention will typically make the symptoms associated with Ménière's disease worse. Women may notice their symptoms becoming worse around their menstrual cycle. Symptoms may also become worse after eating a salty meal.

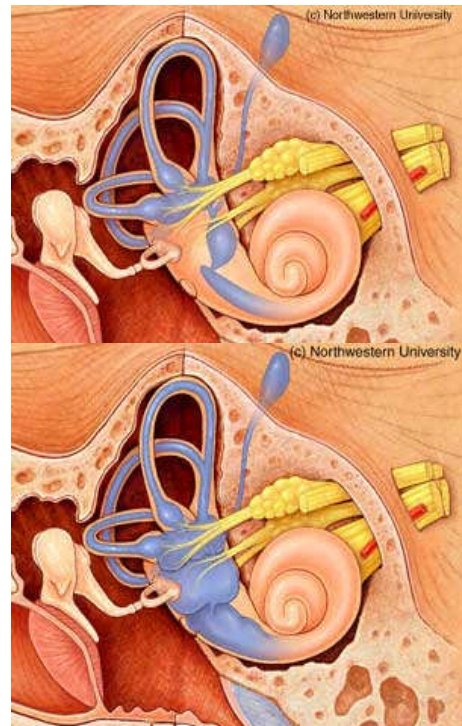


Figure 2

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Treatment Options for Ménière's Disease (cont)

Medical management of Ménière's disease includes diet, diuretics, anti-nausea medications, , anti-anxiety medications, sedatives, and often, antiviral agents. While some also recommend a variety of vitamins and minerals, no good scientific evidence supports their usage. A low sodium diet is the first standard mode of management. Individuals with Ménière's disease should not allow their sodium chloride (table salt) intake to go above 1500mg in a 24 hour period. All foods have sodium to some degree, some more than others. Even food prepared without adding table salt contains sodium chloride. It is in all living plants and animals. Sodium is also added to foods to add flavor and as a preservative. Reading labels of foods and becoming familiar with sodium content of fresh foods allows careful salt restriction. For example, milk is a body fluid and has a significant amount of sodium chloride, about 120 mg per 8 ounces, about 180 mg in a typical 12 ounce glass, or 240 mg in a 16 ounce milk shake.

Commonly, diet alone is not sufficient to control symptoms. Thus, a diuretic (water pill) is usually prescribed. The microscopic pumps that control water filtration in the kidney are similar to the pumps that control fluid regulation in the inner ear. Therefore, diuretics are effective in giving the pumps in the inner ear a boost and allow the ear to regulate the fluid pressures more effectively.

Sedatives like meclizine (Antivert or Bonine) suppress imbalance and nausea. Since stress, anxiety, and depression can be triggers (not causes) of Ménière's disease, treatment may involve sedatives like Valium, Ativan, Xanax (benzodiazepines), or anti-depressants such as tricyclics (amitriptyline) and tetracyclics (mirtazapine) or SSRI agents (fluoxetine, citalopram, etc), and others.

For acute vertigo event management to suppress nausea and vomiting, consider medications like meclizine, sublingual Ativan, sublingual scopolamine or hyoscyamine, or rectal suppositories of agents like promethazine (Phenergan). For quite severe episodes, intramuscular or intravenous injections of promethazine or other medications can be administered. When episodes require these medications often, other management as described below may be indicated.

Recently published research suggests that viruses can cause Ménière's disease. Postulated is that acute release of inflammatory protein affects inner ear fluid pressures (osmotic forces, e.g., inflammation that increases protein concentration can increase inner compartment fluid pressure). If an individual has a history of cold sores, or has evidence of high viral antibodies that are noted during a simple blood test, their symptoms might be improved substantially with antiviral medication. The antiviral medication does not kill the virus but suppresses it by preventing the virus's ability to infect additional cells. A person needs to be on the medication for a few months to notice any significant improvement.

Over 70% of patients establish adequate control of their symptoms within 6 months with just diet control and a diuretic. Up to 85% of patients have a spontaneous cessation of vertigo and imbalance problems within 2-5 years. In other words, being in a hurry to "fix" the problem can be overly aggressive management. For the 15-30% that continue to have symptoms despite strict diet control and diuretic use, other treatment options exist. These other treatments are listed below from the least invasive to the most invasive.

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Treatment Options for Ménière's Disease (cont)

Meniett

The Meniett is a device that claims to pressurize the inner ear to help “milk out” the excess fluid. To allow air pressure from this device to reach the middle/inner ear, a tube through the ear drum membrane is required. Placing a tube in the ear drum membrane is a minor procedure able to be done in the office with a topical anesthetic. The Meniett device is minimally invasive, which means that there is little down time (one can typically go to work the same day).¹ The Meniett is provided by a private medical equipment company and costs about \$3500.00. This cost may not be covered by insurance. The company does allow a 6 week trial period with a down payment that is returned if the device is found to be ineffective. Further information may be obtained from the company web site at www.meniett.com.



Figure 3

Endolymphatic Sac Surgery

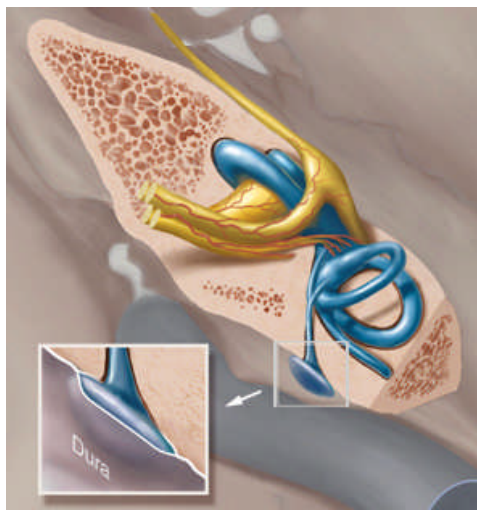


Figure 4

The fluid build up in the inner ears space is regulated by a hormonal relay system between fluid producing cells in the inner ear and the endolymphatic sac (ELS).

Dysfunction of the ELS is thought to be the underlying dysfunctional cause of inner ear membrane swelling in Ménière's disease. Vertigo attack recurrence rates are commonly reduced or eliminated by operating on the ELS. Inserting a small drainage port is called “endolymphatic shunt surgery. In peer-reviewed published studies, the results of installing a “shunt” or destroying the ELS seem quite similar. ELS surgery requires an out patient operation. An incision behind the ear accesses the mastoid bone behind the ear. Drilling the mastoid bone away provides access to the ELS. (Figure 4) The surgery takes about an hour to perform. Most people take about a week off work to recover from surgery. The risk of hearing loss or major vertigo or a serious

complication is minimal. ELS surgery is a good treatment option for patients who have failed maximal medical management and have good hearing. The early success rate for vertigo control is around 70% but long term success rates are lower. So, 30% of patients may undergo surgery and have no significant improvement in their symptoms. However, after ELS surgery, only 15% of folks who have enough continuing trouble to require additional surgical procedures.

¹ Risk: a ventilating tube can cause a perforation ear in the drum membrane or infection in the ear and does require one to keep water out of the ear.

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Treatment Options for Ménière's Disease (cont)

Chemical Labyrinthectomy

Gentamicin is in a class of antibiotics, aminoglycosides, that have been in use since the 1940s. These drugs are well known to be toxic to the inner ear. In the last two decades, this class of antibiotics has been supplanted by other less toxic drugs, but they are still used to treat life threatening infections. As early as the 1950s, the toxic effects to the inner ear were utilized to treat Ménière's disease. While the first drug used was streptomycin, it routinely had hearing toxicity. In the 1960s, gentamicin, then used to treat serious infections, was found to be less toxic to hearing than streptomycin. Nevertheless, it is still toxic to the inner ear, comparatively more toxic to the balance system of the inner ear than it is to the hearing system. Because of that differential toxicity, it can be used to treat patients with intractable vertigo. The major potential value of the toxicity of gentamicin may be its affect on the cells in the inner ear that secrete fluid and that affect may happen more often than toxicity to hearing and balance sensory cells.

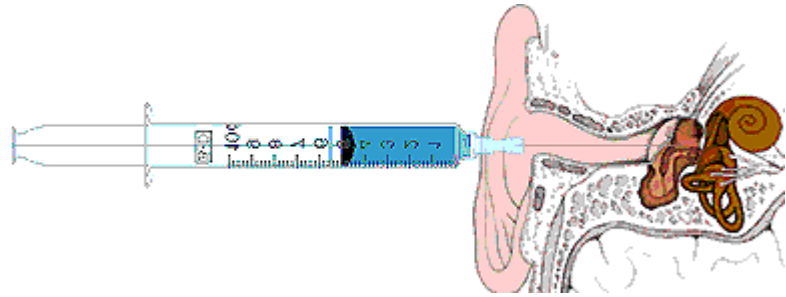


Figure 5

Injecting gentamicin through the ear drum to fill the middle ear allows (Figure 5) the medication diffuses into the inner ear where it selectively destroys the balance system. Once the medication is in the inner ear, it takes 2-8 days before it accumulates enough to affect the inner ear cells. Depending on an individual's sensitivity and how many injections are given, hearing may be permanently affected. This treatment is effective in controlling vertigo in 80 to 90% of patients who receive it. Gentamicin treatment is not generally reversible and changes to the inner ear are usually permanent (some reversal of toxic affects may occur in some folks receiving a single injection). Therefore, a patient should carefully consider his/her options before proceeding with this treatment. After multiple injections, gentamicin that accumulates inside the inner ear seems to reduce inner ear fluid pressures, reducing the risk of Ménière's disease. Gentamicin may also permanently destroy the balance system of the treated inner ear. If the balance system in the treated inner ear becomes very weak or non functional, ruptures of the inner ear inner compartment are unable to cause vertigo episodes. Also, because the treated balance organ becomes weak or non-functional, some, generally mild imbalance is expected after the injection. A rare, unusually sensitive patient may experience noticeable vertigo, nausea, vomiting, and dehydration after the injections. Rarely, a brief hospital stay for re-hydration is necessary. After the expected inner ear toxicity develops, most patients experience chronic imbalance that slowly improves over 2-6 weeks, generally within 4 weeks. Balance and movement exercises started after the injection help restore the balance but some degree of mild chronic imbalance commonly remains.

Vestibular Nerve Section

The vestibular nerve carries signals from the balance organ of the inner ear to the brain. When the inner ear is diseased, as in Ménière's disease, abnormal balance signals are sent to the brain via this nerve. One of the options in the treatment of Ménière's disease is to cut this nerve preventing the abnormal signal from reaching the brain. Since only the balance nerve is cut, hearing is typically preserved. The balance nerve is cut as it passes between the inner ear and the

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brain. In order to access this nerve, a person undergoes general anesthesia and a hole is cut in the skull to access the brain cavity. The nerves are delicately dissected apart and only the balance portion of the nerves is cut. This surgery is effective in controlling vertigo attacks for approximately 95% of operated persons. Hearing is typically preserved. The surgery does require a craniotomy (opening the skull) necessitating an overnight stay in the intensive care unit. Most people are extremely vertiginous (dizzy) for a couple of days after the operation and most need to stay in the hospital for up to 3 days depending on the extent of dizziness. After the acute postoperative vertigo subsides, chronic imbalance lasts for several weeks. The time it takes to regain effective balance is dependent on the individual, age, and amount of activity the patient engages in after surgery. Regaining balance is similar to learning a new language. Younger people have an easier time than older people and the more one works on improving balance, the better it becomes. Some people just have an easier time than others. Your doctor will give you a set of exercises to help you regain your balance quicker.

Surgical Labyrinthectomy

This procedure is complete surgical destruction of the balance organ of inner ear, but it also destroys any residual hearing in the ear. This surgery is extremely effective, controlling vertigo in almost 100% of operated patients. Two ways to do this surgery exist. One is through the ear canal and one is through the mastoid bone behind the ear. The operation through the mastoid removes the dysfunctional balance organ with greater certainty and allows the tiny nerves from the balance organ to be cut. The operation through the ear canal seems just as effective in treating older patients as the mastoid version of this surgery. The operation through the mastoid may be more effective in reducing the chance of dysfunctional regrowth of the balance nerve in younger persons. The surgery is performed under general anesthesia. Because the inner ear is destroyed during the surgery, most people are extremely vertiginous (dizzy) after the operation and need to stay in the hospital for 1-3 days depending on the extent of their dizziness. The vertigo subsides after a few days. Thereafter, most people have chronic disequilibrium for several weeks. The time it takes to regain effective balance is dependent on the individual, age, and amount of activity. Regaining balance is similar to learning a new language; younger people have an easier time than older people, the more one works on improving their balance the better it is, and some people just have an easier time than others. Your doctor will give you a set of exercises to help you regain your balance quicker.

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Treatment	Vertigo Control	Hearing	Time off work	Positives	Negatives
Medical management (low sodium diet, diuretic, antiviral meds, et.al.)	70-80%	Treatment does not cause hearing loss.	No need to be off work	Easy and inexpensive	Takes 4 – 6 wks to notice any effect
Meniett (if medical management fails)	70%	Requires a tube through ear drum membrane, no significant change in hearing	No need to be off work	Office procedure, no real risk of hearing loss	Expensive, \$3500, not covered by insurance
Endolymphatic Sac Surgery	70%	Treatment typically does not cause hearing loss	1-2 weeks off work on average	Preserves residual hearing	Out patient surgery, 30% chance of not having any change is symptoms
Middle Ear Gentamicin Perfusion	90%+	10-20% chance of significant hearing loss if 2 or more injections are given.	No need to be off work for most patients initially. Some require 2-6 weeks off.	Office procedure	Hearing loss is a potential side effect, imbalance after procedure improves with time
Vestibular Nerve Section	95%	Treatment typically does not cause hearing loss, but 15-30% do have worse hearing, some better hearing	3 – 6 weeks needed off work	Preserves residual hearing in most patients.	Operation adjacent to brain requiring a short stay in ICU, imbalance after procedure improves with time
Labyrinthectomy	99%	Complete loss of hearing in operated ear	1 – 2 weeks typically needed of work.	Very good control of vertigo attacks	Imbalance after procedure improves with time