Prolonged I–III Interwave Interval in Cerebellar Astrocytoma

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Abstract  
We are reporting the case of a 41-year-old female diagnosed with a cerebellar astrocytoma. The tumor was detected after the patient was referred for MRI scan because of an abnormal ABR. The ABR was unusual as the I–V interwave intervals (IWIs) were within normal limits bilaterally, but the I–III IWI was prolonged by .40 msec on the left ear in comparison to the right ear. This case report illustrates the importance of the I–III IWI in the detection of retrocochlear pathology and the nonsequential generation of the components of the ABR.  

Key Words: Auditory brainstem response (ABR), cerebellar astrocytoma, interwave interval (IWI)

It is well documented that the I–V interwave interval (IWI) is a powerful, perhaps the most powerful, parameter of the auditory brainstem evoked response (ABR) for the diagnosis of intracranial tumors (Glasscock et al, 1979; Eggermont, 1980; Musiek et al, 1980; Musiek and Gollegly, 1985). Acoustic nerve and other cerebellar-pontine angle tumors may also prolong the I–III and/or III–V IWIs in addition to the I–V IWI. Although abnormal I–V and III–V IWIs in the presence of a normal I–III IWI have been reported (Harris and Almquist, 1981), prolongation of the I–III and I–V IWIs in the face of a normal III–V IWI is a more common finding (Musiek and Gollegly, 1985). What appears to be a highly unusual ABR finding, regardless of pathophysiology, is a prolongation of the I–III IWI when the I–V IWI is normal. Our case illustrates two important features regarding the nature and application of the ABR, namely: (1) the ABR is a composite of multiple generators not necessarily activated in sequence, and (2) although the I–V IWI is considered to be the most powerful ABR parameter for the detection of intracranial tumors, the importance of the I–III IWI should not be underestimated, especially when the I–V IWI is normal.

HISTORY  
A 41-year-old white female was referred to our facility for evaluation of vertigo, headaches, and blurred vision. The dizziness typically occurred when she bent over or looked quickly over her left shoulder. The dizziness usually lasted approximately 15 seconds then resolved. A recent ophthalmologic examination was reported as normal. After examination by an otolaryngologist, she was referred for audimetric, electronystagmographic (ENG), and ABR evaluation.

FINDINGS  
Audiometric evaluation (Fig. 1) revealed normal sensitivity and normal word recognition bilaterally. An ENG was obtained, and it was remarkable for a mild left beating nystagmus in the head hanging position (5 degrees/sec), a left unilateral weakness of 26 percent, and a right beating directional preponderance of 30 percent. ABR testing was obtained at that time using a Nicolet CA 1000. Each ear was tested using clicks of alternating polarity presented through insert earphones. Stimulus in-
Pure Tone Audiometry

- 250 1000 4000 dB
- HL in dB (ANS-69)

Speech Audiometry

- % Correct
- HL in dB

Figure 1 Audiometric results.

Intensity was 95 dB nHL with 50 dB of contralateral masking. Testing was completed at click rates of 21.1/sec and again at 61.1/sec. Stimulus duration was 100 μsec. Acquisition parameters were as follows: sensitivity, 10 μvolts; lower filter, 150 Hz; high filter, 3000 Hz, and 2000 repetitions were acquired. The absolute latencies of waves I and V were within normal limits in the right ear. Absolute latencies of waves I and V were also within normal limits in the left ear. The I–V IWI differed by .24 msec between ears when using a 21.1/sec click rate and .26 msec when using a 61.1/sec click rate. However, the absolute latency of wave III was noted to be prolonged on the left side in comparison to the right (Fig. 2). The I–III IWI differed between ears by .40 msec at click rates of 21.1/sec and 61.1/sec.

Based upon these abnormal ABR and ENG findings, the patient was referred for a gadolinium enhanced magnetic resonance imaging (MRI) scan. The radiologist reported that the patient had a left posterior fossa mass in the region of the cerebellopontine angle (Fig. 3). The mass was subsequently biopsied and found to be a grade II pilocystic astrocytoma. It involved the left cerebellar tonsil, the left cerebellar peduncle, the lower medulla, the spinal cord, and the lateral aspect of the floor of the fourth ventricle. Due to the extent and invasiveness of the lesion, removal of the tumor was not attempted.

The patient subsequently received a 6-week course of radiation therapy with 5400 rads to the posterior fossa. An MRI performed 1 year after diagnosis showed the mass unchanged in size. The patient's symptoms of dizziness, headache, and blurred vision persist.

Figure 2 ABR test: A, Left ear; B, Right ear.

Figure 3 Magnetic resonance imaging scan of the brain stem.
**COMMENTS**

This case serves as a poignant reminder to the clinician that “Auditory information is not simply passed on sequentially from one relay system to another, as implied by the anatomic schematics often shown to depict the anatomy of ABR,” (Hall, 1992, p. 55). That is, the generation of one component (e.g., wave V) at a particular latency may or may not be dependent on the activation of earlier components (e.g., wave III).

In this case, the I–V IWI differed between ears by 0.24 msec. This has led us to re-examine our criteria for significant interaural differences in the I–V IWIs. Traditionally, we had used 0.3 msec as the upper limit of normal for this parameter. Given the findings in this case, we have changed the critical value to 0.2 msec as recommended by Selters and Brackmann (1977). While this may result in an increased false positive rate, sensitivity should be improved.

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**REFERENCES**


