

Vestibular evoked myogenic potentials results of dizzy patients with normal videonystagmography

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Aim

The aim of this study is to detect saccular dysfunction tests using vestibular evoked myogenic potentials (VEMPs) in dizzy patients with normal videonystagmography (VNG) findings.

Patients and methods

Thirty patients complaining of dizziness with normal VNG findings were studied. They were subjected to full assessment of history, basic audiological evaluation, VNG, and VEMPs. VEMPs were evaluated in both ears of all cases through absolute latencies of p13 and n23.

Results

VEMPs showed abnormalities in 19 patients (66.3%). Ten patients (33.3%) showed unilateral absent, six patients (20%) showed bilateral absent, and three patients (20%) showed shifted latencies.

Conclusion

VEMP appears to be a valuable tool in the detection of initial saccular abnormalities initially in dizzy patients with normal VNG findings.

Keywords:

dizziness, vestibular evoked myogenic potentials, videonystagmography

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Introduction

Dizziness is one of the most common reasons for which patients visit their physicians. Balance control depends on receiving afferent sensory information from several sensory systems: vestibular, optical, and proprioceptive. Bioelectric signals generated by body movements in the semicircular canals and in the otolithic apparatus are transported through the vestibular nerve to the vestibular nucleus. All four vestibular nuclei, located bilaterally in the medial longitudinal fasciculus, are linked to central nervous system structures. These central nervous system structures are involved in maintaining visual stability, spatial orientation, and balance control [1].

The complexity of this system makes it difficult for one single test to assess the function of all systems. Meanwhile, videonystagmography (VNG), which is the basic and most widely used test, may yield normal results despite the patient's complaint of dizziness. Patients with dizziness with normal VNG may have otolith dysfunction.

Vestibular evoked myogenic potentials (VEMPs) have been studied since 1960s, but many different centers began to use it to assess the sacculocollic reflex after 1992. They are middle-latency evoked potentials generated by the vestibular–spinal muscle reflex that depend on the functional integrity of the sacculus macula, inferior

vestibular nerve, vestibular nuclei, vestibular–spinal pathways, and neuromuscular plates. Damage to any of these structures may affect the potentials [2].

Therefore, the aim of this study is to detect saccular dysfunction tests using VEMPs in dizzy patients with normal VNG findings.

Patients and methods

In this study, all 30 patients presenting with dizziness were evaluated in the period between December 2012 and November 2013. These patients were recruited from Beni-Suef University Hospital, Misr University for Science and Technology Hospital, and private practice.

Neuro-otological history

A full assessment of neuro-otological history was performed for all patients, including a description of their dizziness complaint, duration of the disease, onset, and course, with a special focus on the frequency, duration, progression, and nature of vertiginous attacks, persistent imbalance, gait problems, accompanying auditory, or vegetative symptoms.

Basic audiological evaluation

(1) Pure tone audiometry (air conduction and bone conduction). Test for assessment of hearing

threshold by pure tone stimulation was performed using a two-channel computerized Audiometer (Orbiter 922 Madsen Denmark, Interacoustics Denmark) and Interacoustics AD 229 including:

- Speech audiometry.
- Speech reception threshold*, using Arabic spondaic words [3].
- Word discrimination score (%)*, using Arabic phonetically balanced words [4].

- (2) ***Immittancemetry (GSI 33 version II and Interacoustic AZ226): single-frequency tympanometry with a probe tone of 226 Hz. Testing of the acoustic reflex threshold (ipsilateral and contralateral).

Vestibular assessment

Complete VNG test battery was performed to assess spontaneous, gaze evoked, positional, and positioning nystagmus. Oculomotor test battery including tracking, saccades, and optokinetic test at a frequency of 40 Hz was performed utilizing the oculomotor module. The bithermal caloric test was also performed; the caloric test was performed using MicroMedical (Springfield, Illinois, USA), mobile eyes spectrum 8.6, two-channel equipment.

As a second step, sternomastoid VEMPs were recorded using a two-channel evoked potential system Biologic Navigator and Vivo Sonic Integrity (Biologic Navigator Pro, Natus Medical Incorporated). The surface-active electrode was placed over the sternomastoid muscle on one side, whereas the reference electrode was placed on the middle of the anterior surface of the clavicle. A forehead electrode was used as an earth. Alternating acoustic clicks (90 dBnHL) were used as a stimulus.

Results

Of the 30 patients included, 16 were women and 14 were men, age range 29–64 years, mean 49.7 years.

All these patients suffered from dizziness: 12 patients (40%) complained of a sense of spinning of their surroundings, 11 patients (36.7%)complained of a sense of imbalance, five patients (16.7%) complained of lightheadedness, and two patients (6.7%) complained of blackouts. There was no history of general disease, or ENT operation or history of any disequilibrium. Otoloscopic examination indicated bilateral normal mobile tympanic membranes.

Despite suffering from dizziness, all these patients had normal VNG; thus, VEMPs were performed and showed abnormal test results in 19 patients (63.3%) (Table 1).

Table 2 shows that the most frequently encountered VEMP abnormality was a unilateral absent response reflecting dysfunction of the corresponding saccule and/or the inferior vestibular nerve.

Discussion

The main aim of the present study was to explore the role and importance of the VEMPs test in explaining the complaint of dizziness when VNG could not find the answer. Dizziness ranks among the most common complaints in medicine, affecting ~20–30% of the general population. However, the term dizziness encompasses a variety of different sensations, each pointing in a distinct diagnostic direction: rotational vertigo or other illusory sensations of motion might indicate a vestibular origin, whereas a sensation of light-headedness, giddiness, unsteadiness, drowsiness, or impending faint implies a nonvestibular origin [5].

The fact that VNG might fail to identify the cause of vestibular dysfunction has been recognized before [6]. This can be attributed to the imprecision of this test as caloric irrigations stimulate the system in a manner equivalent to a frequency between 0.002 and 0.004 Hz. This value is well below the level within which the vestibule–ocular reflex generally functions in daily activities. Moreover, the degree of vestibular imbalance needed to produce a sensation of vertigo may be small relative to the imbalance required to be evident in this test [7].

VEMP was found, in the present study, to show abnormalities in 19 patients with normal VNG (out of 30 patients), 63.3%. Seo *et al.* [8] reported that 70% of patients with normal VNG with a history of brief episodes of a sense of imbalance and tendency to fall have abnormal VEMP. Meanwhile, Rauch [9] reported that VEMPs are highly sensitive to the side of disease in unilateral Ménière’s disease. In contrast, Iwasaki *et al.* [10] reported that only 40 of the 811 patients (5%) were found to have abnormal VEMP responses with normal caloric test responses. Clinical diagnoses

Table 1 Vestibular evoked myogenic potentials (VEMP) test abnormalities

Test	Abnormality [n (%)]
VEMP	19 (63.3)

Table 2 Types of vestibular evoked myogenic potentials abnormalities

Test	n (%)
Unilateral absent	10 (33.3)
Bilateral absent	6 (20)
Shifted latency	3 (10)

of these patients were Ménière's disease acoustic neuroma, and sudden hearing loss with vertigo. This controversy might be attributed to variable degrees of saccular and/or inferior vestibular nerve involvement in different diagnoses with variable stages of each disease.

Conclusion

VEMPs appear to be a valuable tool in the detection of initial saccular abnormalities initially in dizzy patients with normal VNG findings. However, a careful and detailed assessment of history before VNG would be more important to help decide the next step if the result of VNG is normal.

Acknowledgements

Conflicts of interest

None declared.

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