Review Article

Current Treatment of Meniere's Disease

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Abstract

Meniere's disease (MD) is a morbid inner ear disease that manifests disabling symptoms such as episodic vertigo, tinnitus, and fullness in the ear, for which patients seek immediate medical attention. The treatment of disabling vertigo of patients with MD remains controversial. Endolymphatic hydrops of the inner ear is presently considered the pathophysiology for explaining the underlying mechanisms of MD. There are many therapeutic options for MD, but no one is considered a highly effective modality for the cure of the MD. The primary purpose of the medical treatment of MD is to treat his or her symptoms rather than disease. Betahistine and diuretics are usually effective medical treatments for controlling vertigo in MD. However, there is no proven medical therapy for hearing loss or evolution of the disease in MD. There are several reports in favor of intratympanic use of aminoglycosides for the control of vertigo. Endolymphatic sac decompression is a surgical treatment option in the case of medically intractable MD. Vestibular neurectomy and labyrinthectomy are two important surgical techniques for the treatment of disabling vertigo of MD, but these surgical procedures are associated with relatively higher surgical morbidity. Recently, treatment with chemical labyrinthectomy/transtympanic gentamycin injection and endolymphatic sac decompression have gained favor for MD because they have less invasive techniques and are associated with fewer risks and side effects. The objective of this review article is to discuss current treatment options for MD to relieve disabling symptoms of MD and so improving the quality of life.

Keywords: Betahistine, endolymphatic sac decompression, intratympanic gentamycin injection, Meniere's disease

Introduction

Meniere's disease (MD) is a disorder of the inner ear, characterized by episodic vertigo, fluctuating sensorineural hearing loss, and tinnitus.[1] MD is one of the most puzzling inner ear disorders. The episodic or relapsing nature of vertigo in MD significantly affects the patient's quality of life, particularly during the period of acute symptoms.[1] Vertigo in MD usually affects the physical dimension, while hearing loss and tinnitus affect the psychosocial dimension of a patient's life.[2] There are several treatment options for MD are currently available to reduce the severity and its incidence of vertigo episodes, prevent its progression, treating the impact of end-organ damage such as hearing loss, tinnitus, and chronic dizziness with optimum symptomatic relief.[3] The treatment option for MD is based on its invasiveness, severity of the disease, and response to each treatment. There are different treatment modalities adopted for MD which range from lifestyle changes and medical treatment to extensive surgery. The lifestyle changes include reduction of stress, avoidance of caffeine, and reduction of dietary salts.[4] The medical treatment includes antivertigo drugs and diuretics and the surgical treatment includes endolymphatic sac surgery, vestibular neurectomy, and labyrinthectomy.[2] The objective of this review article is to discuss the current knowledge of the treatment of MD. Appropriate treatment of MD prevents this morbid disease and improves the quality of life.

Methods of Literature Search

Multiple systematic methods were used to find current research publications on the current treatment options for MD. We started by searching the Scopus, PubMed, Medline, and Google Scholar databases online. A search strategy using Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines was developed. This search strategy recognized the abstracts of published articles, while other research articles

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were discovered manually from the citations. Randomized controlled studies, observational studies, comparative studies, case series, and case reports were evaluated for eligibility. There were total number of articles 84 (18 Case Reports; 32 cases series; 34 original articles) [Figure 1]. This article focuses only on the current treatment options of MD. This article examines the epidemiology, medical treatment, surgical treatment, and lifestyle modifications of MD. This analysis provides a better understanding of the treatment of MD which will provide prompt relief of disabling symptoms. It will also serve as a catalyst for additional study into a newer treatment protocol for MD.

Epidemiology

MD remains a difficult clinical entity for diagnosis, especially in the early stages when not all classical symptoms might be found. Hence, the incidence and prevalence of this disease are difficult to ascertain.[5] Patients with MD often present to the emergency department with a sudden attack of vertigo and are wrongly diagnosed with having labyrinthitis and discharged home.[5] In the early stage of MD, the patient may present with only cochlear symptoms such as aural fullness and hearing impairment without true vertigo or even tinnitus in the ears. There is a slight female preponderance of up to 1.3 times that of males.[6] MD is much more common in adult age groups in their fourth and fifth decades of life than in the younger age population, although it has been documented in children.[7] One study reported a prevalence of MD is 43/100,000 and an average yearly incidence of 4.3/100,000 population.[8]

Treatment

There are numerous treatment options available for reducing the severity and incidence of morbid symptoms of the MD and decreasing the incidence of episodic attacks of vertigo. These treatments include dietary modifications such as the restriction of salt intake, oral pharmacological therapy such as betahistine, diuretics, and steroids. The surgical treatment includes endolymphatic sac surgery, vestibular nerve section, and labyrinthectomy.[9] Other therapies for MD include the Meniett device.[10] The treatment options of MD are classified into those for the acute period and the intermittent period. The aim of acute vertigo is the alleviation of symptoms of dizziness and nausea during the attack period and improvement of hearing impairment. The aim of the intermittent symptoms is the prevention of vertigo attacks. The algorithm for the treatment of MD is given in Figure 2.

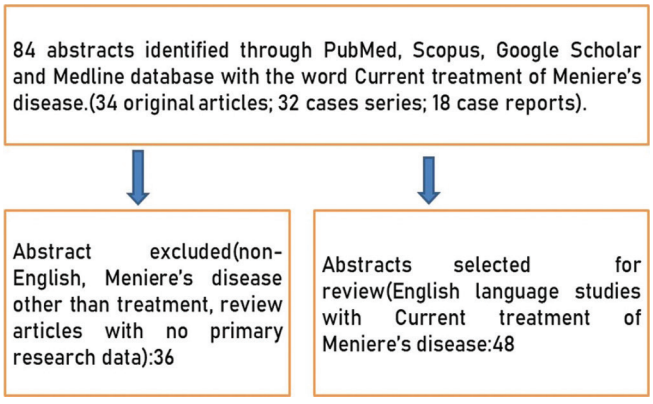

Figure 1: Flow chart for literature search

General treatment

The most important treatment for MD is psychological support which includes explaining the disease to the patient and reassuring the patient for its recovery of manifestations with appropriate treatment.[11] Clinicians should counsel the patients for avoiding underlying aggravating factors such as stress, allergy, or hormonal disturbances. A low salt diet and reduction of alcohol and caffeine are helpful for the reduction of symptoms of MD.[12]

Medical treatment

Diuretics

Recent studies show no relationship between MD and the use of diuretics; however, clinicians prescribe diuretics most of the time.[13] In the case of diuretics, a repeat blood test is required

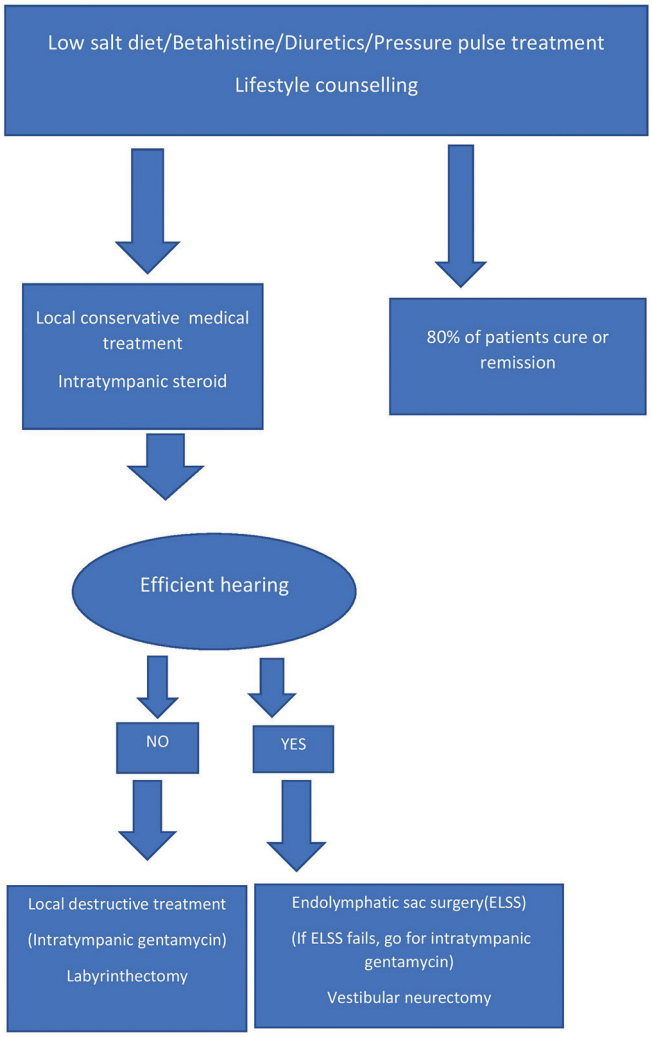

Figure 2: Algorithm for the treatment of MD. MD: Meniere's disease

to ensure that potassium on blood has not decreased. Although potassium-sparing diuretics are frequently prescribed, there is often a slight loss chance of low potassium because of these diuretics. The most commonly prescribed diuretics include a combination of hydrochlorothiazide and triamterene. Patients those allergic to the sulfa group can use acetazolamide or chlorthalidone.[14]

Betahistine

Betahistine is widely prescribed in Europe as the first line of drug for MD. It is an H1 agonist and H3 antagonist and is thought to enhance blood flow through stria vascularis into the cochlea in a dose-dependent fashion.[15,16] It also reduces the activity in vestibular nuclei by the release of neurotransmitters. The effective dose of betahistine is controversial, with recent studies showing greater efficacy of 48 mg thrice daily compared to 16 mg thrice daily and other studies showing further efficacy of dose up to 480 mg daily.[17] Betahistine usually rapidly reduces symptoms of MD. Early treatment with betahistine prevents and relieves chronic disease complications. Although there is no consensus on first-line medical treatment for MD which gives rise to symptomatic improvement and slows the disease process. However, betahistine along with dietary salt restriction and diuretics are considered first-line treatments that have been used for a long.[18]

Steroids

A study shows that a higher incidence of MD (up to 6%) occurs with autoimmune etiology.[19] Elevated levels of serum circulating autoantibodies (anti-nuclear, anti-DNA, rheumatoid factor) are seen in these patients. The majority of MD patients with bilateral ear involvement often respond to steroid treatment. However, there were no double-blind studies have been performed. Intratympanic application of steroids for the treatment of MD is helpful in these cases.[20] However, one double-blind study did not favor the intratympanic steroid injection over the placebo in these cases.[21] Intratympanic dexamethasone injection is helpful to control symptoms of vertigo and hearing loss in patients with MD. One study reported that dexamethasone of 4 g/L injections into the ear transtympanically under local anesthesia reveal approximately 82% complete control of vertigo in comparison to 57% control of the placebo group. This study also documented a 48% subjective improvement of tinnitus, 35% improvement in hearing loss, and 48% improvement in aural fullness in comparison to a significantly lower proportion in the control group.[22] As the majority of patients with MD present with sudden hearing loss, intratympanic injection of steroids may be beneficial to those with sudden onset hearing loss in MD.[23] In this study, patients showed hearing improvement in 40% of cases, was worse only in 4% of cases and did not alter in 56% of those who received intratympanic steroids for hydrops.

Intratympanic gentamycin injection

Gentamycin is an aminoglycoside antibiotic. It is more vestibulotoxic than cochleotoxic and it causes atrophy of Type 1 vestibular cells as well as neuroepithelium.[24] The intratympanic injection may result in hearing loss. Dizziness and unsteadiness may occur following intratympanic injection of gentamycin because of its toxic effects on peripheral vestibular end-organ. The dizziness and unsteadiness can be resolved by performing vestibular rehabilitation.[25] The use of intratympanic gentamycin gives more interest because of its strong impact on vertigo episodes of MD. The recommended dose of gentamycin injection is 26.7 mg/ml concentration and assesses the vestibular physiological responses by calculating the number of vertigo episodes.[24]

Pressure pulse treatment

This is a novel noninvasive technique for the treatment of intractable vertigo in patient of MD where positive pressure is provided by a pulse generator into the external auditory canal. This device is called Meniett (Medtronic Inc., Jacksonville, FL, USA). One study documented a significant reduction of intensity and frequency of vertigo, tinnitus, and aural fullness in patients with MD using the Meniett device in comparison to the patient with MD using a placebo.[26] Pressure treatment by the Meniett device is effective for controlling vertigo in a large number of patients with intractable MD. There are no side effects are associated with the use of the Minett device. The Minett device is a handheld air pressure generator that provides brief pulses of pressure to the inner ear. Treatment is given for 5 min, three times daily. The use of Meniett device needs placement of ventilation tube within the tympanic membrane. The device is then kept in the external auditory canal and pulses of air generated from the device are transmitted from the external auditory canal to the middle ear and thought to vibrate the round window. This is thought to cause endolymphatic redistribution and turnover. The Minett device is a well-tolerated and safe option. However, it can be used if a pressure equalization/ventilation tube cannot be placed. Relative contraindications of the Meniett device include diseases of the external auditory canal-like chronic otitis external which may complicate placement of the device and any middle ear disorders that obstruct access to the round window.

Acute attacks of Meniere's disease

An acute episode of vertigo and other associated symptoms such as tinnitus, nausea, and vomiting manifest the sensations which frighten the patient. The patient typically requires intravenous administration of fluids. The patient is often found in the emergency department rather than the outpatient department otorhinolaryngology. To eliminate the symptoms, anti-vertigo drugs and antiemetics are used.[27,28] Antivertigo medications such as antihistamines, benzodiazepines, and anticholinergics are commonly used to control disabling vertigo.[29] Acute attacks of MD are best treated by bed rest and diazepam is given orally or intravenously with appropriate doses.[29] In severe attacks of MD, droperidol may be titrated intravenously with careful monitoring in the hospital. Intravenous infusion of 7% sodium bicarbonate is also effective to control vestibular symptoms.[29] The antiemetic drugs are metoclopramide and domperidone.

Surgical treatment

There are different surgical techniques used for the treatment of MD. Among different surgical techniques for MD, only a few gained high evidence for successful outcomes such as labyrinthectomy and vestibular neurectomy. Among these two surgical techniques, vestibular neurectomy is selectively issued to superior and inferior vestibular nerves and makes it safe to the cochlear nerve. The efficiency of both surgical techniques is good.[30] Labyrinthectomy and vestibular neurectomy have long been considered the gold standard for the treatment of disabling vertigo in patients with MD as these surgical procedures have been proven to decrease or eliminate episodic vertigo in a high percentage of patients with MD.[31] However, these surgical procedures have a relatively high surgical morbidity and can result in complete hearing loss and permanent vestibular dysfunction leading to imbalance and ataxia.[32] However, endolymphatic sac decompression has gained some favor because of its less invasiveness and is associated with fewer side effects.

Endolymphatic sac surgery

Endolymphatic surgery is aimed at draining, shunting, or decompressing the sac, thereby preventing hydrops through facilitating the outflow of endolymph.[33] This is considered a nondestructive surgical procedure. Endolymphatic sac surgery is aimed to make an incision in the lateral wall of the endolymphatic sac after performing a simple mastoidectomy for releasing endolymphatic sac hydrops. To increase the efficacy of the surgery, many methods like insertion of silastic sheeting into the sac or intra-sac administration of a high dose of steroids have been documented.[34] In 2013, a Cochrane review for the treatment of MD included two randomized control trials where both of which involved endolymphatic sac surgery compared with either pressure equalization tube insertion or mastoid surgery.[33,35] There were no differences were found between the treatment and placebo groups. However, this treatment remains a very controversial topic.[36]

Vestibular neurectomy

It is thought to be the most effective surgical technique for Tmarkin's/drop attacks and for incapacitating MD. The vestibular nerve section can be accomplished via a retrosigmoid or retrolabyrinthine approach.[37] In the case of the retrosigmoid approach, a suboccipital craniotomy is done with monitoring of the facial nerve and auditory evoked potentials. The superior and inferior vestibular nerves are identified and sectioned at the porus acoustics, taking care not to damage the cochlear or facial nerve. The vestibular nerves can be delineated by decompression of the internal auditory canal laterally to locate the landmarks such as horizontal and vertical (Bill's bar) and the singular nerve to the ampulla of the posterior semicircular canal.[38,39] The wound is closed in standard fashion after performing cranioplasty. In the case of the labyrinthine approach, a mastoidectomy is done, with decompression of the sigmoid sinus and identification of the posterior semicircular canal and the vertical segment of the facial nerve. The dura of the posterior fossa is then entered between the otic capsule and sigmoid sinus, and then the internal auditory canal is decompressed to see the individual nerves. The cochlear, vestibular, and facial nerves are identified, and then the vestibular nerve is carefully sectioned. A fat graft is kept within the mastoid cavity for preventing the cerebrospinal fluid (CSF) leak and the wound is closed. If a patient with MD has no useful hearing, the labyrinthectomy is preferred to vestibular neurectomy. Complications of vestibular neurectomy include meningitis, CSF leak, cranial neuropathies, stroke, seizures, death, and risk of surgery and anesthesia. The retrolabyrinthine route reduces the complications of of posterior fossa surgery but associated with risk of complications related to the mastoidectomy. One study showed the risk of >10 decibels sensorineural hearing loss for retrolabyritnhine vestibular nerve sectioning surgery was estimated at approximately 10%.[40] Currently, this procedure is rarely done because less risky and costly alternatives for vestibular ablation are seen. Vestibular physical therapy is useful postoperatively to increase the central compensation and return to functionality.[41]

Labyrinthectomy

Labyrinthectomy is the oldest surgical technique used for the treatment of MD. Surgical labyrinthectomy is the efficient treatment option for debilitating vertigo and Tumarkin drop attacks with excellent control over symptoms in nearly all patients of MD.[42] Although this surgical procedure provides definitive vertigo relief, it depletes all hearing residues, so reserved for preoperative advanced hearing impairment.[30] Currently, this surgical technique is now limited to older patients. This surgical method can be associated with cochlear implantation in the same stage of surgery when a patient presents with associated profound hearing loss.[43] Simultaneous surgical labyrinthectomy and cochlear implantation decrease the surgical and anesthesiological risks and reduce the gap of deafness while avoiding the debatable risk of soft-tissue scarring or ossification of the cochlea.[42] Labyrinthectomy and cochlear implantation should be considered in the case of bilateral MD with bilateral hearing impairment, in patients with unilateral MD with unresponsive vertigo and hearing loss along with debilitating tinnitus.

Lifestyle changes

There are multiple therapeutic options available for MD, but none is considered as effective for eliminating the clinical manifestations of MD. Lifestyle modifications and dietary restrictions are important therapeutic options by the scientific community. Patients with MD are strongly associated with seasonal allergies and circulating immune complex.[44] Patients with MD should avoid allergies by changing their lifestyle so that their quality of life will be improved. Patients with MD improve significantly by treating with immunotherapy for allergies.[45] Symptoms of MD are aggravated by the consumption of large quantities of chocolate, caffeine, alcohol, and salt. However, the exact mechanism for such adverse reactions is not known. Some patients with MD might be

allergic to some of these substances. Hence, patients should be investigated for such food allergies. All patients with MD are advised to reduce their salt intake to a maximum of 2 g/day, and 1.5 g/day if tolerated. They should avoid all sources of caffeinated products, tobacco, and alcoholic products as much as possible. When patients with MD have heavy insomnia or stress, which are thought to be underlying triggering factors, anxiolytics or hypnotics may be used.

Conclusion

MD is an idiopathic inner ear disease characterized by recurrent spontaneous vertigo, fluctuating sensorineural hearing loss, tinnitus, and aural fullness. Although there is currently no cure for MD, majority of patients are relieved by either lifestyle modifications and medical treatment, or endolymphatic surgery. The treatment options of MD should be selected in order of invasiveness, the severity of disease, and the response to each treatment. Vestibular neurectomy is a very good treatment option for controlling vertigo and is available for a patient with good hearing who has failed other treatments. Labyrinthectomy is often undertaken as a last resort and is best reserved for MD patients with unilateral disease and deafness.

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Conflicts of interest

There are no conflicts of interest.

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