

ORIGINAL ARTICLE

## Migraine-associated vertigo

KRISTER BRANTBERG<sup>1</sup>, NATALIE TREES<sup>2</sup> & ROBERT W. BALOH<sup>2</sup>

<sup>1</sup>Department of Audiology, Karolinska Hospital, Stockholm, Sweden, and <sup>2</sup>Department of Neurology, University of California at Los Angeles, Los Angeles, California, USA

### Abstract

**Conclusions.** It is probably not wise to demand a temporal relationship between migraine symptoms and vertigo for the definition of migrainous vertigo. When recurrent vertigo attacks begin at an early age in a patient with normal hearing and migraine, there are few diagnoses other than migraine that need to be considered. **Objective.** The clinical association between migraine and vestibular symptoms, such as dizziness, motion intolerance and spontaneous attacks of vertigo, is well documented. Recently, investigators have attempted to develop diagnostic criteria for this association. We hypothesized that there are multiple migraine-associated vestibular syndromes and studied a more homogenous subset of them (benign recurrent vertigo). **Material and methods.** A structured interview was conducted over the telephone with 40 patients who presented to our neurotology clinic with benign recurrent vertigo and met the International Headache Society criteria for migraine. The structured interview was also conducted with 40 relatives of the patients who reported the same symptoms. **Results.** A marked female predominance was found. Most of the patients had vertigo attacks lasting minutes or hours and most were completely free of dizziness between attacks. Imbalance and nausea typically accompanied the vertigo. However, in half of the cases, vertigo occurred without an association with headache.

**Keywords:** *Benign recurrent vertigo, structured interview*

### Introduction

Migraine is a clinical syndrome characterized by periodic headache along with numerous other symptoms, including dizziness and vertigo. The association between migraine and dizziness extends back to Liveing's classical description in the nineteenth century [1]. Overall, about a quarter of patients with migraine will report episodes of vertigo, either with their typical headache or completely separate from it [2]. In addition, patients with migraine frequently report a lifelong history of sensitivity to motion, with bouts of carsickness as a child and motion sickness as an adult [3]. Although the clinical association between migraine and dizziness is well documented, it is difficult to prove a causal relationship between migraine and dizziness in an individual case. The pathophysiology of migraine-associated dizziness is still unknown. There may well be multiple dizziness syndromes just as there are multiple other migraine syndromes, each with a unique genetic and environmental background.

Recently, investigators have attempted to develop diagnostic criteria for migraine-associated dizziness. Neuhauser et al. [4] and Furman et al. [5] suggested the following criteria for the diagnosis of migrainous vertigo: (i) episodic vestibular symptoms of at least moderate severity (rotational vertigo, other illusory self or object motion, positional vertigo and head motion intolerance); (ii) migraine that meets the International Headache Society (IHS) criteria; (iii) at least one of the following migrainous symptoms during at least two vertiginous attacks: migrainous headache, photophobia, phonophobia, visual or other auras; and (iv) other causes ruled out by appropriate investigations. Using these criteria, they found that a significant proportion of patients in dizziness and headache clinics suffer from migrainous vertigo. In our initial efforts to apply these criteria to our patient population, we immediately became aware of problems. Most patients with migraine complain of head motion intolerance and this symptom will fluctuate from day to day. Furthermore, most patients will report head motion

intolerance when they are having a severe migraine headache. On the other hand, patients with vertigo of any cause will often report sensitivity to light and sound during the acute vertigo attack. The result is that most patients with migraine and many patients with vertigo due to other causes meet the definition for migrainous vertigo. We decided to study a more homogenous population of patients with migraine and recurrent spontaneous episodes of rotational vertigo (benign recurrent vertigo). We conducted a structured interview over the telephone with 40 patients who had presented to our neurotology clinic with benign recurrent vertigo and migraine and, for validation, we conducted the same interview with 40 relatives of these patients who reported benign recurrent vertigo and migraine. Our aim was to define the clinical features of this more restricted migraine vertigo syndrome, with the ultimate goal of developing reliable diagnostic criteria.

## Material and methods

### Case material

We identified 40 patients who presented to our neurotology clinic with recurrent episodes of vertigo who also met the IHS criteria for migraine [6]. The diagnosis of benign recurrent vertigo required: (i) a minimum of three spontaneous attacks of vertigo (an illusion of rotation); (ii) episodes that lasted > 1 min; and (iii) no associated unilateral hearing loss. Patients with benign paroxysmal positional vertigo were excluded as their attacks are triggered by positional change and last < 1 min. Other causes of recurrent vertigo were ruled out by means of history, examination and appropriate diagnostic tests, including audiograms. The study group was part of a larger group taking part in a study of the genetic causes of benign recurrent vertigo. For validation, we selected a second group of 40 subjects with recurrent vertigo and migraine from the families of the probands. These subjects were also participating in the genetic study of benign recurrent vertigo. As they presumably had the same migraine vertigo syndrome but had not sought medical attention, we wondered whether their vertigo syndrome had similar features.

Details regarding the vertigo and migraine symptoms were obtained by means of a structured interview over the telephone. A trained research associate (N. T.) interviewed all probands and relatives using a questionnaire regarding vertigo and migraine symptoms (available upon request). If a subject could not answer a question ("did not know") or if the question was not applicable (effect of menstruation in men or older women), the subject was not included in the tabulation for that question.

## Results

Although there were some differences between the two study groups with regard to their migraine and vertigo features, most features were similar between the two groups. There was a marked female predominance in both groups (Table I). Migraine headaches typically began in the teens, followed several years later by the onset of vertigo. Overall, about half of the subjects had visual aura.

There was variability in the frequency and duration of vertigo attacks in both groups (Table II). Interestingly, the relative group tended to have shorter, less frequent attacks compared to the proband group. Most subjects were free of dizziness between vertigo attacks. Symptoms accompanying the vertigo attack were similar in both groups (Table III). Nearly all subjects reported imbalance and nausea with their attacks. Only half of the patients reported a headache with at least one of their attacks of vertigo. Surprisingly, nearly half reported stiffness or pressure in their ears at the time of the attack of vertigo.

Stress and fatigue were the commonest triggers for vertigo attacks in both groups (Table IV). The relative group reported a higher association with their menstrual period, which can probably be explained by the fact that the relative group was younger on average.

## Discussion

We studied the clinical features of a vertigo migraine syndrome in two study groups: probands who presented to our clinic with benign recurrent vertigo and migraine; and relatives with benign recurrent vertigo and migraine. The same structured interview was conducted over the telephone with each subject to define the characteristic clinical features of this syndrome. Our ultimate goal was to develop diagnostic criteria that can be used for both genetic

Table I. Overall characteristics.

Characteristic	All (n = 80)	Patients (n = 40)	Relatives (n = 40)
Sex (F/M)	68/12		
Age (years) <sup>a</sup>	34, 43, 54	39, 49, 57	33, 40, 48
Age at onset of migraine headache (years) <sup>a</sup>	12, 15, 24	12, 19, 30	11, 15, 20
Onset of migraine predating onset of vertigo (years) <sup>a</sup>	0, 8, 23	3, 11, 36	0, 4, 13
Visual aura (n)	39/80	24/40	15/40

<sup>a</sup>Results are presented in the form 25th quartile, median, 75th quartile.

Table II. Characteristics of vertigo. The values shown represent numbers of patients, with percentages in parentheses.

Characteristic	All ( <i>n</i> =80)	Patients ( <i>n</i> =40)	Relatives ( <i>n</i> =40)
Vertigo frequency	≥1/month: 19/75 (25)	≥1/month: 13/37 (38)	≥1/month: 6/38 (16)
	<1/month→1/year: 34/75 (45)	<1/month→1/year: 13/37 (38)	<1/month→1/year: 21/38 (55)
	<1/year: 22/75 (29)	<1/year: 11/37 (30)	<1/year: 11/38 (29)
Vertigo duration	Minutes: 39/80 (49)	Minutes: 13/40 (33)	Minutes: 26/40 (69)
	Hours: 29/80 (36)	Hours: 20/40 (50)	Hours: 9/40 (23)
	Days: 12/80 (15)	Days: 7/40 (18)	Days: 5/40 (13)
Completely free of dizziness between vertigo attacks	63/77 (82)	27/40 (68)	36/37 (97)

studies and for evaluating treatment protocols. We hypothesized that there are multiple migraine-associated dizziness syndromes and that there are multiple genes and multiple environmental factors underlying these syndromes. By focusing on patients with spontaneous recurrent attacks of rotational vertigo, we tried to identify a homogenous population for genetic studies. By requiring a minimum of three attacks lasting >1 min, other common vertigo syndromes, including benign paroxysmal positional vertigo and vestibular neuritis, were excluded.

As with migraine in general, there was a marked female preponderance in our groups with migrainous vertigo (85%). Of the 33 patients with “definite migrainous vertigo” in the study of Neuhauser et al. [4], 27 (82%) were women. Although hormonal factors in women could explain variable penetrance of a dominant trait, the marked female preponderance in both studies occurs against a simple autosomal dominant mode of inheritance. Typically, migraine headaches occur first, followed by vertigo attacks years later, although occasionally vertigo can be the initial symptom of migraine (benign paroxysmal vertigo of childhood). Nearly half of the patients with migrainous vertigo in this study had visual aura, whereas only about a quarter of patients with other migraine syndromes have visual aura [7,8].

Most patients with migrainous vertigo have attacks lasting minutes to hours and most are completely free of dizziness between attacks. Surprisingly, only 50% of our patients had ever had a headache with a

vertigo attack. Therefore, in most cases, vertigo occurs independent of migraine headache. Imbalance and nausea are almost always present with the attacks of vertigo, and nearly half of all patients report some feeling of pressure or stuffiness in their ears with the vertigo. The same triggers previously reported for migraine symptoms are common triggers for vertigo attacks.

Although we agree with Neuhauser et al. [4] that a more comprehensive definition of migrainous vertigo is needed, we would suggest that there are multiple migraine dizziness syndromes and that each requires different criteria for diagnosis. By including symptoms such as illusory self motion, positional vertigo and head motion intolerance, most patients with migraine might report such symptoms during a severe headache. In order to develop reliable criteria for the diagnosis of migrainous vertigo, it is important to have reliable clinical data from a well-defined population with migrainous vertigo.

Headache is not a common accompaniment of migrainous vertigo. Only half of our patients reported ever having had a headache with an attack of vertigo. These findings are similar to those in many previous reports on migraine-associated vertigo [3,9,10]. Therefore, it will not be possible to define migrainous vertigo on the basis of headache. In our experience, other symptoms, such as photophobia and phonophobia, are too non-specific to be useful as diagnostic criteria for migrainous vertigo. Based on the data from this study and other data in the

Table III. Factors associated with vertigo. The values shown represent numbers of patients, with percentages in parentheses.

Factor	All ( <i>n</i> =80)	Patients ( <i>n</i> =40)	Relatives ( <i>n</i> =40)
Loss of balance when walking	67/77 (87)	33/38 (87)	34/39 (87)
Nausea or vomiting	68/79 (86)	36/39 (92)	32/40 (80)
Headache	39/78 (50)	21/40 (53)	18/38 (47)
Stuffiness or pressure in the ears	32/75 (43)	16/37 (43)	16/38 (42)

Table IV. Factors that made worse or precipitated an attack of vertigo. The values shown represent numbers of patients, with percentages in parentheses.

Factor	All ( <i>n</i> =80)	Patients ( <i>n</i> =40)	Relatives ( <i>n</i> =40)
Stress or emotional upset	39/67 (58)	19/36 (53)	20/31 (65)
Fatigue	34/68 (50)	22/37 (59)	12/31 (39)
Hunger	19/66 (29)	8/35 (23)	11/31 (35)
Menstrual period	14/53 (26)	4/29 (14)	10/24 (42)
Physical activity	13/67 (19)	6/35 (17)	7/32 (22)
Alcohol	8/69 (12)	6/36 (17)	2/33 (6)

literature, it is probably not wise to demand a temporal relationship between migraine symptoms and vertigo for the definition of migrainous vertigo.

Ideally, the development of diagnostic criteria for migrainous vertigo will be based on the understanding of the pathophysiology of the migraine syndrome. Although there have been recent advancements in our understanding of the molecular mechanisms of migraine, its pathophysiology is still poorly understood. There is broad agreement that there is a major genetic component, although there are probably multiple genes involved and multiple migraine syndromes. One model disorder that might provide insight into the pathophysiologic mechanism of migraine symptoms is familial hemiplegic migraine (FHM1) caused by mutations in a neuronal calcium channel gene *CACNA1A* [11,12]. Patients with FHM1 have episodes of hemiplegia accompanied by migraine headaches. Within families with FHM1, some affected members have episodic vertigo and ataxia and some just have migraine headaches without hemiplegic episodes. Furthermore, there are clear instances of non-penetrance, where asymptomatic subjects have the genetic mutation. Similarly, in families with benign recurrent vertigo, most patients have both migraine headache and vertigo but some just have vertigo attacks and others just have migraine headache [13]. Some meet the diagnostic criteria for basilar migraine. Although the gene or genes responsible for benign recurrent vertigo are not known, presumably the same genetic mechanism is at work within a given family. If episodic vertigo can be the only manifestation of the migraine syndrome (as apparently occurs in some members of these families) then it will be very difficult to establish reliable diagnostic criteria that rely on other migraine symptoms. Until the gene or genes that cause migrainous vertigo are found, diagnostic criteria should probably focus on the features of the vertigo and on ruling out other causes. Furthermore, migrainous vertigo could very well be "ear-related", either explained on the basis of vasospasm of the vestibular branches of the internal auditory artery, similar to what occurs in retinal migraine [14], or due to a defective ion channel. As ion channels in the inner ear are critical for maintaining the potassium-rich endolymph and neuronal excitability (as calcium enters neurons, potassium exits), a defective ion channel could lead to reversible hair cell depolarization and vertigo attacks.

Attacks of migrainous vertigo typically last for several minutes to several hours and most patients are free of dizziness between attacks. When such vertigo attacks begin at an early age in a patient who meets the IHS criteria for migraine, there are few other diagnoses than migraine that need to be

considered. Ménière's disease requires unilateral ear symptoms and hearing loss and, by requiring a minimum of three attacks, infections involving the ear and vestibular nerve are effectively ruled out. Patients with migraine-associated vertigo often complain of ear stuffiness and pressure but do not develop progressive hearing loss.

Finally, recognizing the diagnosis of migrainous vertigo is important, not only because it is a common syndrome [3], but also because the same prophylactic medication used to treat migraine headache can control vertigo attacks [9].

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