AMERICAN ACADEMY OF OTOLARYNGOLOGY–HEAD AND NECK SURGERY FOUNDATION

*Supplement*

Otolaryngology–Head and Neck Surgery
2020, Vol. 162(2S) S1–S55

DOI: 10.1177/0194599820909438
http://otojournal.org
SAGE

# Clinical Practice Guideline: Ménière's Disease

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*Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.*

## Abstract

*Objective.* Ménière's disease (MD) is a clinical condition defined by spontaneous vertigo attacks (each lasting 20 minutes to 12 hours) with documented low- to midfrequency sensorineural hearing loss in the affected ear before, during, or after one of the episodes of vertigo. It also presents with fluctuating aural symptoms (hearing loss, tinnitus, or ear fullness) in the affected ear. The underlying etiology of MD is not completely clear, yet it has been associated with inner ear fluid (endolymph) volume increases, culminating in episodic ear symptoms (vertigo, fluctuating hearing loss, tinnitus, and aural fullness). Physical examination findings are often unremarkable, and audiometric testing may or may not show low- to midfrequency sensorineural hearing loss. Conventional imaging, if performed, is also typically normal. The goals of MD treatment are to prevent or reduce vertigo severity and frequency; relieve or prevent hearing loss, tinnitus, and aural fullness; and improve quality of life. Treatment approaches to MD are many and typically include modifications of lifestyle factors (eg, diet) and medical, surgical, or a combination of therapies.

*Purpose.* The primary purpose of this clinical practice guideline is to improve the quality of the diagnostic workup and treatment outcomes of MD. To achieve this purpose, the goals of this guideline are to use the best available published scientific and/or clinical evidence to enhance diagnostic accuracy and appropriate therapeutic interventions (medical and surgical) while reducing unindicated diagnostic testing and/or imaging.

**Keywords**

fluctuating aural symptoms, electrocochleography, endolymphatic hydrops, endolymphatic sac decompression, gentamicin, labyrinthectomy, Meniett device, sensorineural hearing loss, sodium-restricted diet, vestibular testing, quality of life

Received July 17, 2019; accepted February 7, 2020.

## Introduction

Ménière's disease (MD) is a clinical syndrome affecting approximately 50 to 200 per 100,000 adults and is most common between the ages of 40 and 60 years.[1] In 1861, Prosper Ménière noted that vertigo, off-balance, and hearing loss symptoms associated with MD reflected a lesion of the inner ear. Strict clinical classification to diagnose MD has been established by the American Academy of Otolaryngology–Head and Neck Surgery (AAO-HNS).[2-4] These diagnostic criteria for MD were recently revised by the Classification Committee of the Barany Society in cooperation with several national and international organizations and were later approved by AAO-HNS Equilibrium Committee.[5,6] These revisions include 2 categories:

Definite MD:

- Two or more spontaneous attacks of vertigo, each lasting 20 minutes to 12 hours
- Audiometrically documented fluctuating low- to midfrequency sensorineural hearing loss (SNHL) in the affected ear on at least 1 occasion before, during, or after 1 of the episodes of vertigo
- Fluctuating aural symptoms (hearing loss, tinnitus, or fullness) in the affected ear

- Other causes excluded by other tests

Probable MD:

- At least 2 episodes of vertigo or dizziness lasting 20 minutes to 24 hours
- Fluctuating aural symptoms (hearing loss, tinnitus, or fullness) in the affected ear
- Other causes excluded by other tests

The diagnosis of MD is made clinically, as the disease typically presents with unilateral ear symptoms that can last for several decades.[7] MD attacks are typically random and episodic (approximately 6-11 per year), with periods of remission that may last months to years.[1] As such, the diagnosis of MD is typically not made at 1 point in time; rather, it may take months or even years to fully appreciate the clinical manifestations leading to definitive diagnosis. To maximize treatment, it is important to clinically distinguish MD from other independent causes of vertigo that may mimic MD and present with hearing loss, tinnitus, and aural fullness. Diseases such otosyphilis, vestibular neuritis, acute labyrinthitis, and others respond to different treatments. Due to the variability in clinical presentation in patients with definite and probable MD, it is important to acknowledge that a full and accurate diagnosis may take many months to attain. This is an important consideration since this speaks to the natural history and variable clinical presentation of MD that the panelists on this clinical practice guideline (CPG) felt should be highlighted. This can directly affect clinical decision making and subsequent treatment recommendations.

The underlying etiology of MD is not completely clear, yet it has been associated with anatomic changes in inner ear fluid volumes described by the term *endolymphatic hydrops* (ELH), a hallmark feature of the disease that can be pathologically confirmed postmortem.[8,9] While EHL is not synonymous with MD, endolymph within the inner ear membranous labyrinth is postulated to increase, culminating in episodic ear symptoms, including vertigo, fluctuating hearing loss, tinnitus, and aural fullness. Schuknecht and Gulya[10] postulated the theory of Reissner's membrane rupture secondary to endolymphatic duct distention. These microtears would allow potassium-rich endolymph to bathe cochlear hair cells and the eighth cranial nerve. As such, repeated exposure to toxic levels of potassium-rich perilymph could cause episodic spinning vertigo as well as long-term decline in auditory function (reviewed in Oberman et al[11]). While it has been reported that ELH was found in all patients with MD, not all found to have ELH had concurrent MD.[12] The clinical records and histopathologic slides of all cases of ELH in the otopathology laboratory at the Massachusetts Eye & Ear Infirmary were reviewed (n = 79), which included 35 cases with ''idiopathic hydrops'' and 44 cases having secondary hydrops in addition to some other otologic disease process. Among the idiopathic cases, 26 (74%) had clinical MD symptoms, while 9 (26%) did not meet the diagnostic criteria for MD. Because it is understood that ELH may be a final common pathologic pathway for a variety of inner ear insults, it is difficult to draw solid conclusions regarding the symptomatology experienced by the 44 cases of secondary hydrops, due to factors such as clinical symptom overlap between hydrops and other otologic diseases or possible vestibular organ damage and deafferentation, which could limit the possibility for affected subjects to experience vertigo.

Disorders that may (eg, autoimmune inner ear disease, temporal bone fracture, otosyphilis, end-stage otosclerosis, endolymphatic sac tumors, acoustic neuromas)[9] or may not (eg, vestibular migraine [VM]) be associated with ELH can mimic MD, thereby placing an important emphasis on diagnostic accuracy. This also posits that ELH may cause MD but suggests that ELH may simply be a by-product of a separate underlying process that leads to MD. Therefore, ELH may be necessary but not sufficient for MD development.

The natural course of MD is typically progressive and fluctuates unpredictably. In the early stages of disease onset, the frequency of acute vertigo attacks increases during the first few years and may eventually decline to near complete cessation of vertigo.[13] The natural progression of vertigo attack periodicity and severity over time in MD patients is not well understood, as others have reported that patients with MD can have severe attacks of vertigo even 20 years after the initial diagnosis.[14] While the patients' hearing may worsen or persist, patients with MD may also have hearing that stabilizes over time. In fact, a 20-year longitudinal study demonstrated that 82% of MD patients experienced moderate to severe hearing loss (mean pure tone hearing loss $>$50 dB).[15] Given the episodic nature of MD attacks, it

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**Table 1.** Key Definitions for Ménière's Disease (MD) Guideline.[72,a]

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|---|---|
| Vertigo | Sensation of self-motion (rotary spinning) or movement of the environment when neither is occurring or the sensation of distorted self-motion (rotation or spinning) during an otherwise normal head movement |
| Imbalance | Sense of unsteadiness, or instability; discrete from vertigo; may be ongoing and not episodic |
| Acute MD attack | Vertigo episode that lasts for 20 min to 12 hours and aural symptoms (timing impacted by treatment onset) |
| Active MD | Describes periods during which episodic acute attacks of MD occur with some regularity |
| Definitive MD | See above definitions in body of text |
| Drop attacks (Tumarkin's Otolithic Crisis) | Sudden fall associated with discrete MD attacks with no warning; the patient does not lose consciousness. Drop attacks may be experienced during later stages of MD and they are not present in every patient |
| Usable hearing | Levels of adequate hearing perception often defined by the patient; may be audiometrically defined based on level of hearing loss (HL), pure tone average (PTA) and word recognition/discrimination scores (WRS) from vestibular schwannoma literature:<br>AAO-HNS Scale:<br>Class A: Discrimination 70-100%; PTA <30 dB<br>Class B: Discrimination 50-69%; PTA 31-50 dB<br>Class C: Discrimination 50-69%; PTA >50 dB<br>Class D: Discrimination <50%; any PTA<br>Most clinicians consider Class A and B/C to be useable or serviceable hearing; Class D not considered serviceable hearing |
| Probable MD | See criteria within body of CPG |
| PTA | Pure Tone Average measured by audiometry |
| Hearing loss in MD | Often fluctuates from low- to mid-frequency but over time may involve all frequencies |

[a]Reprinted from the *Journal of Vestibular Research*, vol 19, Bisdorff A, Von Brevern M, Lempert T, Newman-Toker DE, Classification of vestibular symptoms: towards an international classification of vestibular disorders, 1-2, copyright 2009, with permission from IOS Press.

is challenging to distinguish between asymptomatic periods when the disease is quiescent in between attacks and the positive effects of treatment versus alternative diagnoses that may mimic MD (eg, VM). Moreover, in the elderly patient or in the patient with long-standing MD who no longer manifests significant vestibular disturbance, there may not be typical MD-like temporal patterns. These patients may manifest episodes of severe imbalance or ''vague'' dizziness. Some vertigo control (up to 60%) has been documented in the placebo groups of published randomized controlled trials (RCTs),[16-19] with commensurate improvements in symptoms other than hearing loss irrespective of treatment.[20] These features pose challenges for formalized clinical trials to study MD, as the power of the studies is nearly impossible to achieve given the low incidence and natural fluctuations of MD.

The goals of MD treatment are to prevent or at least reduce the severity and frequency of vertigo attacks. In addition, treatment approaches aim to relieve or prevent hearing loss, tinnitus, and aural fullness and improve overall quality of life (QOL). Treatment approaches to MD are many and typically include modifications of lifestyle factors (eg, diet), mental health treatment, or medical and/or surgical treatment. A separate goal is to enhance patient preferences and preference-centered care to minimize the adverse effects of therapies in both scope and frequency. Because the etiology of MD is not clearly known, inherent limitations about the efficacy of proposed treatments exist. Moreover, the variable or variables that cause symptoms in the setting of ELH are not clearly understood. As a result, the literature reports many MD studies that are poorly designed and often underpowered with inadequate controls, which can lead to inconclusive results. This can lead to the belief by many clinicians in specific unsubstantiated therapeutic approaches, resulting in tremendous practice pattern variation and subjective treatment regimens and reporting of MD control.

Some of the traditional treatment approaches for MD include dietary/lifestyle and/or trigger management approaches[21,22]; medical, surgical, complementary/alternative, allergy, immunomodulatory, vestibular, and aural therapy; and oral[21,22] or intratympanic (IT) medications—all with variable results.[23,24] For those MD patients with persistent and disabling attacks after several months of conservative therapy, other more invasive or involved treatments can be considered.[25,26] One main consideration about the choice of treatment is the hearing status and whether it is usable or not. In those patients with usable hearing (based on vestibular schwannoma literature; see definitions in **Table 1**), nonablative procedures have been advocated. These interventions include those designed to affect the natural history of MD with conservation of inner ear auditory function by suppressing vestibular function or endolymph production. Conversely, in those patients with no meaningful/useful hearing, surgical or chemical inner ear ablative treatments are often implemented.[27] The rationale for ablative approaches is to attempt to convert a dynamic fluctuating inner ear lesion (active MD) to a static state through destruction of the inner ear. In doing so, most therapies are designed to control vertigo rather than other MD-associated symptoms (eg, hearing loss, ear fullness, tinnitus) even though they are also quite vexing to patients.

The purpose of this CPG is to evaluate the many possible therapies for MD and to use evidence-based data from published literature to report on their efficacy in controlling MD symptoms, keeping in mind that MD may affect both ears in 10% to 25% of cases over time.[28] The only existing guideline to assist health care providers in the diagnosis and management of MD patients to date is a consensus statement that is >2 decades old. This updated CPG uses current evidence-based data and a multidisciplinary approach to improve timely, accurate MD diagnosis for optimal symptom control and patient outcomes. Key definitions used within this guideline can be found in **Table 1**.

## Guideline Purpose

The primary purpose of this CPG is to improve the quality of the diagnostic workup and treatment outcomes of MD. To achieve this purpose, the goals of this CPG are to use the best available published scientific and/or clinical evidence to enhance diagnostic accuracy and appropriate therapeutic interventions (medical and surgical) while reducing unindicated diagnostic testing and/or imaging. The CPG is intended for all health care providers (eg, emergency medicine, primary care, otolaryngology, neurology, audiology, physical/vestibular therapy), in any setting, who are likely to encounter, diagnose, treat, and/or monitor patients with suspected MD. The target patient for the CPG is ≥18 years old with suspected diagnosis of definite or probable MD. The CPG makes specific recommendations about the history and physical examination of potential MD patients, the appropriate diagnostic workup, and effective treatment options that may include medical and/or surgical intervention. The CPG focuses only on MD, recognizing that MD may arise in conjunction with or separate from other conditions presenting with vertigo, hearing loss, and/or tinnitus. This CPG does not discuss the specific management of those conditions that may mimic MD. This CPG is not intended for comprehensive management of MD.

In 1995, the AAO-HNS published a consensus statement on the diagnosis of MD.[2] These criteria were reviewed in 2015 by the Equilibrium Committee, yet over 2 decades have elapsed since the original publication. Therefore, this current multidisciplinary group was convened to review the most recent and updated published scientific and clinical evidence available to craft an updated version of the MD consensus statement as a formal CPG. By using a published transparent CPG process, the primary goal was to create actionable statements (key action statements [KASs]) that reflect current evidence-based advances in knowledge with respect to MD.

Main considerations in this CPG are to increase rates of accurate diagnosis, improve symptom control with appropriate treatments, and reduce inappropriate use of medications, procedures, or testing. It is also intended to reduce adverse events associated with undiagnosed or untreated MD. Other CPG considerations include increasing patient-provider shared decision making, minimizing diagnostic and treatment costs, reducing unnecessary return physician visits, and maximizing the health-related QOL of individuals afflicted with MD.

This CPG is also designed to clarify the term ''vertigo.'' Because many ''dizzy'' patients present with some form of subjective movement hallucination (eg, rocking side to side, listing, imbalance, light-headedness), it is the sensation of spinning that is characteristic of acute inner ear disorders and MD. Typically, among those who experience them, spinning attacks of vertigo with MD abate over time, and movement symptoms become vague. It is important to note that MD should have spinning vertigo at some point in its presentation. Currently, the public and the medical community in general have great confusion and disagreement about the term ''vertigo,'' and one goal of this CPG is to clarify that terminology as it relates to the diagnosis and management of MD.[29]

## Health Care Burden

### *Epidemiology*

Accurate estimation of the incidence and prevalence of MD has proved to be challenging, due to methodological limitations and the rarity of the condition. Prevalence estimates as low as 3.5 per 100,000 and as high as 513 per 100,000 have been reported from studies worldwide.[30] These estimates may reflect geographic and demographic variation, but they are also likely influenced by differences in case definitions over time (eg, 1972 American Academy of Ophthalmology and Otolaryngology criteria[3] vs 1995 AAO-HNS criteria[2]), settings (hospital vs outpatient), duration, and methods of case capture (survey, records, or insurance claims).[31] One of the most rigorous studies involved reviewing the health records of 103,797 inhabitants of an Italian community between 1973 and 1985.[32] Using the 1972 American Academy of Ophthalmology and Otolaryngology guidelines,[3] the researchers arrived at an incidence of 8.2 per 100,000, from which they calculated a prevalence of 205 per 100,000. The largest cohort assessed was drawn from insurance claims from 60 million commercially insured Americans, yielding an estimated prevalence of 190 per 100,000.[30] Thus far, no epidemiologic study has employed the most recent Barany Society diagnostic criteria.[5]

MD is almost exclusively reported in adults, with <3% of cases estimated to occur at age <18 years.[33-36] The disease is most prevalent between ages 40 and 60 years, with peak onset in the 40s to 50s.[37-42] In a large US claims–based study, the prevalence increased with age, ranging from 61 per 100,000 patients aged 18 to 34 years to 440 per 100,000 patients aged >65 years.[30] Despite differences, most studies cite either an equal prevalence between males and females or a slightly higher prevalence of MD in women than in men,[14,35,38,41,42] with a reported female:male ratio in the United States of 1.89:1.[30] Data on the prevalence of bilateral MD yield variable estimates. Simultaneous presentation with bilateral MD appears to be exceptionally rare, whereas bilateral involvement may affect a significant number of patients within 2 decades of disease onset.[43] In

many MD patients, the most detrimental decline in hearing and balance function occurs within the first decade of diagnosis,[43] yet patients continue to have long-standing deficits that render MD a chronic disease.[44]

## Impairments

MD is associated with substantial functional disability, although the level of handicap varies across individuals.[45] As the clinical diagnostic criteria state, most patients with MD have some level of hearing loss, tinnitus, ear fullness, or balance disturbance, with nearly one-third afflicted by severe symptoms in one of these categories.[46] Sensory loss and unpredictable episodic attacks often further restrict participation during work, domestic, and leisure activities.[47,48] While most patients are able to perform activities of daily living between attacks, during acute MD episodes, they are likely to become entirely or partially dependent on the assistance of others.[45] Individuals with MD are also at increased risk of falling. Among the UK Biobank sample (n = 1376), MD patients were more than twice as likely to have experienced $\geq$2 falls in a year (13.7% vs 6.6%, $P < .001$).[39] Major injuries, including hip fractures, occur more frequently when falls are experienced by individuals with vertigo than by those without and may result in nursing home placement and further loss of independence.[49,50]

## Quality of Life

Based on validated metrics, the overall QOL of MD patients appears to be similar to patients experiencing other chronic illnesses.[51,52] As they face a chronic battle with fluctuating balance and auditory dysfunction, MD patients also experience a heavy emotional burden. Health-related QOL has been assessed in patients with MD by the SF-36 (Short Form–36), a validated instrument that consists of 8 subscales that reflect different aspects of QOL (eg, general and mental health, physical functioning, role limitations) and 2 summary scores for physical and mental components of QOL.[53] On the SF-36, MD ranks closer to minor medical problems in physical handicap scores but closer to major medical problems in emotional handicap.[46] Vertigo is more closely associated with the physical aspects of QOL instruments, whereas hearing loss and tinnitus have greater impact on psychological aspects.[54] When the intrusiveness of chronic conditions was compared, MD ranked higher than end-stage renal disease and laryngeal cancer.[55] Notably, during acute MD attacks, ratings of the quality of well-being fall between those of noninstitutionalized patients with Alzheimer's disease and patients with end-stage cancer or AIDS, making acute MD attacks one of the most debilitating conditions that do not require institutionalization.[51] As such, anxiety and/or depression is common in MD patients,[56] with 33% of men and 41% of women affected with MD carrying diagnoses of depression.[55]

## Health Care Costs

The diagnosis and management of MD produces significant direct health care costs. The symptom of dizziness is one of the most common reasons for ambulatory care visits in the United States and often leads to high utilization of diagnostic services (ie, imaging, audiovestibular, and cardiac testing) as well as consultation with various clinical specialists.[57,58] In one series, patients had undergone a mean 3.2 diagnostic tests, including magnetic resonance imaging (MRI; 78%), computed tomography (CT) or x-rays (52%), electro- or videonystagmography (VNG; 64%), electrocardiography (51%), and electroencephalography (36%), before receiving the diagnosis of MD.[59] Some patients with classic MD symptoms experience lengthy diagnostic delays, potentially driving greater health care utilization. In a Finnish sample, 20% of patients experienced a delay in MD diagnosis of $\geq$5 years following the onset of hearing loss and vertigo.[37] Additional costs are incurred if patients first receive an incorrect diagnosis.

As MD is a chronic clinical condition with occasional acute episodes, MD patients require health care resources for decades, including additional clinical encounters and devices for auditory rehabilitation.[60] Patients in the UK Ménière's Society reported needing $\geq$5 visits to their general practitioners per year.[60] Among practices in the US-based CHEER network (Creating Healthcare Excellence through Education and Research), MD patients had an average of 3.2 otolaryngology clinic visits per year, with IT injections of steroids or gentamicin being the most common procedure performed (90%), followed by endolymphatic sac decompression (8%), transmastoid labyrinthectomy (2%), and vestibular nerve section (VNS; 0.4%).[61] Thus far, 1 study in the United Kingdom has characterized the economic burden of MD, and the total direct costs were estimated to be £61.3 million (US $81.1 million) annually.[60] Similar analyses have not been carried out in the United States.

## Indirect Costs

The direct costs of MD are surpassed by the indirect costs estimated to result from reductions in work productivity, increased sick leave, and lost earnings.[60] Patients report that work performance is most affected by vertigo, followed by hearing loss and the unpredictability of acute MD attacks.[45] Among patients presenting to a US academic medical center, 86% reported that their job performance had suffered as a result of their symptoms; 70% had to modify their jobs to be able to perform them; and 35% changed jobs.[45] Similarly, in the 3 months prior to presenting for care in clinics in Europe, Asia, and Africa, 70% of patients with MD lost working days; 72% required a reduced workload; 9% changed jobs; and 9% quit their jobs altogether.[62] Consequently, patients with MD have lower average household incomes and are more likely to receive disability benefits.[60,63] The long-term financial effects may be particularly severe, as the disease typically strikes during work-productive midlife. The annual cost of lost earnings from MD in the United Kingdom was estimated at £442.7 million (US $585.9 million). Altogether, indirect costs constituted 88% of the total cost estimate for MD. Notably, the per-person average total annual cost was estimated to be

between £3341 (US $4421.65) and £3757 (US $4972.21), which is greater than estimates for asthma and migraine.[60]

## Methods

### General Methods

This CPG was developed with an explicit and transparent a priori protocol for creating actionable statements (KASs) based on supporting evidence and the associated balance of benefit and harm as outlined in the ''Clinical Practice Guideline Development Manual, Third Edition: A Quality-Driven Approach for Translating Evidence into Action.''[64] The Guideline Development Group (GDG) consisted of 21 panel members representing experts in advanced practice nursing, audiology, consumer advocacy, emergency medicine, family medicine, otolaryngology, otology and neurotology, otolaryngic allergy, neuroradiology, and neurology.

### Literature Search

An information specialist conducted 2 systematic literature searches using a validated filter strategy to identify CPGs, systematic reviews (SRs), and RCTs. The following search terms were used:

> ''meniere disease''[MeSH Terms] OR meniere*[tiab] OR ''endolymphatic hydrops''[MeSH Terms] OR (endolymphatic[tiab] AND hydrops[tiab]) OR (cochle*[tiab] AND hydrops[tiab]) OR (vestibular[tiab] AND hydrops[tiab]) OR (morbus[tiab] AND meniere*[tiab]) OR tumarkin[tiab] OR (Vestibulocochlear[tiab] AND hydrops[tiab]) OR ''drop attack''[tiab] OR ''episodic vertigo''[tiab] OR ''periodic vertigo''[tiab] OR ''fluctuating vertigo''[tiab].

The English language searches were performed from February to March 2018 in multiple databases, including PubMed (MEDLINE), Excerpta Medica database (Embase), Cumulative Index to Nursing and Allied Health, Cochrane Central Register of Controlled Trials, National Guideline Clearinghouse, National Institutes for Health and Care Excellence (United Kingdom), SIGN (Scotland), New Zealand Guidelines Group, Australian National Health and Medical Research Council, TRIP Database, Guideline International Network, Canadian Medical Association Database, NHS Evidence (United Kingdom), Australian National Health and Medical Research Council, Guideline Internal Network, Cochrane Database of Systematic Reviews, Web of Science, the Allied and Complementary Medicine Database, CAB Abstracts, Agency for Healthcare Research and Quality, and Health Services/Technology Assessment Texts.

1. The initial search for CPGs identified 64 guidelines. After removal of duplicates and references that did not meet the inclusion criteria, a total of 18 guidelines were distributed to the panel for review. Quality criteria for including guidelines were (a) an explicit scope and purpose, (b) multidisciplinary stakeholder involvement, (c) systematic literature review, (d) explicit system for ranking evidence, and (e) explicit system for linking evidence to recommendations. The final data set retained 6 guidelines that met inclusion criteria.
2. The initial search for SRs identified 424 SRs or meta-analyses. After removal of duplicates and irrelevant references, a total of 96 SRs were distributed to the panel for review. Quality criteria for including reviews were (a) relevance to the guideline topic, (b) clear objective and methodology, (c) explicit search strategy, and (d) valid data extraction methods.[64] The final data set retained was 55 SRs or meta-analyses that met inclusion criteria.
3. The initial search for RCTs identified 558 RCTs. After removal of duplicates and irrelevant references, a total of 77 RCTs were distributed to the panel for review. Quality criteria for including RCTs were (a) relevance to the guideline topic, (b) publication in a peer-reviewed journal, and (c) clear methodology with randomized allocation to treatment groups. The total final data set retained 27 RCTs that met inclusion criteria.

In a series of conference calls, the GDG defined the scope and objectives of the proposed guideline. During the 18 months devoted to guideline development, the GDG met twice, with in-person meetings following the format previously described.[64] Electronic decision support software (BRIDGE-Wiz; Yale Center for Medical Informatics, New Haven, Connecticut) was used to facilitate creating actionable recommendations and evidence profiles.[65] Internal electronic review and feedback on each guideline draft were used to ensure accuracy of content and consistency with standardized criteria for reporting CPGs.[66]

American Academy of Otolaryngology–Head and Neck Surgery Foundation (AAO-HNSF) staff used the Guideline Implementability Appraisal and Extractor to appraise adherence of the draft guideline to methodological standards, to improve clarity of recommendations, and to predict potential obstacles to implementation.[66] Guideline panel members received summary appraisals and modified an advanced draft of the guideline based on the appraisal. The final draft of the updated CPG was revised per the comments received during multidisciplinary peer review, open public comment, and journal editorial peer review. A scheduled review process will occur at 5 years from publication or sooner if new compelling evidence warrants earlier consideration.

### Classification of Evidence-Based Statements

Guidelines are intended to reduce inappropriate variations in clinical care, to produce optimal health outcomes for patients, and to minimize harm. The evidence-based approach to guideline development requires that the evidence supporting a policy be identified, appraised, and summarized and that an explicit link between evidence and statements be defined. Evidence-based statements reflect

**Table 2.** Strength of Action Terms in Guideline Statements and Implied Levels of Obligation.[a]

| Strength | Definition | Implied Obligation |
|---|---|---|
| Strong recommendation | A strong recommendation means the benefits of the recommended approach clearly exceed the harms (or, in the case of a strong negative recommendation, that the harms clearly exceed the benefits) and that the quality of the supporting evidence is high (grade A or B).[b] In some clearly identified circumstances, strong recommendations may be based on lesser evidence when high-quality evidence is impossible to obtain, and the anticipated benefits strongly outweigh the harms. | Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present. |
| Recommendation | A recommendation means that the benefits exceed the harms (or, in the case of a negative recommendation, that the harms exceed the benefits), but the quality of evidence is not as high (grade B or C).[b] In some clearly identified circumstances, recommendations may be based on lesser evidence when high-quality evidence is impossible to obtain, and the anticipated benefits outweigh the harms. | Clinicians should also generally follow a recommendation but should remain alert to new information and sensitive to patient preferences. |
| Option | An option means that either the quality of evidence is suspect (grade D)[b] or well-done studies (Grade A, B, or C)[b] show little clear advantage to one approach versus another. | Clinicians should be flexible in their decision making regarding appropriate practice, although they may set bounds on alternatives; patient preference should have a substantial influencing role. |

[a]Adapted from the American Academy of Pediatrics classification scheme.[396]
[b]See Table 3 for definitions of evidence grades.

both the *quality of evidence* and the *balance of benefit and harm* that is anticipated when the statement is followed. The definitions for evidence-based statements are listed in **Tables 2** and **3**.

Guidelines are never intended to supersede professional judgment; rather, they may be viewed as a relative constraint on individual clinician discretion in a specific clinical circumstance. Less frequent practice variation is expected for a strong recommendation than what might be expected with a recommendation. Options offer the most opportunity for practice variability.[67] Clinicians should always act and decide in a way that they believe will best serve their individual patients' interests and needs, regardless of guideline recommendations. Guidelines represent the best judgment of a team of experienced clinicians and methodologists addressing the scientific evidence for a specific topic.[68]

Making recommendations about health practices involves value judgments on the desirability of various outcomes associated with management options. Values applied by the GDG sought to minimize harm and diminish unnecessary and inappropriate therapy. A major goal of the panel was to be transparent and explicit about how values were applied and to document the process.

### *Financial Disclosure and Conflicts of Interest*

The cost of developing this CPG, including the travel expenses of all panel members, was covered in full by the AAO-HNSF. Potential conflicts of interest for all panel members in the past 5 years were compiled and distributed before the first conference call and were updated at each subsequent call and in-person meeting. After review and discussion of these disclosures,[69] the panel concluded that individuals with potential conflicts could remain on the panel if they (1) reminded the panel of potential conflicts before any related discussion, (2) recused themselves from a related discussion if asked by the panel, and (3) agreed not to discuss any aspect of the CPG with industry before publication. Last, panelists were reminded that conflicts of interest extend beyond financial relationships and may include personal experiences, how a participant earns a living, and the participant's previously established ''stake'' in an issue.[70]

## Guideline Key Action Statements

Each evidence-based statement is organized in a similar fashion: a KAS in bold, followed by the strength of the recommendation in italics. Each KAS is followed by an ''action statement profile'' that explicitly states the quality improvement opportunity, aggregate evidence quality, level of confidence in evidence (high, medium, low), benefit, harms, risks, costs, and a benefits-harm assessment. Additionally, there are statements of any value judgments, the role of patient preferences, clarification of any intentional vagueness by the panel, exceptions to the statement, any differences of opinion, and a repeat statement of the strength of the recommendation. Several paragraphs subsequently discuss the published evidence supporting the statement. An overview of each evidence-based KAS in this guideline can be found in **Table 4**.

**Table 3.** Aggregate Grades of Evidence by Question Type.[a]

| Grade | CEBM Level | Treatment | Harm | Diagnosis | Prognosis |
|---|---|---|---|---|---|
| A | 1 | Systematic review[b] of randomized trials | Systematic review[b] of randomized trials, nested case-control studies, or observational studies with dramatic effect | Systematic review[b] of cross-sectional studies with consistently applied reference standard and blinding | Systematic review[b] of inception cohort studies[c] |
| B | 2 | Randomized trials or observational studies with dramatic effects or highly consistent evidence | Randomized trials or observational studies with dramatic effects or highly consistent evidence | Cross-sectional studies with consistently applied reference standard and blinding | Inception cohort studies[c] |
| C | 3-4 | Nonrandomized or historically controlled studies, including case-control and observational studies | Nonrandomized controlled cohort or follow-up study (postmarketing surveillance) with sufficient numbers to rule out a common harm; case series, case-control, or historically controlled studies | Nonconsecutive studies; case-control studies; or studies with poor, nonindependent, or inconsistently applied reference standards | Cohort study, control arm of a randomized trial, case series, or case-control studies; poor-quality prognostic cohort study |
| D | 5 | Case reports, mechanism-based reasoning, or reasoning from first principles | | | |
| X | N/A | Exceptional situations where validating studies cannot be performed and there is a clear preponderance of benefit over harm | | | |

Abbreviation: CEBM, Oxford Centre for Evidence-Based Medicine.

[a]Adapted from Howick and colleagues (Oxford Centre for Evidence-Based Medicine Work Group).[397]

[b]A systematic review may be downgraded to level B because of study limitations, heterogeneity, or imprecision.

[c]A group of individuals identified for subsequent study at an early, uniform point in the course of the specified health condition or before the condition develops.

**Table 4.** Summary of Guideline Key Action Statements.

| Statement | Action | Strength |
|---|---|---|
| Statement 1. Diagnosis of Ménière's disease | Clinicians should diagnose definite or probable Ménière's disease in patients presenting with 2 or more episodes of vertigo lasting 20 minutes to 12 hours (definite) or up to 24 hours (probable) and fluctuating or nonfluctuating sensorineural hearing loss, tinnitus, or pressure in the affected ear, when these symptoms are not better accounted for by another disorder. | Recommendation |
| Statement 2. Assessing for vestibular migraine | Clinicians should determine if patients meet diagnostic criteria for vestibular migraine when assessing for Ménière's disease. | Recommendation |
| Statement 3. Audiometric testing | Clinicians should obtain an audiogram when assessing a patient for the diagnosis of Ménière's disease. | Strong recommendation |
| Statement 4. Utility of imaging | Clinicians may offer magnetic resonance imaging (MRI) of the internal auditory canal (IAC) and posterior fossa in patients with possible Ménière's disease and audiometrically verified asymmetric sensorineural hearing loss. | Option |
| Statement 5. Vestibular or electrophysiologic testing | Clinicians should not routinely order vestibular function testing or electrocochleography to establish the diagnosis of Ménière's disease. | Recommendation against |
| Statement 6. Patient education | Clinicians should educate patients with Ménière's disease about the natural history, measures for symptom control, treatment options, and outcomes. | Recommendation |
| Statement 7. Symptomatic management of vertigo | Clinicians should offer a limited course of vestibular suppressants to patients with Ménière's disease for management of vertigo only during Ménière's disease attacks. | Recommendation |
| Statement 8. Symptom reduction and prevention | Clinicians should educate patients with Ménière's disease on dietary and lifestyle modifications that may reduce or prevent symptoms. | Recommendation |
| Statement 9. Oral pharmacotherapy for maintenance | Clinicians may offer diuretics and/or betahistine for maintenance therapy to reduce symptoms or prevent Ménière's disease attacks. | Option |
| Statement 10. Positive pressure therapy | Clinicians should not prescribe positive pressure therapy for patients with Ménière's disease. | Recommendation against |
| Statement 11. Intratympanic steroid therapy | Clinicians may offer, or refer to a clinician who can offer, intratympanic steroids to patients with active Ménière's disease not responsive to noninvasive treatment. | Option |
| Statement 12. Intratympanic gentamicin therapy | Clinicians should offer, or refer to a clinician who can offer, intratympanic gentamicin to patients with active Ménière's disease not responsive to nonablative therapy. | Recommendation |
| Statement 13. Surgical ablative therapy | Clinicians may offer, or refer to a clinician who may offer, labyrinthectomy in patients with active Ménière's disease who have failed less definitive therapy and have nonusable hearing. | Recommendation |
| Statement 14a. Role of vestibular therapy for chronic imbalance | Clinicians should offer vestibular rehabilitation/physical therapy for Ménière's disease patients with chronic imbalance. | Recommendation |
| Statement 14b. Role of vestibular therapy for acute vertigo | Clinicians should not recommend vestibular rehabilitation/physical therapy for managing acute vertigo attacks in patients with Ménière's disease. | Recommendation against |
| Statement 15. Counseling for amplification and hearing assistive technology | Clinicians should counsel patients, or refer to a clinician who can counsel patients, with Ménière's disease and hearing loss on the use of amplification and hearing assistive technology. | Recommendation |
| Statement 16. Patient outcomes | Clinicians should document resolution, improvement, or worsening of vertigo, tinnitus, and hearing loss and any change in quality of life in patients with Ménière's disease after treatment. | Recommendation |

The role of patient preferences in making decisions deserves further clarification. For some statements, where the evidence base demonstrates clear benefit, the role of patient preference for a range of treatments may be less relevant (as with intraoperative decision making). Clinicians should provide patients with clear and comprehensible information on the benefits to facilitate patient understanding and shared decision making, which in turn leads to better patient adherence and outcomes. In cases where the supporting evidence is weak or the benefits are unclear, shared decision making employing a collaborative effort between the clinician and an informed patient is extremely useful.[71] Factors related to patient preference include, but are not limited to, absolute benefits (number needed to treat), adverse effects (number needed to harm), cost of drugs or procedures, and frequency and duration of treatment, as well as less tangible personal factors (eg, religious and/or cultural beliefs or personal levels of desire for intervention).

**STATEMENT 1. DIAGNOSIS OF MÉNIÈRE'S DISEASE: Clinicians should diagnose definite or probable Ménière's disease in patients presenting with 2 or more episodes of vertigo lasting 20 minutes to 12 hours (definite) or up to 24 hours (probable) and fluctuating or nonfluctuating sensorineural hearing loss, tinnitus, or pressure in the affected ear, when these symptoms are not better accounted for by another disorder.** *Recommendation based on observational studies with consistently applied reference standard and a preponderance of benefit over harms.*

## Action Statement Profile: 1

- Quality improvement opportunity: Improving accuracy of diagnosis and increasing awareness of proper diagnosis for MD. National Quality Strategy domain: Effective Communication and Care Coordination
- Aggregate evidence quality: Grade C, based on observational studies with consistently applied reference standard
- Level of confidence in evidence: High
- Benefits: Improved accuracy and efficiency of diagnosis, appropriately directed treatment, reduced misdiagnosis, appropriately directed diagnostic testing, educating clinicians about accurate diagnosis, appropriate referrals, reduced use of inappropriate testing, reduced cost, improved patient QOL
- Risk, harm, cost: Provider time for making diagnosis
- Benefit-harm assessment: Preponderance of benefit over harm
- Value judgments: The group preferred to be more inclusive in the initial clinical diagnosis to capture more patients who prove to have MD with the understanding that some patients with other diagnoses may initially be included.
- Intentional vagueness: Use of *definite* versus *probable*. Also, the presence of documented/audiometrically objectified hearing loss may not be present at the time of testing.
- Role of patient preferences: Small
- Exclusions: None
- Policy level: Recommendation
- Differences of opinion: There was disagreement among the panel regarding whether to include fluctuation as part of the criteria.

## Supporting Text

The purpose of this statement is to identify patients who may have MD and differentiate them from patients with other potential diagnoses that may present with episodic vertigo or sudden-onset ''dizziness.'' By definition, MD is a clinical diagnosis. A comprehensive discussion of all etiologies that present with vertigo is beyond the scope of this KAS and this CPG, but it is the responsibility of the evaluating clinician/provider to conduct an appropriate patient history and physical to thoroughly evaluate the patient, with the specific intent of identifying another underlying cause of these symptoms. While the acute and episodic onset of symptoms is a cardinal feature of MD, not all patients with the eventual clinical diagnosis of MD may present initially with these symptoms. As such, a thorough history of the presenting and ongoing subsequent attacks/episodes is required to help establish the diagnosis.

Strict clinical classification to diagnose definite or probable MD has been established by the AAO-HNS.[2-4] These diagnostic criteria for MD were revised by the Barany Society.[5] These revisions include 2 categories:

Definite MD:

- Two or more spontaneous attacks of vertigo, each lasting 20 minutes to 12 hours
- AND
- Audiometrically documented low- to midfrequency SNHL in the affected ear on at least 1 occasion before, during, or after 1 of the episodes of vertigo
- AND
- Fluctuating aural symptoms (hearing loss, tinnitus, or ear fullness) in the affected ear
- AND
- Other causes excluded by other tests

Probable MD:

- At least 2 episodes of vertigo or dizziness lasting 20 minutes to 24 hours
- AND
- Fluctuating aural symptoms (hearing loss, tinnitus, or fullness) in the affected ear
- AND
- Other causes excluded by other tests

**Table 5.** Common Causes of Vertigo/Dizziness and Their Differentiating Features from MD.

| Condition | Clinical Presentation | Differentiation from MD |
|---|---|---|
| Autoimmune (ie, multiple sclerosis) | Often progressive fluctuating bilateral hearing loss that is steroid responsive | May present with vision, skin, and joint problems |
| Benign paroxysmal positional vertigo | Positional vertigo lasting less than a minute (ie, seconds) | Not associated with hearing loss, tinnitus, or aural fullness; short duration of vertigo spells |
| Infectious (ie, Lyme disease) | Viral (ie, adenovirus) or bacterial (ie, staph/strep); can lead to complete hearing loss and vestibular crisis event with prolonged vertigo and/or hearing loss | Losses are often permanent and do not fluctuate; can present with severe otalgia and fever |
| Otosyphilis | Sudden unilateral or bilateral sensorineural fluctuating hearing loss, tinnitus, and/or vertigo | Vertigo attacks not typically associated with aural symptoms immediately before or after attacks |
| Stroke/ischemia | Vertigo may last for minutes with nausea, vomiting, severe imbalance; may also include visual blurring and drop attacks | Insults are often permanent and do not fluctuate; may be comorbid with dysphagia, dysphonia, or other neurologic symptoms and signs. Usually no associated hearing loss, tinnitus |
| Vestibular migraine | Presents with attacks lasting hours but can also present with attacks lasting minutes or >24 hours | Timing of attacks may be shorter or longer than MD. Hearing loss less likely. Patients often have a migraine history; more photophobia than visual aura |
| Vestibular schwannoma | May present with vertigo; majority present with chronic imbalance and asymmetric hearing loss and tinnitus | Chronic imbalance more likely than profound episodic vertigo; hearing loss does not typically fluctuate |
| Labyrinthitis | Sudden severe vertigo with profound hearing loss and prolonged vertigo (ie, >24 hours) | Vertigo, nausea with hearing loss; not episodic, not fluctuating |
| Vestibular neuritis | Viral infection of vestibular system; leads to acute prolonged vertigo with prolonged nausea, vomiting without hearing loss, tinnitus, or aural fullness. Severe rotational vertigo lasts 12 to 36 hours with decreasing disequilibrium for the next 4 to 5 days | Vertigo, nausea without hearing loss |

Abbreviation: MD, Ménière's disease.

The history and physical examination should evaluate for neurologic (ie, stroke, migraine), other neurotologic/otologic (ie, cerebellopontine angle [CPA] tumors, benign paroxysmal positional vertigo [BPPV]), oncologic, inflammatory, or infectious or vascular causes. While not all-inclusive, **Table 5** outlines many other causes of acute and fluctuating vertigo/dizziness that may mimic MD and lists some of their distinguishing features from MD.

To reliably establish the clinical diagnosis, it is important to first ensure that the patient is describing actual vertigo (sense of rotation or spinning), the hallmark symptom of MD. It should be noted that some elderly patients with long-standing and now recurrent MD may not clinically manifest frank vertigo symptoms but rather present with episodes of vestibular disturbance or ''vague'' dizziness. Vertigo is defined by the Barany Society as a false sensation of self-motion and a false sensation that the visual surrounding is spinning or flowing.[72] Many patients will use a vague description of ''dizziness'' to describe symptoms or attacks that may be indicative of lightheadedness or presyncopal episodes, which are not consistent with MD. The Barany Society defines ''dizziness'' as the sensation of disturbed or impaired spatial orientation without a false or distorted sense of motion. As a result, these patients may provide an unreliable history that can make the diagnosis of MD difficult or lead to mismanagement of the problem.

It is important to clinically educate patients who have acute inner ear disorders so that they may be able to clearly define their symtpoms. A confident description of spinning is typically specific for inner ear dysfunction and MD. Clinicians should ask patients detailed/specific questions about the vertigo attacks, including the nature of the onset (spontaneous or provoked), duration of active vertigo (second, minutes, hours, or entire day), and concurrent otologic symptoms (fluctuating hearing, tinnitus, aural fullness) just before, during, or after the vertigo attack. The clinician should also inquire if vertigo onset is provoked by head position (rule out BPPV) and if the patient is experiencing falls (ie, drop attacks) during these episodes. Loss of consciousness (fainting without recollection of the actual event) is never a symptom of MD.

A thorough otologic history (ie, prior ear surgery, otorrhea/chronic ear infections, otalgia, or prior hearing loss, either sensorineural or conductive) should be addressed at the time of evaluating a patient with suspected MD, including medical/surgical history (ie, allergies, neurologic history, ongoing headaches or facial numbness that may have been consistent with CPA tumors to include, but not be

limited to, vestibular schwannomas; note that strokes, tumors, and other neurologic problems that cause dizziness may not be characterized by acute spinning), medications (ie, blood pressure, diuretics, chronic vestibular suppressive medications), and family and social history (ie, tobacco, caffeine, recreational drug use, or herbals/alternative medications). Clinicians should also take a thorough history about possible diseases that can mimic MD that also present with fluctuating hearing loss, tinnitus, and aural fullness, including VM, otosyphilis, and acute labyrinthitis. Since VM is a disorder that may closely mimic MD, it is important that evaluating clinicians inquire thoroughly about migraine in the patient's past or current medical history (see KAS 2). In migraine, ''hearing loss'' may be a perception of difficulty processing sound, as opposed to hearing it, and auditory complaints in migraine are often bilateral. Clinicians should inquire about vertigo triggers that include light sensitivity and motion intolerance as well as any prior or ongoing treatments for migraine or VM. VM may present with short (<15 minutes) or prolonged (>24 hours) periods of vertigo duration. Visual auras are more likely to be described before, during, or after attacks, and hearing loss is mild or absent and stable over time. These last 2 symptoms, combined with motion intolerance and light sensitivities in migraine, can help make the clinical differentiation from MD.

The emotional impact of this condition should also be addressed and should not be underestimated. Patients often struggle with ongoing vertigo attacks and incapacitating tinnitus and hearing loss. Clinicians can provide welcomed assistance to their patients by providing reasonable treatment expectations about recovery and duration of symptoms (see KAS 6 on patient education).

**STATEMENT 2. ASSESSING FOR VESTIBULAR MIGRAINE: Clinicians should determine if patients meet diagnostic criteria for vestibular migraine when assessing for Ménière's disease.** *Recommendation based on nonconsecutive studies, case-control studies, or studies with poor, nonindependent, or inconsistently applied reference standards with a preponderance of benefit over harm.*

## Action Statement Profile: 2

- Quality improvement opportunity: VM is a common cause of dizziness that can closely mimic MD. Appropriate assessment for VM could lead to more appropriate treatment. National Quality Strategy domains: Prevention and Treatment of Leading Causes of Morbidity and Mortality, Effective Communication and Care Coordination
- Aggregate evidence quality: Grade C, based on case-control studies or studies with poor, nonindependent, or inconsistently applied reference standards
- Level of confidence in evidence: Low, studies were done in specialty populations and may not be generalizable to more primary care populations
- Benefits: Accuracy of diagnosis, avoid unnecessary treatments or testing, potential for more appropriate treatment, patient education, promotes multidisciplinary care
- Risk, harm, cost: Extra time for assessment. Referral to other specialists.
- Benefit-harm assessment: Preponderance of benefit over harm
- Value judgments: None
- Intentional vagueness: None
- Role of patient preferences: Small
- Exclusions: None
- Policy level: Recommendation
- Differences of opinion: None

## Supporting Text

The purpose of this statement is to emphasize that the clinical features of MD and VM overlap. As such, MD can be mistakenly diagnosed in patients who have VM. The misdiagnosis can lead to unnecessary testing, referrals, and treatments. This can inconvenience patients and delay symptom improvement. Uncertainty about the formal diagnosis is common during the early course of symptoms and whenever the audiometric criteria for MD is not met. The 2 conditions can also occur concurrently. VM patients are typically younger and more likely to be female when compared with those with MD. A multidisciplinary panel has established diagnostic criteria for VM that require the current or prior history of migraine headaches (see **Table 6** for diagnostic criteria of migraine)[73,74] and also migraine features (ie, migraine headaches, photo- or phonophobia, visual aura) with at least 50% of the vestibular episodes (see **Table 6** and **Table 7** footnotes a-c).[75] Conversely, MD should be diagnosed when the characteristic audiometric hearing loss is identified on audiograms, even when migraine features are present.[75]

Reports of the similarities between MD and VM were found in Prosper Ménière's original writings. In his seminal work that implicated the inner ear in attacks of vertigo, Ménière stated, ''Persons who are subject to migraine often present symptoms analogous to those which we have described. . . . I have observed and pointed out this fact for a long time.''[76] Despite Ménière's observations in 1861, the general medical community has been slow to adopt migraine as a cause of vestibular/auditory symptoms. It took until the third edition of the International Headache Society's classification of headache disorders—published in 2018—for VM to be officially listed as an episodic migraine syndrome.[74] Vestibular specialists, however, have long considered migraine to be a common cause of dizziness in specialty clinics, and survey research indicates that it is also common in the general population.[77,78] The slow adoption of migraine as a common cause of vestibular/auditory symptoms might relate to the previous use of other diagnostic labels, such as *benign recurrent vertigo* and *vestibular Ménière's disease*—which are now considered VM.[79] Migraine with brainstem

**Table 6.** ICHD Diagnostic Criteria for Migraine.[a]

**1.1 Migraine without aura**

Previously used terms:

Common migraine; hemicrania simplex.

Description:

Recurrent headache disorder manifesting in attacks lasting 4-72 hours. Typical characteristics of the headache are unilateral location, pulsating quality, moderate or severe intensity, aggravation by routine physical activity, and association with nausea and/or photophobia and phonophobia.

Diagnostic criteria:

A. At least 5 attacks[1] fulfilling criteria B-D

B. Headache attacks lasting 4-72 hours (when untreated or unsuccessfully treated)[2,3]

C. Headache has at least 2 of the following 4 characteristics:

1. Unilateral location
2. Pulsating quality
3. Moderate or severe pain intensity
4. Aggravation by or causing avoidance of routine physical activity (e.g. walking or climbing stairs)

D. During headache, at least 1 of the following:

1. Nausea and/or vomiting
2. Photophobia and phonophobia

E. Not better accounted for by another ICHD-3 diagnosis.

Notes:

[1]One or a few migraine attacks may be difficult to distinguish from symptomatic migraine-like attacks. Furthermore, the nature of a single or a few attacks may be difficult to understand. Therefore, at least 5 attacks are required. Individuals who otherwise meet criteria for 1.1 *Migraine without aura* but have had fewer than 5 attacks should be coded 1.5.1 *Probable migraine without aura*.

[2]When the patient falls asleep during a migraine attack and wakes up without it, duration of the attack is reckoned until the time of awakening.

[3]In children and adolescents (aged $<$18 years), attacks may last 2-72 hours (the evidence for untreated durations $<$2 hours in children has not been substantiated).

**1.2 Migraine with aura**

Previously used terms:

Classic or classical migraine; ophthalmic, hemiparaesthetic, hemiplegic, or aphasic migraine; migraine accompagnée; complicated migraine.

Description:

Recurrent attacks, lasting minutes, of unilateral fully reversible visual, sensory, or other central nervous system symptoms that usually develop gradually and are usually followed by headache and associated migraine symptoms.

Diagnostic criteria:

A. At least 2 attacks fulfilling criteria B and C

B. One or more of the following fully reversible aura symptoms:

1. Visual
2. Sensory
3. Speech and/or language
4. Motor
5. Brainstem
6. Retinal

C. At least 3 of the following 6 characteristics:

1. At least 1 aura symptom spreads gradually over $\geq$5 minutes
2. Two or more aura symptoms occur in succession
3. Each individual aura symptom lasts 5-60 minutes[1]
4. At least 1 aura symptom is unilateral[2]
5. At least 1 aura symptom is positive[3]
6. The aura is accompanied, or followed within 60 minutes, by headache

D. Not better accounted for by another ICHD-3 diagnosis.

Notes:

[1]When, for example, 3 symptoms occur during an aura, the acceptable maximal duration is 3 $\times$ 60 minutes. Motor symptoms may last up to 72 hours.

[2]Aphasia is always regarded as a unilateral symptom; dysarthria may or may not be.

[3]Scintillations and pins and needles are positive symptoms of aura.

Abbreviation: International Classification of Headache Disorders.

[a]Adapted from ICHD diagnostic criteria for migraine.[74]

**Table 7.** Barany Diagnostic Criteria for Vestibular Migraine.[75,a]

*1. Vestibular migraine*

A. At least 5 episodes with vestibular symptoms[a] of moderate or severe intensity,[b] lasting 5 min to 72 hours[c]

B. Current or previous history of migraine with or without aura according to the International Classification of Headache Disorders (ICHD)[d]

C. One or more migraine features with at least 50% of the vestibular episodes[e]:

- headache with at least two of the following characteristics: one sided location, pulsating quality, moderate or severe pain intensity, aggravation by routine physical activity
- photophobia and phonophobia[f]
- visual aura[g]

D. Not better accounted for by another vestibular or ICHD diagnosis

*2. Probable vestibular migraine*

A. At least 5 episodes with vestibular symptoms[a] of moderate or severe intensity,[b] lasting 5 min to 72 hours[c]

B. Only one of the criteria B and C for vestibular migraine is fulfilled (migraine history *or* migraine features during the episode)

C. Not better accounted for by another vestibular or ICHD diagnosis[h]

[a]Vestibular symptoms; as defined by the Barany Society's Classification of Vestibular Symptoms and qualifying for a diagnosis of VM, include:

- Spontaneous vertigo including:
  - Internal vertigo, a false sensation of self-motion, and
  - External vertigo, a false sensation that the visual surrounding is spinning or flowing,
- Position vertigo, occurring after a change in head position,
- Visually-induced vertigo, triggered by a complex or large moving visual stimulus
- Head motion-induced vertigo, occurring during head motion,
- Head motion-induced dizziness with nausea. Dizziness is characterized by a sensation of disturbed spatial orientation. Other forms of dizziness are currently not included in the classification of vestibular migraine.

[b] Vestibular symptoms are rated "moderate" when they interfere with but do not prohibit daily activities and "severe" if daily activities cannot be continued.

[c] Duration of episodes is highly variable: About 30% of patients have episodes lasting minutes, 30% have attacks for hours and another 30% have attacks over several days. The remaining 10% have attacks lasting seconds only, which tend to occur repeatedly during head motion, visual stimulation, or after changes of head position. In these patients, episode duration is defined as the total period during which short attacks recur. At the other end of the spectrum, there are patients who may take four weeks to fully recover from an episode. However, the core episode rarely exceeds 72 hours.

[d] Migraine categories 1.1 and 1.2 of the ICDH

[e] One symptom is sufficient during a single episode. Different symptoms may occur during different episodes. Associated symptoms may occur before, during or after the vestibular symptoms.

[f] Phonophobia is defined as sound-induced discomfort. It is a transient and bilateral phenomenon that must be differentiated from recruitment, which is often unilateral and persistent. Recruitment leads to an enhanced perception and often distortion of loud sounds in an ear with decreased hearing.

[g] Visual auras are characterized by bright scintillating lights or zigzag lines, often with a scotoma that interferes with reading. Visual auras typically expand over 5–20 minutes and last for less than 60 minutes. They are often, but not always restricted to one hemifield. Other types of migraine aura, (e.g. somatosensory or dysphasic aura), are not included as diagnostic criteria because their phenomenology is less specific, and most patients also have visual auras.

[h] History and physical examinations do not suggest another vestibular disorder, *or* such a disorder is considered but ruled out by appropriate investigations *or* such disorder is present as a comorbid or independent condition, but episodes can be clearly differentiated. Migraine attacks may be induced by vestibular stimulation. Therefore, the differential diagnosis should include other vestibular disorders complicated by superimposed migraine attacks.



aura (formerly called basilar migraine, which is a migraine variant) can overlap with VM but requires $\geq$2 brainstem symptoms, and aura symptoms should be limited to 5 to 60 minutes in duration.[74]

The precise mechanisms that lead to the vestibular/auditory symptoms in VM are not known. Genetic factors likely establish the basis for migraine symptoms. The pathophysiology likely relates to transient changes in chemical signaling and possibly cerebral vascular vasospasm.[79] The exact location of the dysfunction is not known and likely varies from patient to patient and possibly even from attack to attack. Nystagmus during attacks of VM can be a central or peripheral pattern.[80-82] The peripheral system is also more implicated when unilateral auditory symptoms are present. Migraine patients frequently have cerebellar and deep white matter lesions on MRI.[83,84]

Based on the high prevalence of migraine in general, it is not uncommon for a patient to have both MD and VM. In both population-based studies and outpatient clinics using the Barany diagnostic criteria or the International Classification of Headache Disorders definition of VM, the prevalence of VM is high (2.7% in population studies and 10% in outpatient clinics).[85-87] A recent retrospective cohort study from a dizziness specialty clinic in South Korea found that 35% (88 of 251) of MD patients also met criteria for definite or probable VM.[88] Therefore, the epidemiology of VM should be respected in the decision-making process. When there is uncertainty about VM or MD, treatment decisions can be difficult but should proceed through noninvasive therapeutic trials prior to any surgical or inner ear ablative interventions. Destructive interventions should be reserved for those with severe progressive hearing loss/lack of usable hearing. Adequate clinical trials of abortive or prophylactic medicines in VM are not available. Therefore, VM is not ''ruled out'' by a lack of response to typical migraine medicines.

**STATEMENT 3. AUDIOMETRIC TESTING: Clinicians should obtain an audiogram when assessing a patient for the diagnosis of Ménière's disease.** *Strong recommendation based on SRs of cross-sectional studies with consistently applied reference standard and blinding for diagnostic testing with a preponderance of benefit over harms.*

## Action Statement Profile: 3

- Quality improvement opportunity: Determining both pure tone thresholds and measures of speech recognition will lead to more accurate diagnosis and appropriate and timely referrals for aural rehabilitation, hearing aids, and/or cochlear implants and may have significant implications for treatment options. National Quality Strategy domain: Effective Communication and Care Coordination
- Aggregate evidence quality: Grade A, based on SRs of cross-sectional studies with consistently applied reference standard and blinding for diagnostic testing
- Level of confidence in evidence: High
- Benefits: Improving diagnostic accuracy, identifying deficits in contralateral ear (question of bilateral disease), improving treatment planning, establishing baseline of hearing prior to treatment, directing treatment options based on degree of residual hearing (ablative vs nonablative), and identifying opportunities for aural rehabilitation
- Risk, harm, cost: Cost of testing, time of testing, patient distress at unrecognized hearing loss, discrimination based on hearing impairment (vocation, access to disability benefits)
- Benefit-harm assessment: Preponderance of benefit over harm
- Value judgments: An audiogram is essential to make the diagnosis of definite MD.
- Intentional vagueness: None. Also, the presence of a documented/audiometrically objectified hearing loss may not be present at the time of testing.
- Role of patient preferences: Small. Some patients may elect not to get an audiogram for various reasons.
- Exclusions: None
- Policy level: Strong recommendation
- Differences of opinion: There was a minority of the group who felt that patients with probable MD can be treated without an audiogram, but the majority felt that the audiogram is key to confirming the diagnosis and all subsequent management. One committee member noted that there are no studies in MD that assess outcomes in those receiving an audiogram as compared with those who do not. The audiogram is required to move from a diagnosis of possible MD to definite MD. Some patients and providers may elect to proceed with noninvasive management without an audiogram.

## Supporting Text

The purpose of this statement is to highlight the importance of obtaining audiometric data on all patients with a suspected clinical diagnosis of MD. Hearing loss was part of the original description of this disease and remains a necessary criterion based on the current international concensus.[76,89-91] Audiometry is necessary to differentiate probable versus definite MD. Audiometry should include pure tone air conduction thresholds (pure tone average [PTA]) bilaterally, ruling out or quantifying any conductive component of the hearing loss (bone conduction thresholds, tympanometry, acoustic reflex measures, and/or otoscopy), and including a measure of speech recognition (ie, word recognition/discrimination score [WRS]) in each ear. If audiometric testing is not available for the initial otolaryngology evaluation, tuning fork evaluation can be used to identify asymmetrical hearing loss and whether there is a conductive component to the loss,[92] although a recent SR assessing tuning fork accuracy ''does not support the individual reliance on tuning fork tests for clinical screening and surgical candidacy assessment.''[93] Certainly, if this shows any concerns for asymmetric hearing loss, a dedicated booth audiogram with speech testing must be conducted to validate concerns about asymmetric hearing loss. Rarely patients may resist audiometric assessment, and in these instances the patient must take an active shared decision-making role in deciding whether to undergo formal audiometry. Diagnostic criteria for MD require episodic vertigo, fluctuating hearing loss (sensorineural in the low to midfrequencies), tinnitus, and a perception of fullness in the involved ear.[79,94-96] While not excluding other frequencies of fluctuating hearing loss that may apply to MD, for the purposes of this document, ''low- to midfrequency hearing loss'' refers to audiometric frequencies $\leq$2000 Hz.[96] As MD typically (initially) presents unilaterally,

the patient often has an asymmetric hearing loss. The AAO-HNS defines asymmetric hearing loss as a difference in PTA (average threshold at 500, 1000, and 2000 Hz) between ears of >15 dB or a difference >15% between ears in WRS.[97] As such, a patient with no documented evidence of hearing loss during acute attacks or evidence of permanent threshold shifts on audiometric testing does not meet diagnostic criteria for definite MD, and an alternative diagnosis should be considered.

MD (at least in the early stages) will typically produce a modest decrease in standardized speech recognition thresholds. Any patient whose WRSs are worse than expected for the PTA in the involved ear should be assessed for the possibility of retrocochlear pathology to include, but not be limited to, auditory neuropathy or vestibular schwannoma. A low- to midfrequency hearing loss that is mixed in nature should be investigated further to identify any underlying cause of the conductive component, such as mechanical/middle ear causes for the loss or a possible dehiscence of the superior semicircular canal.

As a subset of patients with MD will eventually manifest this disorder bilaterally,[43] it is important to document hearing loss in both ears to not only identify the stability of MD in the initially involved ear but to also document the potential onset of the disorder in the contralateral ear. The presence of bilateral disease must be considered when formulating treatment options. In many cases, treatment decisions for MD are dependent on the frequency and nature of vertigo attacks and the level of intact hearing or hearing loss that the patient has.

Rehabilitation for hearing loss must consider both the involved and noninvolved ears and is based on both PTAs and measures of speech recognition (ie, WRS). Those with hearing loss may benefit from traditional amplification if WRSs are deemed useful for understanding speech (see KAS regarding rehabilitation). In the case of profound hearing loss in ≥1 affected ears, contralateral routing of sound (CROS) devices or cochlear implantation may be an option.

**STATEMENT 4. UTILITY OF IMAGING: Clinicians may offer magnetic resonance imaging (MRI) of the internal auditory canal and posterior fossa in patients with possible Ménière's disease and audiometrically verified asymmetric sensorineural hearing loss.** *Option based on observational and case studies with a preponderance of benefit over harm.*

### *Action Statement Profile: 4*

- Quality improvement opportunity: To reduce variations of care and unnecessary expense as well as potential adverse effects from radiation (if CT is used) and/or contrast (CT/MRI) exposure. National Quality Strategy domain: Making Quality Care More Affordable
- Aggregate evidence quality: Grade D, based on observational and case studies
- Level of confidence in evidence: Medium
- Benefits: Avoid unnecessary testing, minimize cost and adverse events, maximize the diagnostic yield of MRI when indicated, avoid radiation, patient reassurance
- Risk, harm, cost: Cost of the MRI scan, potential risks of contrast agents, potential for risk of injury in MRI scanner (eg, heating of metallic wires and implants or subsequent malfunction of implants with magnetic components), physical discomfort of the imaging procedure (noise, claustrophobia), psychological distress of incidental findings (and further workup necessitated by those findings), and potential for delayed/missed diagnosis[98]
- Benefit-harm assessment: Preponderance of benefit over harm
- Value judgments: None
- Intentional vagueness: None
- Role of patient preferences: Moderate
- Exclusions: Patients unable or unwilling to have MRI
- Policy level: Option
- Differences of opinion: The group was divided regarding the benefit of MRI. Specifically, many clinicians were uncomfortable treating MD without ruling out inner ear or retrocochlear lesions in either unilateral hearing loss or subsequent second-side loss in the setting of possible bilateral MD. Others felt comfortable using nonablative therapies without MRI.

### *Supporting Text*

There are potential benefits and downsides to MRI use in patients with presumptive MD, and providers should discuss these to promote effective shared decision making. In patients presenting with unilateral or bilateral ear symptoms (ie, fullness, hearing loss, tinnitus) regardless of vertigo, the primary purpose of MRI is to exclude an inner ear or retrocochlear lesion, including, but not limited to, vestibular schwannoma, other internal auditory canal or CPA mass (eg, meningioma), or abnormal brain finding (eg, multiple sclerosis, vascular lesion). The only existing CPG recommending MRI screening for asymmetric hearing loss is for sudden SNHL[99] based on a 2.7% to 10.2% prevalence of CPA tumors. It has been estimated that >600 patients with dizziness and nonsudden asymmetric hearing loss would need to be screened with MRI to identify 1 patient with a CPA mass/tumor.[100]

Patients with suspected or diagnosed MD typically have episodes of recurrent vertigo, fluctuating auditory symptoms (tinnitus and ear fullness), and the characteristic low- to midfrequency SNHL documented on audiogram. In patients with an inner ear or retrocochlear lesion, such as a schwannoma, the hearing loss typically has minimal fluctuation and usually shows steady or sudden declines with no interval improvements. The asymmetry on an audiogram is typically in the mid- to high range (eg, 3000 Hz)[101]; the dizziness is

described as nonspecific chronic imbalance without discrete vertigo attacks; and there may be other cranial nerve findings (eg, trigeminal nerve involvement). Two challenges regarding decisions about the use of MRI for asymmetric hearing loss in patients suspected of MD include the following: (1) expert clinicians have only moderate agreement in classifying audiograms as asymmetric or not,[102] and (2) the prevalence of unilateral hearing loss (defined as PTA $\geq$25 dB in 1 ear) is 8.9% of the US population aged 20 to 69 years.[103]

The primary rationale for early screening for inner ear or retrocochlear lesions is that surgery is more likely to preserve hearing when the tumor is small as compared with moderate or large lesions. Interestingly, unilateral hearing loss was not associated with reduced health-related QOL in a population-based study.[104] However, the QOL of patients with unilateral SNHL deteriorated particularly with regard to mental functioning to levels similar to those found in patients with bilateral SNHL.[105] In addition, patients are often observed over an extended time even when a schwannoma is identified. The primary disadvantages for early neuroimaging include cost, inconvenience to the patient, false-positive results or incidental findings that could result in patient distress, the need for additional testing, and the risk of any procedures (eg, intravenous contrast). Noncontrast MRI has been proposed as a cost-effective means to evaluate for vestibular schwannoma and other causes of unilateral SNHL.[106-108] Noncontrast examinations can miss small schwannomas or inflammatory processes,[109,110] and postcontrast MRI may be of use if the noncontrast examination is discordant with clinical and audiologic findings.[111,112]

MRI research is also exploring findings specific to MD. Delayed MRI after IT, intravenous, or trans–eustachian tube contrast delivery allows for differentiation of the endolymphatic and perilymphatic fluid. Much of the recent literature regarding imaging in MD has been in the development of this technique. Currently, there are 5 large (53-74 patients)[113-117] and another 25 smaller case series that evaluated MD patients with delayed postcontrast MRI.[118-142] These data revealed that distention of the endolymphatic space in the cochlea and vestibule (ELH) is commonly identified in patients with definite MD and more frequently than other causes of SNHL or vertigo. However, this finding is not present in all patients with MD, and there remains variability within imaging protocols and proposed grading/assessment systems.[114,133,143-148] Studies employing delayed postcontrast MRI during conservative management[149] following medical therapy,[150-152] IT gentamicin,[153-155] and endolymphatic sac surgery[156-159] in MD patients did not produce imaging characteristics that correlated with treatment responsiveness or symptomatic improvement. No studies compared findings in the clinically relevant circumstance of clinical uncertainty. Hence, use of imaging to make the diagnosis of MD is still under investigation. As there is no ''gold standard'' test for MD, results are confounded by efficacies of the interventions as well.

When possible, MRI studies should be interpreted by a board-certified neuroradiologist given the potential subtlety of findings. Patients may be unable to have MRI due to implanted ferromagnetic materials[160] or are unwilling due to claustrophobia or cost. While MRI does not involve irradiation, patients should be aware of the risks of gadolinium-based MRI contrast agents, which include (1) rare occurrence of anaphylaxis, (2) the potential development of nephrogenic systemic fibrosis, (3) acute renal failure in patients with preexisting renal insufficiency,[105] and (4) retention of gadolinium-based contrast agents (GBCAs) in patients.[161] To date, no adverse events have been reported from gadolinium retention in the brain. Since 2017, the Food and Drug Administration has required that educational information be provided to each patient before receiving GBCAs.[161,162]''Health care professionals should consider the retention characteristics of each agent when choosing a GBCA for patients who may be at higher risk for gadolinium retention. These patients include those requiring multiple lifetime doses, pregnant women, children, and patients with inflammatory conditions. Minimize repeated GBCA imaging studies when possible, particularly closely spaced MRI studies.''[161]

**STATEMENT 5. VESTIBULAR OR ELECTROPHYSIOLOGIC TESTING: Clinicians should not routinely order vestibular function testing or electrocochleography (ECochG) to establish the diagnosis of Ménière's disease.** *Recommendation against based on systematic reviews of cross-sectional studies and observational ECochG studies.*

## *Action Statement Profile: 5*

- Quality improvement opportunity: Avoidance of unnecessary testing. National Quality Strategy domains: Patient Safety, Prevention and Treatment of Leading Causes of Morbidity and Mortality
- Aggregate evidence quality: Grade B, based on SRs of cross-sectional studies and observational ECochG studies
- Level of confidence in evidence: Medium, based on difficulty in assessing the quality of the SRs, the meta-analyses, and the subgroups within the cohort
- Benefits: Avoidance of unnecessary testing, decreased cost, improved efficiency of diagnosis, reduced patient burden of unpleasant testing
- Risk, harm, cost: Missed or delayed diagnosis of comorbid conditions
- Benefit-harm assessment: Preponderance of benefit over harms
- Value judgments: While some of these tests may have a role in individualized patients, MD requires a clinical and audiometric diagnosis.
- Intentional vagueness: The word *routine* is used to allow for individualized use of these testing modalities in some of the settings specified in the supporting text.

- Role of patient preferences: Small
- Exclusions: None
- Policy level: Recommendation against
- Differences of opinion: None

## Supporting Text

The purpose of this statement is to emphasize that patients with a history and symptoms consistent with MD should not routinely undergo formal vestibular function testing or ECochG to establish the diagnosis of MD. Rather, MD remains a clinical diagnosis based on patient-reported symptomatology and audiometric data.[5,6]

Vestibular function testing and ECochG assess the integrity of different portions of the audiovestibular system. Testing of vestibular function includes VNG with caloric testing, rotary chair, video head impulse testing (vHIT), and cervical and ocular vestibular evoked myogenic potentials (cVEMP and oVEMP). Results of vestibular testing and ECochG often fluctuate throughout the course of MD, and the degree of damage detected correlates poorly with patient-perceived disability.[163] Currently, there are not sufficient high-quality RCTs, SRs, or meta-analyses reporting high diagnostic testing accuracy for MD. As such, diagnostic criteria for MD do not include vestibular function testing or ECochG data.[5,6] Additionally, the utilization of vestibular testing for dizziness evaluations varies significantly among clinical practices, practice settings (academic vs community), and geographic regions.[164,165] Unnecessary vestibular testing can contribute to delays in diagnosis and increased direct and indirect costs to patients and providers.[166] Not all facilities that care for patients with MD have the equipment and ability to perform vestibular or electrophysiologic testing; therefore, waiting for these tests to be completed or for referrals to other facilities may delay initiation of treatment and add to travel time/cost for patients. The current data do not support a consistent level of high sensitivity and specificity to diagnose MD with these tests to justify the routine use in all patients suspected of having MD. In some cases, these tests can lead to patient morbidity and prolonged recovery.[167] Additionally, there are patients who meet diagnostic criteria for MD but have normal vestibular testing results. These results do not necessarily rule out MD. There *are* instances in which vestibular function testing and ECochG may be helpful in evaluating and managing individual patients with MD, described later in this section.

ECochG measures the electrical responses of the cochlea and auditory nerve to acoustic stimulation. An auditory stimulus is presented to the ear, and electrical responses are recorded, including the cochlear microphonic, the summating potential (SP) generated by cochlear hair cells, and the cochlear nerve action potential (AP), which is equivalent to wave I of the auditory brainstem response. ECochG has historically been used in assessment of patients with presumed ELH. ELH is believed to generate abnormally large SP amplitudes relative to AP amplitudes by distending the basilar membrane toward the cochlear scala tympani.[168] An association of MD with an overaccumulation of endolymph in the inner ear is well described in temporal bone studies.[169] Thus, an elevated SP/AP ratio may indicate MD pathology. However, variations in recording techniques, stage of disease, and stability of hearing loss influence these measurements.[170] In an SR of the diagnostic testing accuracy of ECochG for MD, the sensitivity of ECochG ranged from 66.7% to 85.7%, and specificity ranged from 80% to 100%.[171] Variations in threshold values and measurement techniques precluded meta-analysis.[171] Patients with a shorter duration of disease may not have developed cochlear changes that result in abnormal ECochG, therefore decreasing the sensitivity to detect pathology.[171] Additionally, different stimuli and techniques for measuring ECochG responses create variations in measurements.[127] Tone burst stimuli have demonstrated greater sensitivity in detecting cochlear hydrops comparative to click stimuli with transtympanic electrodes.[127,172] Other calculations and techniques to measure ECochG with the SP/AP amplitude and area ratio have also been suggested to improve the diagnostic accuracy for MD.[173,174] A retrospective review of 178 patients at a single institution that had ECochG examinations that calculated SP/AP amplitude and area ratio with specialized software demonstrated an overall sensitivity of 92% and specificity of 84% to diagnose MD.[173] However, other studies of patients with MD that had ECochG measurements completed did not have as high a sensitivity with similar calculations assessing the SP/AP area.[174] The protocol and analysis to perform ECochG have not been standardized, and software used in more sensitive studies is not available to all testing facilities. Clinicians should be mindful that elevation of the SP/AP amplitude and area ratio is not unique to patients with MD and may also be observed in the presence of a third mobile window of the inner ear, such as a superior semicircular canal dehiscence.[163,175]

VNG involves recording eye movements during a battery of tests that assess vestibular function. Caloric testing is one component of VNG and is best used to identify unilateral peripheral vestibular hypofunction. The caloric test provides ear-specific information with temperature-driven nonphysiologic low-frequency stimulation of the horizontal semicircular canal. In cross-sectional studies and case series of patients with MD, 65% of patients have unilateral weakness noted on caloric testing.[176-178] Thus, a substantial proportion of MD patients are expected to have normal results. Normal caloric testing should not rule MD out. vHIT is another vestibular test that uses high-frequency stimulation to assess function of all 6 semicircular canals independently. By using high-speed recordings of eye movements during and after high-velocity head impulses, vHIT yields a measure of vestibulo-ocular reflex gain (eg, ratio of slow-phase compensatory eye velocity to head velocity) as well as the pattern of corrective saccades that result from a canal functional deficit. Discordant results between vHIT and caloric testing have been observed in multiple studies of patients with MD.[176,177,179] In a series of 88 patients with definitive MD based on AAO-HNS 1995 criteria,[2] 67% of

patients had abnormal caloric testing, of which 45% had normal vHIT results.[176] There are several theories for this discordance, including (1) that MD results in selective damage to type II hair cells that affect the low-frequency response of the crista during caloric testing while preserving the high-frequency response driven by type I hair cells during vHIT[180] versus (2) that caloric asymmetry in MD results from alterations in inner ear fluid dynamics from ELH rather than from actual canal paresis.[179] Currently there is insufficient evidence to support use of this pattern of discordant caloric testing and vHIT results as a diagnostic tool for MD. However, these tests can be useful to identify a unilateral peripheral hypofunction, which may help guide further management, specifically in uncompensated cases. Rotational chair testing stimulates both ears simultaneously, providing a binaural vestibulo-ocular reflex response and measurement of peripheral vestibular function. However, it does not provide lateralizing information or identify the affected ear. Rotational chair testing may be useful for assessing bilateral vestibular hypofunction and compensation for peripheral vestibular weakness.[181,182]

Vestibular evoked myogenic potentials (VEMPs) are used to assess the function of the otolith organs and their afferent vestibular pathways. cVEMPs provide information from the saccule and inferior vestibular nerve, whereas oVEMPs provide information from the utricle and the superior vestibular nerve.[183] The 2017 American Academy of Neurology practice guideline on VEMP testing reviewed the literature on use of cVEMP and/or oVEMP for the diagnosis of MD, yielding 8 studies with class 3 evidence ratings. Results were conflicting or inconclusive, and no study established that VEMP could be used as a stand-alone test to diagnose MD. The practice guideline concluded that there is insufficient evidence to determine if cVEMP or oVEMP is useful for diagnosing MD.[183] In some studies, cVEMP provided evidence of vestibular dysfunction in the ear affected by MD based on an ipsilaterally absent cVEMP response. Therefore, cVEMPs may serve as an adjunct measure of vestibular dysfunction in the evaluation of patients with MD.[183] A recent meta-analysis of 30 studies demonstrated that cVEMPs had 49% sensitivity and 95% specificity for identifying primary or delayed ELH. Sensitivity, specificity, and accuracy improved when cVEMP testing was obtained during periods of acute attacks, in later-stage disease, and with bone conduction assessment. However, there are limitations in this analysis, as the included studies used 2 different methods for clinical diagnosis of MD and details of the analysis are not well described.[184] In an SR that compared VEMP results in patients with unilateral MD and patients with VM, 1 study identified lower cVEMP amplitudes in the affected ear of MD patients in response to tone burst at 500 Hz.[185] An additional study showed lower ratios of the amplitude from tone burst at 500 Hz to that at 1000 Hz in patients with MD.[185] VEMPs may also have a role in prediction of evolving bilateral MD.[186] A case-control study of 82 patients with MD demonstrated that 27% of unaffected ears had elevated thresholds and altered cVEMP tuning frequency like that seen in affected ears, suggesting a potential role in identifying asymptomatic or presymptomatic ELH.[186]

While routine use of vestibular function testing and ECochG is not recommended to diagnose MD, the tests may provide information beneficial to the evaluation and management of specific individuals. These tests may provide a supportive role in the diagnosis of MD, specifically when patients present with atypical symptoms or when there is difficulty determining the affected ear, which may be helpful when considering ablative interventions. The tests are most appropriately used when the results will be utilized to alter patient management. Specifically, vestibular testing should be performed to assess the integrity of the vestibular system prior to completing an inner ear ablative procedure for MD treatment. As bilateral peripheral vestibular hypofunction has a significant impact on QOL and functioning,[187] full assessment of the vestibular function in the contralateral ear is warranted to determine the risks prior to permanent vestibular ablation. Vestibular testing may also be used to assess the effectiveness of ablative treatment. A prospective cohort study of 25 patients with MD was tested with VEMP and caloric testing pre- and post-IT gentamicin injections. Absent VEMPs and caloric responses after treatment were correlated with significant symptom improvement at 6-month follow up.[188] Additionally, if patient symptoms are suggestive of other vestibular disorders, vestibular testing can be helpful to evaluate for these other causes. However, use of vestibular testing is best directed by patient history for appropriate interpretation of testing results and guidance of patient management.

In summary, MD is a clinical diagnosis that does not require routine use of ECochG or formal vestibular function testing. In individual situations, these tests may provide complementary information to lateralize MD as well as assess the vestibular system prior to and during ablative treatments. Availability and feasibility of the specialized equipment and training needed to complete these tests, as well as the cost of this equipment, should be considered when determining the best management for each patient. Thus, clinicians may use ECochG and vestibular function tests in patients with MD if necessary to alter their evaluation or management.

**STATEMENT 6. PATIENT EDUCATION: Clinicians should educate patients with Ménière's disease about the natural history, measures for symptom control, treatment options, and outcomes.** *Recommendation based on an RCT on patients educating themselves and shared decision-making literature and a preponderance of benefit over harm.*

## *Action Statement Profile: 6*

- Quality improvement opportunity: Informing patients about their disease to participate in shared decision making. National Quality Strategy domain: Effective Communication and Care Coordination

- Aggregate evidence quality: Grade C, single RCT evaluating a patient education booklet and the considerable literature on shared decision making
- Level of confidence in evidence: High
- Benefits: Patient engagement, patient satisfaction, improved adherence to treatment, avoidance of unnecessary treatments, more optimal use of health care resources, improved symptom control, improved shared decision making
- Risk, harm, cost: Time for education, patient distress, diagnosis uncertainty
- Benefit-harm assessment: Preponderance of benefit over harm
- Value judgments: Education allows for improved shared decision making. This assumes that the patient is not already appropriately educated.
- Intentional vagueness: None
- Role of patient preferences: Small, but patients may express preference for optimal method of education
- Exclusions: None
- Policy level: Recommendation
- Differences of opinion: None

## *Supporting Text*

The purpose of this statement is to affirm the importance of shared decision making when diagnosing, caring for, and managing patients with MD. Clinicians are encouraged to engage and educate patients about MD, with information that is clearly understandable and relevant to the disorder. Clinicians should take the time to explain MD and treatment options. When there is open patient-clinician communication and when education is provided about health outcomes and treatment options, patients are empowered to make informed decisions, adhere to treatment plans, and have greater satisfaction and better outcomes.[189-191]

Clinicians should inform patients about MD, symptoms of the condition, and ways to manage those symptoms. Education should include lifestyle modifications, dietary restrictions, anticipated diagnostic testing, and treatment options. Long-term effects of the disease, which include hearing loss, vestibular/balance problems, and tinnitus, should also be discussed. Treatment options should be explained to the patient, with risks and benefits of each option. Before considering highly invasive and ablative surgical procedures such as a labyrinthectomy, patients should be informed that MD does affect the contralateral ear in some patients, which could leave the patient without meaningful hearing or vestibular function. Education should be provided both verbally and in handouts, when available, written at a level that the patient can readily comprehend (**Table 8**). Sufficient time should be allowed for patient questions and answers, to promote shared decision making. In clinical studies, time constraints were one of the most cited barriers in implementing shared decision making in clinical practices.[192] However, shared decision making is supported by evidence from 86 RCTs showing knowledge gained by patients, more confidence in decisions, and more active patient involvement.[193] Allowing the appropriate time to educate the patient will not only provide patients with the necessary tools to equally participate in their health plans but will also build trust, providing a better patient-clinician relationship.

In patients with MD, there is only 1 RCT supporting the benefit of patient education. This RCT looked at the effectiveness of booklet-based education to manage symptoms of MD. Patients were randomized to 3 groups: a waiting-list control group, a vestibular rehabilitation (VR) group, and a symptom control group. The *Vestibular Rehab* booklet was designed to promote exercises to help in the recovery from symptoms. The *Symptom Control* booklet was geared toward helping the patient reduce stress that can exacerbate the symptoms of MD. Both the VR and symptom control groups showed statistically significant improvements in terms of reduced handicap, which was measured at 3 and 6 months after baseline, according to the Dizziness Handicap Inventory (DHI). The VR group showed additional improvements in reduced symptoms, anxiety, and negative beliefs about dizziness.[194] These results demonstrate a definite benefit to providing patients with the necessary information to help in self-management.

Incorporating patients' values and beliefs into the decision-making process increases their participation, improves patient well-being, and results in better adherence to treatment with fewer concerns about illness and higher patient satisfaction.[195] Ways to implement this process involve

- Providing clear, appropriate, and understandable information regarding MD, symptomatology, lifestyle modifications, diagnostic testing, long-term risks of the condition, and psychological impact of the disease.
- Discussing treatment options that include diet and lifestyle modifications, medications, IT injections, or potential surgical treatment options. With each treatment option, risks and benefits should be explained in detail.
- Eliciting patient values, concerns, and psychological needs when treating and managing MD. Encouraging patients to reach out to support groups if indicated.
- Reaching a patient-clinician consensus on an individualized treatment plan.
- Building a patient-clinician partnership with open communication. Encouraging patients to keep journals of symptoms, triggers, and alleviating factors, as well as stressing the importance of continued follow-up.

Patients are often stressed and anxious when they are unwell and suffer from a chronic condition. As such, patients may not be able to integrate all the information provided to them in a single consultation and may need to

**Table 8.** Frequently Asked Questions.

| Question | Answer |
|---|---|
| What is Ménière's disease (MD)? | MD is an ongoing inner ear disorder, diagnosed by symptoms of 2 or more episodes of vertigo that last between 20 minutes to 24 hours. Other symptoms that you may have along with vertigo include<br>• Fluctuating hearing loss<br>• Your ear feeling like it is full or plugged<br>• Tinnitus: a ringing, buzzing, or other noise in your ear<br>The disorder is believed to be caused by too much fluid within the inner ear. |
| What is vertigo? | Vertigo makes you feel like you are spinning or moving when you are still. It is caused when your vestibular system isn't working properly. Vertigo can be due to nonvestibular causes. |
| What is the vestibular system? | The vestibular system includes the inner ear and vestibular pathways in the brain dedicated to balance, coordination, and maintenance of posture. |
| What is tinnitus? | Tinnitus is when you hear ringing, buzzing, or other noises in your ear, when there is nothing causing the noise. Tinnitus sounds are different for each patient.[398] |
| What is fluctuating hearing loss? | This sensation can occur early in MD onset when the hearing abruptly changes, alternating between worsening and improving. |
| How is the diagnosis of MD made? | Your health care provider will ask questions to get a history of your symptoms and may also send you for additional testing. The following questions may be asked about your symptoms:<br>• How often do the symptoms occur?<br>• How long do the symptoms last?<br>• Describe your dizziness.<br>• How severe are the symptoms?<br>• Do you have hearing loss with the dizziness? How long does that last? Does the hearing loss fluctuate?<br>• Do you have other ear complaints (fullness or changes in tinnitus) with the dizziness?<br>• Has your dizziness caused you to fall?<br>• Do you have tinnitus (ringing, buzzing, or other noises in your ear) along with the dizziness?<br>• Does your ear feel full during your attacks of dizziness or hearing loss?<br>• When you are feeling dizzy: Do you have headaches? Do any lights or sunlight make you feel worse? Does it make you feel worse when you move?<br>• Anyone in your family have similar symptoms?<br>Keeping a journal of symptoms can help your health care provider make an accurate diagnosis. Sometimes it takes many visits to diagnose MD. |
| What testing might be ordered? | Your health care provider may have you get the following testing:<br>• **Audiogram**<br>This is a hearing test. An audiologist performs this test. It measures the level of hearing from low to high frequency.<br>○ No significant risk of testing<br>○ Test can be time-consuming (about 30 minutes)<br>• **Video- or electronystagmogram**<br>This exam evaluates vestibular function of the ear, the vestibular centers of the brain, and the oculomotor system. In a darkened room, eye movements are recorded as warm and cool water or air is added into each ear canal. The test evaluates how the eyes and ears coordinate with the brain.<br>○ Risks of vertigo, nausea with testing<br>○ Tests are time-consuming (about 1 hour)<br>○ May cause discomfort with changes in body positions<br>• **Electrocochleography**<br>Electrocochleography measures the electrical responses of the cochlea and auditory nerve to electrical stimulation.<br>○ Risks include discomfort in the ear.<br>• **Magnetic resonance imaging (MRI) of the brain**<br>A type of imaging that uses magnetic energy to view brain and nerve anatomy. Intravenous contrast is often required to improve the images. The machine contains powerful magnets, so patients with stainless-steel or nontitanium implants may not be able to have MRI. Risks of MRI include<br>○ Allergy to contrast dye<br>○ Discomfort with intravenous placement |

*(continued)*

**Table 8.** (continued)

| Question | Answer |
|---|---|
| | ○ If you have a fear of smaller spaces, you may feel uncomfortable going through the tunnel of the MRI machine |
| What are some of the treatments for this condition? | There is no cure for MD. There are ways to manage the condition and help control symptoms. Treatment for MD falls into the following categories (from least to most aggressive):<br>• Diet restrictions: Although not all people get relief with making changes to their diet, it is important to try to see if these changes help to decrease symptoms.<br>○ Low-sodium diet (1500-2300 mg daily; specific milligram recommendations based on the American Heart Association and not a previous MD treatment guideline)[215]<br>○ Limit alcohol consumption<br>○ Limit caffeine intake<br>• Medications may help reduce the symptoms.<br>○ Diuretics—medications that remove excess body fluid<br>○ Antivertigo medications for acute vertigo symptoms<br>○ Antihistamines to treat allergies<br>○ Betahistine (histamine analogue to increase vasodilation to inner ear)<br>• Noninvasive therapies<br>○ Vestibular rehabilitation (physical therapy)<br>○ Hearing aids<br>• Middle ear injections through the ear drum in the affected ear<br>○ Steroids<br>○ Gentamicin<br>• Surgery<br>○ Endolymphatic sac decompression (hearing sparing)<br>○ Vestibular nerve section (hearing sparing)<br>○ Labyrinthectomy (hearing ablative) |
| What can I do to decrease my symptoms? | To assist with your symptoms, your physician can help you figure out things that may be making you feel bad, including sodium, alcohol, caffeine, weather, allergies, and stress. |
| How can MD affect my quality of life? | MD can change how you feel about the way you live your life. Your symptoms may make you feel sick and tired, or you may have a hard time hearing or paying attention. Many times, when patients are feeling better, they think about how bad they felt and feel scared. It is important to see your health care provider regularly to answer your questions and help make you feel better. |
| What is the natural history of MD? | • It is an adult-onset disorder (most commonly between 40 and 70 years).<br>• Vertigo attacks and fluctuations in hearing, tinnitus, and ear fullness are sporadic and unpredicted.<br>• While the patient's hearing may worsen or persist, patients with MD may also have hearing that stabilizes over time. Residual or permanent inner ear balance loss may require long-term vestibular therapy for compensation. |
| Are there other educational links or support groups for MD? | Patients should be encouraged to join a support group to gain knowledge, resources, and support from others. Some resources that have links to support groups:<br>• Vestibular Disorders Association, https://vestibular.org/finding-help-support<br>• Ménière's Resources Inc, http://menieresresources.org/<br>• Ménière's Society, http://www.menieres.org.uk/<br>• Ménière's Research Fund Inc, https://menieresresearchaustralia.org/<br>• Hearing Health Foundation, https://hearinghealthfoundation.org/<br>**Additional educational resources:**<br>• National Institutes of Health, "Ménière's Disease,"https://www.nidcd.nih.gov/health/menieres-disease<br>• American Academy of Otolaryngology—Head and Neck Surgery, "Ménière's Disease,"https://www.entnet.org//content/menieres-disease |

**Table 9.** FAQ for MD Triggers.

| Question | Answer |
|---|---|
| What triggers will make my symptoms worse or bring on a vertigo attack? | MD triggers vary from patient to patient. It is possible that you have one trigger or you may have many. You may want to consider keeping a food and activity diary to help you identify what your triggers are. |
| If I know that sodium is a trigger for me, how much can I consume daily? | While there is no sodium recommendation specifically for patients with MD, the American Heart Association recommends an "ideal" limitation of 1500 mg and consuming no more than 2300 mg. |
| I have a high-stress job/life, and it makes my symptoms worse. How can I avoid stress? | Stress can play a role in making MD symptoms worse. It is hard to live a stress-free life; however, there are several ways to help manage stress. A few examples are getting adequate sleep and exercise, meditation, support groups, and avoiding natural depressants such as alcohol and drugs |
| Is there a special diet I should follow to avoid an attack? | Diet may not affect everyone the same way. However, increased sodium consumption can increase fluid in the inner ear. Reading food labels can help you keep track and avoid excessive sodium consumption. Foods that are naturally low in sodium include fresh fruits and vegetables, whole food (not processed), and fresh beef, poultry, and fish. Also, increased caffeine consumption has been known in some to trigger an attack, but it does not affect everyone. |
| What lifestyle changes can I make to help prevent symptoms? | MD is a very complex disease and can be very difficult to treat. However, living a healthy lifestyle and developing coping mechanisms is a great practice to maintain good health. It may also help to control symptoms of MD. Examples of this are<br>• Limit salt/sodium in your diet<br>• Avoid excessive caffeine, alcohol, and nicotine<br>• Eat well-balanced meals throughout the day<br>• Drink plenty of water throughout the day, avoiding high-sugar beverages<br>• Manage stress appropriately.<br>○ Get plenty of exercise<br>○ Get enough sleep<br>○ Join a support group<br>○ Journal<br>○ Practice breathing exercises<br>• Identify and manage any allergies<br>• Patients with increased bouts of vertigo should be assessed for sleep apnea. |

Abbreviation: MD, Ménière's disease.

receive education across multiple visits to integrate the necessary information to make informed decisions regarding their health care. Having a patient advocate (family member or friend) attend the discussions with the medical team is desirable, as that person can assist the patient in making individualized decisions.

In conclusion, the GDG recommends education of patients who are diagnosed with MD. Education ensures that patients are well informed and can participate in shared decision making regarding their own health care needs. Education is necessary to improve patient understanding, which will empower, motivate, and help patients adhere to their plans of care and promote better patient outcomes.

**STATEMENT 7. SYMPTOMATIC MANAGEMENT OF VERTIGO: Clinicians should offer a limited course of vestibular suppressants to patients with Ménière's disease for management of vertigo only during Ménière's disease attacks.** *Recommendation based on nonrandomized or historically controlled studies, including case-control and observational studies, and a preponderance of benefit over harm.*

### *Action Statement Profile: 7*

- Quality improvement opportunity: Communication with clinicians and their patients about how and when to use vestibular suppressants to control vertigo. National Quality Strategy domains: Effective Communication and Care Coordination, Person and Family Centered Care
- Aggregate evidence quality: Grade C, nonrandomized or historically controlled studies, including case-control and observational studies
- Level of confidence in evidence: Medium due to grade C evidence.
- Benefits: Better symptom control, improved QOL
- Risk, harm, cost: Cost, side effects—urinary retention, dry mouth, visual changes, sedation, addiction. Impaired vestibular compensation
- Benefit-harm assessment: Preponderance of benefit over harm
- Value judgments: Vertigo can have a detrimental impact on QOL, and patients tend to feel better when vertigo symptoms are alleviated.

- Intentional vagueness: None
- Role of patient preferences: Large depending on severity of symptoms
- Exclusions: None
- Policy level: Recommendation
- Differences of opinion: None

### Supporting Text

The purpose of this statement is to educate clinicians regarding the appropriate use of medications broadly categorized as central vestibular suppressants for the control of acute vertigo attacks in patients with MD. Vestibular suppressants primarily appear to act by suppressing central vestibular neural activity at the level of the brainstem and concomitantly suppressing nausea. These medications fall into 3 pharmacologic classes—first-generation antihistamines, benzodiazepines, and anticholinergics. It must be emphasized that the utilization of these medications for control of vertigo and nausea predated the requirements for evidence-based studies to verify therapeutic efficacy. As such, while these medications are commonly used and are felt to be effective by both patients and clinicians, there is a paucity of peer-reviewed evidence to document their effectiveness. It must also be stressed that these medications should be used only to suppress acute vertiginous events. Chronic use of these drugs is undesirable, as these agents can suppress central adaptation/compensation to vestibular loss and can thus perpetuate symptoms of chronic imbalance.

First-generation antihistamines cross the blood-brain barrier and bind to several neurotransmitter receptors, including histamine and muscarinic acetylcholine receptors.[196-198] The ability to bind to these various sites likely accounts for their ability to suppress a variety of symptoms, including vertigo and nausea. Commonly used antihistamines include dimenhydrinate (25-50 mg every 6 hours), meclizine (12.5-25 mg every 8 hours), or diphenhydramine (25-50 mg every 6 hours). All these drugs suppress vertigo and nausea likely with equal efficacy. In the United States, diphenhydramine and promethazine (a phenothiazine with antihistaminic properties) are typically the most readily available in an injectable formulation.[199-201] All can cause hypersomnolence, dry mouth, and urinary retention.

Benzodiazepines are gamma aminobutyric acid receptor agonists, are also effective at suppressing vertigo, and can thus secondarily mitigate vertigo-associated nausea.[196-198] A large variety of benzodiazepines are available in a variety of formulations. Historically, diazepam (2-10 mg every 8 hours) has been used for vertigo control.[201] There is perhaps a theoretical advantage to the use of lorazepam (1-2 mg every 8 hours) due to its rapid onset of action and shorter half-life.[199,200] Clonazepam (0.5-1.0 mg every 8 hours) has also been used for acute vertigo suppression.[196] Most experts recommend against the use of alprazolam due to tachyphylaxis and complications associated with drug withdrawal.[197] There is no evidence for the superiority of 1 benzodiazepine over the other for vertigo control and similarly and no evidence for the superiority of the antivertiginous effects of benzodiazepines when compared with first-generation antihistamines. All benzodiazepines carry significant risk for drug dependence.[202,203]

Centrally acting anticholinergic drugs (scopolamine and atropine) and glycopyrrolate block muscarinic receptors and can suppress acute vertigo attacks.[196-198,204] Scopolamine is most commonly used in a transdermal formulation created primarily to prevent motion sickness. All anticholinergics can cause blurring of vision, dry mouth, dilated pupils, urinary retention, and sedation. Because of their side-effect profile and potential for significant toxicity and withdrawal effects when used for more than several days, they are not commonly prescribed for acute vertigo control associated with MD. There is insufficient evidence demonstrating the relative efficacy of any given class over another.[205-207]

**STATEMENT 8. SYMPTOM REDUCTION AND PREVENTION: Clinicians should educate patients with Ménière's disease on dietary and lifestyle modifications that may reduce or prevent symptoms.** *Recommendation based on RCTs, observation studies, and cohort studies with indeterminate benefit, with preponderance of benefit over harms.*

### Action Statement Profile: 8

- Quality improvement opportunity: Identification of MD triggers may reduce symptoms in some patients. Allergies have been shown to contribute to symptoms of MD in up to 30% of the patients. National Quality Strategy domains: Effective Communication and Care Coordination, Person and Family Centered Care, Prevention and Treatment of Leading Causes of Morbidity and Mortality
- Aggregate evidence quality: Grade C, based on a dearth of RCTs regarding dietary modifications (1 small RCT on sodium restriction, negative for effectiveness but with study limitations; 1 relatively strong observational/survey study showing advantage to both low sodium and caffeine restriction), 1 RCT regarding decreasing stress hormone vasopressin and 1 RCT of booklet-based symptom control via relaxation and cognitive-behavior strategies to reduce anxiety, 1 RCT regarding an acupressure technique for treatment of dizziness and 2 SRs regarding acupuncture, 3 RCTs regarding antisecretory therapy (2 positive, 1 negative for effectiveness), and a number of observational studies and a strong literature review (human and animal) regarding the role of treatment of allergy symptoms in reducing symptoms of MD in allergic patients. There is a Cochrane SR currently underway for dietary modifications.
- Level of confidence in evidence: High.
- Benefits: May improve symptom control, avoid unnecessary lifestyle modifications, improved QOL,

patient empowerment, potential avoidance of more invasive/higher-risk therapy
- Risk, harm, cost: Time of counseling, burden of potentially ineffective lifestyle modifications on the patient/family, potential risk of hyponatremia, increased cost of Ménière's diet
- Benefit-harm assessment: Preponderance of benefit over harms
- Value judgments: While the evidence of benefit of dietary and lifestyle modifications is limited, individual patients may have identifiable triggers, the identification of which may improve symptom control
- Intentional vagueness: None
- Role of patient preferences: Small regarding the provision of education but large with regard to the choice to adopt lifestyle or dietary changes or not
- Exclusions: None
- Policy level: Recommendation
- Differences of opinion: A small group of panel members felt that there was a limited role and expressed concern regarding possible negative effects of sodium restriction, specifically hyponatremia, although this has not been reported in any of the studies and could be minimized as a risk with use of appropriate nutritional counseling.

### *Supporting Text*

The purpose of this statement is to educate clinicians about the importance of identifying potential lifestyle triggers as an approach to decreasing MD symptoms or attacks. The triggers focused on in this section include excessive dietary sodium and caffeine, allergic triggers, and stress (**Table 9**). Patients with MD frequently ask about their ability to recognize and avoid triggers for MD to better manage their symptoms, thus improving QOL. Historically, limiting dietary sodium, caffeine, and alcohol, as well as allergy control and/or methods of stress reduction, have long been advocated.[24,208] There is no real consensus agreement regarding these preventative measures due to the paucity of RCTs in the literature.

### *Dietary Modifications*

The primary dietary modifications recommended in clinical practice have been sodium restriction and caffeine reduction/elimination, with some also limiting alcohol use. An SR[209] found no clinically important results from RCTs comparing sodium restriction and no sodium restriction or caffeine restriction and no treatment/usual care. There were no RCTs or SRs to support that these dietary restrictions prevent MD attacks. As such, they categorized both as ''unknown effectiveness.'' One identified RCT[210] found no evidence that dietary sodium restriction was effective in controlling symptoms of MD. However, the number of subjects was small, and there is no indication that subjects were given any information or counseling regarding sodium and diet. No RCTs were found that included caffeine or alcohol, and only a few very recent studies were found that specifically included caffeine[211] or alcohol.[212] The caffeine study found that MD patients had a higher mean daily caffeine intake than control subjects or patients with vertigo from other causes.

One large observational/survey study with 136 patients did provide evidence for a role of dietary restriction of sodium and caffeine in alleviating vertigo and dizziness associated with MD.[213] They used AAO-HNS vertigo class and functional rating as outcome measures in a questionnaire that also provided patient ratings of use of sodium and caffeine restriction diets, with questions addressing dietary behavior/compliance (eg, are you following the diet? how long? how often? how difficult?), nutritional knowledge, and participant perceptions regarding dietary modification as a viable treatment. Most patients also received other treatments and retrospectively rated their symptoms from prior to diet. However, there were statistically significant relationships between compliance, including knowledge, and vertigo and dizziness improvement for both low-sodium diet and caffeine restriction. The authors concluded that if providers are going to recommend dietary modification as adjunct treatment for MD, effectiveness may be greatly improved by including referral to a registered dietitian, who can provide nutrition education, lifestyle support, and follow-up care necessary for an optimal outcome. It is also mentioned that nutrition counseling is a cost-effective modality when it limits surgical or pharmaceutical interventions, medical office visits, and/or employment disability. Luxford et al showed that many patients are able and willing to try dietary modification for treatment of their vertigo symptoms.[213] This was the only study that included detailed information about patient use of dietary modifications in MD. One recent study with a small number of patients found that the group with the lowest mean urinary sodium excretion after following a low-sodium diet had better vertigo control and hearing improvements, with increased plasma aldosterone concentrations. The authors concluded that a low-sodium diet may induce an increase in the plasma aldosterone concentration that can activate ion transport and absorption of endolymph in the endolymphatic sac.[214] The GDG notes that the American Heart Association recommends no more than 2300 mg of sodium a day and an ideal limit of no more than 1500 mg per day for most adults.[215] Currently, no specific guideline exists that can recommend a specific daily sodium intake to prevent MD attacks; therefore, this current CPG utilizes the American Heart Association's endorsement as a reasonable parameter of a sodium-restricted diet. Specific daily sodium intake parameters to control MD attacks represents a need for future research.

No evidence was found to directly support or exclude alcohol or nicotine restriction. These, with sodium and caffeine restriction, are areas for future research. Moreover, cannabis is being increasingly investigated as a potential treatment option in many chronic diseases. However, there is no evidence for or against the use of cannabinoids in treating patients with MD.

### Allergy Testing and Treatment

The prevalence of diagnosed allergy has been reported to be higher in those with a history of MD as compared with the general population.[216,217] Although no RCTs were found regarding allergy testing and treatment in relation to reducing symptoms of MD, many studies have shown a relationship of allergy to MD.[218,219] Banks et al[218] and Weinreich and Agrawal[219] reported that an association between allergy and MD has been shown in cross-sectional and observational studies, while animal studies have shown evidence of allergic activity within the inner ear. They concluded that given the low risk to patients, inclusion of allergen avoidance and immunotherapy should be considered in the treatment plan to help patients control MD symptoms. The link between VM and MD has also been explored[220] (see KAS 4), as well as a link between migraine and allergy,[221] and it has been suggested that allergy may well be the link between migraine and MD.[217] Therefore, recommending allergy control as part of a MD treatment plan is not unreasonable and is low risk to the patient with a history of inhalant or food allergies. The use of immunotherapy, if needed, may be weighed against potential side effects.

### Stress Reduction

Studies have shown that plasma concentrations of the stress hormone vasopressin (pAVP), its receptor V2 (V2R), and V2R-linked water channel aquaporin-2 (AQP2) in the endolymphatic sac are significantly higher in MD patients than in controls.[222,223] One RCT compared a control group (traditional oral medication, including diuretics, betahistine, diphenidol, dimenhydrinate, and diazepam) with each of 3 other groups treated with methods known or believed to decrease pAVP: abundant water intake, sleeping in a dark room, or insertion of tympanostomy tubes.[224] Stress hormone pAVP concentrations were significantly reduced after treatment, although depression and stress questionnaire measures were not significantly changed. Vertigo control and hearing improvement were significantly better at the 24-month follow-up in all 3 treatment groups as compared with controls. This study focused on stress hormone vasopressin management rather than stress management and suggested that these techniques to reduce pAVP are an option for patients who live in demanding social environments. Sleeping in darkness may increase pAVP at night and maintain the hormonal circadian rhythm.

Another RCT examined the effectiveness of booklet-based education in patients with MD and included an arm using applied relaxation and controlled breathing, challenging negative beliefs, and lifestyle modification to reduce anxiety (cognitive-behavioral strategies) as compared with a waiting-list control group, with 120 subjects in each group.[194] The self-help booklet group showed greater subjective improvement in health, confidence in understanding and coping with illness, and improved handicap (DHI). Also, those who reported adherence had better outcomes. The authors concluded that self-management booklets offer an inexpensive and easily disseminated means of helping people with MD to cope with dizziness symptoms. Subjects were a volunteer sample from a self-help group, not ''random'' MD patients.

### Acupuncture and Alternative Therapy

Two SRs evaluated the literature regarding acupuncture for MD. The most recent found that acupuncture might be a promising therapeutic approach for MD, with some positive findings in vertigo control (negative for effect in hearing improvement and DHI), but currently available evidence is insufficient to make a definitive conclusion, with studies of poor quality.[225] An earlier review included Chinese language articles, finding studies of varying quality but an overall weight of evidence suggesting that there may be beneficial effects from acupuncture for those who are in an acute phase or who have had MD for years.[226] In addition, 1 RCT was found that compared Diaoshi Jifa acupressure with Ginkgo and oral betahistine and a control group that took only Ginkgo and oral betahistine.[227] This was a single-center study that assessed only short-term effect (24 hours) but found that the experimental group had greater improvement of DHI scores overall and on all 3 subscales used as compared with controls. The number of subjects was very small. Thus, overall, there is a lack of sufficient evidence at this point to recommend acupuncture.

Although scientific studies of efficacy are lacking, dietary restrictions and stress reduction are both conservative ancillary treatment options with minimal risk and cost that may help improve symptoms in some MD patients and reduce the need for more aggressive, destructive, or expensive treatments. Allergy testing and treatment in patients with history or symptoms suggestive of allergy are likely to benefit the patient in relation to allergy symptoms, with the added potential to help reduce MD symptoms; therefore, it is cost-effective and of minimal added risk to offer this treatment option.

**STATEMENT 9. ORAL PHARMACOTHERAPY FOR MAINTENANCE: Clinicians may offer diuretics and/or betahistine for maintenance therapy to reduce symptoms or prevent Ménière's disease attacks.** *Option based on observational studies and a Cochrane review on betahistine and oral diuretics with a balance of benefits and harms.*

### Action Statement Profile: 9

- Quality improvement opportunity: Improved symptom control. National Quality Strategy domains: Prevention and Treatment of Leading Causes of Morbidity and Mortality, Person and Family Centered Care
- Aggregate evidence quality: Grade B, based on observational studies and a Cochrane review on betahistine and oral diuretics
- Level of confidence in evidence: Medium. High risk of bias reported in most studies included in SR

- Benefits: Improved vertigo control, improved QOL
- Risk, harm, cost: Cost of therapy, side effects of medications, promotion of ineffective therapy
- Benefit-harm assessment: Balance of benefits and harm
- Value judgments: There are different practice patterns among treating physicians on the panel. There is no specific preference for one agent over another, and that is why they were grouped for this statement.
- Intentional vagueness: None
- Role of patient preferences: Large
- Exclusions: Patients with comorbid conditions making these medications contraindicated (ie, renal or cardiac disease, asthma). Allergies or sensitivities to these medications
- Policy level: Option
- Differences of opinion: None

## *Supporting Text*

The purpose of this statement is to inform clinicians about the role of oral medications as maintenance therapy in patients with chronic MD—recognizing that patients may vary in their response to these medications. It is important to note that these potential maintenance medications are intended for patients with active MD symptoms, not as abortive treatments for acute MD attacks. The underlying pathophysiology of MD is unclear; however, ELH has historically been regarded as the histopathologic correlate.[228,229] Multiple etiologies have been proposed to explain the presence of ELH in MD patients. These etiologies include viral infection,[230-232] ionic imbalance,[233,234] genetic predisposition,[235-237] dietary factors,[238,239] autoimmune abnormalities,[240-243] vascular abnormalities,[244] and allergic responses.[245,246] Diuretics and betahistine have been used to reduce the frequency of MD attacks by targeting some of these mechanisms.[247]

Diuretics are believed to alter the electrolyte balance in endolymph, subsequently reducing endolymph volume.[22] They are categorized by their mechanism of action and include thiazides (which inhibit sodium and chloride reabsorption from the distal convoluted tubules of the kidney), potassium sparing (which inhibits the sodium-potassium exchange within the collecting ducts), loop (which inhibits sodium reabsorption), and carbonic anhydrase inhibitors (which increase excretion of sodium, potassium, bicarbonate, and water).[22,248] A Cochrane SR originally published in 2006 and updated in 2010 was conducted to assess the effect of diuretics on the frequency and severity of attacks (tinnitus, imbalance, hearing loss, and progression of symptoms) in patients with MD.[22] The authors identified 10 studies; however, none met the inclusion criteria due to problems with allocation (not randomized, n = 4; unclear allocation, n = 2; or not placebo controlled, n = 7) or problems with extracting data from placebo-controlled trials (n = 2). The 2 placebo-controlled RCTs that were excluded in the Cochrane SR were the Klockhoff 1967 trial and the van Deelen 1986 trial. Those studies were both crossover trials that involved comparing either hydrochlorothiazide with placebo[249] or triamterene/hydrochlorothiazide with placebo,[250] but both were limited by not publishing data on the period of time before the crossover, thus being susceptible to the carryover phenomenon. While the effects of diuretics on MD could not be rigorously evaluated due to a lack of high-quality studies, some studies in the Cochrane SR did report improvement in patients' vertigo with the use of diuretics.[20]

The most commonly prescribed diuretics are thiazides with or without potassium-sparing diuretics such as hydrochlorothiazide/triamterene or spironolactone[251] as well as the carbonic anhydrase inhibitor acetazolamide (Diamox) as a second-line therapy.[20] Thiazides are contraindicated in patients with gout, and potassium-sparing diuretics are contraindicated in patients with acute or severe renal failure.[248] Since the prolonged use of thiazides can precipitate gout, other diuretic options should be considered. Clinicians should monitor electrolytes and blood pressure in patients who are prescribed diuretics.

Betahistine dihydrochloride is an oral compounded medication that has been used worldwide for the treatment of peripheral vertigo. It is a histamine analog that strongly antagonizes histamine H3 receptors and acts as a weak agonist on histamine H1 receptors.[252,253] While its mechanism of action remains unclear, it is not Food and Drug Administration approved for use in MD; therefore, conflicting evidence exists regarding whether it is beneficial in controlling vertigo. A 2016 Cochrane SR performed a meta-analysis evaluating the effect of betahistine as compared with placebo in reduction of vertigo symptoms in patients with underlying vertigo (patient population included patients with MD, benign paroxysmal vertigo, and other vertigo).[254] The authors found that patients taking betahistine had a 30% greater rate of reduction in vertigo symptoms as compared with those taking placebo (pooled risk ratio, 1.30; 95% CI, 1.05-1.60).[254] In other words, the number needed to treat would be 5 patients, meaning that a clinician would have to treat 5 patients with betahistine to have 1 patient report reduction in vertigo symptoms.

For patients with MD (n = 139), the effect of betahistine was stronger than placebo, with MD patients reporting a 56% reduction in vertigo when taking betahistine as compared with placebo (risk ratio, 1.56; 95% CI, 0.92-2.65).[254] These results, however, must be interpreted with caution. The quality of evidence for the primary outcome is low—the majority of the studies did not report clear randomization strategies or implementation of blinding, both of which are critical in assessing a subjective outcome such vertigo.[254] Additionally, there was a large amount of statistical and clinical heterogeneity in how the studies evaluated vertigo, with few using validated tools. Therefore, the authors noted that better quality evidence is needed to evaluate the effectiveness of betahistine as compared with placebo.[254]

A recently published double-blind RCT set out to address the risk of bias previously seen in other trials by evaluating the effect of betahistine on vertigo attacks in MD (BEMED trial).[255] Vertigo attacks with or without aural fullness, tinnitus, and changes in hearing were recorded by the patient in a written diary. The results from the BEMED trial were not included in the 2016 Cochrane SR, but the trial was mentioned as ongoing or recently completed.[254] The interventions were placebo, low-dose betahistine (48 mg/d), and high-dose betahistine (144 mg/d). The authors found a significant decline in vertigo attacks across all groups over the 9-month treatment period. There were no significant differences in mean attack rate per 30 days between the placebo and betahistine groups evaluated at 7 to 9 months of the treatment period.[255] Therefore, use of low- or high-dose betahistine for 9 months did not change the mean number of vertigo attacks related to MD as compared with placebo.[255] While the BEMED trial findings are in stark contrast to the 2016 Cochrane SR, the BEMED trial is a well-designed study as compared with the low quality studies included in the Cochrane SR. The Cochrane SR authors highlighted that ''further research is likely to have an important impact'' on the interpretation of the meta-analysis results which favored betahistine.[254] Thus, the BEMED trial may represent the best evidence that we have. Currently, this CPG committee is unable to make a definitive statement on use of betahistine to control MD symptoms. Serious medical side effects with betahistine are rare. Reported side effects included headache, balance disorder, nausea, nasopharyngitis, feeling hot, eye irritation, palpitations, and upper gastrointestinal symptoms.[254,255] Betahistine should be used with caution in patients with asthma and history of peptic ulcer disease and avoided in patients with pheochromocytoma.[256]

If oral medication is initiated, the patient should be reassessed as often as clinically warranted for an improvement or stabilization of symptoms as well as to monitor for intolerance of medication or side effects. There are no clear data to suggest the length of time that these agents should be used for. Most betahistine studies covered only a 2- to 12-week period,[257] although the newest study covered a 9-month treatment window[255]; diuretic studies ranged widely from 10 days to 24 years.[61] The clinician and patient should discuss titrating down or stopping the medication once the patient's symptoms subside.

### Other Oral Agents Reviewed

There are several other medications that have historically been used by providers for treatment of symptoms related to MD, including oral steroids, antivirals, and benzodiazepines. There are limited data available on many of these medications; this is an area for future research. Oral steroids showed an overall improvement in vertigo in one small pilot study,[258] while another cited no hearing improvement with oral steroids.[259] A small prospective cohort study was conducted comparing 2 antiviral treatments in MD (n = 31), and only 39% showed improvement in hearing within 2 months and complete vertigo control (n = 12 of 31).[260] Given the limited amount of high-quality studies looking at the role of these alternative agents as maintenance therapy for chronic MD, this GDG cannot currently make a recommendation on their use.

**STATEMENT 10. POSITIVE PRESSURE THERAPY: Clinicians should not prescribe positive pressure therapy to patients with Ménière's disease.** *Recommendation against based on a systematic review and randomized trials showing ineffectiveness of devices like the Meniett devices with a preponderance of benefit over harm for not using.*

### Action Statement Profile: 10

- Quality improvement opportunity: Avoidance of ineffective therapy. National Quality Strategy domain: Prevention and Treatment of Leading Causes of Morbidity and Mortality
- Aggregate evidence quality: Grade B, based on a Cochrane SR and 2 small RCTs on Meniett device showing no effect
- Level of confidence in evidence: High
- Benefits: Avoidance of ineffective therapy
- Risk, harm, cost: Patient or physician concerns at the lack of positive pressure therapy as an option if other noninvasive treatments have failed, with remaining options being destructive and/or invasive procedures.
- Benefit-harm assessment: Preponderance of benefit over harms
- Value judgments: While this therapy is generally ineffective, there may be rare patients with limited other options.
- Intentional vagueness: None
- Role of patient preferences: Small
- Exclusions: None
- Policy level: Recommendation against
- Differences of opinion: A small group of panel members felt that some evidence supports the use of the Meniett device and that it could be used in symptomatic patients who have not obtained relief from other nonablative treatments.

### Supporting Text

The purpose of this statement is to discourage the use of the positive pressure–generating devices such as the Meniett device for MD. These devices are considered minimally invasive, as they deliver small pressure pulses to the inner ear via an earpiece placed in the external ear canal. A tympanostomy tube (placed in the eardrum) allows the micropulses to enter the middle ear space, where it then transfers the pressure to the inner ear, resulting in a displacement of the excess inner ear fluid (endolymph), theoretically resulting in ''normal'' inner ear pressure. The micropressure (<12 bar) is not painful and is essentially the same pressure that is applied to the ear when one swims 4 to 5 feet under

water. The optimal frequency for using the device is 3 applications of the pressure daily for at least 6 weeks. If there is no improvement in vertigo after 6 weeks, then it is unlikely that the device is efficacious for a particular patient.[261]

The recommendation against use of positive pressure therapy is based on 2 recent SRs of RCTs of the use of the Meniett device for MD. Syed et al,[262] using multiple search registries, reviewed 4 RCTs that compared the Meniett device and a placebo device in patients with MD. Patients were followed for 2 weeks to 4 months. There was no significant difference in the impact on vertigo control in either group (Meniett vs placebo). As such, the authors concluded that the Meniett device was not effective in the treatment of vertigo in MD. Van Sonsbeek et al,[263] utilizing multiple databases, reviewed 5 RCTs whose goals were to evaluate the effects of positive pressure therapy on vertigo control in MD patients. As in the other review, they determined that there was no compelling evidence that positive pressure treatment was effective for vertigo in MD.

In contrast, proponents of Meniett device use point to potential efficacy based on an RCT in MD. Gürkov et al[264] found that the Meniett device improved vertigo but did not improve hearing or vestibular function and thus recommend it as a second-line therapy after a 2-year trial.[265] They further claimed that the Meniett device is a safe and effective option for vertigo control. Other findings and recommendations have been made by Ahsan et al[266] and by Zhang et al,[267] yet there are peer-reviewed publications that state that insertion of a tympanostomy tube alone may be effective in MD treatment.[268,269] Moreover, while the meta-analysis by Ahsan et al reported a slight short-term improvement in vertigo control in MD, much of the data from that analysis were from retrospective or level 4 studies. In addition, the average follow-up was only 5 months, and there were low numbers of patients in both treatment and control groups.

There is some moderate quality evidence from 2 studies that hearing levels are worse in patients who use positive pressure therapy. While the positive pressure therapy device itself is minimally invasive, tympanostomy tubes are required that carry associated risks. These include the risks of anesthesia (minimal with topical or local anesthesia), and the specific risks of persistent tympanic membrane perforation (minimal; approximately 2%-4%) after treatment is completed that may be accompanied by chronic otorrhea (approximately 1%) and tympanosclerosis and possible resultant hearing loss or iatrogenic cholesteatoma. Thus, due to the recent RCTs and the Cochrane SR, the use of positive pressure therapy, such as that with a Meniett device, is not recommended. There may be rare exceptions in subpopulations that are high risk for general anesthesia or contraindications to other destructive procedures where this therapeutic modality may be utilized as a last resort to treat MD. Providers need to clearly advise patients about the current data that suggest that it may not be helpful in controlling MD symptoms.

**STATEMENT 11. INTRATYMPANIC STEROID THERAPY: Clinicians may offer, or refer to a clinician who can offer, intratympanic (IT) steroids to patients with active Ménière's disease not responsive to noninvasive treatment.** *Option based on a systematic review and a randomized controlled trial with a preponderance of benefit over harm.*

## Action Statement Profile: 11

- Quality improvement opportunity: Improved vertigo control. National Quality Strategy domains: Effective Communication and Care Coordination, Prevention and Treatment of Leading Causes of Morbidity and Mortality, Person and Family Centered Care
- Aggregate evidence quality: Grade C, based on 1 Cochrane review that concluded limited efficacy for disability score and 1 small RCT looking at dexamethasone and gentamicin with 90% symptom reduction
- Level of confidence in evidence: High
- Benefits: Improved vertigo control, no risk of hearing loss, less risk of systemic side effects, improved QOL (dizziness handicap), no loss of vestibular function (nonablative therapy)
- Risk, harm, cost: Cost, perforation, possible need for multiple injections, infection, discomfort of the procedure, time for treatment
- Benefit-harm assessment: Preponderance of benefit over harm
- Value judgments: While this is less definitive than gentamicin therapy, the favorable risk-benefit profile makes this a good option for patients.
- Intentional vagueness: The term *noninvasive* refers to medical therapy and lifestyle modification.
- Role of patient preferences: Medium
- Exclusions: None
- Policy level: Option
- Differences of opinion: There was some controversy regarding whether the aggregate evidence strength in favor of this intervention is a grade B or a grade C. Given this, a few panel members felt that this statement should be a recommendation rather than an option.

## Supporting Text

The purpose of this statement is to elucidate the role of IT steroid therapy in the management of MD. First described in 1991,[270] evidence for the mechanism of action suggests that IT steroid therapy stabilizes the vascular endothelium and improves cochlear blood flow through anti-inflammatory effects, as well as effects on cochlear ion and fluid homeostasis.[271-278] While there are fewer data for IT steroid therapy than for IT gentamicin therapy, there have been RCTs and a Cochrane review performed.

**Table 10.** Intratympanic Steroid Therapy Dosing and Frequency.

| | | |
|---|---|---|
| Dose | Dexamethasone sodium phosphate<br>Stock: 4 mg/mL or 10 mg/mL<br>Compounded: 16 mg/mL or 24 mg/mL | Methylprednisolone sodium succinate<br>Stock: 30 mg/mL or 40 mg/mL<br>Compounded: 62.5 mg/mL |
| Frequency | Inject 0.4-0.8 mL into middle ear space, from once only or up to 3 to 4 sessions every 3 to 7 days depending on clinical response | |

The level of complete vertigo control (class A), as defined by the AAO-HNS guidelines for the diagnosis and evaluation of therapy in MD,[2] was less for IT steroid therapy (31%-90% of subjects) than for IT gentamicin therapy (70%-87% of subjects).[279-282] One RCT[283] and 1 SR[281] concluded that IT gentamicin therapy may provide superior vertigo control in patients with severe or recurrent vertigo or advanced MD. Steroid therapy via IT delivery appears to have less risk of treatment-associated hearing loss than IT gentamicin therapy, 0% to 8% versus 12.5% to 15.4%, respectively.[279,280,282,284] One study found a similar improvement in aural fullness with both IT steroid (38%) and IT gentamicin therapy (31%).[280] As in sudden hearing loss,[99] 2 SRs suggest that IT steroid therapy may have a role in salvaging hearing secondary to a MD flare,[285,286] although 1 RCT found no benefit regarding hearing salvage.[283]

When compared with placebo or with conventional medical therapy in 1 RCT[287] and in 3 SRs,[285,286,288] IT steroid therapy generally has shown to yield greater improvement in vertigo symptoms (85%-90% vs 57%-80%). Variable benefit has been found with the associated symptoms of tinnitus and aural fullness, with 1 RCT comparing IT steroids against placebo[289] showing improvement in tinnitus (48% vs 20%), hearing loss (35% vs 10%), and fullness (48% vs 20%). Two SRs[285,290] comparing IT steroids against placebo or conventional therapy showed no benefit in associated symptoms. One study found statistically significant vertigo control when IT steroid therapy was combined with oral betahistine therapy: 44% control among subjects treated with IT steroid therapy without betahistine and 73% control among subjects treated with IT steroid therapy with betahistine.[291] Initial work with a sustained-release form of dexamethasone has documented a reduction in vertigo frequency with 3- and 12-mg doses (56% and 73%, respectively) when compared with placebo (42%), with similar reductions in tinnitus.[292] Follow-up studies reported reduced vertigo severity that was not statistically significant as compared with placebo and no difference in tinnitus perception.[293] Statistically significant reduction in average number of daily vertigo spells and number of vertigo days per month was noted.[293] Overall, IT steroid therapy is well tolerated with low side effects and/or complications. The most frequently cited complications are postprocedure otitis media (7%)[281] and persistent tympanic perforation (3%-38%).[292,293]

A challenge in assessing the effectiveness of IT steroid therapy is the variability in treatment protocols described in the literature. Methylprednisolone and dexamethasone are commonly used but have markedly different pharmacokinetics (Table 10). Methylprednisolone more readily penetrates the round window and achieves higher concentration in the endolymph after IT injection than does dexamethasone; however, dexamethasone is more rapidly absorbed into the stria of the inner ear and surrounding tissues than methylprednisolone.[294-296] There is no literature of sufficient quality comparing methylprednisolone and dexamethasone with respect to outcome. Number of doses, time between doses, length of follow-up, and the effects on vertigo control, tinnitus, and aural fullness vary considerably.[284] Various concentrations have been used, and it remains unclear if higher concentrations yield better results. Specifically, a recent review of inner ear pharmacokinetics noted that commonly used dexamethasone sodium phosphate appears to be ill-suited for use in IT therapy, and there are very few data regarding the inner ear pharmacokinetics of commonly used methylprednisolone sodium succinate.[297]

Steroid therapy via IT delivery may be considered an alternative for oral steroid therapy[258,288,298,299] and IT gentamicin therapy.[279-282] Oral steroids have significant risk of side effects,[99,298] and patients with usable hearing—class A or B as defined by AAO-HNSF guidelines for the evaluation of hearing preservation in acoustic neuroma (vestibular schwannoma)[300]—may be hesitant to undergo an ablative inner ear therapy with a known potential for hearing loss. As such, there is a significant role for patient preference when offering IT steroid therapy.[220]

**STATEMENT 12. INTRATYMPANIC GENTAMICIN THERAPY: Clinicians should offer, or refer to a clinician who can offer, intratympanic (IT) gentamicin to patients with active Ménière's disease not responsive to nonablative therapy.** *Recommendation based on 2 randomized trials and several systematic reviews indicating efficacy in the treatment of vertigo with a preponderance of benefit over harm.*

## *Action Statement Profile: 12*

- Quality improvement opportunity: Improved vertigo control. National Quality Strategy domains: Prevention and Treatment of Leading Causes of Morbidity and Mortality, Person and Family Centered Care
- Aggregate evidence quality: Grade B, based on 2 RCTs and several SRs indicating efficacy in the treatment of vertigo

- Level of confidence in evidence: High
- Benefits: Improved vertigo control, improved QOL, faster return to work, Avoidance of general anesthetic, a risk of hearing loss (relative to surgical labyrinthectomy), improved safety
- Risk, harm, cost: Hearing loss, ear drum perforation, persistent imbalance, need for multiple treatments
- Benefit-harm assessment: Preponderance of benefit over harm
- Value judgments: None
- Intentional vagueness: The term *inadequate control* may vary for different patients.
- Role of patient preferences: Large regarding timing and when to initiate therapy
- Exclusions: Patients with contralateral disease or hypofunction. Patients with a known hypersensitivity to aminoglycosides
- Policy level: Recommendation
- Differences of opinion: None

## *Supporting Text*

The purpose of this statement is to advocate for the role of IT gentamicin injections for the treatment of active MD not responsive to noninvasive treatment. Gentamicin is an aminoglycoside that causes toxicity to the inner ear, specifically targeting the sensory cells of the vestibular system as well as the hair cells within the cochlea.[301] While aminoglycosides have both cochleotoxic and vestibulotoxic effects, gentamicin has a strong predilection toward chemically ablating the vestibular system. As such, gentamicin has been shown to decrease vertigo symptoms in MD patients and is less invasive than surgical ablation.[17,19,302-307]

Delivery methods include direct injection into the middle ear through the tympanic membrane (referred to as either transtympanic or IT therapy), inserting a middle ear ventilation tube with or without a catheter, and surgically inserting a microcatheter into the middle ear. Although there is no standard of care for delivery methods, IT injections tend to be the most common method reported in the literature. In addition to the variation of delivery methods, there is a lack of specific recommendation for gentamicin dosage. In an SR performed by Chia et al,[303] a total of 980 patients in 27 studies evaluated multiple delivery methods of gentamicin (multiple daily dosing, weekly dosing, low dose, continuous, and titration). Of the 27 studies reviewed, an estimated complete vertigo control rate of 73.6% was reported. Titration therapy significantly improved control of vertigo in 81.7% patients ($P = .001$). Conversely, the lowest-dose method resulted in lower symptom control in 66.7% patients enrolled ($P < .001$). The other methods showed no statistically significant difference.[303] Additionally, weekly titration had less overall hearing loss of 13.1% ($P = .08$) as compared with other groups. Results for overall hearing loss from all studies combined is 25.1%. The multiple daily dosing had a higher rate of hearing loss of 34.7% ($P < .02$). Other methods of gentamicin delivery measured hearing loss at the following rates: low dose (23.7%), titration (24.2%), and continuous (24.4%), which are not statistically significantly different. Profound hearing loss for all groups is 6.6% with no significant difference in the rate of profound hearing loss posttreatment. Profound hearing loss rates with each delivery method are as follows: weekly, 6.0%; continuous, 6.4%; multiple daily, 6.4%; titration 6.7%; and low dose, 6.7%.[303]

In a 2003 SR of 34 articles assessing the evidence for IT gentamicin in patients with MD with respect to improvement of vertigo, tinnitus, and change in hearing, pooled results from 1273 patients showed an overall improvement in vertigo control in 89% (study range, 73%-100%) of patients and tinnitus in 57% (study range, 0%-82%) of patients. Hearing worsened in 26% (study range, 0%-90%) of patients. The SR also looked at concentrations of gentamicin injected into the middle ear, which ranged from 10 to 80 mg. In studies injecting 40 mg/mL, vertigo improvement was noted in 91% and hearing loss in 91% patients at a highly variable level (eg, 0%-90%). Studies using 30 mg/mL resulted in a pooled vertigo control rate of 91% (75%-100%) with 27% experiencing hearing loss (0%-38%). Studies using <30 mg/mL showed improved vertigo in 89% of patients (73%-100%), with 24% of patients (0%-75%) experiencing hearing loss. Pooled results for multiple daily dosing showed vertigo improvement in 96% (75%-100%) and hearing loss in 26% (0%-75%). Daily dosing protocols showed improvements in vertigo in 84% of patients (76%-97%) with hearing loss in 32% of patients (4%-45%). Weekly dosing protocols improved vertigo in 87% of patients (75%-100%) with 21% of patients (0%-37%) experiencing hearing loss.

To date, there have been only 2 double-blind RCTs examining IT gentamicin injections in the treatment of uncontrolled unilateral MD in patients who failed conservative medical therapy. Stokroos and Kingma[19] found that 100% of patients (n = 12) who received IT gentamicin injections (30 mg/mL) were free from vertigo attacks for 6 weeks after the last dose ($P = .002$). The patients who received placebo (n = 10), however, also reported decrease in symptoms ($P = .028$). The authors reported no hearing loss in either group.[19] In a separate study, Postema et al[17] treated patients with uncontrolled unilateral MD who had failed conservative medical management with IT injections of 30 mg/mL (0.4 mL) weekly via pressure equalization tube. They measured vertigo symptoms, aural fullness, tinnitus, and hearing loss. In the gentamicin group (n = 16), there was a decrease in reported aural fullness, vertigo symptoms, and minimal ($8 \pm 18.1$ dB, mean $\pm$ SD) hearing loss on audiometry. Vertigo symptoms decreased in 56% of patients 1 year after treatment. Tinnitus did not significantly change. There were no changes in vertigo, hearing loss, or aural fullness in the placebo group (n = 12).[17] In a Cochrane review looking at the 2 RCTs from Stokroos and Kingma[19] and Postema et al,[17] the review determined that both studies adequately address the questions posed with a

total number of 50 patients enrolled. Both studies found a significant reduction in vertigo complaints with IT gentamicin and steroid injections. Stokroos and Kingma[19] reported a decrease in vertigo attacks per year from 74 ± 114 (mean ± SD) to zero after 1 year of treatment with IT gentamicin injections ($P$ = .002). In the placebo group, there was a decrease in vertigo from 25 ± 31 attacks before treatment to 11 ± 10 attacks after treatment ($P$ = .028). Postema et al[17] reported a reduction of vertigo score from 2.1 ± 0.8 (mean ± SD) to 0.5 ± 0.6 in the gentamicin group. The vertigo score did not change in the placebo group. For hearing, there was no significant change in hearing for the gentamicin group (60 ± 18.7 dB) before versus (54 ± 20 dB) after treatment ($P$ = .17) or in the placebo group (53 ± 16.5 dB before vs 58.8 ± 20 dB after treatment; $P$ = .24).[19] Additionally, the average increase in hearing loss was 18.1 dB in the gentamicin group, while in the placebo group it was 0.0 ± 0.7 dB.[17] No statistical comparison was provided, but 1 subject had a 60-dB hearing loss in the gentamicin group, 1 patient had a 20-dB improvement in hearing, and 1 other had a 30-dB hearing improvement in the gentamicin group.

This GDG supports the use of IT gentamicin injections as a safe and effective treatment option for patients with unilateral MD who have failed more conservative therapies. Studies show that IT gentamicin injections are well tolerated, improve vertigo symptoms, and have a low incidence of severe hearing loss.[17,19,303-308] Caution must be given to patients who have bilateral MD, as chemical ablation carries the risk for significant bilateral vestibular hypofunction and rare hearing loss. Moreover, despite its effectiveness, the vestibular status of the other (noninvolved) ear should be assessed before recommending treatment with gentamicin to avoid potential bilateral hypofunction. While there is no specific dosing protocol, the literature supports dosing on a weekly or ''as needed'' basis, given that there is a lower effect on hearing as compared with high-dose or infusion therapy.[302,303] The effectiveness of therapy is based on the patient's subjective relief of symptoms or lack thereof. Additional testing can be performed, particularly for those who show persistent vertigo after gentamicin injection. Some tests are more reliable than others in predicting whether gentamicin injections have been successful. It is expected that the patient will display reduced caloric responses after ITG; however, absence of caloric response is not reliable when analyzing the correlation of vertigo control and gentamicin effect.[307] The absence of vestibular-evoked myogenic potentials (VEMPs) is a more reliable predictor of vertigo control than caloric testing. The rotatory chair can also be performed to assess if there is a reduction in the vestibulo-ocular reflex after rotation toward the side that received IT gentamicin. Head thrust test is reliable in the evaluation of IT gentamicin efficacy. The presence of a positive head thrust will be seen after IT gentamicin.[307] Some patients may not have relief from IT gentamicin injections due to anatomic barriers to the round window. These barriers can be related to gentamicin not coming into contact or permeating through the round window due to inadequate injection technique or an air bubble trapped at the round window. Other contributors to unsuccessful IT gentamicin therapy include decreased permeability related to chronic inflammation, scarring, fibrous tissue, fat plug, or second false round window membrane.[309]

Patient education and shared decision making regarding gentamicin are important given the possibility of hearing loss from these injections. Although infrequent, hearing can deteriorate in some patients after administration. There is not a standard algorithm when it comes to retesting pure tone audiograms with speech discrimination scores; however, subjective questions related to hearing loss were assessed prior to the administration of gentamycin. Prior to and after IT gentamicin, PTA with WRS should be performed to assess for hearing loss. Education must include the risks and benefits of IT gentamicin injections, which include persistent tympanic membrane perforation, hearing loss, need for multiple injections, lack of central vestibular compensation after peripheral vestibular ablation, possible need for completion surgical labyrinthectomy, and the risk of developing bilateral MD, which may be as high as 50% when following patients over a decade. Those who receive IT gentamicin should be counseled about the possible need for VR therapy to achieve central compensation for the incurred peripheral vestibular loss. This is particularly important in the elderly who are at risk for falls that can be quite devastating. All patients who receive gentamicin should be aware that central compensation may take weeks to months and many may experience persistent imbalance/dizziness.

**STATEMENT 13. SURGICAL ABLATIVE THERAPY: Clinicians may offer, or refer to a clinician who may offer, labyrinthectomy in patients with active Ménière's disease who have failed less definitive therapy and have nonusable hearing.** *Recommendation based on observation studies and case series with a preponderance of benefit over harm.*

### *Action Statement Profile: 13*

- Quality improvement opportunity: Improve awareness of effective therapy. National Quality Strategy domains: Effective Communication and Care Coordination, Prevention and Treatment of Leading Causes of Morbidity and Mortality, Person and Family Centered Care
- Aggregate evidence quality: Grade C, based on observation studies and case series data that show efficacy
- Level of confidence in evidence: High
- Benefits: Definitive vertigo control, expedient treatment (single definitive treatment), ability to stop other less effective therapy (that may have side effects), control of drop attacks
- Risk, harm, cost: Risks of surgery, loss of residual hearing, need for general anesthetic, reduced

therapy options in the event that the patient develops bilateral disease, poor compensation after surgery, active tinnitus
- Benefit-harm assessment: Preponderance of benefit over harm
- Value judgments: Labyrinthectomy represents a standard for control of active vertigo in MD
- Intentional vagueness: Nonusable hearing is not specifically defined and may be determined in conjunction with the patient. Less definitive therapy is also vague, as failed nerve section may be considered more invasive but may not have resolved symptoms.
- Role of patient preferences: Large opportunity for shared decision making
- Exclusions: Bilateral disease or vestibular hypofunction in the other ear
- Policy level: Recommendation
- Differences of opinion: A minority of panel members felt that *offer* was too strong a term but that a discussion about this intervention should be undertaken.

## Supporting Text

The purpose of this statement is to emphasize that clinicians may offer surgical labyrinthectomy only to a small subset of patients with persistent, symptomatic unilateral MD refractory to conservative treatments with nonusable hearing in the affected ear. Shared decision making between the provider and patient is necessary for this recommendation. Labyrinthectomy may be offered, as it has the benefit of providing a definitive treatment for MD but also has associated risks, morbidity, and a recovery period that the patient and provider need to consider. There has been a decline in surgical management of MD in more recent years due to the rise of less invasive treatment options, including IT therapies.[310,311] The following points should be addressed and understood by the patient to improve the shared decision-making process so that he or she may have the information to make the best decision. Given the irreversible inner ear destructive nature of surgical labyrinthectomy, patient selection and definitive diagnosis of MD in the affected ear chosen for surgical ablation are critical. Alternative causes of vertigo should be ruled out in patients who present with refractory symptoms given that other disorders, such as concurrent VM or anxiety, could play a role in a patient's uncontrolled symptoms. Labyrinthectomy should be considered in those patients who have persistent disabling vertigo refractory to more conservative treatments options (including sodium restriction, dietary modifications, and oral and IT medications) and with nonusable hearing.

In this CPG, the term ''nonusable hearing'' is used to indicate that the hearing is not functional for communicative purposes. **Table 11** (adapted from Table 2)[312] shows a classification scheme that attempts to differentiate ''usable hearing'' from ''nonusable hearing.'' The AAO-HNS has also published a hearing categorization scheme that is useful for identifying nonusable hearing.[2] This 4-category scheme (A-D) is also based on the PTA (in this case including 0.5, 1, 2, and 3 kHz) as well as speech recognition/discrimination (or, herein, the WRS). For this scheme, category D, with WRS <50% regardless of PTA, would (by most clinicians) be categorized as nonusable hearing. Ultimately, the decision of hearing being usable or not must be determined by the patient with the hearing loss.

**Table 11.** The American Academy of Otolaryngology—Head and Neck Surgery Hearing Classification Criteria.

| Hearing Category | Average PTA, dB HL | Speech Discrimination, % |
|---|---|---|
| A | ≤30 | >70 |
| B | >30 to ≤50 | ≥50 |
| C | >50 | ≥50 |
| D | Any level | <50 |

*Labyrinthectomy.* Labyrinthectomy, most commonly performed via a transmastoid approach, is a definitive surgical procedure that attempts to abolish abnormal vestibular input in a diseased ear.[313,314] The goal of labyrinthectomy is to completely remove the abnormal sensory neuroepithelial elements of the semicircular canals and otolith organs that are believed to cause vertigo episodes in MD patients.[315] The success rate for relieving vertigo is estimated to be >95%,[316,317] as it converts a dynamic fluctuating inner ear disease to a static one that no longer flares, which is particularly beneficial to patients who experience Tumarkin's otolithic crises (drop attacks), which tend to occur in the later stages of MD.[318] The success rate of >95% is supported by 3 large case series. Diaz et al evaluated vertigo control in 44 MD patients who underwent labyrinthectomy.[319] All patients had unilateral disease with a diagnosis of definitive MD as defined by the 1995 AAO-HNSF Committee on Hearing and Equilibrium guideline. Vertigo control was also classified by the 1995 AAO-HNSF Committee on Hearing and Equilibrium guideline, with class A representing no episodes of vertigo within a 6-month period that occurred 18 to 24 months following an intervention (eg, labyrinthectomy). In this case series, 97% of patients (31 of 32) reported complete control of vertigo. The remaining 12 patients were less than 18 to 24 months from labyrinthectomy, but all reported complete control of vertigo.[319] Another case series, by Kemink et al, looked at 110 patients with nonusable hearing and persistent labyrinthine disability who underwent transmastoid labyrinthectomy.[316] More than half of these patients (n = 64) had MD, but the diagnostic criteria that the authors used to diagnose MD were not reported. Nonusable hearing was defined as a PTA >60 dB and a speech discrimination score ≤50%. Postoperative assessment of vertigo control occurred between 3 and 10 years following transmastoid labyrinthectomy. Approximately 88% of patients (n = 97)

reported complete absence of vertigo, and 9% (n = 10) had marked relief of vertigo, resulting in 97% of patients (n = 107) having either complete or marked relief of vertigo. Langman and Lindeman evaluated the control of vertigo in 43 patients who underwent transmastoid labyrinthectomy.[317] All patients had disabling vertigo and nonusable hearing. Nearly 60% of the patients who underwent transmastoid labyrinthectomy (n = 26) had MD, which was defined as the presence of fluctuating or progressive hearing loss with episodic vertigo in their patient population. Postoperatively, follow-up on vertigo control ranged from 1 to 13 years. Complete resolution of vertigo attacks was reported in 95.3% of patients (n = 43).

Labyrinthectomy is a successful, single, definitive surgical procedure that may be appealing to patients with nonusable hearing rather than a trial of less definitive interventions that may require long-term medication administration or repetitive interventions (eg, IT gentamicin or steroid injections). Patients report improvement in their QOL, specifically in the physical, emotional, and social functional domains,[319,320] but there are variations in the ability of patients to return to the workforce after surgery. A case series reported data that roughly half of MD patients with refractory unilateral vertigo and nonusable hearing (56%) returned to work following surgical labyrinthectomy.[321] Major comorbidities from labyrinthectomy include complete vestibular and hearing loss, possible development or worsening tinnitus in the affected ear, and prolonged postural instability potentially secondary to those who fail to achieve central vestibular compensation for this now complete peripheral vestibulopathy.[310] This potential prolonged problem should be addressed prior to surgery with the patient as part of the shared decision-making process, and a detailed discussion on vestibular therapy should be employed in patients who may have difficulty with central compensation of a unilateral vestibular weakness—especially in elderly patients or those who would have occupational difficulty.[322] This is also particularly important in the elderly who are at risk for falls that can be quite devastating. All patients who undergo surgical ablation via labyrinthectomy should be aware that central compensation may take weeks to months and many may experience persistent imbalance/dizziness. Given that labyrinthectomy ablates hearing and vestibular function, it is often contraindicated when the patient has only 1 hearing ear and/or bilateral MD. Rates of bilateral MD range from 2% to 78%, and risk increases with the duration of disease.[43,323] Surgical risks of labyrinthectomy include cerebrospinal fluid (CSF) leakage from the internal auditory canal, facial nerve injury,[316,324] as well as the routine risks of surgery that include bleeding, wound infection, and anesthesia.

Preoperative counseling with the MD patient should always be performed and include specific details of the surgery, potential complications, and projected outcome and prognosis. It should involve a detailed discussion regarding additional morbidity associated with labyrinthectomy, including loss of any residual hearing in the operative ear, postoperative dizziness requiring central vestibular compensation, risk for chronic disequilibrium and unsteadiness, and the possibility of bilateral vestibular dysfunction if there is development of contralateral MD.[323] Evaluation with audiovestibular function testing should be performed in patients preoperatively to assess contralateral vestibular function. Additionally, it is now possible to consider hearing restoration in a labyrinthectomy patient via cochlear implantation. Studies describing simultaneous cochlear implantation at the time of labyrinthectomy aim to reduce the duration of deafness and have found that these patients perform well with their cochlear implant, with some achieving high consonant-nucleus-consonant scores of up to 85%.[325-327]

Surgical intervention with labyrinthectomy for treatment of unilateral MD converts a fluctuating diseased vestibular system into a unilateral static and permanent vestibular hypofunction, which leads to acute postural instability, visual blurring with head movement, and subjective dizziness and/or imbalance.[328] Subsequent central vestibular compensation is required for patients to avoid persistent dizziness/chronic imbalance related to an asymmetry in the vestibular system. Despite definitive surgical intervention, residual imbalance can play a large role in a patient's QOL and functional ability. A 2015 Cochrane Database SR found a statistically significant difference in favor of VR as compared with placebo intervention (see KAS 14).[329]

*Vestibular Nerve Section.* Given that patients will develop complete hearing loss after undergoing labyrinthectomy, VNS has been performed in MD patients with refractory symptoms, good contralateral vestibular function, and usable hearing.[311] Patients who qualify for this procedure should be carefully selected. VNS is not specifically classified as an inner ear ablative procedure; rather, it is an intradural procedure that involves selective transection of the vestibular nerve while preserving the cochlear nerve.[322] Retrospective cohort studies have demonstrated vertigo control rates that range from 78% to >90%.[330-334] Complications from this procedure include hearing loss, facial nerve injury, postoperative headache, and risks of craniotomy, such as bleeding, meningitis, and CSF leak.[317,322] Residual vestibular function resulting in persistent symptoms may result due to incomplete VNS, as there is not a well-defined separation between the vestibular and cochlear nerve.[335] Given the invasive nature of VNS as compared with other management options that have similar or better outcomes, VNS should be offered only in select cases of active vertigo unresponsive to all therapies, usable hearing, no evidence of contralateral disease, and a reasonable expectation of compensation following surgery.[310,335]

Drop attacks associated with MD are relatively rare, making it difficult to construct prospective trials to evaluate treatment efficacy for that specific manifestation of the disease. When they do occur, however, drop attacks can result in potentially significant complications, including head and skeletal trauma. Thus, a recent expert consensus statement emphasized the role of vestibular ablative treatment, such as

VNS (as opposed to endolymphatic sac surgery) for the treatment of drop attacks associated with MD.[311]

*Endolymphatic Sac Surgery.* This CPG makes no recommendation regarding the use of endolymphatic sac decompression due to its uncertain benefit and discordant results when comparing small controlled studies and larger and more numerous uncontrolled studies. The CPG notes that this procedure is not classified as an inner ear ablative procedure. It is simply placed in this portion of the CPG for comparison sake, as it is a surgical procedure that may be utilized by some clinicians. First described in 1927 by Portmann,[336] 11 years prior to identification of the pathologic hallmark of MD-ELH,[228] endolymphatic sac surgery is still performed for the treatment of MD. Since its popularization in the 1960s, it has been one of the most controversial topics in neurotology. In fact, Schuknecht included endolymphatic shunt surgery as 1 of his ''myths of neurotology.''[337]

Endolymphatic sac surgery is a nonablative surgical procedure. Surgery involving the endolymphatic sac is broadly divided into 4 types: endolymphatic sac incision, endolymphatic subarachnoid shunting, endolymphatic mastoid shunting, and endolymphatic decompression. The evolution of surgery involving the endolymphatic sac is noteworthy, as Portmann's initial technique involved decompression, quite similar to that of Shambaugh et al[338] as well as the more recent wide posterior fossa decompression endolymphatic sac vein decompression technique.[339,340] House[341] popularized the endolymphatic subarachnoid shunt, a technique that was further modified with the description of an endolymphatic mastoid shunt, which reduced the risk of intracranial and hearing complications.[342] In the creation of an endolymphatic mastoid shunt, authors have described incision and opening of the sac or incision and placement of a Silastic sheet, tubing, or 1-way valve.[343-345]

A critical review of the extensive reports pertaining to the efficacy of endolymphatic sac surgery allows the following conclusions to be made.

1. Approximately 80% to 90% of patients undergoing endolymphatic sac surgery have total or substantial vertigo control at 2 years after surgery. With an increasing period of follow-up, the chance of a favorable therapeutic result declines. At 5 years postsurgery, approximately 60% of patients have total or substantial vertigo control. Vertigo control further declines at 10-year follow-up. It must be emphasized that these data pertain to the results of a single surgical intervention. Some studies incorporate results of primary and subsequent revision surgery into a single data pool. Given the potential placebo response to this surgery, this approach to analysis inflates the apparent benefit. Conversely, other authors confine their outcome measure to *total* vertigo control. This more rigid criterion of surgical success diminishes the apparent benefit.[342,344,346,347]
2. The therapeutic results of the various surgical modifications to endolymphatic sac surgery described here are essentially equivalent.
3. Regardless of the method used, endolymphatic sac surgery is of low risk, with <2% incidence of complete SNHL.[348] Rare complications include CSF leak, facial paralysis, vertigo, and wound infection.

Significant controversy regarding the efficacy of endolymphatic sac procedures followed the publication of the randomized double-blind Danish Sham Surgery Study.[349-352] This study evaluated 30 patients with MD refractory to medical treatment: 15 of whom were randomized into the ''active'' surgical group undergoing endolymphatic mastoid shunt, as compared with the control group of 15 patients undergoing a ''placebo'' mastoidectomy. The primary outcome measure was vertigo control. Secondary outcome measures included changes in audiometric data, changes in patients' assessments of symptoms, and patient and surgeon evaluation of efficacy of the procedure (both patient and surgeon were blinded to the specific procedure performed).

Both endolymphatic sac surgery and mastoidectomy groups demonstrated a reduction in vertigo; however, there was no difference in the level of vertigo control when the sac surgery and mastoidectomy groups were compared. These findings were consistent at 1-, 3-, 6-, and 9-year follow-up evaluations. The conclusion drawn from the study was that endolymphatic sac surgery was no better than a placebo procedure in controlling vertigo in patients with MD.

Given the pervasive use of endolymphatic sac surgery in the treatment of MD at that time, it is not surprising that these publications provoked both controversy and criticism. The majority of the criticism has been leveled at the interpretation of the data at the 1-year follow-up.[353,354] A reassessment of the original data by Welling and Nagaraja did show statistically significant differences between groups when comparing patient diary assessments in postoperative dizziness and aural pressure.[354] However, it must be pointed out that these authors did not have access to the original raw data but rather derived the data from the figures published in the first publication. It should be noted that the further reports on longer-term follow-ups have not been similarly criticized.

The 2 main lessons of the Danish Sham Surgery Study are as follows. First, both patients in the active (sac) surgery and placebo (mastoidectomy) arms of the study demonstrated a dramatic reduction in vertigo. That placebo surgery can result in a resolution of symptoms of vertigo in close to 70% of patients is truly a remarkable finding. Proponents argue that drilling a mastoid may have been therapeutic in the placebo group.[349,355] Yet, the debate over the meaning of the study has focused on possible differences in symptom control rates *between* groups that are negligible in magnitude when compared with the overall response rate in *both* groups. Second, at subsequent follow-up periods after 1 year, there was no difference in the vertigo control rates.

Given that the placebo treatment (mastoidectomy) may not serve as an actual placebo group in this study, this CPG does not advocate the use of mastoidectomy alone as a therapeutic approach for MD. This simply highlights the complexity of this disease and discloses the ongoing needs for future research in optimal treatment options for MD.

**STATEMENT 14a. ROLE OF VESTIBULAR THERAPY FOR CHRONIC IMBALANCE: Interictal instability and following ablative therapy: Clinicians should offer vestibular rehabilitation/physical therapy for Ménière's disease patients with chronic imbalance.** *Recommendation based on systematic reviews and limited RCTs with a preponderance of benefit over harm.*

## *Action Statement Profile: 14a*

- Quality improvement opportunity: Offer therapy for patients who have chronic imbalance, bilateral MD, and/or following ablative therapy. Promoting effective therapy and increased patient safety. National Quality Strategy domains: Safety, Promoting Effective Prevention/Treatment
- Aggregate evidence quality: Grade A, based on SRs and limited RCTs
- Level of confidence in evidence: High
- Benefits: Improved symptom control, safety, reduced risk of falls, improved confidence, improved QOL
- Risk, harm, cost: Cost of therapy, time for appointments, potential exacerbation of acute symptoms
- Benefit-harm assessment: Preponderance of benefit over harm
- Value judgments: While ineffective acutely, VR therapy has a significant role in the chronic management of MD patients.
- Intentional vagueness: Imbalance encompasses multiple varying scenarios, including vestibular dysfunction and chronic balance problems
- Role of patient preferences: Small; however, patients can have a larger role in deciding if they choose to do VR.
- Exclusions: Patients in the setting of an acute attack
- Policy level: Recommendation
- Differences of opinion: None

## *Supporting Text*

The purpose of this statement is to define the role of VR/physical therapy in the management of MD patients with chronic imbalance. The natural history of MD involves progressive decline of unilateral peripheral vestibular function with activation of central nervous system compensatory mechanisms. Patients with inactive or end-stage disease with complete central vestibular compensation may be free of symptoms; however, those with unilateral peripheral vestibular hypofunction due to MD with incomplete central vestibular compensation may experience significant chronic imbalance symptoms that include subjective dizziness, postural instability, and impaired vision during movement. The burden of disease related to these symptoms is a significant public health problem,[356] as patients with unilateral vestibular hypofunction are at a significantly higher risk of falls.[357] Patients with bilateral MD have a limited ability to compensate for the peripheral vestibular loss and are at an even higher risk of falls and fall-related injuries than those with unilateral disease or unaffected age-matched peers.[358] Interventions that expedite or facilitate adequate central nervous system compensation are highly sought after to reduce burdensome symptoms and improve patient QOL, while minimizing economic cost to the health care system.[328]

VR refers to wide range of physical exercises and maneuvers that are intended to promote recovery of function and mitigation of symptoms related to balance disorders. This intervention was originally described by Cooksey[359] and Cawthorne[312] with the objective of promoting central vestibular compensation; however, refinement and modification of VRT over time have led to a wide range of physical exercises that ''promote gaze stability . . . habituate symptoms . . . improve balance and gait . . . [and include] walking for endurance.''[328] Recent CPGs have provided strong recommendations for VR to treat symptoms related to chronic unilateral or bilateral peripheral vestibular hypofunction based on level 1 evidence as well as strong recommendations to use VR to improve QOL and decrease psychological stress related to these vestibular symptoms.[328]

Despite these recommendations, there is limited research focused on the use of VR in the management of MD, and some research in this field has even excluded MD patients due to the fluctuating nature of the disease.[360] A recent Cochrane review identified 39 studies involving the effectiveness of VR patients with unilateral peripheral vestibular hypofunction of various etiologies. Three RCTs were identified that exclusively involved patients with chronic vestibular symptoms due to MD.[329] From this review, Garcia et al[361] reported that virtual reality–based VR combined with diet and medical management improved subjective symptoms based on the DHI and Dizziness Analogue Scale as compared with those treated with diet and medical management alone. Yardley and Kirby[194] utilized a VR program delivered through a booklet of exercises that resulted in a significant improvement of vestibular-associated activity restrictions as compared with controls. Scott et al[362] found no improvement on balance-related measures as compared with controls using applied relaxation classified as a form of VR. This Cochrane review did not identify a significant level of evidence to suggest that one form of VR was better than others.[329] Another SR assessing the literature for VR in MD identified 2 RCTs and 3 prospective cohort studies.[363] Although there is some evidence of benefit from VR, the strength of this literature is significantly weakened due to short-term follow-up after intervention, small sample sizes, diverse methodology, and significant study bias.

There are additional circumstances where VR may be offered to treat chronic imbalance due to MD. Ablative

medical (eg, IT gentamicin) or surgical (eg, labyrinthectomy or VNS) management of refractory episodic vertigo may result in total or near total unilateral peripheral vestibular hypofunction. Patients who receive these treatments may have chronic imbalance if central vestibular compensation has been incomplete; therefore, they are candidates for post-treatment VR. A recent clinical guideline[328] identified a level 1 RCT that assessed the role of VR following ablative surgical treatment of MD. When compared with controls, those who received postoperative VR had improved motion sensitivity and subjective improvement of symptoms based on the DHI.[364] VR may also be utilized to treat chronic imbalance symptoms in bilateral MD. These patients face a complicated clinical course and may have limited treatment options due to the potential harm inherent to ablative treatment. Based on VR clinical guidelines,[328] there is a strong recommendation to use VR for patients with bilateral vestibular hypofunction. This is based on 4 level 1 RCTs and 5 level 3-4 studies. Despite demonstrating the benefit of VR in alleviating chronic imbalance via objective and subjective measures, these studies are limited by small sample sizes and the utilization of heterogeneous study samples that include a wide range of underlying diseases in addition to MD. Regardless of the limitations in the quality/volume of available research, there is growing evidence showing benefits versus harm to patients undergoing VR. As such, MD patients should be offered VR as a treatment for chronic imbalance.

**STATEMENT 14b. ROLE OF VESTIBULAR THERAPY FOR ACUTE VERTIGO: Clinicians should not recommend vestibular rehabilitation/physical therapy for managing acute vertigo attacks in patients with Ménière's disease.** *Recommendation against based on RCTs studied that evaluated acute vertigo but were not specific to MD and a preponderance of benefit over harms.*

## Action Statement Profile: 14b

- Quality improvement opportunity: Avoidance of inappropriate/ineffective therapy. National Quality Strategy domains: Patient Safety, Prevention and Treatment of Leading Causes of Morbidity and Mortality
- Aggregate evidence quality: Grade B, based on subset analysis of RCTs that failed to identify any studies on the topic as well as expert opinion extrapolated from evidence from a CPG
- Level of confidence in evidence: Medium; the RCTs evaluated acute vertigo but were not specific to MD
- Benefits: Avoidance of noneffective therapy, preserving coverage for physical therapy at a later stage of disease, avoidance of potential exacerbation of symptoms
- Risk, harm, cost: Delay of treatment in patients with an underlying vestibular hypofunction
- Benefit-harm assessment: Preponderance of benefit over harms
- Value judgments: Avoidance of inappropriate therapy
- Intentional vagueness: None
- Role of patient preferences: None
- Exclusions: None
- Policy level: Recommendation against
- Differences of opinion: None

## Supporting Text

The purpose of this statement is to define the role of VR/physical therapy in the management of the severity and frequency of acute vertiginous attacks with definite or probable MD. Vertigo attacks lasting 20 minutes to 24 hours accompanied by fluctuating low- to midfrequency SNHL, aural fullness, and tinnitus are a typical manifestation of active MD. These attacks are distinct from other MD-associated symptoms, such as chronic imbalance, motion sensitivity, disequilibrium, dizziness, and oscillopsia (eg, ataxia in the dark and inability to maintain stable focus on horizon). Efficient reduction in the severity and frequency of acute vertigo in MD is a vital treatment objective, and it is critical to avoid unnecessary ineffective interventions.

VR refers to a compilation of exercises and physical maneuvers to treat chronic balance disorders. The overarching goal of VR is to reduce balance-related symptoms while improving postural stability and daily functioning. By combining active head movements with the integration of other sensory information, VR induces central vestibular compensation and habituation to alleviate the symptoms of chronic balance disorders.[365] The AAO-HNS has endorsed VR as a ''valid therapeutic modality for the treatment of persistent dizziness and postural instability due to incomplete central vestibular compensation after peripheral vestibular or central nervous system injury.'' Balance retraining therapy is also of significant benefit for fall prevention in the elderly patient who may experience multiple sensory and motor impairments or for those who have sensory disruption with moving visual information.''[366] This therapy has become a primary treatment for patients with stable peripheral and central vestibular hypofunction[360]; however, for the fluctuating nature of vestibular dysfunction manifested in acute MD attacks, the role of VR is undefined.[365]

There is strong evidence from a recent CPG demonstrating benefit of VR in patients with unilateral and bilateral peripheral vestibular disorders in the acute and subacute settings who experience ongoing symptoms.[328] This guideline included research among patients with vestibular neuritis,[367] vestibular schwannoma,[368,369] postsurgical peripheral vestibular hypofunction,[364] and other vestibulopathies; however, there is a lack of evidence to support the use of VR to treat acute vertigo attacks in MD. Despite the documented benefit of VR in the acute setting, this guideline recommended excluding patients who have compensated vestibular dysfunction and a ''possible exclusion'' of patients with active

MD.[328] Furthermore, this guideline recommended stopping VR for patients with acute vertigo and fluctuating vestibular function from active MD based on level 5 evidence.[328] Despite this recommendation and the lack of clear evidence of effectiveness, VR has been used as a treatment option for non-MD disorders with fluctuating vestibular function, such as VM.[370]

A Cochrane review of VR research found no studies specifically addressing the use of VR in the treatment of acute vertigo; however, the review found no evidence of harm for any patient receiving VR for unilateral peripheral vestibular dysfunction.[329] An SR and clinical evidence assessment from 2007 reported that VR is optional in the management of acute vertiginous attacks of MD patients.[95] The 2007 review found no RCTs regarding benefits or harms for VR in this setting. An update to this clinical evidence assessment in 2015 proposed VR as optional for treatment of acute vertigo MD attacks.[209] The 2015 review also found no evidence of reduction of frequency or severity of acute vertigo attacks from the literature but also identified no harms from VR. Their recommendation for optional VR was based on nonblinded research from an RCT that utilized virtual reality VR and reported lower subjective dizziness symptoms on the DHI among active MD patients receiving therapy.[361] Overall, there is a lack of evidence to support the use of VR to mitigate the severity or frequency of acute vertigo episodes in patients with MD. The limited evidence of the potential benefit for subjective improvement in patients with active MD must be weighed against the potential harms of the costs incurred and time invested in VR.

**STATEMENT 15. COUNSELING FOR AMPLIFICATION AND HEARING ASSISTIVE TECHNOLOGY: Clinicians should counsel patients, or refer to a clinician who can counsel patients, with Ménière's disease and hearing loss on the use of amplification and hearing assistive technology.** *Recommendation based on cohort studies of hearing outcomes in MD and benefits of amplification and cochlear implants with a preponderance of benefit over harms.*

## Action Statement Profile: 15

- Quality improvement opportunity: Shared decision-making opportunities between patients and clinicians regarding MD and hearing loss and the use of amplification and other hearing assistive technologies. National Quality Strategy domains: Effective Communication and Care Coordination, Person and Family Centered Care
- Aggregate evidence quality: Grade C, based on cohort studies of hearing outcomes in MD and benefits of amplification and cochlear implants
- Level of confidence in evidence: High
- Benefits: Improved function, improved QOL, improved hearing, less missed work
- Risk, harm, cost: Clinicians and patients' time, creation of unrealistic expectations
- Benefit-harm assessment: Preponderance of benefit over harms
- Value judgments: The handicap of associated hearing loss is underrecognized in MD patients
- Intentional vagueness: None
- Role of patient preferences: Small regarding counseling, large in terms of choice to use these technologies
- Exclusions: None
- Policy level: Recommendation
- Differences of opinion: None

## Supporting Text

The purpose of this statement is to inform clinicians about the benefits of amplification and other hearing assistive technologies and to encourage shared decision making between MD patients and clinicians about hearing loss and the use of these technologies.

SNHL is one of the key criteria for the diagnosis of MD.[6] SNHL, even mild[371] and unilateral,[372] is associated with considerable functional, cognitive, social, economic, and health consequences.[373] No medical or surgical intervention has yet been shown to effectively prevent or correct SNHL associated with MD. While there is ample literature supporting the use of hearing aids and other hearing technologies for SNHL, relatively little has focused on rehabilitation of SNHL due to MD.[374-378]

The nature of the SNHL dictates the approach to aural rehabilitation. SNHL in MD presents unique challenges, and these change over time.[43] In early stages of MD, SNHL commonly fluctuates in the affected ear and may be only intermittent. Fitting hearing aids in mild, fluctuating SNHL is difficult, as an initially successful fitting may be followed by complaints that the sound is too soft, too loud, or distorted soon thereafter.[376] Furthermore, overamplification could induce permanent SNHL due to excessive exposure to high-level acoustic stimuli.[379] Later in the clinical course, fluctuation tends to wane and progress to nonusable hearing in the affected ear. Additional problems with fitting hearing aids include poor speech discrimination—most commonly measured as a WRS—and the limited tolerance for amplification because of the narrow dynamic range, which is the decibel difference between the threshold for an acoustic stimulus and the level at which that sound becomes uncomfortable. As these considerations can have a substantial impact on success with various rehabilitative solutions, it is imperative that clinicians explain them to MD patients and their families to set appropriate short- and long-term expectations.

Conventional hearing aids involve a microphone, an amplifier, and a speaker that increases sound volume to the affected ear.[380] These are typically custom fit to an individual's SNHL based on audiometric testing. Modern hearing aid technology also includes hardware (eg, multiple

microphones) and software (ie, digital noise reduction) that allow precise control for a patient's dynamic range and optimal hearing in a variety of listening environments. Modern digital hearing aids often require programming or manual adjustment by a hearing aid professional as SNHL fluctuates or progresses. Newer technology may allow patients to self-test their hearing and adjust hearing aid output accordingly.[376] While hearing aids can yield marked functional improvements, they are expensive and typically not covered by health insurance, including Medicare.

Personal sound amplification involve a microphone, amplifier, and a speaker. They may also allow for tuning the sound output to preferentially enhance the frequencies most affected by SNHL, much as a hearing aid is fitted to an individual's HL. These devices are typically much less expensive than conventional hearing aids; however, they lack a hearing aid's sophisticated components that may address, for example, the narrow dynamic range and distortion that many MD patients experience. Thus, they would be of most value for patients with mild or intermittent SNHL or as an initial sound amplification device.

When SNHL progresses to severely compromised WRS or the dynamic range is too narrow, a conventional hearing aid may make hearing worse. The next step in rehabilitation might involve a CROS hearing aid. These devices include a microphone worn on the affected ear and send the sound to an amplifier/speaker on the better-hearing ear. If both ears have SNHL, microphones are placed on both ears (BiCROS). These devices facilitate the detection of sound coming from the severely impaired side. In contrast to conventional hearing aids, which aim for optimal hearing in both ears, CROS solutions do not produce significant improvement in either sound localization or understanding speech in the presence of background noise.

Some patients with severe to profound SNHL in the affected ear and normal hearing (<20 dB HL PTA) in the better-hearing ear will express frustration with wearing any hearing device on the better-hearing ear. In such cases, patients may derive benefit from bone-anchored hearing devices. Bone-anchored devices provide sound awareness on the severely impaired side but have the same limitations with sound localization and speech reception in noise. In contrast to hearing aids, such implants are often covered by insurance.

If SNHL is so severe that amplification provides limited benefit, cochlear implants may be employed. At present, these devices involve an external sound processor and an internally implanted receiver-stimulator.[381] The sound processor converts sound to an electrical signal that is passed across the skin to the receiver-stimulator, which in turn sends a signal to a series of electrodes implanted within the cochlea. Cochlear implants can restore a substantial level of hearing to profoundly hearing-impaired MD patients,[382,383] even those who have undergone inner ear ablative labyrinthectomy.[384] These devices have also been used effectively for MD with single-sided deafness,[385] but many insurance companies will cover their use for only bilateral profound SNHL.

**STATEMENT 16. PATIENT OUTCOMES: Clinicians should document resolution, improvement, or worsening of vertigo, tinnitus, and hearing loss and any change in quality of life in patients with Ménière's disease after treatment.** *Recommendation based on the controlled arms of RCTs, outcomes from RCTs, cohort studies, and observational studies with a preponderance of benefit over harm.*

## Action Statement Profile: 16

- Quality improvement opportunity: Tracking outcomes of therapy provides an opportunity for modification of management to optimize outcomes. To ensure that patients have follow-up until symptoms are under adequate control. National Quality Strategy domain: Effective Communication and Care Coordination
- Aggregate evidence quality: Grade C, based on the controlled arms of RCTs, outcomes from RCTs, cohort studies, and observational studies
- Level of confidence in evidence: Medium due to Grade C evidence
- Benefits: Opportunity to adjust for more effective therapy, possibility of more accurate diagnosis, opportunity for hearing rehabilitation, patient engagement
- Risk, harm, cost: Cost and time of visits
- Benefit-harm assessment: Preponderance of benefit over harms
- Value judgments: Not applicable
- Intentional vagueness: The word *symptoms* can refer to vertigo, hearing loss, tinnitus, or pressure depending on what is of most concern to the patient
- Role of patient preferences: Medium. Some patients with subjectively adequate disease control may choose not to follow up
- Exclusions: None
- Policy level: Recommendation
- Differences of opinion: Several group members wanted to document symptoms before, during, and after treatment, and others wanted to specifically document change in symptoms.

## Supporting Text

The purpose of this statement is to focus on the importance of follow-up in patients with MD, to evaluate for other disease etiologies, to identify patients who would benefit from increased or decreased intensity of therapy, and to reduce the use of ineffective therapy.

Baseline assessment should be obtained of all the possible clinical symptoms to evaluate effectiveness of therapeutic options undertaken. MD has a variable clinical presentation

and can present with sudden-onset vertigo with tinnitus, fluctuating hearing, and/or fullness of the ear. It can also manifest with potentially devastating drop attacks, nausea, and vomiting.

One of the major goals of therapy is adequate control of vertigo. Episodes of vertigo are unpredictable and seem to have the most significant impact on QOL.[43] The data on long-term prevalence of vertigo are variable. Some show a decrease in incidence of attacks or complete resolution.[386,387] Others show a worsening of vertigo symptoms associated with contralateral ear involvement, although these data are not consistent.[28,386,388,389] Follow-up to determine a patient's level of control of vertigo with current therapy allows for changes in therapy if control is inadequate or potential reduction in therapy if patients have complete vertigo control.

Hearing loss is another variable component of MD, although in most cases it progresses with longer duration of disease.[390,391] Hearing impairment can be divided into low frequency, mostly prominent in early stages, and high frequency, which can manifest in later stages of the disease process.[392,393] Audiometric testing is an important component of follow-up to inform further therapeutic or rehabilitative options.

Determination of adequate follow-up for MD is dependent on the severity and progression of the disease. If vertigo is not adequately controlled, if hearing loss is progressive, or if the patient is experiencing more frequent drop attacks, there may be alternate therapeutic options. Patients with severe or progressive disease should have more frequent follow-up, but those who have stabilized or have fewer disabling symptoms may not require it as frequently. Utilizing baseline assessment and frequent follow-up in the early stages of the disease will allow for accurate and effective therapy, including, but not limited to, aural/vestibular rehabilitation. A questionnaire that establishes a baseline assessment to outline patient needs may help dictate the long-term surveillance schedule that will afford the patient and physician the best opportunity to optimize outcome.

Measurement of QOL before and after therapeutic interventions can provide a valuable tool for evaluation of long-term effect and outcome data development. There are many tools available that assess a patient's QOL before and after surgical labyrinthectomy.[46,319,355,394,395] The CPG currently does not recommend a specific QOL measure over another; rather, this CPG recommends that the provider use a measure that will lead to a consistent evaluation of the MD patient. Future research into the various QOL measures is required before a standard QOL metric can be endorsed. As such, a widespread adaptation and collation of a comprehensive multicenter tool can contribute toward a deeper understanding of the value of interventions and progress in patient-centered outcomes.

## Implementation Considerations

The complete guideline is published as a supplement to *Otolaryngology–Head and Neck Surgery* to facilitate reference and distribution. A full-text version of the guideline will also be accessible free of charge at www.entnet.org, the AAO-HNS/F website. A podcast discussing the guideline and KASs will be made available. The guideline was presented to members at the AAO-HNSF 2019 Annual Meeting & OTO Experience as a panel presentation prior to publication.

Anticipated barriers to applying the recommendations in the guideline include (1) lack of knowledge penetration of current diagnostic criteria for MD, VM, and other vestibular disorders; (2) difficulty of changing entrenched clinician practice patterns, including use of diagnostic testing (eg, overuse of vestibular testing) and nonevidence-based management strategies; (3) variability in access and quality of diagnostic tests (ie, audiograms, MRI), treatment options (eg, betahistine, IT therapy, surgery, vestibular therapy) based on setting of care, geographic location, and the training of the treating clinician; and (4) time restrictions and heavy clinical workloads (eg, precluding thorough patient education). The first 2 may be addressed with educational materials, active learning from experts and opinion leaders, and continuing medical education events. Short of overarching health care reform, the last 2 barriers may require approaches specific to local contexts, including multiprofessional collaboration, altered clinical workflows, and financial incentives.

Supporting materials have been developed to assist in guideline implementation. An algorithm for diagnosis and treatment has been developed to provide decision support to clinicians choosing among different diagnostic pathways and treatment options (**Figure 1**). The algorithm allows for a more rapid understanding of the guideline's logic and the sequence of the action statements. The GDG hopes that the algorithm can be adopted as a quick-reference guide to support the implementation of the guideline's recommendations.

As patient education and shared decision making are essential components in the appropriate management of MD, an outline of what the GDG deemed to be essential components of clinician-provided patient education has been developed (**Table 8**). Adherence to diet and lifestyle modifications can be particularly challenging for patients to navigate. Thus, pertinent educational materials (**Table 9**) will be developed in conjunction with the GDG's patient advocate. Additionally, a resource list for patients and their families has been developed to assist them in identifying reliable sources of information and support groups (**Table 8**).

The AAO-HNSF will continue to promote adherence to the guideline's recommendations through its quality improvement activities. Per AAO-HNSF policy, the guideline will be reviewed and updated 5 years from the time of publication.

### *Research Needs*

1. Clinical epidemiologic studies to standardize categories of disease stage, severity, and treatment response, as well as optimal follow-up time frames for outcome assessment.

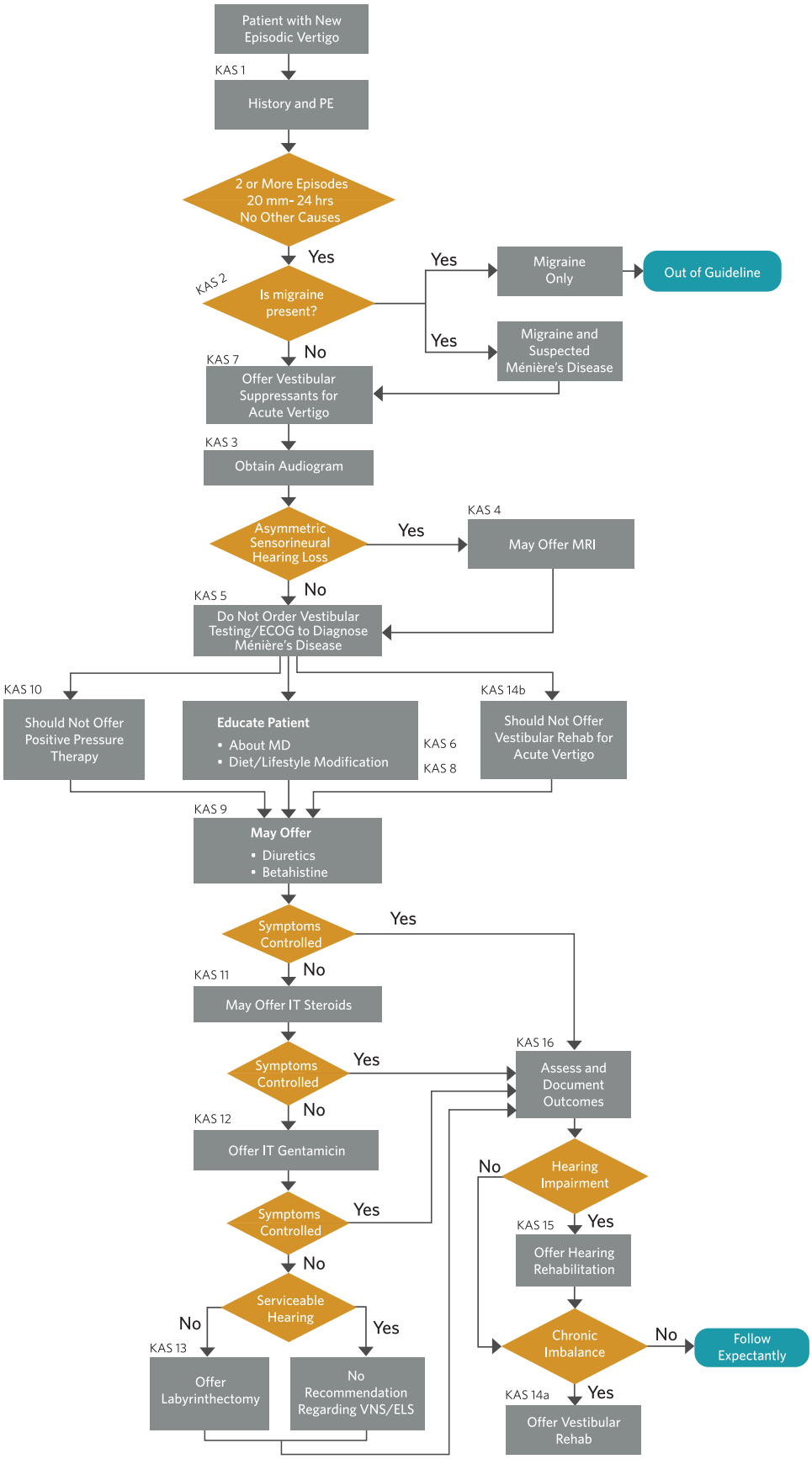


**Figure 1.** Clinical practice guideline: Ménière's disease algorithm. ECOG, electrocochleogram; ELS, endolymphatic sac; IT, intratympanic; KAS, key action statement; MD, Ménière's disease; MRI, magnetic resonance imaging; PE, physical examination; VNS, vestibular nerve section.

2. Development and validation of clinically relevant measures of QOL.
3. Identification of true pathophysiology of the condition or conditions that would lead to a constellation of symptoms of MD.
4. Definitions: Currently there is no clear definition or standardization of stages, severity, and response to treatment that are universally accepted for MD. Here are some suggestions to consider.
   a. Stage of disease
      i. Active (having MD attacks weekly or monthly)
      ii. Chronic (having MD attacks a few times per year, otherwise in good control)
      iii. ''Burned out'' (severe to profound hearing loss with no further activity from the ear secondary to natural progression or ablative intervention)
   b. Severity of disease
      i. Mild (occasional mild vertigo attacks with minimal hearing loss, tinnitus, and fullness; each episode lasts no more than a few minutes)
      ii. Moderate (occasional moderate to severe MD attacks or infrequent debilitating episodes)
      iii. Severe (frequent debilitating episodes with severe symptoms)
   c. Failure of treatment
      i. Failure of conservative measures could be defined as minimal or poor response to trigger management, including salt and other dietary modifications.
      ii. Failure of medical management could be defined as above patients with those who have also failed oral medication (eg, diuretics, betahistine, steroids).
   d. Quality of life. There is a need for standardization of disease-specific QOL measures for this condition.
   e. Follow-up. There is a need for standardization of follow-up for MD patients in terms of management of symptoms as well as long-term hearing and balance outcomes.
5. Audiologic testing.
   a. Can audiogram patterns differentiate MD from retrocochlear pathology? This information may prevent unnecessary imaging studies.
6. Role of imaging studies for MD.
   a. Is there a correlation between MRI findings (post-IT or delayed intravenous contrast) and degree of MD? Can MRI be useful in diagnosing probable versus definite MD, particularly in the early stages of the disorder?
   b. To help us make a stronger case for or against routine use of imaging, we need a study that determines the rate of retrocochlear/underlying lesions among patients who present with MD per current diagnostic criteria.
7. Role of migraine management.
   a. Should all recalcitrant MD patients be managed with migraine prophylaxis?
8. Management of acute vertigo attacks. There is a clear need for well-designed trials for management of acute symptoms of MD patients, including antiemetic and antivertigo medications and oral steroids for acute events.
9. Better identification and documentation of individual triggers. This would help better manage disease and potentially help with distinguishing different subtypes of MD. For example, some MD patients are quite salt sensitive, yet others have no issue with salt or hydration changes but are quite sensitive to stress, allergy, or barometric pressure changes.
10. Sodium restriction. Well-designed prospective double-blinded RCTs are needed for sodium restriction for MD patients.
    a. There is no clear evidence if absolute levels or fluctuation has the true benefit.
    b. It is not known if there is a specific subtype of MD patient who will have an ideal response to sodium restriction.
    c. Patient compliance and QOL need to be assessed while on such a restricted diet.
    d. Different methods of patient education, including nutrition consult, could be assessed.
11. Determine the optimal duration of trigger avoidance and pharmacotherapy once vertigo is controlled.
12. Endolymphatic sac decompression:
    a. A well-designed prospective double-blinded multicenter trial is needed on endolymphatic sac decompression for MD patients who have failed conservative measures and medical management.
    b. Does general anesthesia by itself provide any improvement in MD patients?
13. Vestibular rehabilitation and balance therapy.
    a. Prospective trials are needed for assessing the long-term balance issues after labyrinthectomy, particularly in patients who will eventually develop bilateral disease.
    b. Can early balance and vestibular therapy help with long-term imbalance and anxiety associated with MD?
    c. Can virtual reality treatment, including vestibular rehabilitation home solutions, decrease fall risk in MD patients?
14. IT gentamicin injections. There is currently no standardization in terms of protocol or titration. Prospective RCTs are needed to delineate the optimal dosage as well as titration to hearing and balance.
15. IT steroid injections. There is currently no standardization in terms of protocol or titration. Prospective RCTs are needed to better delineate the optimal dosage as well as titration to hearing and balance.
16. Positive pressure therapy. There is a need to assess if there are any subpopulations of MD patients who would benefit from positive pressure therapy.
17. Cannabinoids. Well-designed RCTs are needed to assess the role for cannabinoids in treatment of MD.
18. Complementary medicine. Perspective well-designed RCTs are needed to assess the effect of acupuncture and other methods of complementary medicine for MD.

## Acknowledgments

We gratefully acknowledge the support provided by Jessica Ankle, from the AAO-HNSF, for her assistance with this guideline's graphic designs and Lara Handler for her assistance with the literature searches.

## Disclaimer

This clinical practice guideline is not intended as an exhaustive source of guidance for managing patients with MD. Rather, it is designed to assist clinicians by providing an evidence-based framework for decision-making strategies. The guideline is not intended to replace clinical judgment or establish a protocol for all individuals with this condition and may not provide the only appropriate approach to diagnosing and managing this program of care. As medical knowledge expands and technology advances, clinical indicators and guidelines are promoted as conditional and provisional proposals of what is recommended under specific conditions but are not absolute. Guidelines are not mandates. These do not and should not purport to be a legal standard of care. The responsible physician, based on all circumstances presented by the individual patient, must determine the appropriate treatment. Adherence to these guidelines will not ensure successful patient outcomes in every situation. The AAO-HNSF emphasizes that these clinical guidelines should not be deemed to include all proper treatment decisions or methods of care or to exclude other treatment decisions or methods of care reasonably directed to obtaining the same results.

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## Disclosures

**Competing interests:** Patrick J. Antonelli—consultant for Metarmor and Otonomy; honoraria from Alken and Vindico Medical Education; research funding from Alcon, Medtronic ENT, Otonomy, and Edison Pharmaceuticals; Robert Burkard—salaried employee, University of Buffalo; Matthew L. Bush—consultant for MedEl (Surgical Advisory Board); consultant for Oticon Medical; research funding from National Institutes of Health and Advanced Bionics; Jennifer Derebery—stockholder, House Providence Hearing Health Centers; stockholder and owner, House Healthcare, Inc; stockholder, Ear Lens Corporation; consultant and stockholder, Tusker Medical Inc; Kevin A. Kerber—royalty from Oxford University Press (*Clinical Neurophysiology of the Vestibular System*, fourth edition); consulting fees from American Academy of Neurology; research funding from National Institutes of Health and Agency for Healthcare Research and Quality; speaking honoraria from Texas Neurological Association and Kaiser Permanente; Brian J. McKinnon—consultant for hearLife Clinic; American Society of Geriatric Otolaryngology leadership role (treasurer); honoraria from Oticon and Cochlear; royalty from Springer; research funding from Oticon; stock in Resonance Medical; expert witness; Alexis Vosooney—stockholder, 3M; Lorraine C. Nnacheta—salaried employee of the AAO-HNSF; Nui Dhepyasuwan—salaried employee of the AAO-HNSF; Erin M. Buchanan—salaried employee of the AAO-HNSF.

**Sponsorships:** AAO-HNSF.

**Funding source:** AAO-HNSF.

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