Module 4 Assignment: Meniere's Disease

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A. Introduction

Meniere's disease (MD), also known as "Endolymphatic Hydrops," or "Hydrops,"[1] is a chronic condition distinguished by an abnormally high volume of endolymph fluid present in the labyrinths of the inner ear.[1-3] As a result, there is interruption of the sensory communication between inner ear and brain,[2] and individuals diagnosed with MD always present with disruptions in both auditory and balance functions.[1-4] The condition may develop at any age, but is most common in those who are 40 to 60 years old.[2,5] MD typically begins by manifesting in one ear, though at least 25-35% of patients may eventually experience bilateral ear involvement.[4] At a prevalence of 0.2-0.5%,[4,5] at least 615,000 Americans are affected by Meniere's, with close to 45,000 new cases identified each year.[2]

The presentation of Meniere's disease is highly variable, making the condition very difficult to study.[1-4] It is believed that patients with MD may sometimes be misdiagnosed with migraine or vice versa, due to symptomatic similarities. However, individuals with Meniere's always present with hearing loss in (at least) one ear, do not experience debilitating headaches during vertigo attacks, and only rarely complain of "brain fog" all of which separate them from patients with migraine.[4] There is some speculation that migraine disorder may be a source of Meniere's disease,[4] but relatively little is known about what causes the condition. Additional proposed risk factors/causes include issues with fluid circulation, ear infection, head trauma, allergic or autoimmune reaction, alcohol or tobacco use, fatigue, stress, and genetic predisposition.[1-5] Because of the great diversity which characterizes most aspects of condition, an effective strategy for preventing development of MD has yet to be identified.[1-3]

Attacks of Meniere's disease vary considerably from person to person and even from one onset to another within the same individual. Onset may happen without warning, or may follow preliminary symptoms such as auditory "fullness," hearing changes, or tinnitus in the involved ear. Though severity differs, a "typical" attack involves hearing loss, increased pressure and ringing/roaring in the affected ear, and vertigo which may induce nausea, vomiting, sweating, balance disturbance, and even drop attacks.[1-3] The patient may also experience anxiety, diarrhea, vision disturbances (including nystagmus), and pulse irregularities.[1,3] Attacks persist anywhere from 20 minutes to 24 hours, with an average of 2-4 hours. A number of attacks may commence within a short window of time (clusters), or occur months (even years) apart.[1-3,5] Each episode normally leaves the individual exhausted and in need of bed rest.[1,3] For those who experience frequent and/or longer attacks, this can become a truly exhausting cycle.

B. APTA Guide Pattern

According to the APTA's *Guide to Physical Therapist Practice,* individuals with Meniere's disease and other similar vestibular disorders are best classified under Practice Pattern 5A: Primary Prevention/Risk Reduction for Loss of Balance and Falling.[8]

C. Pathology/Pathophysiology

Meniere's primarily affects the inner ear which contains the organs of balance (semicircular canals, otolithic organs) and hearing (cochlea). The membranous labyrinth which surrounds these organs is filled with endolymph fluid, which in turn stimulates signaling between the inner ear structures and the brain. In an individual with MD, this signaling becomes abnormal, resulting in impaired function in the auditory and vestibular systems.[2]

The exact cause behind Meniere's disease remains unknown, and there is no clear consensus about what mechanisms may be most responsible for acute onset of symptoms during an attack.[1-5] The most popular current theory suggests that individual attacks begin as the result of heightened inner ear pressure related to an abnormal increase in endolymph volume.[2,3,5] The build-up may occur due to impaired drainage through the endolymphatic duct/sac or abnormalities of the vestibular aqueduct, or secondary to excessive fluid secretion by the stria vascularis. However, it should be noted that increased inner ear pressure, while a hallmark of Meniere's disease, is not unique to the condition, and therefore cannot alone explain onset.[5] Rauch (2010) suggests a "Meniere's ear" is one in which there is a disruption of the homeostatic mechanisms which regulate inner ear fluid cycling, nerve and cell signaling, blood flow, ion movement, energy metabolism, etc.[4] As a result, the organs of the inner ear (controlling balance and hearing) are left more vulnerable to various triggers such as stress, fatigue, emotional distress, co-morbidities, changes in pressure, specific foods, and high salt intake which may cause abnormal signaling between inner ear and brain, leading to the appearance of symptoms.[3,4]

As endolymph pressure builds, the membranous labyrinth may tear, allowing perilymph to mix with endolymph.[3,5] This combination harms the hair cells of the inner ear. Cochlear hair cells are most sensitive, perhaps explaining why hearing declines in so many patients with MD. The motion-sensing hair cells of the vestibular system are a little less delicate, though continuous exposure to an endo- and peri- lymph mixture has been shown to decrease "caloric response" in an involved ear and lead to chronic instability over many years.[9]

Meniere's disease can lead to mechanical changes in the otolith organs of the inner ear (the utricle and saccule). A rapid mechanical change can trigger the vestibular reflexes in such a way that the patient feels in danger of falling over despite standing tall. In the long-term, a continuous cycle of dilation and shrinking can cause the saccule to adhere to the stapes as MD progresses. Such a structural irregularity in the inner ear can also lead to onset of chronic instability which manifests even in-between attacks.[5]

Currently, it does not appear that Meniere's disease results in the complete destruction of the cochleovestibular nerve.[10] However, the condition may be connected to neural decline in affected animal models and more research is needed.[11] Much of the pathophysiology of MD remains to be discovered, and there is very little information available on the condition's effects on the nervous system, aside from the fact that it affects communication between the inner ear and brain, and may trigger aspects of the autonomic response (i.e. sweating, irregular heartbeat). Meniere's can also affect vision and cause nystagmus, further suggesting that there may be a neurologic component.

Because patients with balance disorders are often prone to low activity,[8] Meniere's disease may also contribute to poor musculoskeletal status and reduced cardiopulmonary fitness due to deconditioning.

D. Impairments, and Limitations in Activity & Participation

During the intervals between MD episodes, symptoms may be entirely absent or continuously present. Likewise, for some patients, Meniere's symptoms resolve with time, while for others, the condition progresses to become debilitating. The extent of impairment and limitation connected to the disease is likely to vary across the individual's lifespan, and even from day to day. Disability may be more pronounced in one area of daily life than another, and function may improve or return to normal during symptom-free periods between attacks.[1-3]

a. Impairments: All individuals with Meniere's disease experience involvement in balance and hearing by diagnostic definition.[1-4] Other forms of sensory impairment include:[1-4,6,7]

- Hearing loss (most common)
- Tinnitus
- Elevated ear pressure
- Pain/headache
- Balance deficits
- Vertigo/dizziness
- Nausea
- Fatigue
- Vision disturbances

The high level of unpredictability associated with Meniere's can also take its toll on the individual, leading to impaired mental and/or emotional function:[1,3,6,7]

- Sleep disturbances or increased need for sleep
- Mental and emotional function (including "fear of attacks" and of "the future," feelings of powerlessness, embarrassment, and guilt)

b. Activity Limitations: The most commonly reported activity limitation among patients with MD is poor quality communication due to hearing loss.[6] Declining auditory condition also limits ability to listen to music and watch TV. Mobility issues represent another large class of activity limitations for this population with the most trouble experienced during walking (particularly in the dark). Since attacks of Meniere's disease can completely debilitate an individual, driving a car can present a particular challenge (and hazard) for affected persons. Long trips, unfamiliar roads, and darkness are commonly cited as aspects of the driving experience in which limitation is most severely felt. Patients with MD may feel that they cannot travel alone due to the need for support in the event of an attack.[6,7] Since changes in pressure are considered a potential trigger for symptom onset,[3] airplane travel, and accessing locations situated at high altitudes can be additional areas of limitation.[6,7]

c. Participation Limitations: The very nature of Meniere's disease can play a role in restricting activity, since patients must plan their lives around attacks which may (or may not) occur at any time. Restrictions are often acutely felt in aspects of social participation. Patients commonly report negative effects on "interpersonal relationships" including hesitation to visit friends and family, or to socialize in public

settings due to embarrassment or fear of being seen as a burden by others should symptoms arise. Participation in other community activities such as playing sports, engaging in other recreational activities or hobbies, and attending social functions (including religious services) may be limited for many of the same reasons.[6,7] Patients with MD may find it difficult to attend (or enjoy) events held in "noisy or reverberant places," thus reducing access to movie theaters, concerts, busy stores, and indoor sporting events.[7] Workplace participation restrictions are another common result of living with Meniere's. Patients report feeling the need to change their work patterns due to the uncertainty of when an attack might begin. It may become difficult to attend meetings, or to work evenings or overtime. Ability to attend classes and complete coursework may be affected, as well as the ability to schedule in advance and keep appointments. Living with Meniere's may necessitate a career change for some patients, while others find that they are unable to continue working at all or to find a new job.[6,7]

E. Environmental & Individual Factors

Given the incredible variability of Meniere's disease, and the relatively sparse understanding of its mechanisms, predicting prognosis for an individual remains very difficult. There are few established indicators for gauging disease progression, and symptoms may disappear, often without warning or inexplicably progress into a debilitating chronic condition.[1,3] Since there is no known cure for MD, prognosis and quality of life appear to be influenced by the success of symptom management and personal coping ability.[1-5] Maintaining consistency through a regular daily routine with set times for well-balanced meals, getting enough sleep, and engaging in regular exercise while avoiding excessive fatigue seems to improve quality of life.[1,4] Outcome is more positive for individuals who maintain good health, or who carefully manage any additional health issues.[4] Adherence to a low-sodium diet also seems to reduce symptom onset for those with MD.[4-6] In contrast, symptoms are worse in those who smoke, or drink alcohol, and in those with bilateral vs. single ear involvement.[1,2,4] Individuals with Meniere's disease are at high risk for developing psychological conditions such as anxiety or depression which can also significantly reduce the benefits of other rehabilitation measures if unaddressed.[5,7] In a study of Meniere's-specific impact on quality of life, Levo (2010) identifies the presence and severity of vertigo episodes, communication issues, fatigue, inability to work, lifestyle limitations, and anxiety due to uncertainty of the disease as key factors in predicting the effect of MD on an individual's general health. Individual attitude and expectations are also likely to play a role in outcome,[6] as is availability of a support network.[1,3,5-7]

F. Interventions

In the absence of a cure for Meniere's disease, effective management of the disorder is vital to improving quality of life and function for those with the condition. It is estimated that 60-80% of this population can be addressed successfully with non-surgical treatments which minimize the risk for additional complicatons.[3]

The use of oral medications is a standard component of conservative intervention for Meniere's. Diuretic pills may be used on a daily basis to help control fluid volume and pressure increase in the inner ear.[1-5] A range of vestibular suppressants including diazepam, meclizine, promethazine, and Dramamine can be used to prevent symptoms of vertigo, nausea and vomiting or to relieve them during an attack.[1-3,5] Anti-depressants or anti-anxiety medications can help manage the psychological aspects of living with Meniere's disease. Calcium channel blockers, and (rarely) steroids or immune suppressants may also be utilized.[5]

In recent years, the FDA has approved an external pressure-pulse generator to aid in preventing symptoms of vertigo and dizziness. The "Meniett device" attaches to the outer ear, and delivers regular air pressure pulses to the middle ear which in turn influence the endolymph in the inner ear.[2,5] Currently, this form of treatment appears to benefit 70% of patients with MD.[5]

Perhaps the most common form of conservative treatment for patients with Meniere's disease is adoption of a low-sodium diet plan, which combined with diuretics helps to stabilize fluid volume in the inner ear.[1-4] As with other aspects of Meniere's intervention, dietary guidelines aim to preserve consistency within the body by keeping daily salt intake below 1000 mg, and minimizing sugar, alcohol, and caffeine consumption which can trigger or exacerbate symptoms of MD.[5] It is suggested that meals of comparable size be consumed at set times during the day, and that snacking be kept to a minimum and on a regular schedule as well. Fluids should be consumed regularly throughout the day, and an effort should be made to replenish fluids that may be lost in hot weather. Sports drinks may be used to replenish electrolytes during exercise, and should be sipped gradually rather than consumed quickly.[4,5] Alcohol is not necessarily banned for patients with Meniere's, but should be limited to one glass per day as symptoms allow.[5]

Because stress and fatigue has the potential to trigger onset of Meniere's symptoms, participation in cognitive therapy or relaxation activities such as yoga or tai-chi may also be helpful to individuals with MD. This form of intervention can provide an outlet for social interaction, while helping to relieve anxiety and improve the patient's ability to cope with the challenges of daily life.[1,2]

Another option for rehabilitation of patients with Meniere's disease is Vestibular Rehabilitation Therapy (VRT). The goal of the exercise-based intervention is to "retrain" the brain following vestibular impairment, while reducing over-reliance on vision or proprioception, and reducing non-beneficial movement patterns which may be unsafe and/or increase symptom expression. VRT also encourages the body to lose its sensitivity to dizziness/vertigo-provoking movements through repetition and habituation.[2,12-14] For many patients, VRT begins as a very unpleasant program, since symptoms are regularly elicited while the body and brain adapt. However, for those who manage to persevere, it is VRT can result in a significant reduction of symptom onset, and for some, no other intervention may be needed.[12, 13]

The aims of Vestibular Rehabilitation Therapy can be expressed by means of four sub-goals: 1) enhance gaze stability; 2) improve postural stability; 3) reduce vertigo; 4) enhance ability to perform ADLs. Exercises focus on stretching, strengthening, voluntary eye movement, VOR-challenging head movements, movements of the body which encourage vestibulospinal regulation, and exercises which isolate and emphasize other senses such as vision or somatosensory. Activities concerning head and eye movements are used to address gaze stability, while activities involving a narrow base of support, standing on unstable surfaces (i.e. foam or a pillow), and/or closing the eyes improve postural stability. Exercise choices include:

- VOR-related tasks (i.e. focusing on one target, then transferring eyes to another target before turning the head to improve smooth pursuit eye movement)
- Exercises to challenge visual dependence (i.e. practicing activities barefoot with a blindfold or during exposure to moving, visually-distracting stimuli such as striped curtains to improve proprioception)
- Rocking back and forth from heels to toes to enhance recovery of normal postural strategies
- Exercises to reduce the severity of vertigo (i.e. looking at a hand stretched over the head, then bending to bring the hand to the opposite foot while keeping the eyes fixed on that hand)
- For more advanced patients, recreational activities involving eye, hand, and body coordination can be useful (i.e. golf, bowling, tennis or badminton)

Han and associates (2011) suggest that gaze stability can improve by practicing 4 to 5 times per day for as little as 20 minutes total. The authors also advocate completion of at least 20 minutes of gait and balance exercises on a daily basis for patients with vestibular dysfunction.[14]

One disadvantage of seeking to use VRT as an intervention for Meniere's disease is that the technique is designed to benefit individuals with stable (no evidence of progression) vestibular deficits. Since MD is characterized by spontaneous symptom onset, VRT remains a controversial treatment option.[13-15] In recent years, the approach has been used successfully to rehabilitate patients after Meniere's-related surgery, where sudden onset of symptoms is more controlled.[12-14] In a 3-month comparison study, patients receiving (non-gentamicin) intra-ear injections were supplied with self-management informational books on either vestibular rehabilitation, and symptom control rehabilitation (relaxation techniques and controlled breathing to minimize exacerbation of symptoms due to patient anxiety. In contrast to controls, both groups reported increased feelings of well-being, and confidence in understanding of Meniere's disease and how to cope with it. The most effective component of the intervention was identified as "advice for planning and engaging in activity" causing the authors to suggest that educating the patients about how to live with Meniere's disease may help to alleviate stress and anxiety.[13]

Currently, research is underway to explore the feasibility and efficacy of using VRT in the earlier (and less stable) stages of Meniere's rehabilitation. Gottshall et al (2010) admit that it is yet unknown if VRT will be able to improve instability when function is still fluctuating considerably from day to day. However, the authors report potential, given observations of improvement when VRT is utilized as an intervention for migraine-associated dizziness

(MAD). Though the condition is admittedly not identical to Meniere's, MAD does produce small balance irregularities which (as in MD) are present between attacks; this is the target for improvement. It is therefore hoped that the technique may be able to improve balance instability experienced between acute onsets of Meniere's symptoms as well. If nothing else, early VRT may be present a platform from which to enhance integration of visual, vestibular, and somatosensory integration, and a tool through which to begin soothing patient anxiety. Gottshall believes that there may be a "subset of patients with Meniere's disease" who will respond well to early VRT, and future research will focus on identifying such individuals.[15] Perhaps VRT will one day be able to join the ranks of conservative interventions for managing Meniere's disease.

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