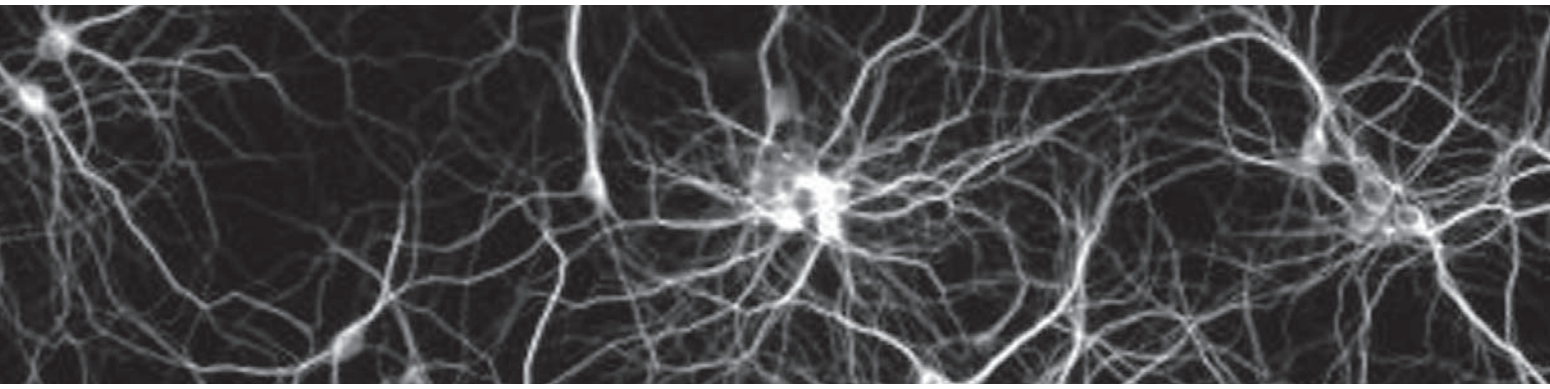

Vestibular migraine considering new diagnostic criteria

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ABSTRACT − Vestibular migraine is one of the causes of spontaneous vertigo. Around 50 to 60 percent of migraine patients experience vertigo following a migraine attack, and in about half of the patients vertigo occurs unrelated to the headache. It is clinically manifested as a rotatory, positioning, visually- or head-movement-related vertigo. In more than 60% of cases, photo- or phonophobia occurs. Changes in electronystagmography/videonystagmography results are more common in patients with migraine than in the rest of the population, but very different and unspecific. Although accepted, the lack of universally acclaimed definition of vestibular migraine prevented clinicians and researchers to recognize it more often. In July 2012, the Bárány Society's Committee for Classification of Vestibular Disorders and Subcommittee for the Classifications of Migraine of the International Society for Headaches have co-published diagnostic criteria for vestibular migraine and probable vestibular migraine as part of the project in the classification of otoneurologic disorders. Diagnosis of vestibular migraine is based on the presence of different forms of vertigo with moderate or severe intensity, which occur often and last between 5 minutes and 72 hours, as well as on the history of migraine and exclusion of other causes of vestibular symptoms. For the first time, we are in possession of proposed criteria for the diagnosis of vestibular migraine, which will facilitate the diagnosis of this common but insufficiently diagnosed vertiginous entity.

Key words: migraine, episodic recurrent vertigo, vestibular migraine, diagnostic criteria

INTRODUCTION

The association between migraine and vestibular sense has been known since 1861, when Prosper Ménière described Ménière's syndrome in patients with migraine (1). Later, other authors also observed correlation of symptoms such as tinnitus, hearing loss and vertigo with migraine. When described, vertiginous spells that occur during mi-

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graine headaches or related to them, during a peaceful period, are called vestibular migraine (VM), migraine vertigo (MV), migraine related vertigo (MRV), and it is supposed that benign vertigo related to the position that occurs during childhood is also a form of this entity. It is the most common cause of vertigo occurring spontaneously, and according to some authors, the second most common cause of vertigo in general (2-4). Until recently, vertigo related to migraine was, similar to benign paroxysmal positional vertigo (BPPV), rarely diagnosed and frequently neglected by the clinicians. In recent years, the awareness of this phenomenon has increased significantly due to the scientific work of many authors, both worldwide and in Croatia (5-7).

ETIOPATHOGENESIS

Taking into account empirical and epidemiological arguments in favor of the existence of a common etiopathogenesis of migraine and VM (8), as well as abnormalities found in vestibular experiments during and between vertiginous episodes (9), various hypotheses have been proposed for VM, and all come from the presumed pathophysiological mechanism of migraine.

In spite of the general hypothesis on the origin of VM, which is no longer considered to be valid, and nowadays it is considered to be a primary brain disorder (10), the theory of the specific internal auditory artery vasospasm still remains a potential explanation for the peripheral vestibular and auditory symptoms of migraine (11), similar to the retinal vasospasm observed in retinal migraine (12).

Another hypothesis seeking to explain the pathophysiology of VM presents migraine aura as a probable clinical equivalent to cortical spreading depression, while vertigo is the most common manifestation of basilar migraine aura (13,14).

The development of molecular techniques has led to the new momentum in the theories on different molecular channelopathies, so neither ion channels defect should be left out as a potential contributing factor in the development of VM. The concept of ion channel disorder is particularly interesting for VM, since different mutations in the CACNA1A gene that encodes a transmembrane component of the neuronal calcium channel can provoke family hemiplegic migraine or episodic attacks of ataxia type 2 (15). In addition to calcium metabolism, potassium also has a potential role in the development of VM. Namely, a mutation in the KCNA1 gene is a common finding in family episodic ataxia syndrome, which can be presented as recurrent vertigo with migraine (16). However, analysis of patients with familial migraine with vertigo excluded mutation in the CACNA1A gene in some patients (17), leaving the question of the role of ion channel mutations in the pathophysiology of VM open.

Finally, one of the latest hypotheses when considering the pathophysiology of VM is activation of the specific neural structures. Functional positron-emission tomography images during acute migraine attack identified activation of the brain stem regions in projection of the coeruleus and dorsal raphe nucleus, suggesting that these structures are involved in the induction of migraine attacks (18). Since vestibular nuclei receive noradrenergic projections from the locus coeruleus (19) and serotonergic input from the dorsal raphe nucleus (20), it is possible that activation of these structures during migraine attacks also affects the central vestibular processing (21). Observation of eye movements during and between VM attacks suggests primarily the existence of central vestibular disorders, but the possibility of a peripheral vestibular cause is not completely excluded either (22).

In conclusion, our review of current literature suggests that VM is a heterogeneous vestibular disorder, in the onset and progression of which different pathophysiological mechanisms are involved.

EPIDEMIOLOGY

Migraine is a widely spread disease, as evidenced by a comprehensive recently published survey including revision of 19 previous studies dealing with migraine in adults according to the International Classification of Headache Disorders II (ICHD-II) criteria. According to the results, the annual prevalence of migraine is 11.5%, probable migraine 7%, while their combined annual prevalence is 18.5% (23). Mostly women of reproductive age are affected (2-3 times more often than men) (24). In Germany, according to Neuhauser *et al.* and Neuhauser, the annual prevalence of vertigo in general population is 4.9% and of vestibular migraine 0.89% (25,26). Results of the survey conducted in Croatia have shown the annual prevalence of migraine with and without aura to be 7.5% and of probable migraine 11.3%. Joint annual prevalence of migraine and probable migraine is 13.0% and is higher in the inland part of Croatia than in coastal Croatia (27). Vertigo was by far more com-

mon in patients with migraine than in the control group of patients with tension headaches or those without headache (28). Nevertheless, the association of these two entities is still so intertwined and controversial, and the clinical manifestations are so varied that some authors speak of "a chameleon among episodic vertiginous syndromes" (29).

CLINICAL SYMPTOMS

There are a large variety of typical symptoms, which patients themselves are often not aware of. They can occur in various forms, e.g., as spontaneous rotatory (subjective or objective) vertigo or positional vertigo, as visually-induced vertigo (caused by movement of large and complex visual stimuli), as head motion-induced dizziness (taking place subsequent to the motion of the head and accompanied by nausea and loss of spatial orientation), as well as blurriness, instability, and instability while standing or walking. With a well-taken history data, one can easily distinguish between vertigo as a vestibular and dizziness as a non-vestibular phenomenon (30). The only form of non-vestibular symptoms related to VM is head motion-induced dizziness with nausea. It occurs spontaneously, periodically, and usually lasts between several minutes and several hours, but sometimes it can be measured in seconds or days. According to the results, 32% to 63% of patients with migraine have an accompanying vertigo, which in 45% of cases occurs regardless of headache (31,32). Migraine attacks occurred as vertigo in over 60% of cases, followed by photo- or phonophobia, as well as aura in some patients.

Changes in electronystagmography/videonystagmography (ENG/VNG) reports are more common in migraine patients than in healthy population, but are rather diverse and nonspecific (33).

DIAGNOSIS

There is no single pathognomonic test which can help in setting the correct diagnosis of VM. A detailed medical history is critical as in other types of vertigo (34,35). It is essential to write a diary of headache, recording all of its characteristics for at least three months. It is important to be familiar with the International Headache Society (IHS) criteria for the diagnosis of headache, which determine the type of headache very accurately (36). The findings of otoneurologic examination are normal in most cases, but sometimes in acute vertigo a spontaneous or positional, horizontal, rotatory and vertical type of nystagmus can be observed (37). Dix-Hallpike test can sometimes yield subjectively but not objectively positive results. Vestibular tests are only used to exclude other causes of vertigo. Although very varied and nonspecific, vestibular laboratory test abnormalities in patients with VM in the periods between attacks are twice as likely as in patients suffering from migraines (38).

One of the recent clinical studies indicates abnormal results in at least one of the three laboratory tests carried out in 66% of VM patients, mostly after performing the head shaking test (HST) (39). This is understandable given that these patients are very sensitive to movement, and it is characteristic that most of them (about 70%) experienced an illusion of the surrounding moving around them or themselves moving through the surrounding. Definitive diagnosis can only be set in the case of migraine with aura or vertigo that occurs simultaneously with headaches. Definitive diagnosis is often made by exclusion of other possible causes of vertigo or *ex juvantibus*, according to a positive response to antimigrainous therapy.

In July 2012, The Bárány Society Committee for Classification of Vestibular Disorders and the International Society for Headaches Subcommittee for the Classification of Migraine published diagnostic criteria for VM and probable VM jointly, as part of a larger project of otoneurologic disorders classification. The diagnosis of VM is based on the presence of various forms of vestibular symptoms with moderate or severe intensity that appear frequently and last between 5 minutes and 72 hours; the history of migraine; and exclusion of other possible causes of vestibular symptoms (40). These criteria have been incorporated in the 3rd edition of the ICHD-III, published in 2013, i.e. in an annex concerning new disorders necessitating more studies. Precisely defined, the criteria that must be met for the diagnosis of VM and probable VM are as follows:

VESTIBULAR MIGRAINE

A) At least five episodes of migraine with vestibular symptoms[1] of moderate or severe intensity[2] lasting between 5 minutes and 72 hours[3]

[1] Vestibular symptoms qualified for the diagnosis of vestibular migraine include:
- spontaneous vertigo, which includes:
  1) "subjective vertigo", an illusion of spontaneous moving through the visual surrounding, and
  2) "objective vertigo", an illusion of visual surrounding spinning or flowing

B) Current or previous history of migraine with or without aura according to ICHD[4]

C) In over 50% of vestibular episodes[5] one or more features of migraine are found:

– headache with at least two of the following features: one-sided, pulsating, moderate or severe pain, pain amplification in normal physical exertion

– photophobia and phonophobia[6]

– visual aura[7]

D) Without better explanation within other vestibular or ICHD diagnoses[8]

PROBABLE VESTIBULAR MIGRAINE

A) At least five episodes of migraine with vestibular symptoms of moderate or severe intensity lasting between 5 minutes and 72 hours

B) One of the criteria B or C for vestibular migraine

C) Without better explanation within other vestibular or ICHC diagnoses

Along with everything else, migraine attacks can be triggered by vestibular stimulation. Thus, the differential diagnosis should include other vestibular disorders further complicated by the added migraine.

DIFFERENTIAL DIAGNOSIS

The largest differential diagnostic problem is Ménière's disease or *Morbus Ménière* (MM), with a similar duration as VM, but never lasting longer than 48 hours, which is often the case with VM. In addition, MM is generally accompanied by characteristic symptoms of progressive unilateral hearing loss (mostly in lower frequencies). Hearing impairment with VM is rare and less significant, occurs mostly bilaterally and worsens over time.

The ENG/VNG findings in both diseases show unilateral labyrinth lesion, which is present in every MM case to a lesser or greater extent, while in VM it occurs in only 20%-25% of cases. VM is often (25%) accompanied by positive positional test, as well as by nystagmus finding within different searches. Tinnitus is very strong in MM, either unilaterally or bilaterally, while in VM it has lower intensity, in case it ever occurs. Photophobia is a symptom that often occurs in connection with VM and never with MM.

Finally, it should be noted that these two diseases can coexist (41,42). In this case, MM should be treated by all principles of its treatment. Concerning MM, in terms of differential diagnosis, one should always think of the possible BPPV (because a significant portion (25%) of VM patients had positive Dix-Hallpike test), as well as vestibular neuronitis, perilymphatic fistula and transient is-

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- positional vertigo that occurs after a change in head position
- visually induced vertigo launched by complex or significant visual stimuli
- vertigo due to head motion that occurs during movement of the head
- dizziness caused by head motion, accompanied by nausea and a feeling of impaired spatial orientation.

[2] Severe vestibular symptoms are those that interfere with daily activities to the extent that they cannot be continued, and moderate symptoms interfere with daily activities, but to the extent that they can be resumed.

[3] The length of these episodes varies: about 30% of patients have episodes lasting for several minutes, 30% have migraine attacks that last for hours, and 30% have migraine attacks lasting for several days. The remaining 10% have attacks that last for seconds and occur repeatedly during head movements, visual stimulation, or after change in head position. In these patients, the length of the episode is defined as the total period during which these brief attacks last. At the other end of the spectrum are patients who need four weeks to recover from one episode, although the main episode rarely exceeds 72 hours.

[4] Mygraine types 1.1 and 1.2 according to ICHD.

[5] One symptom is enough during a single episode. Different symptoms may occur during various episodes. Related symptoms may occur before, during or after vestibular symptoms.

[6] Phonophobia is defined as a discomfort caused by sound. It is a temporary bilateral phenomenon and must be distinguished from the recruitment, which is unilateral and durable. Recruitment means the occurrence of heightened perception, often distortion of loud sounds in the ear with a significant hearing impairment.

[7] Visual auras are characterized by bright scintillating lights or zigzag lines, often with an outburst that interferes with reading. They typically intensify in 5-20 minutes and last less than 60 minutes. They are often, but not always limited to one hemisphere. Other forms of migraine aura, or somatosensory or dysphasic aura, are not included in the diagnostic criteria because their phenomenology is less specific, and most patients also have visual auras.

[8] Medical history and otoneurologic review do not suggest a different vestibular disorder, or such a disorder is taken into account, but was rejected after an appropriate search, or such a disorder exists as a comorbid or independent case, but the episodes can be easily distinguished from one another.

chemic attack. Also, BPPV that occurs during childhood and adolescence, according to several authors, is closely associated with VM in later life (43-45).

A much larger differential diagnostic problem may arise in case of basilar migraine (in ICHD-III, migraine with brain stem aura) (36), sometimes accompanied by hearing impairment similar to that in MM. However, the hearing damage does not deteriorate over time, and the disease is usually accompanied by many neurologic symptoms, i.e. ataxia, dysarthria, visual disturbances such as diplopia and visual symptoms like spots or flashes, simultaneously in both temporal and nasal fields of both eyes, bilateral paresthesias and reduction and/or complete loss of consciousness.

TREATMENT

There is still no specific cure for VM, so the treatment actually comes down to common migraine treatment, a disease in its surface. More precisely, it corresponds to the treatment of migraine with aura (4).

BEHAVIOR THERAPY

Behavior therapy advocates avoiding certain foods and beverages, as well as changes in lifestyle and habits. It is recommended not to eat chocolate, carob, monosodium glutamate (found in fast food, Chinese food, soy sauce, yeast, some soups and salad dressings), aged cheeses (Colby, Roquefort, Brie, Gruyere, Cheddar, Bleu, Mozzarella, Parmesan, Boursault, Romano), aspartame, red wine, sherry, scotch and bourbon. It is desirable to give up caffeine and taking unnecessary painkillers (which causes rebound phenomenon), to regulate menstrual cycle and sleep, and to avoid stress.

PHARMACOTHERAPY

The treatment of VM is primarily prophylactic because the treatment of a migraine attack itself does not show satisfactory results. Many nonspecific drugs have been used in migraine prevention with varying degrees of success. Preventive migraine treatment should be initiated if the patient has more than 3 migraine attacks a month, which last longer than 48 hours, or when acute therapy is not effective or is contraindicated. In the case of VM, prophylaxis should be performed in all patients because the disease is often not synchronous with headache, while calm periods without headaches but with episodes of vertigo can sometimes last for years.

According to the latest recommendations of the European Federation of Neurological Societies (EFNS), first-line drugs for migraine prevention and VM therapy are β-blockers (propranolol, metoprolol), the calcium channel blocker flunarizine, and the anticonvulsants topiramate and valproic acid.

As second-line therapy, they classify the tricyclic antidepressant amitriptyline, nonsteroidal anti-inflammatory drug naproxen, root extract of the plant *Petasites hybridus* (common butterbur) in high doses, and the β-blocker bisoprolol (46).

In relation to the EFNS, the latest American Academy of Neurology and American Headache Society's guidelines, based on several important clinical studies (47), also recommend *Petasites hybridus* as Level A (48,49).

Guidelines of the Canadian Headache Society partly coincide with those guidelines, but they also recommend the tricyclic antidepressant amitriptyline, mineral magnesium and vitamin riboflavin (B2), as the clinical studies confirm their efficacy (50).

Recommendations of the Croatian Society for Neurovascular Disorders, Croatian Medical Association, from 2012 are generally consistent with the relevant European and international guidelines. As the first group of drugs in the prevention of migraines, there are tricyclic antidepressant amitriptyline, serotonin antagonists pizotifen and dihydroergotamine and antiepileptic gabapentin. Monotherapy or a combination of β-blockers and tricyclic antidepressants is recommended (51,52).

Treatment should be strictly individual considering the particularities of each individual patient, the side effects of certain medications, other diseases of which the patient is suffering, and the availability as well as the cost of the drug. The selected drug should be prescribed by introducing it through the lowest effective doses, which are then gradually increased and given over a period of at least three months to show its full effect. Patient should be warned that the drug will have its full effect only after a period of at least 6 weeks. If the drug is successful, the patient should continue taking it for a year.

VESTIBULAR REHABILITATION

When it comes to the application of vestibular rehabilitation, opinions are divided as in the case of

VM there is an unstable deficiency of one or both labyrinths. In such cases, central nervous system cannot decide and recognize which of the deficits to compensate since they are very fast and constantly changing. Vestibular rehabilitation has proved useful in uncommon VM, if quiet periods between attacks last for at least several weeks. In this case, treatment should be intensive and repeated after each subsequent attack (53). Some authors even claim that vestibular rehabilitation should only be used in cases of complications such as loss of patient's confidence in his/her own balance and visual dependence (54).

CONCLUSION

Although awareness of a significant proportion of VM among the causes of vertigo has been present for years, clear and generally accepted criteria for diagnosis have not been made until now. Today, we have proposed criteria for the diagnosis of VM, which greatly facilitate the diagnosis of this common, but unfortunately, underdiagnosed vertiginous entity. Further development of diagnostic criteria as well as nomenclature and classification of vertigo is necessary because they have been noted and shown in many different ways, which creates significant difficulties for researchers attempting a comparative analysis.

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Vestibularna migrena u svjetlu novih dijagnostičkih kriterija

SAŽETAK – Vestibularna migrena je jedan od uzroka spontano nastalih vrtoglavica. Javlja se kod 50 %-60 % bolesnika s migrenom, a kod oko polovine njih vrtoglavica se javlja nevezano uz napadaj glavobolje. Klinički se manifestira kao kružna, položavajuća, vidno ili pokretima glave potaknuta vrtoglavica. U preko 60 % slučajeva praćena je foto- ili fonofobijom. Promjene u elektronistagmografskom i ostalim laboratorijskim nalazima češće su kod bolesnika s migrenom nego kod ostale populacije, ali dosta raznolike i nespecifične. Usprkos priznatosti, manjak univerzalno prihvaćene definicije vestibularne migrene onemogućava kliničare i istraživače u češćem prepoznavanju. U srpnju 2012. godine Odbor za klasifikaciju vestibularnih poremećaja Bárányjeva društva i Pododbor za klasifikaciju migrena Međunarodnoga društva za glavobolje zajednički su objavili dijagnostičke kriterije za vestibularnu migrenu i vjerojatnu vestibularnu migrenu kao dio većega poduhvata za klasifikaciju otoneuroloških poremećaja. Dijagnoza vestibularne migrene temeljena je na prisutnosti različitih oblika vrtoglavice umjerenoga ili jakog intenziteta koji se učestalo pojavljuju, u trajanju između 5 minuta i 72 sata, anamnestičkim podatcima o migreni i isključenju ostalih uzroka vestibularnih simptoma. Prvi put posjedujemo kriterije za dijagnozu vestibularne migrene, što će uvelike olakšati dijagnostiku toga ne tako rijetkog, ali nažalost nedovoljno dijagnosticiranoga uzroka vrtoglavice.

Ključne riječi: migrena, epizodična povratna vrtoglavica, vestibularna migrena, dijagnostički kriteriji