

Effects of clinical factors on auditory brainstem responses in patients with asymmetric hearing loss

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Abstract

Objective: To evaluate the auditory brainstem responses (ABRs) in patients with asymmetric hearing loss (ASHL).

Methods: Data on 245 patients (men = 106; women = 139) with ASHL were gathered, retrospectively. Effects of sex, age, stimulation side, and hearing level on ipsilateral ABRs were carried out by multivariate linear regression.

Results: Waves III and V latencies were only significantly affected by sex and hearing level but not by age and stimulation side, in patients with ASHL. In addition, wave V latencies were positively correlated with age in men, but not in women; III–V intervals were significantly affected only by sex and age but not by stimulation side or hearing level.

Conclusion: Effects of clinical factors on ABR were different between patients with ASHL and normal-hearing subjects.

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Keywords: Auditory brainstem responses; Asymmetric hearing loss; Clinical factors; The wave III; The wave V

1. Objectives

Auditory brainstem response (ABR) has become a routine clinical tool for hearing and neurologic assessment [1]. In previous studies, many factors, such as sex, age, hearing acuity, and stimulus intensity, were found to exert a significant influence on ABR wave latency [2–8]. For example, women were shown to have shorter latencies and higher amplitude than men [9,10]. Waves I–V or III–V transmission time were shorter for the women compared with men [7,11,12], who had higher thresholds to evoke ABR than women did [13].

With regard to the age factor, the older group had a greater mean value of both absolute peak latencies and interpeak latencies than the younger group [14,15]. In addition, compared with young adult women, the latencies of ABRs waves increased in menopausal females [16]. The effect of age on latencies was more pronounced in men than in women [6].

Watson [11] found that wave I displayed latency extension with increasing levels of high-frequency hearing loss, while for wave V, increases in latency were dependent on both the degree and the slope of hearing loss. Jerger et al [8] found that the interactive effect between gender and degree of hearing loss was observed for wave V, but not for waves I or III. Prosser et al [17] also indicated that wave V obtained in defined cochlear lesions showed a linear relation with patients' pure tone hearing loss at 2 and 4 kHz. However, the effect of hearing level on the III–V intervals was never discussed.

Furthermore, the ABRs elicited from two sides were also different. Larger wave V amplitude elicited from the right ear stimulation than from the left ear stimulation was reported [10]. Eldredge et al [18] also reported that shorter interwave intervals and larger amplitudes were consistently observed in response to right ear stimulation.

To date, the effects of sex, age, stimulation side, and hearing levels on the ABR, especially on III–V intervals, were seldom discussed together in patients with asymmetric hearing loss (ASHL). Therefore, in this study, we tried to

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Table 1
The clinical data for women and men

Sex	Women	Men
Number	139	106
Mean age (SD)	51.9 (18.5)	49.6 (17.9)
Mean PTA (SD)		
Better ears	<u>23.2 (13.2)</u>	<u>27.2 (16.7)</u>
Worse ears	<u>38.4 (22.1)</u>	<u>43.7 (20.5)</u>

Abbreviation: S.D.: standard deviation.

evaluate these clinical factors on ABR responses. In addition, we hypothesize that the impact of those clinical factors affecting ABR would be different in patients with ASHL, compared with normal-hearing patients.

2. Methods

From January 2004 to April 2006, 245 Taiwanese patients with ASHL who had received an examination of ABR in an outpatient department of tertiary referral center were gathered for retrospective analysis. Asymmetric sensorineural hearing loss (SNHL) was defined as 15 dB or greater asymmetry in 2 or more frequencies [19]. The pure tone average (PTA) was calculated from the mean of hearing thresholds on 2 and 4 k Hz. Both ears were tested on all patients, and the ABRs ipsilateral to the stimulation side were recorded.

Exclusion criteria included ear or brain tumors, a history of any neurologic, psychiatric, or significant medical illness, or a history of substance abuse. In addition, we dropped the ABR data if wave III or wave V morphologies were not clearly identified.

The ABRs was generated by transient acoustic stimuli (90 dB nHL, broad-band clicks with duration of 100 μ s), and they were detected with two surface electrodes placed on the forehead just above the intercilium, and the other two surface electrodes were placed on the bilateral mastoid area of each patient. With a commercially available, computer-based device (Intelligent Hearing Systems, Miami, FL), the sound stimuli were presented as the rate of 11 to 12 times per second. A total of 1024 sound stimuli were detected and, by means of signal averaging, was able to detect reliable ABR waveforms in a matter of minutes.

The multivariate linear regression was performed on the wave III and wave V latencies and III–V duration by sex,

Table 2
Mean latencies of wave III and wave V in women and men

PTA	Women		Men	
	Mean latencies (SD)		Mean latencies (SD)	
	Wave III	Wave V	Wave III	Wave V
≤ 30	3.78 (0.22)	5.56 (0.51)	3.89 (0.21)	5.79 (0.26)
30 < ≤ 50	3.85 (0.19)	5.70 (0.22)	4.02 (0.28)	5.91 (0.27)
50 < ≤ 70	3.96 (0.20)	5.84 (0.22)	4.05 (0.23)	5.99 (0.23)
> 70	4.09 (0.32)	5.98 (0.29)	4.28 (0.17)	6.18 (0.22)

Abbreviation: S.D.: standard deviation.

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