

Main Article

Arun Pajaniappane takes responsibility for the integrity of the content of the paper

Cite this article: Pajaniappane A. Assessment and management of vestibular migraine within ENT. *J Laryngol Otol* 2024;1–5. <https://doi.org/10.1017/S0022215123002062>

Received: 17 March 2023

Revised: 23 June 2023

Accepted: 18 July 2023

Keywords:

Vertigo; neuro-otology; inner ear; postural balance; evidence-based medicine

Corresponding author:

Arun Pajaniappane;

Email: arun.pajaniappane@stgeorges.nhs.uk

Assessment and management of vestibular migraine within ENT

Arun Pajaniappane^{1,2}

¹Department of Audiovestibular Medicine, St George's University Hospitals NHS Trust, Tooting, UK and

²Harley Street Audiovestibular Clinic, London, UK

Abstract

Objective. Vestibular migraine is a newly recognised and debilitating condition. This article aims to provide an overview of what is known of vestibular migraine, delineating its diagnostic criteria and presenting some initial management strategies to aid ENT professionals in delivering optimal care when patients first present to the otolaryngology clinic.

Method. Although traditionally underdiagnosed, there are now clearly defined diagnostic criteria to aid accurate diagnosis of vestibular migraine.

Results. A detailed history and clinical examination are the cornerstone of the diagnostic process, but supportive evidence is required from appropriate audio-vestibular tests and imaging.

Conclusion. This is a unique condition that commonly initially presents to ENT. This article provides a summary of diagnostic and management strategies to facilitate early diagnosis and first-line treatment that can be employed in general ENT settings, which may be particularly useful given the limited availability of specialist audio-vestibular medicine and neuro-otology services.

Introduction

There has been a long-established link between migraine and vertigo since as early as the nineteenth century.¹ However, only in more recent times was the formal and systematic study of vertigo in relation to migraine disorders established.^{2,3} It was not until the paper by Neuhauser *et al.*⁴ that a distinct entity of migraine-related episodic vestibular symptoms gained greater definition and the terminology came into wider usage. Various terms including migrainous vertigo, migraine-associated vertigo and migraine-associated dizziness, amongst others, have since been employed to describe this newly defined unique clinical entity.⁵ However, it was eventually only in 2012 that the term 'vestibular migraine' was agreed on by expert consensus, with establishment of diagnostic criteria for uniformity of terminology and diagnosis.⁶

The term 'vestibular symptom' is used to define a range of patient descriptors, including vertigo, dizziness, unsteadiness and imbalance. There has been expert consensus on the definition of different terms.⁷ Vestibular symptoms arise from an underlying disorder of the vestibular system. Traditionally, these are broadly divided into peripheral and central vestibular disorders.⁸

As peripheral vestibular disorders tend to form a significant proportion of the presentations to hospital, ENT is traditionally the first port of call for the consultation and assessment of a patient experiencing dizziness (up to 88 per cent in one study).⁹ As a result, there will be a sizeable number of patients with central vestibular disorders seen by ENT, including vestibular migraine. Vestibular migraine is an entity that can span across ENT, neurology and audio-vestibular medicine (where available). As a result, patients may have multiple visits consulting different specialists, increasing diagnosis and treatment times, as well as associated co-morbidities.

Epidemiology of vestibular migraine

The lifetime prevalence of vestibular migraine has been estimated by studies as being between 1 per cent and 2.7 per cent of the adult population.^{5,10} It has been described as the second most common cause of vertigo,¹¹ the commonest cause of spontaneous vertigo and the most common neurological cause of vertigo.¹² In one study, vestibular migraine was diagnosed in 10.3 per cent of migraineurs in a neurology clinic.¹³

Vestibular migraine tends to have a higher prevalence in women and affects those of a younger average age compared to the typical patient who has had balance or dizziness problems in the previous 12 months. Age under 40 years, a history of head trauma, a history of anxiety or depression, and female sex are all associated with increased odds of having vestibular migraine. Hearing loss and cardiovascular disease were not associated with increased risk.¹⁰

There has recently been increasing awareness, interest and research into this unique condition. However, vestibular migraine as an entity continues to remain poorly recognised, diagnosed and managed, with diagnosis rates quoted to be as low as 1.8 per cent.¹⁴

Clinical features of vestibular migraine

Vestibular migraine is defined by discrete episodic attacks of vestibular symptoms lasting anywhere between 5 minutes up to 72 hours. The Bárány Society and International Headache Society diagnostic criteria⁶ (Table 1) fortunately provide a solid framework to aid in the diagnostic process.

Vestibular migraine can present with a relatively broad range of symptoms, although migraine headaches during an attack are not an obligatory feature. Migraine headaches occurred in less than 50 per cent of patients during an episode and tended to be less severe.^{12,15} Even when there are associated migraine headaches, there can be a temporal disassociation between the headache and vestibular symptoms.⁴ The condition can hence present a diagnostic challenge.

Patients may report a wide range of vestibular symptoms, leading to difficulty describing the attacks. Beh *et al.* reported that certain patients describe up to six different vestibular symptoms during an attack.¹⁵

Patients can present with both triggered and/or spontaneous attacks of vertigo. Triggered vertigo includes positional, head motion induced or visually induced attacks. It can be a common presenting symptom^{15,16} and can be mistaken for Benign Paroxysmal Positional Vertigo (BPPV). Positional testing, assessment of nystagmus and regular follow up are key to reducing diagnostic confusion. Spontaneous vertigo can be represented by any number of different vestibular symptoms, including spinning vertigo.¹⁵

Photophobia and phonophobia frequently occur during attacks and are part of the diagnostic criteria. Auditory symptoms including tinnitus and aural fullness can also occur during an attack and can persist interictally. Persistent and measurable hearing loss is possible but uncommon.^{12,15}

Assessment of vestibular migraine

Vestibular migraine is typical of an episodic vestibular syndrome, as defined by Newman-Toker and Edlow (2015) when introducing the acronym 'TitrATE', a diagnostic approach to aid clinicians when patients present with acute vertigo.¹⁷ The acronym stands for Timing (classifying dizziness into acute, episodic or chronic), Triggers (identifying any obvious triggers such as head position) and Targeted Exams (targeted neurological examination including eye movements). However, vestibular migraine can also present acutely, akin to an acute vestibular syndrome, when presenting for the first time. Table 2 outlines the main features and differences between the presentations of acute and episodic vestibular syndrome.

Detailed patient history and clinical examination are the cornerstone of the diagnostic process. The acronym 'SO STONED' is useful when taking a history from the vestibular patient, to define symptoms clearly.¹⁸ It covers key aspects of the history in a structured format, to aid the clinician in formulating an appropriate diagnosis. It stands for: Symptoms – the type and nature of symptoms; Often – the frequency of attacks; Since – how and when symptoms commenced; Trigger – any factors that provoke or exacerbate symptoms; Otology – any associated otological symptoms; Neurology – any associated neurological symptoms; Evolution – the progression of symptoms since onset; and Duration – how long symptoms last for, particularly if episodic.

Alongside history-taking, a detailed neuro-otological examination, including cranial nerve assessment, eye movements and positional testing, should be performed in all patients presenting with a history of vestibular symptoms, as outlined in Table 3. Additional examinations based on clinical indications are described in Table 4.

Table 1. Diagnostic criteria for vestibular migraine*

Criteria	Definite vestibular migraine	Probable vestibular migraine
A	≥5 episodes with vestibular symptoms of moderate or severe intensity, lasting 5 minutes to 72 hours	≥5 episodes with vestibular symptoms of moderate or severe intensity, lasting 5 minutes to 72 hours
B	Current or previous history of migraine with or without aura according to ICHD	Only 1 of criteria B & C for vestibular migraine is fulfilled (migraine history or migraine features during the episode)
C	≥50% of vestibular episodes should occur with ≥1 of following migraine features: 1. Headache with ≥2 of following characteristics: – 1-sided location – Pulsating quality – Moderate or severe pain intensity – Aggravation by routine physical activity 2. Photophobia & phonophobia 3. Visual aura	Not better accounted for by another vestibular or ICHD diagnosis
D	Not better accounted for by another vestibular or ICHD diagnosis	

*Criteria jointly formulated by the Committee for Classification of Vestibular Disorders of the Bárány Society and the Migraine Classification Subcommittee of the International Headache Society. ICHD = International Classification of Headache Disorders

Table 2. Vestibular symptoms can be broadly classified into two main groups on acute presentation

Acute vestibular syndrome	Episodic vestibular syndrome (EVS)
Acute-onset, persistent, continuous vestibular symptoms	Discrete episodic attacks of vestibular symptoms
Symptoms lasting ≥24 hours	Symptoms lasting seconds, minutes or several hours
Occasionally in conjunction with other features, including nausea, vomiting, gait instability, head motion intolerance & nystagmus	Triggered EVS – triggered by an action or event such as head movement or postural change
Can be post-exposure to head trauma, drugs etc., or spontaneous	Spontaneous EVS that occurs without any preceding triggers

Table 3. Standard neuro-otological examinations

Otосcopy
Pure tone audiometry & tympanometry; if unavailable, perform tuning fork test
Cranial nerve examination
Cover–uncover test for strabismus & latent nystagmus assessment
Eye movement examination
– Smooth pursuit
– Saccades
– Convergence
– Nystagmus assessment with & without visual fixation
Abbreviated cerebellar examination
– Finger-to-nose & heel-to-shin tests
– Tests for dysdiadochokinesia
– Tone
– Gait
– Romberg's test
– Tandem walking
Specialist tests
– Bedside (or video) Head Impulse Test
– Unterberger's stepping test
– Hallpike or Side-Lying manoeuvre for posterior canal BPPV assessment
– Supine roll test for horizontal canal BPPV assessment

BPPV = benign paroxysmal positional vertigo

Dual pathology can also be present, with identification of concurrent Ménière's disease in certain patients, as well as increased incidence of BPPV in migraine disorders.^{19–21}

The diagnosis of vestibular migraine should be based on symptom adherence to the current diagnostic criteria, with the caveat that symptoms cannot be accounted for by other similar conditions. However, it is prudent to note that there can be wide symptom overlap with other vestibular disorders, and these should be considered and appropriately investigated as indicated.

Investigations are hence an important part of the diagnostic process, and include magnetic resonance imaging of the head and internal acoustic meatus, to identify retrocochlear, cerebellar, pontine angle, brainstem and cerebellar pathology.

There can be significant symptomatic overlap between vestibular migraine and Ménière's disease, with no current definitive tests available to reliably differentiate between the two conditions. Audiometry is a key investigation to be considered in all patients presenting with vestibular symptoms.

Table 4. Additional examinations based on clinical indication

Fistula test	Observation of eyes for nystagmus with Frenzel goggles, whilst pressuring each ear canal using tragal pressure or tympanometry
Valsalva test	Observation of eyes for nystagmus with Frenzel goggles, whilst performing Valsalva manoeuvre
Timed Up & Go (TUAG) or dual-task TUAG	Sensitive & specific test for identifying risk of falls, particularly amongst older adults, or where there are multiple co-morbidities

It can be useful in differentiating vestibular migraine from Ménière's disease, particularly in the later stages, as diagnosis of Ménière's disease requires audiometric confirmation of unilateral hearing loss, whilst in vestibular migraine this is not an expected feature, or tends to be bilateral.²²

During acute vestibular migraine attacks, video Frenzel assessment or video-oculography can show pathological spontaneous or central positional nystagmus. This was identified in a study in up to 70 per cent of patients.¹⁶ Interictal nystagmus including positional nystagmus has also been noted in around 42 per cent of patients.^{15,23}

Vestibular function tests are useful to determine associated peripheral vestibular dysfunction. During the interictal period, caloric testing results were abnormal in up to 42 per cent of vestibular migraine patients in one study.²⁴ In the author's own experience, and as reported in a locally conducted unpublished study, up to 30 per cent of vestibular migraine patients had vestibular dysfunction on a battery of vestibular function tests. Abnormal vestibular function test results indicating semi-circular canal dysfunction were predictive of the requirement for prolonged medication treatment in vestibular migraine patients.²⁵ They are also a useful indicator for patients who may subsequently benefit from vestibular rehabilitation. However, it should be noted that abnormal vestibular function test findings are also found in Ménière's disease patients with comparative results, although some study findings were suggestive of greater abnormalities amongst this patient group.²⁶

Should there be any suspicion of Superior Semi-circular Canal Dehiscence (SSCD) in the patient history, high-resolution computed tomography scan of the temporal bones, cervical and/or ocular vestibular-evoked myogenic potentials testing should be considered.²⁷

The clinician should also be aware that the concurrent presentation of headaches and vestibular symptoms in the same patient, both prevalent conditions in the population, does not automatically equate to a diagnosis of vestibular migraine. Consideration of further referral to neurology services, for characterisation and treatment of alternate primary or secondary headache disorders, should be considered. Further information on different types of headaches can be found in the British Association for the Study of Headache guidelines.²⁸

Management of vestibular migraine

High-quality evidence on the management of vestibular migraine is distinctly lacking given the dearth of randomised, controlled trials. A recent systematic review and meta-analysis was only able to identify 13 studies with sufficient outcome measures to be included in their analysis.²⁹ Hence, management of vestibular migraine is currently based on expert opinion, case series, retrospective and observational studies. However, high-quality studies on migraine headaches can also be cross-referenced and cautiously applied to the management of vestibular migraine.

Individual acute vestibular migraine attacks can be treated symptomatically with prochlorperazine, up to 10 mg, either via oral or intramuscular routes. Prochlorperazine has been shown to be an effective treatment for acute migraine in randomised, controlled trials.³⁰ Its anti-vertiginous effect is an added advantage, proving to be of significant benefit in the vestibular migraine population. This class of drug should be used with caution in older adults and in those with pre-existing cardiovascular disease. Longer-term use should be

avoided because of sedation, vestibular sedative, and extra pyramidal side effects.

Triptans are a class of drug used as abortive treatment for migraine when taken at the outset. In a randomised case-control study, zolmitriptan was found to be effective in 38 per cent of vestibular migraine patients, as opposed to 22 per cent in the placebo group.³¹ Furman, Marcus and Balaban showed an improvement of vestibular-induced motion sickness in migraineurs with rizatriptan.³² These options can hence be trialled for the management of acute vestibular migraine attacks, and should be taken at the start of an attack or during any prodromal phase.

Should there be concurrent headache, this can be managed as per current migraine treatment guidelines, with high-dose non-steroidal anti-inflammatory drugs or aspirin, if there are no contraindications.

Vestibular migraine patients should be counselled on the importance of longer-term lifestyle modifications for improved symptom control. This includes regular sleep, aerobic exercise, stress management, regular meals, and maintaining a diary for the identification and avoidance of any obvious triggers such as caffeine. There is also evidence base for the use of certain supplements, which can be effective as migraine prophylaxis.³³

If episodic vertigo due to vestibular migraine is frequent and disabling, migraine prophylaxis treatment should be considered, as treating individual episodes is not an option. When to initiate migraine prophylaxis treatment in vestibular migraine patients has not been clearly defined. However, the American Headache Society consensus statement and guidelines for migraine headaches recommend consideration of prophylaxis when there is a significant impact on daily routines despite acute treatment, and when the frequency and severity of attacks is significant. Prophylaxis can be considered with even 2 severe headache days per month, when triptans are used for 10 or more days per month, or when non-steroidal anti-inflammatory drugs or analgesics are used for 15 or more days.³⁴ These recommendations can be cautiously applied to the vestibular migraine patient group when deciding on migraine prophylaxis.

Studies of migraine prophylaxis treatment in vestibular migraine cases continue to remain limited. The only randomised, controlled study to investigate migraine prophylaxis for vestibular migraine had to be terminated early, without any clear benefit of metoprolol over placebo.³⁵

Calcium channel blockers such as flunarizine³⁶ and cinnarizine^{37,38} have been shown to be effective prophylactic agents in the vestibular migraine population. As cinnarizine is also an antihistamine, it has the potential for vestibular sedation, and long-term use should be avoided.³⁹

British National Formulary treatment guidelines by the National Institute for Health and Care Excellence⁴⁰ recommend propranolol hydrochloride and other beta blockers as first-line preventative treatment in episodic and chronic migraine headaches. Topiramate can be considered if a beta blocker is unsuitable. Tricyclic antidepressants such as amitriptyline and nortriptyline have also been shown to be effective migraine prophylaxis agents, and can again be considered first-line agents. These guidelines can be applied with caution to the vestibular migraine population, as previous observational studies have found benefit.

A meta-analysis of 13 studies did examine all the above treatment options in the vestibular migraine population; whilst all treatments showed an improvement, no further conclusions could be drawn given the variability of studies and

symptoms.²⁹ A more recent comprehensive review of treatment options identified 23 studies, but, similarly, found it difficult to identify good quality studies and evidence; nevertheless, it did offer some sound practical advice.⁴¹

- Vestibular migraine is typified by episodic vestibular symptoms lasting 5 minutes to 72 hours
- Attacks can occur in the absence of migraine headaches
- Bárány Society criteria are a useful aid for diagnosis
- Audio-vestibular tests and imaging play an important role in diagnosis
- Management is holistic, including treatment of individual attacks as well as migraine prophylaxis

Venlafaxine, a serotonin and noradrenaline reuptake inhibitor, has been shown to be as effective as amitriptyline and propranolol in reducing vestibular migraine attacks, and can be useful in patients with a concurrent mood disorder.^{42,43}

All studies have shown a degree of heterogeneity in terms of effectiveness and tolerability of migraine prophylaxis agents. Migraine preventative drugs should be chosen according to the patient's needs, co-morbidities, medical history and side effect profile.^{33,41}

Once the decision has been made for migraine prophylaxis treatment, the American Academy of Family Physicians guidelines⁴⁴ recommend that therapy be commenced at the lowest effective dose, with up-titration every two to four weeks, considering and balancing the benefit to the side effect profile. Prophylaxis should be tried for at least three months at the maximum tolerated dosage prior to deciding on effectiveness. Therapy should be continued until there is at least 6–12 months of symptom control, prior to slow tapering and discontinuation.

The role of vestibular rehabilitation and exercises in the vestibular migraine population remains inconclusive. A recent review identified that, despite the improvements associated with vestibular rehabilitation and exercises shown in all the studies, the evidence remains unclear given the variable quality of studies.⁴⁵ In the author's own experience, vestibular rehabilitation can play a part when there is an associated peripheral vestibular disorder, and/or in cases where desensitisation is required for associated visual sensitivity and head motion intolerance.

Conclusion

Vestibular migraine is a distinct and now well recognised common diagnostic entity resulting in disabling episodic vestibular symptoms. Patients with vestibular migraine are commonly seen by the ENT team when they are referred acutely, or in out-patient clinic settings. Diagnosis rates continue to remain poor. However, fortunately, there are now clear and well-defined diagnostic criteria to facilitate improved recognition of the disorder. As vestibular migraine is a diagnosis of exclusion, with significant symptom overlap with other vestibular disorders, detailed clinical assessment and investigations, including audio-vestibular testing and imaging, are essential.

Vestibular migraine patients are commonly referred from ENT settings to audio-vestibular medicine or neurology services, for diagnosis and further management. Audio-vestibular medicine or specialist neurology services may not be available in the local area. Delays in diagnosis and commencement of treatment following referral commonly result in both physical and psychosocial co-morbidities. Hence, early provisional diagnosis, counselling and different treatment options can be very

effective in reducing subsequent morbidity; these should be considered in any ENT setting, even if referral is made to a more specialist dizziness clinic, neurologist or audio-vestibular physician.

Vestibular migraine treatment is multifaceted, involving the management of acute attacks, modifications to lifestyle including trigger management, consideration of migraine prophylaxis when attacks are frequent and disabling, as well as treatment and rehabilitation of associated vestibular conditions such as BPPV and peripheral vestibular disorders.

Recognition and treatment of co-morbid mood disorders is also a crucial aspect in the holistic management of vestibular migraine patients. The wider multidisciplinary team, including those from psychology, physiotherapy and audiology services, all have important roles to play in best practice management.

Competing interests. None declared

References

- 1 Liveing E. *On Megrin, Sick-Headache and Some Allied Health Disorders: A Contribution to the Pathology of Nerve Storms*. London: Churchill, 1873;129–48
- 2 Kuritzky A, Ziegler DK, Hassanein R. Vertigo, motion sickness and migraine. *Headache* 1981;**21**:227–31
- 3 Kayan A, Hood JD. Neuro-otological manifestations of migraine. *Brain* 1984;**107**:1123–42
- 4 Neuhauser H, Leopold M, von Brevern M, Arnold G, Lempert T. The interrelations of migraine, vertigo, and migrainous vertigo. *Neurology* 2001;**56**:436–41
- 5 Neuhauser HK, Radtke A, von Brevern M, Feldmann M, Lezius F, Ziese T *et al*. Migrainous vertigo: prevalence and impact on quality of life. *Neurology* 2006;**67**:1028–33
- 6 Lempert T, Olesen J, Furman J, Waterston J, Seemungal B, Carey J *et al*. Vestibular migraine: diagnostic criteria. *J Vestib Res* 2012;**22**:167–72
- 7 Bisdorff A, Von Brevern M, Lempert T, Newman-Toker DE. Classification of vestibular symptoms: towards an international classification of vestibular disorders. *J Vestib Res* 2009;**19**:1–13
- 8 Agrup C, Gleeson M, Rudge P. The inner ear and the neurologist. *J Neurol Neurosurg Psychiatry* 2007;**78**:114–22
- 9 Bécarea Martínez C, Arroyo Domingo MM, López Llamas A, Marco Algarra J, Morales Suárez-Varela MM. Vertigo and dizziness in hospital: attendance, flow and characteristics of patients. *Acta Otorrinolaringol Esp (Engl Ed)* 2018;**69**:219–25
- 10 Formeister EJ, Rizk HG, Kohn MA, Sharon JD. The epidemiology of vestibular migraine: a population-based survey study. *Otol Neurotol* 2018;**39**:1037–44
- 11 Bisdorff AR. Management of vestibular migraine. *Ther Adv Neurol Disord* 2011;**4**:183–91
- 12 Dieterich M, Obermann M, Celebisoy N. Vestibular migraine: the most frequent entity of episodic vertigo. *J Neurol* 2016;**263**:S82–9
- 13 Cho SJ, Kim BK, Kim BS, Kim JM, Kim SK, Moon HS *et al*. Vestibular migraine in multicenter neurology clinics according to the appendix criteria in the third beta edition of the International Classification of Headache Disorders. *Cephalalgia* 2016;**36**:454–62
- 14 Geser R, Straumann D. Referral and final diagnoses of patients assessed in an academic vertigo center. *Front Neurol* 2012;**3**:169
- 15 Beh SC, Masrour S, Smith SV, Friedman DI. The spectrum of vestibular migraine: clinical features, triggers, and examination findings. *Headache* 2019;**59**:727–40
- 16 von Brevern M, Zeise D, Neuhauser H, Clarke AH, Lempert T. Acute migrainous vertigo: clinical and oculographic findings. *Brain* 2005;**128**:365–74
- 17 Newman-Toker DE, Edlow JA. TiTrATE: a novel, evidence-based approach to diagnosing acute dizziness and vertigo. *Neurol Clin* 2015;**33**:577–99
- 18 Wuyts FL, Van Rompaey V, Maes LK. 'SO STONED': common sense approach of the dizzy patient. *Front Surg* 2016;**3**:32
- 19 Liu YF, Xu H. The intimate relationship between vestibular migraine and Meniere disease: a review of pathogenesis and presentation. *Behav Neurol* 2016;**2016**:3182735
- 20 Murofushi T, Tsubota M, Kitao K, Yoshimura E. Simultaneous presentation of definite vestibular migraine and definite Ménière's disease: overlapping syndrome of two diseases. *Front Neurol* 2018;**9**:749
- 21 Chu CH, Liu CJ, Lin LY, Chen TJ, Wang SJ. Migraine is associated with an increased risk for benign paroxysmal positional vertigo: a nationwide population-based study. *J Headache Pain* 2015;**16**:62
- 22 Lopez-Escamez JA, Carey J, Chung WH, Goebel JA, Magnusson M, Mandalà M *et al*. Diagnostic criteria for Meniere's disease. *J Vestib Res* 2015;**25**:1–7
- 23 Radtke A, von Brevern M, Neuhauser H, Hottenrott T, Lempert T. Vestibular migraine: long-term follow-up of clinical symptoms and vestibulo-cochlear findings. *Neurology* 2012;**79**:1607–14
- 24 Yoo MH, Kim SH, Lee JY, Yang CJ, Lee HS, Park HJ. Results of video head impulse and caloric tests in 36 patients with vestibular migraine and 23 patients with vestibular neuritis: a preliminary report. *Clin Otolaryngol* 2016;**41**:813–17
- 25 Kang WS, Lee SH, Yang CJ, Ahn JH, Chung JW, Park HJ. Vestibular function tests for vestibular migraine: clinical implication of video head impulse and caloric tests. *Front Neurol* 2016;**7**:166
- 26 Tabet P, Saliba I. Meniere's disease and vestibular migraine: updates and review of the literature. *J Clin Med Res* 2017;**9**:733–44
- 27 Bi WL, Brewster R, Poe D, Vernick D, Lee DJ, Eduardo Corrales C *et al*. Superior semicircular canal dehiscence syndrome. *J Neurosurg* 2017;**127**:1268–76
- 28 Ahmed F, Bahra A, Tyagi A, Weatherby S. *BASH National Headache Management System for Adults, 2019*. Hull: British Association for the Study of Headache, 2019
- 29 Byun YJ, Levy DA, Nguyen SA, Brennan E, Rizk HG. Treatment of vestibular migraine: a systematic review and meta-analysis. *Laryngoscope* 2021;**131**:186–94
- 30 Friedman BW, Esses D, Solorzano C, Dua N, Greenwald P, Radulescu R *et al*. A randomized controlled trial of prochlorperazine versus metoclopramide for treatment of acute migraine. *Ann Emerg Med* 2008;**52**:399–406
- 31 Neuhauser H, Radtke A, von Brevern M, Lempert T. Zolmitriptan for treatment of migrainous vertigo: a pilot randomized placebo-controlled trial. *Neurology* 2003;**60**:882–3
- 32 Furman JM, Marcus DA, Balaban CD. Rizatriptan reduces vestibular-induced motion sickness in migraineurs. *J Headache Pain* 2011;**12**:81–8
- 33 Beh SC. Vestibular migraine: how to sort it out and what to do about it. *J Neuroophthalmol* 2019;**39**:208–19
- 34 Ailani J, Burch RC, Robbins MS; Board of Directors of the American Headache Society. The American Headache Society Consensus Statement: update on integrating new migraine treatments into clinical practice. *Headache* 2021;**61**:1021–39
- 35 Bayer O, Adrion C, Al Tawil A, Mansmann U, Strupp M; PROVEMIG investigators. Results and lessons learnt from a randomized controlled trial: prophylactic treatment of vestibular migraine with metoprolol (PROVEMIG). *Trials* 2019;**20**:813
- 36 Rashid SMU, Sumaria S, Koochi N, Arshad Q, Kaski D. Patient experience of flunarizine for vestibular migraine: single centre observational study. *Brain Sci* 2022;**12**:415
- 37 Taghdiri F, Togha M, Razeghi Jahromi S, Refaiean F. Cinnarizine for the prophylaxis of migraine associated vertigo: a retrospective study. *Springerplus* 2014;**3**:231
- 38 El-Badry MM, Samy H, Kabel AM, Rafat FM, Sanyelbhaa H. Clinical criteria of positional vertical nystagmus in vestibular migraine. *Acta Otolaryngol* 2017;**137**:720–2
- 39 Towse G. Cinnarizine – a labyrinthine sedative. *J Laryngol Otol* 1980;**94**:1009–15
- 40 National Institute for Health and Care Excellence. Migraine [Treatment summaries. In: <https://bnf.nice.org.uk/treatment-summaries/migraine> [22 December 2023]
- 41 Smyth D, Britton Z, Murdin L, Arshad Q, Kaski D. Vestibular migraine treatment: a comprehensive practical review. *Brain* 2022;**145**:3741–54
- 42 Hedayat M, Nazarbaghi S, Heidari M, Sharifi H. Venlafaxine can reduce the migraine attacks as well as amitriptyline: a noninferiority randomized trial. *Clin Neurol Neurosurg* 2022;**214**:107151
- 43 Salviz M, Yuce T, Acar H, Karatas A, Acikalin RM. Propranolol and venlafaxine for vestibular migraine prophylaxis: a randomized controlled trial. *Laryngoscope* 2016;**126**:169–74
- 44 Ha H, Gonzalez A. Migraine headache prophylaxis. *Am Fam Physician* 2019;**99**:17–24
- 45 Alghadir AH, Anwer S. Effects of vestibular rehabilitation in the management of a vestibular migraine: a review. *Front Neurol* 2018;**9**:440