The many faces of migraine – audiatory and vestibular presentation: a case study

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INTRODUCTION

Migraine is characterised by diversity in clinical presentations, which sometimes may represent a significant clinical dilemma. This is a case of a 48 year old man (MN) who prior to the audiovestibular assessment had been extensively investigated by the neurologist and cardiology teams for unexplained “blackouts” - sudden loss of consciousness (LOC). He also had two episodes of unexplained hearing loss, auditory hallucinations, and dizziness, the latter for which he sought help. Neurological investigations included EEG, carotid doppler, the tilt table test and CT/MRI brain and cardiological investigations 24 hr ECG, transtorhachio echo and a reveal implant, with no abnormality identified.

A CASE STUDY

Audiovestibular presentation.

MN was referred to Audiovestibular clinic for hearing loss, four years after initial LOC. MN had hearing difficulty (greater on the left), intermittent tinnitus and marked loudness discomfort. A detailed description of LOC was obtained: LOC occurred suddenly, on average once a month, sometimes while sitting. It usually occurred in crowded and noisy places, preceded by a brief feeling of everything being “bright and loud”, followed by LOC for a few minutes and a feeling of nausea and dizziness up to 2 days. He has also had episodes of nausea, vomiting and dizziness at night, waking him up from sleep, and on waking in the morning, as well as dizziness and disorientation in visually challenging situations. In addition, he has had intermittent left “stabbing” headache. His family history was positive: 2 of his 3 brothers are affected by migraine.

Audiatory and Vestibular Assessment

The clinical examination revealed a strong visual dependency. The following tests were performed:

- The pure tone audiometry (PTA) showed a bilateral sensorineural hearing loss of a flat configuration: right 35-40 dBHL, left 45-55 dBHL (Fig. 1, lower traces). PTA was also performed after the treatment (Fig. 1, upper traces).

- Transient evoked otoacoustic emissions (TEOAEs) (ILO Otolodynamics Ltd, Kemp et al. 1990): Strong TEOAEs were recorded on the right, while only the low amplitude high-frequency responses were recorded on the left (Fig. 2, upper traces before treatment; the lower traces after the treatment).

- The caloric test (VNG) showed a significant left directional preponderance (41%) and non-significant right canal paresis (13%) (Fig. 3).

- Sinusoidal and rotational tests (VNG, NeuroKinetics, Inc.) showed a significant left directional preponderance (DP).

- Visual enhancement of the vestibulo-ocular reflex (VOR) was significantly high (>1.12).

This test was performed using the computerised chair rotated at the frequency of 0.16Hz and peak velocity of 60°/s for 4 cycles; the pattern of small circles of different sizes (stationary) projected onto completely encircling wall. Resulting eye movements are a combination of VOR and OKN responses. The VOR suppression was normal.

- Vestibular evoked myogenic potentials (VEMPs) were absent on the left, while was a high level response (200 µV); the reference range 20-150µV on the right (Fig. 4).

Biologic Navpro EP System was used.

- Subjective Visual Vertical (SVV) (NeuroKinetics, Inc.) showed a significant deviation to the right (2.3°; normal up to 2°), while Subjective Visual Horizontal (SVH) showed a significant clockwise deviation (5.5°; normal up to 3.5°) (Fig. 5).

RESULTS

Interpretation of Results

The elevated PTA thresholds in the presence of TEOAEs are suggestive of auditory dysfunction (rather than hearing loss due to cochlear cell structure damage), greater on the left and left at the lower frequencies, which was reversible, considering an improvement following the prophylactic treatment of migraine. The vestibular findings indicated a dysfunction with a significant asymmetry and increased sensitivity of the semicircular system (left significant drift on the caloric and position tests) and of the otolith system (the right high VEMP responses, 200µV). The latter finding could be of relevance to the patient’s abnormal response to loud noises, as a triggering factor of an acute episode, including LOC. There was also evidence of a significant dysfunction of the otolith system in general (the results of SVV and SVH).

As a result of vestibular dysfunction, the patient has developed a marked visual dependency, which was reflected in the high visual VOR enhancement gain.

The most affected part of the inner ears are the left cochlea and left otolith (saccule), judged by the low TEOEs and absent VEMPs on that side.

DISCUSSION

It is well recognised that migraine can cause multiple sensory dysmodulation and increased sensitivity, as a result of cortical disinhbition, which is the hallmark of migraine (Goadsby, 2012). In this case, the results of the high level responses of TEOAEs and VEMPs on the better (right) side suggest, in general, a reduction in descending suppression, which may reflect cortical disinhbition. However, the semicircular and otolith systems on the left (worse) side seem to be affected in different ways: while the otolith system appears depressed, the sensitivity of the semicircular system is increased. The auditory function seems affected in a similar way as the otolith system, by depression. These findings reflect the complexity of the inner ear control mechanisms, particularly of the vestibular system.

Migraine may affect the auditory and vestibular system through the descending, efferent system. It has been demonstrated in numerous studies that stimulation of the distal auditory efferent system would lead to cochlear suppression (Ceranic et al, 1996), while stimulation of the vestibular efferent would lead to excitation (Halt et al, 2011). The Fig. 6 illustrates potential mechanism of the effect of migraine on peripheral auditory and vestibular systems.

Diagnosis and Treatment

Migraine-related auditory and vestibular dysfunction, greater on the left, was diagnosed. MN received migraine prophylactic treatment (Propranolol), following which his hearing on the right has returned to normal and on the left nearly normal (25 dBHL), as presented in Fig 1. The frequency of dizziness has gradually decreased and subsequently resolved; he had no further LOC.

REFERENCES

Goadsby. Ann Indian Acad Neurol. 15 (Suppl 1); 2012.
Holt at al 2012, Review; Vestibular efferent circuitry in the periphery and central nervous system, 2011.