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Letter to the Editor

Differential diagnosis of apogeotropic positional nystagmus in the emergency room

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Dear Editor,

In the emergency room, the most common cause of dizziness is benign paroxysmal positional vertigo (BPPV) [1]. BPPV is usually diagnosed by a characteristic nystagmus. Horizontal direction-changing apogeotropic positional nystagmus (APN) in the supine head-roll test is one such nystagmus suggestive of BPPV (horizontal semicircular canal cupulolithiasis-type) [2]. Thus, dizzy patients with APN tend to be diagnosed with BPPV when they have no other obvious neurologic symptoms. However, APN is also known to be associated with cerebellar lesions [3]. Because patients with cerebellar lesion may sometimes visit the emergency room with isolated dizziness [4], it is necessary to establish a simple method to differentiate APN in cerebellar lesions and BPPV.

1. Methods

We compared APN in patients with cerebellar lesions (n = 12) and BPPV (n = 27). In this study, cerebellar lesion patients were included when they had dizziness with APN and had neuroradiologically confirmed cerebellar lesions (infarction 4, hemorrhage 5, tumor 2, and degeneration 1). BPPV patients were included when they had dizziness with APN without other neurologic findings, their MRI was normal, and their symptom and nystagmus disappeared within one week through physical therapy (Supplement 1). Using video-oculography (IRN-2, Morita Mfg. Corp., Kyoto, Japan), the slow phase velocity, amplitude, and frequency of the APN in each lateral position of the supine head-roll test was quantitatively measured. Nystagmus-reversal time (NRT), defined in this study as the time from head-reversal (one lateral position to the other lateral position) to nystagmus-reversal in the supine head-roll test, was also measured (Supplement 2). Differences in APN parameters were analyzed by the Wilcoxon rank-sum test. JMP 10.0.2 (SAS Institute Inc., Cary, NC, USA) was used for all statistical analyses, and p values $< .05$ were considered significant.

2. Results

The slow phase velocity of APN was significantly slower, and the amplitude of APN was significantly smaller, in cerebellar lesion patients when compared to BPPV patients. NRTs in cerebellar lesion patients were all < 1 s, whereas NRTs in BPPV patients ranged from 2 to 12 s (Supplement 2, Table 1).

3. Discussion

This study revealed that the APN in cerebellar lesion patients was significantly weaker (slower velocity and smaller amplitude) than that in BPPV patients. However, using velocity or amplitude alone, it is still difficult to differentiate APN in cerebellar lesion patients from APN in BPPV patients due to overlapping distributions. By contrast, by examining the NRT data, cerebellar lesion patients can be easily differentiated from BPPV patients, even in the emergency room, by their characteristically short NRT (< 1 s).

Previous work has established that in cerebellar lesion patients, the strength of the position-induced nystagmus peaks initially and then decreases with time [5]. The strongest initial positional nystagmus in cerebellar lesion patients may contribute to the short NRT. The APN in BPPV is thought to be generated by a heavy cupula, bent by gravity. Although the precise mechanism is unknown, disinhibited canal-driven signals derived from head-roll test, and otolith-driven signals derived from lateral head position, are both postulated to generate cerebellar APN [3,5,6]. Variances in the capacity of the velocity storage mechanism (VSM) of the vestibulo-ocular reflex (which of canal-driven signal VSM and otolith-driven signal VSM is mainly involved, or whether there is VSM damage due to cerebellar lesion) may also contribute to the difference in NRT between cerebellar lesion and BPPV.

It has been reported that findings other than APN, such as additional oculomotor or neurological findings, are necessary for the differentiation of APN associated with cerebellar lesions from APN resulting from BPPV [3]. However, assessing APN from the supine head-roll test itself can also be a key to the classification of cerebellar lesions from BPPV. Although the sample is small, we demonstrate that short NRT (< 1 s) are suggestive of cerebellar lesions whereas long NRT (≥ 2 s) are indicative of BPPV (Supplement 3).

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Table 1
Characteristics of nystagmus induced by the head-roll test in cerebellar lesion and benign paroxysmal positional vertigo patients.

			Cerebellar lesion	Benign paroxysmal positional vertigo	P value
Apogeotropic positional nystagmus	Lateral position with stronger nystagmus	Slow phase velocity, deg./s	5.7 (3.6–8.4)	8.9 (4.2–18.9)	0.070
		Amplitude, deg	3.8 (2.1–4.1)	4.6 (3.1–6.7)	0.004
		Frequency, Hz	1.9 (1.2–3.0)	1.8 (1.2–2.6)	0.951
		NRT, *sec*	< 1	5 (4–6)	–
	Lateral position with weaker nystagmus	Slow phase velocity, deg./s	1.8 (1.2–3.3)	4.1 (1.7–10.5)	0.026
		Amplitude, deg	1.5 (1.1–2.6)	3.0 (1.9–4.2)	0.008
		Frequency, Hz	1.0 (0.5–1.4)	1.2 (0.8–2.1)	0.042
		NRT, sec	< 1	8 (5–10)	–

Data are shown as median (range).
Magnitudes for the slow phase velocity, amplitude, and frequency are average values of nystagmus over a 5-s period corresponding to when induced nystagmus appears most prominently. The P value of NRT was not shown in the table because it was not numerical (i.e. < 1 s).
NRT, nystagmus reversal time.

Conflict of interest

The authors have no conflicts of interest to disclose.

Ethics approval

This study was approved by the ethics committee of Yokohama Brain and Spine Center (No. 141400601).

Contributors

KJ conceived of and designed the study and drafted the manuscript. YK and ES collected the data. KJ and ES analyzed and interpreted the data. All authors critically reviewed the manuscript for important intellectual content and approved the final version for submission.

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