

A brief study of this inner ear idiopathic disease biology essay

[Science](#), [Biology](#)



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A brief history of Meniere's Disease

In 1861, Prosper Meniere published a paper on vertigo that developed as a result of inner ear disorders. Throughout his career as a physician, he worked with patients who had similar symptoms of vertigo and hearing loss, which led him to postulate that the symptoms, later coined as Meniere's disease, might be the result of damage to the inner ear and not from cerebral dysfunction which was the popular belief before his research (Baloh, 2001). Broad associations with inner ear trouble and symptoms have been considered Meniere's disease with many documented cases until around 1972. The American Academy of Otolaryngology (AAO) classifies Meniere's disease as having the following symptoms: spontaneous onset recurrent vertigo; fluctuating temporal and permanent hearing loss associated with one or both ears; aural pressure buildup, and tinnitus of the inner ear (Committee, 1995). The disease symptoms vary in severity for each individual and can be extremely disruptive to normal life for patients.

Symptoms associated with Idiopathic Endolymphatic Hydrops

Meniere's disease is also known as idiopathic endolymphatic hydrops which refers to the condition of having excess pressure within the inner ear endolymph. This pressure buildup occurs without a known reason and is a requirement for the symptoms to be treated as Meniere's disease and not another endolymphatic hydrops related dysfunction such as medication or infection. Symptoms will almost always include aural swelling or tinnitus

inclusive of temporal vertigo and are classified by those varying degrees (Li, 2013).

Vertigo

The report on defining Meniere's disease by the AAO suggests that, " Vertigo is the sensation of motion when no motion is occurring relative to earth's gravity," and can cause severe dizziness and nausea during attacks (Committee, 1995). Vertigo causes a general feeling of discomfort, lack of equilibrium and/or spatial disorientation in the patient and in Meniere's disease the vertigo fits come without warning. These feelings often occur during active movement and passive movement for minutes to hours and the individual is usually left in disequilibrium for days. The categorized definitive Meniere's disease vertigo episode will have a horizontal nystagmus of the eyes and last for 20 minutes or more. Vertigo limits movement and can disrupt normal function when left untreated.

Tinnitus

Most people have experienced tinnitus at some point, which is a ringing sound (or any sound) that emanates within the ear and can be symptomatic of many different complications. The sound itself can be caused from external trauma to neurological disorders. The Tinnitus associated with Meinere's disease is typically continual and in many cases more severe sounds will occur such as buzzes, clicks, and loud roaring (Li, 2013).

Hearing Loss

Typical hearing loss in Meniere's disease patients occurs among the lower frequencies. The hearing loss can sound distant or diminished. Often the hearing loss occurs in one ear and fluctuates from periods of hearing loss to recovery of hearing loss. Progression of Meniere's disease often ends in difficult hearing or full hearing loss in the affected ear(s).

Aural Pressure Fullness

For the average patient there is a general feeling of fullness in the inner ear(s), which is required for diagnosis if there is no presence of tinnitus. The fullness can precede vertigo or any of the symptoms usually leading to an uneasy feeling that may be mistaken as a migraine headache or an ear infection.

Other symptoms

Symptoms that can occur with the onset of a Meniere's disease vertigo episode can include nausea, fatigue, diarrhea, anxiety, vomiting, soreness, and lightheadedness among other symptoms (Li, 2013). The experience can be very difficult to manage for the average patient.

Causes for Meniere's disease and its effect on the vestibular ear

The exact cause of Meniere's disease eludes researchers; however, all the symptoms can be described by the increases in endolymph pressure within the inner ear. This causes two major issues that generate the varying symptoms: Increased pressure lowers the inertial response in cilia located in the vestibular semicircular canals causing lagging responses to the change

in inertia; and change in pressure is also projected to hold differences in ion concentrations that may cause damage to cilia (and stereocilia) in the semicircular canals, otoliths (untested) and cochlea. Generally the root causes of this pressure buildup relate to other medical issues such as infection, dehydration, or trauma, but Meniere's disease specifically describes cases where these dysfunctions have no explainable cause. Three major theories on the root cause of the pressure buildup include ion transport disruption and cochlear pressure displacement. Endolymphatic hydrops actual refers to the nature of the distended endolymphatic space that has been offset by an increased volume of endolymph, which can lead to potential rupturing of endolymphatic sac. Each theory revolves around the answer to how the endolymph buildup occurs. The first theory posited a disruption in the cochlear perilymph, which would alter the pressure in the vestibule and account for the difference in pressure; the offset would generate a higher potassium ion concentration as from the perilymph into the vestibular endolymph. In a 2003 study, this theory was refuted by Dr. Warmerdam, who found significant pressure differences between the vestibule and cochlea were not identified and concentration differences were not found to be significant between the inner ear vestibular and cochlear space between the normal ear and effected ears in guinea pigs (Warmerdam, 2003). In a more recent study conducted by Dr. Alec Salt, homeostasis in endolymphatic vestibular space was found to be a result of ion transport processes. This data suggests that any specific malfunction of the inner ear ion transport system could increase the inner ear endolymphatic volume, but because of the complex balance between the

different ion concentrations within the inner ear it is difficult to ascertain the specific ion channels that are being affected and what physiological effect is disrupting normal ion flow (Salt, 2010). Additionally, Current research corroborates with the suspicion that Meniere's may be a systemic disease of the inner ear that is a bilateral condition—separating the conditions specific to the Vestibular ear (Vertigo) and Cochlear ear (Hearing loss and tinnitus). The third theory relies on the significant correlation (HSV presence in 100% post mortem; $P=.02$) of the presence of Herpes Simplex Virus (HSV) located in the vestibular ganglia of Meniere's diagnosed patients post mortem (Vrabec, 2009). This theory posits that HSV may cause an immune response that is responsible for the ion channel disruption. Unfortunately, not enough evidence is available to support a specific etiology for Meniere's disease. Many possible etiologies exist and have been suggested in different studies: including autoimmune diseases, trauma, infections, stress, allergies, and many other potential candidates for origin. The nature of the symptoms of Meniere's disease is similar to many other diseases and makes diagnosis and treatment very complicated.

Progression of Meniere's disease in the inner ear

The nature of the progression of the disease is most likely systemic and caused by various unknown inflammatory factors. These factors cause an increase in vestibular endolymphatic pressure over time. When the pressure reaches a certain threshold, the symptoms begin developing in the patient. Vertigo symptoms begin presenting on occasion while either tinnitus develops in the cochlea; pressure builds in the vestibular apparatus, or both.

After years of continued disruption to the inner ear system, eventually, minor to advanced hearing loss due to the destruction of cochlear hairs and increased frequency of vertigo and aural pressure will occur in one or more ear. These symptoms vary to the specific individual and may be genetic (Klar, 2006). Long term disease progression can lead to full hearing loss in the affected ears, and advanced vertigo symptoms.

Diagnosis and treatments

The average onset symptoms occur between ages 40 to 50 with symptoms showing up as early as age 20. " Meniere's disease is a diagnosis of exclusion and EH can also be found in several other conditions," (Pyykko, 2013). In order to properly diagnosis the disease, a series of tests are often issued to a patient.

Current Research

A day in the life of a Meniere's patient