

Epidemiological evidence for a link between vertigo and migraine

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Abstract. Both migraine and dizziness/vertigo rank among the most common complaints in the general population. Worldwide, the lifetime prevalence of migraine is about 14%. Approximately 20% to 30% of the general population are affected by dizziness and vertigo.

Given the high prevalence of vertigo and migraine in the general population it is not surprising that many patients suffer from both symptoms. Nonetheless, in the last decade epidemiological arguments have progressively accumulated to strengthen the hypothesis that vertigo is linked to migraine beyond a mere chance concurrence. Several studies with selected patient groups have shown that the prevalence of vertigo is increased in patients with migraine. Vice versa, patients presenting to a dizziness clinic have a history of migraine more often than would be expected by chance. The epidemiological link between vertigo and migraine has recently been confirmed on the population level.

The relation between vertigo and migraine is intricate. In vestibular migraine, vertigo is conceptualized as a vestibular symptom caused by migraine. Vestibular migraine is the most common cause for recurrent spontaneous vertigo with a lifetime-prevalence in the general population of about 1%. Other vestibular disorders that display an increased prevalence of migraine are benign paroxysmal positional vertigo and Menière's disease. Furthermore, migraine is associated with motion sickness, rare ataxia disorders and psychiatric syndromes that can also manifest with vertigo and dizziness.

Keywords: Migraine, vestibular, vertigo, dizziness

1. Introduction

The clinical association between vestibular symptoms and migraine has gained increasing recognition during the last two decades. However, the interrelations between vertigo and migraine are complex. First, both migraine and vertigo are common complaints in the general population and may coexist in a patient just by coincidence. Second, some vertigo syndromes have been shown to be epidemiologically associated

with migraine. According to our current understanding, these disorders are linked to but not caused by migraine: Menière's disease, benign paroxysmal positional vertigo, motion sickness, rare cerebellar disorders and several psychiatric syndromes which may manifest with vertigo and dizziness. Finally, there is vestibular migraine that is conceptualized as episodic vertigo as a manifestation of migraine. In specialized dizziness clinics, vestibular migraine is one of the most common causes of recurrent vertigo, ranking before Menière's disease [7,39].

Thus far, our understanding of vestibular migraine is based on clinical and epidemiological observations, whereas the pathophysiology remains speculative. This article presents the epidemiological evidence for the

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Table 1
Diagnostic criteria for migraine [1]

A.	At least 5 attacks fulfilling criteria B-D
B.	Headache attacks lasting 4–72 hours
C.	Headache has at least two of the following characteristics: <ol style="list-style-type: none"> 1. unilateral location 2. pulsating quality 3. moderate or severe pain intensity 4. aggravation by or causing avoidance of routine physical activity
D.	During headache at least one of the following: <ol style="list-style-type: none"> 1. nausea and/or vomiting 2. photophobia and phonophobia
E.	Not attributed to another disorder

link between migraine and vertigo and for the concept of vestibular migraine in particular.

2. Epidemiology of migraine

Migraine is a primary headache disorder that is thought to be due to a central neuronal hyperexcitability with a strong, but complex genetic component [14]. Diagnostic criteria for migraine are defined by the International Classification of Headache Disorders (Table 1).

Numerous population-based studies have shown that the lifetime prevalence of migraine is largely consistent across industrialized countries ranging from 13% to 16% [8,18,35]. Women are affected two to three times more often than men and the age of onset peaks in the second decade of life.

3. Epidemiology of vertigo

Dizziness and vertigo [6] affect approximately 20% to 30% of the general population [2,23,31,57]. The epidemiology of vestibular vertigo was examined only recently. A large cross-sectional study yielded a lifetime prevalence of dizziness/vertigo and vestibular vertigo of 36.2% and 10% respectively in an older Australian population with 3654 participants aged ≥ 49 years [21]. A recent study on the epidemiology of vestibular vertigo representative for the general adult population in Germany used a two-stage approach [42]. The first step was a screening of a sample of the general population for moderate or severe dizziness or vertigo (German National Health Interview Survey 2003, $n = 4,869$), followed by detailed validated neurotologic interviews aimed to differentiate non-vestibular dizziness from vestibular vertigo and to classify underlying dis-

orders ($n = 1003$). The lifetime prevalence of vertigo in adults aged 18–79 years was 7.4%, the one-year prevalence was 4.9% and the one-year incidence was 1.4%. Vertigo was recurrent in most cases (88%). The survey also showed that similar to migraine, vertigo has a strong female preponderance (1-year prevalence ratio male to female 1:2.7).

4. Diagnostic criteria for vestibular migraine

Like migraine itself, vestibular migraine cannot be diagnosed by specific diagnostic markers but only on the basis of history. To date, there are no diagnostic criteria approved by medical societies for vestibular migraine. Confusingly, various terms including benign recurrent vertigo, migraine-associated dizziness, migraine-associated vertigo, migraine-related vestibulopathy, migrainous vertigo and vestibular migraine have been applied to roughly the same patient population.

According to proposed definitions, the diagnosis of vestibular migraine requires recognition of migraine according to universally accepted diagnostic criteria (Table 1). However, the current International Classification of Headache Disorders (ICHD) of the International Headache Society (IHS) does not include vertigo as a migrainous symptom in adults, except in the framework of basilar-type migraine [1]. More than 60% of patients with basilar-type migraine have vertigo as an aura symptom [51]. However, for a diagnosis of basilar-type migraine, the ICHD requires at least two aura symptoms originating from the brainstem or both hemispheres simultaneously and lasting between 5 and 60 minutes, followed by a migraine headache. Less than 10% of patients with vestibular migraine fulfill these criteria [11,16,39]. Furthermore, most adult patients with vestibular migraine cannot be classified as migraine with aura because (i) isolated vertigo is not recognized as an aura in the ICHD and (ii) in most patients with vestibular migraine the duration of vestibular symptoms is not compatible with the time frame of a migraine aura.

A preliminary classification, using operational clinical criteria modeled on the ICHD, proposed two separate diagnostic categories [39]: *definite*, and *probable* vestibular migraine (Table 2). In a follow-up study, these diagnostic criteria have proven a high validity [46]. Furman et al. developed a diagnostic interview applying these criteria [20]. Currently, the Classification Committee of the Barany-Society develops diag-

Table 2
Diagnostic criteria for vestibular migraine [39]

Definite vestibular migraine	
A.	Episodic vestibular symptoms ¹ of at least moderate severity
B.	Current or previous history of migraine according to the IHS [1]
C.	One of the following migrainous symptoms during ≥ 2 attacks of vertigo: migrainous headache, photophobia, phonophobia, visual or other auras
D.	Other causes ruled out by appropriate investigations
Probable vestibular migraine	
A.	Episodic vestibular symptoms ¹ of at least moderate severity
B.	One of the following: <ol style="list-style-type: none"> Current or previous history of migraine according to the IHS [1] Migrainous symptoms during vestibular symptoms Migraine-precipitants of vertigo in more than 50% of attacks: food triggers, sleep irregularities, hormonal change Response to migraine medications in more than 50% of attacks
C.	Other causes ruled out by appropriate investigations

Comment: Vestibular symptoms are rotational vertigo or another illusory self or object motion. They may be spontaneous or positional. Vestibular symptoms are “moderate” if they interfere with but do not prohibit daily activities and “severe” if patients cannot continue daily activities.

nostic criteria for vestibular migraine that are based on a modification of the criteria proposed by Neuhauser and coworkers. Besides vertigo, these operational criteria will probably include dizziness and unsteadiness as vestibular symptoms qualifying for a diagnosis of vestibular migraine.

4.1. Epidemiology of vestibular migraine

In specialized dizziness clinics, vestibular migraine is the most common causes of spontaneous recurrent vertigo, accounting for almost 10% of diagnoses [7, 39]. The lifetime prevalence of definite vestibular migraine in the general population has been identified to be 1% [41].

Vestibular migraine may occur at any age [11,15] although rarely after the sixth decade of life [16]. In most patients, migraine begins earlier in life than vestibular migraine [9,16]. There is a female preponderance with a female to male ratio ranging between 1.5 and 4.5 to 1 [16,41]. Familial occurrence has been reported, indicating an autosomal dominant pattern of inheritance with decreased penetrance in men [43].

5. Epidemiological association of migraine and vertigo

As both vertigo and migraine rank among the most common complaints in medicine, it is crucial to ask for the evidence supporting a specific link between vestibular symptoms and migraine beyond a chance concurrence. In several studies, the prevalence of migraine in unselected dizziness clinic patients has been found to be higher than expected [3,50]. Furthermore, all case

control studies published to date indicate a more than chance association of migraine with vertigo. The prevalence of migraine was 1.6 times higher in 200 dizziness clinic patients than in 200 age and sex-matched controls [39]. Conversely, in migraineurs, the prevalence of vertigo is higher as compared to non-migraineurs. In a seminal study, 53 out of 200 unselected migraine patients reported vertigo, compared with nine out of 116 patients with tension headache (27% vs 8%) [30]. Similarly, two other case control studies found an increased prevalence of vertigo and dizziness in migraineurs [32, 55].

Even more striking is the preponderance of migraine in patients with recurrent vertigo of unknown cause, not fulfilling diagnostic criteria for Menière’s disease. Cha et al. found that 87% of 208 patients with benign recurrent vertigo met the criteria for migraine and that 70% of these fulfilled the diagnostic criteria for definite vestibular migraine [13]. In 72 patients with recurrent vertigo of unknown cause, the prevalence of migraine was six times higher as compared to an age and sex-matched control group (61% vs 10%) [33]. Likewise, in patients with recurrent vertigo of unknown cause, Rassekh and Harker found a prevalence of migraine of 81% as compared to 22% in patients with Menière’s disease [48].

Only recently, the intersection of vertigo and migraine has been examined on the population level. Assuming a lifetime prevalence of migraine of 14% [27] and a lifetime prevalence of vertigo of 7.4% [42], we can calculate a chance coincidence of 1%. Notably, a large epidemiological general population study found that about 3 times more adults have a history of both vertigo and migraine than would be expected by chance alone, namely 3.2% [42]. Recently, the link between

migraine and vertigo has been confirmed by an even larger population-based study showing that individuals with migraine are much more likely to have vertigo and vertigo with accompanying headache (OR 3.8 and 8, respectively) than non-migraineurs [40].

6. Associations between migraine and other causes for vertigo and dizziness

If 3.2% of the adult general population have migraine and vertigo [42], 1% of those have a chance coincidence and 1% have definite vestibular migraine [41], what accounts for the remaining 1.2%? We can assume that this group contains individuals with probable vestibular migraine, not fulfilling strict criteria for definite vestibular migraine. Furthermore, besides benign paroxysmal positional vertigo (BPPV) and Menière's disease (MD), several non-vestibular disorders have been shown to be statistically associated with migraine. The pathogenetic basis of these associations is poorly understood.

6.1. Benign paroxysmal positional vertigo

Benign paroxysmal positional vertigo (BPPV) is the most common vestibular disorder, affecting at least 10% of the population during lifetime [54]. Migraine is well known as a risk factor for BPPV, although the pathophysiologic link remains enigmatic. The prevalence of migraine in patients with idiopathic BPPV was twice as high as that in age and sex matched controls [34]. Another study found that the frequency of migraine was three times higher in idiopathic BPPV than in BPPV secondary to head trauma or surgery [25]. An epidemiological study that aimed to identify risk factors and comorbid conditions of BPPV in the general population found the strongest association for BPPV with migraine (OR 7.5) [54]. The link between BPPV and migraine is supported by the findings that idiopathic BPPV, but not BPPV secondary to head trauma [29] and labyrinthine disease [28] has a female preponderance.

6.2. Menière's disease

Menière's disease (MD) is frequent in dizziness clinics, but rare in the general population with a prevalence of less than 0.2% [47,56]. Migraine as an accompanying symptom of an episode of MD has been reported anecdotally [4,24,44]. A prospective case-

control study found that the lifetime prevalence of migraine was higher in 78 patients with MD according to the American Academy of Otolaryngology criteria compared to age and sex-matched controls (56% vs 25%, $p < 0.001$). Interestingly, Menière attacks were always accompanied by migrainous symptoms (migrainous headaches, photophobia, aura) in 45% of patients with MD [45]. This finding illustrates the clinical dilemma that differentiation between vestibular migraine and MD can be intricate and sometimes, patients fulfil criteria for both disorders [44]. Notably, a recent study suggests that migraine may lead to a greater susceptibility to develop MD. Cha et al. found that patients with MD and migraine had an earlier age of onset, a higher rate of concurrent bilateral hearing loss and a greater family history of migraine headaches and episodic vertigo than patients with MD without migraine [12]. The interrelation between MD and migraine is complicated by the fact that vertigo – at least when induced by caloric irrigation – can act as a migraine trigger [38].

6.3. Motion sickness

Motion sickness is the most common vestibular symptom in patients with migraine and migraineurs report more often motion sickness (30% to 70%) than controls with tension headache or without headache (20% to 40%) [17,30,32,36]. This association is more pronounced in children [5] and in migraine with aura [32].

6.4. Cerebellar disorders

Migraine is linked in various ways to the cerebellum [53], but most migraine patients have only sub-clinical ataxia and oculomotor dysfunction. However, there are rare inherited channelopathies that manifest with episodic or progressive cerebellar ataxia and vertigo. Episodic ataxia type 2 (EA-2) is the most common episodic ataxia syndrome, leading in about 50% of patients to vertigo and migraine headaches [26]. EA-2 is allelic with familial hemiplegic migraine type 1, a rare subtype of migraine that can manifest with progressive ataxia and is often associated with episodic vertigo [22].

6.5. Psychiatric syndromes

There is a complex interrelation between dizziness and vertigo, migraine and some psychiatric disorders.

Dizziness is the second most common symptom of a panic attacks after palpitations [37] and can be a symptom of major depression as well [52]. A population survey in the U.S. found that the prevalence of any mental disorder in migraineurs was 1.5 and 3.1 times higher compared to non-migraine headache and non-headache groups respectively [49]. More specifically, both panic disorder and major depression are bidirectionally associated with migraine [9,10]. Because of the frequent association of dizziness, migraine and anxiety, Furman and colleagues proposed a new syndrome designated “migraine-anxiety related dizziness” (MARD) [19].

7. Conclusion

Epidemiological studies provide consistent evidence for a link between migraine and vestibular symptoms. In individuals with both vertigo and migraine, we can assume a chance coincidence in about one out of three and an association beyond chance in about two-thirds. Besides vestibular migraine, several vestibular, cerebellar and psychiatric syndromes account for the link between migraine and vertigo.

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