Auditory Brainstem Neural Responses in Young HIV-Infected and HIV-Uninfected South African Children

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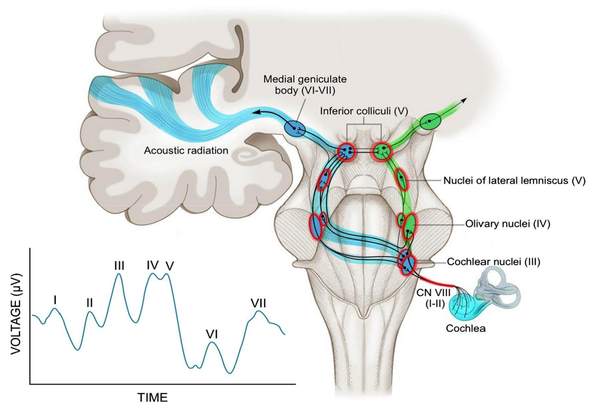
Introduction

- HIV-related central nervous system disease can be a result of untreated perinatal HIV infection (PHIV).
- It is possible that antiretroviral therapy for PHIV could also negatively affect the auditory nervous system.
- Auditory brainstem responses (ABRs) are used to evaluate the afferent neural integrity of auditory nerve fibers from the cochlea to more inferior portions of the central auditory system.
- Children with HIV/AIDS have longer ABR peak latencies and lower peak amplitudes suggesting a lack of auditory neural synchrony.



Aims

The aim of this study was to evaluate ABR data from children participating in the Auditory Research in Children with HIV: Cape Town (ARCH: Cape Town) study. Specifically to:

1) Examine peak I, III, and V latencies, in milliseconds (ms), of ABRs in PHIV, perinatally HIV-exposed, but uninfected (PHEU), and HIV-unexposed, uninfected (HUU) children.
2) Examine peak V amplitude, in microvolts (μV), of ABRs in PHIV, PHEU, and HUU children.

Methods

Study Sample

- There were 129 children from ARCH: Cape Town with ABR data included.
- There were 74 PHIV children (40 girls and 34 boys), 29 PHEU children (8 girls and 21 boys), and 26 HUU children (13 girls and 13 boys).
- All children were assessed between 11-12 years of age.

Procedures

- The ABR procedure is a portion of a larger audiology protocol of the ARCH study, but only measures specific to the ABR data are reported here. A single audiologist (Elliott) collected all of the data and was blinded to HIV exposure status.
- Otoscopy and tympanometry were performed to evaluate whether any outer or middle ear pathologies would affect the ABR research procedures.
- Once electrode sites were prepared, surface electrodes were attached to the child's high forehead, the right and left earlobes, and the center of the forehead (ground).
- ABRs were obtained using rarefaction and condensation clicks through insert earphones at a rate of 11.1/sec and at 75 decibels (dB) normal hearing level (nHL).
- Ipsilateral and contralateral tracings were obtained simultaneously.

Procedures (cont.)

- Each child was instructed to remain as quiet as possible and that they did not need to respond while a minimum of 2000 clicks were presented. During the measures, the lights were dimmed, the child reclined on a cot, and most fell asleep.
- ABRs were obtained in each ear and completed at least twice to ensure waveform repeatability.

Outcome variable

- ABR peak I, III, and V latencies and peak V amplitudes in each ear were identified. All latencies and amplitudes were determined independently, then reconciled between investigators (Torre and Elliott) when there were discrepancies.

Statistical Analyses

- ABR data from PHEU and HUU children were combined as the comparison group for all analyses.
- Individual ABR peak latencies and peak V amplitude data of both ears were analyzed simultaneously between PHIV and combined PHEU/HUU groups using generalized estimation equation models (SAS, Version 9.4) with exchangeable working correlation and adjusting for age and sex.

Results

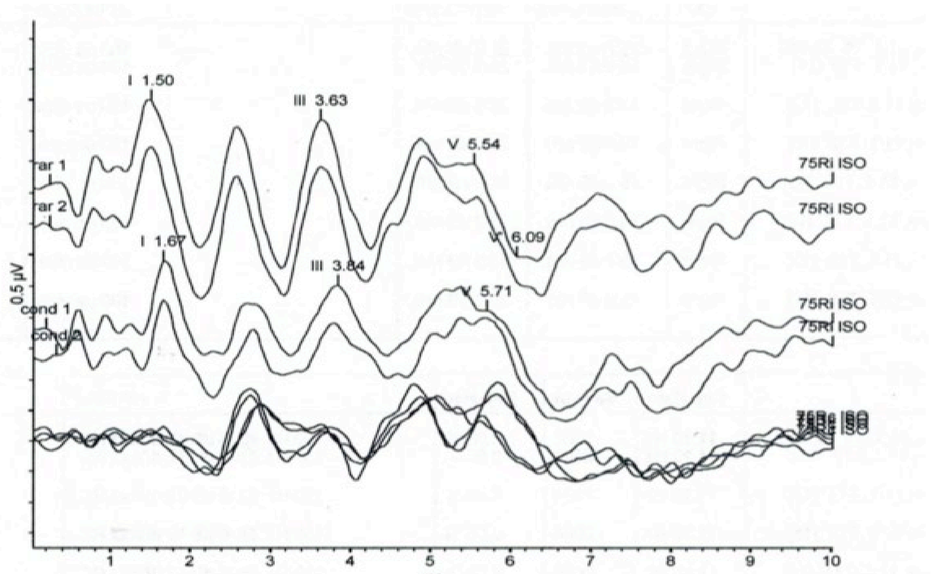


Figure 1. An example of ABR waveforms, for rarefaction (rar) and condensation (cond) stimuli is shown.

- The above ABR waveforms are from a child in ARCH: Cape Town. The top two ipsilateral tracings were recorded using rarefaction stimuli, the middle two ipsilateral tracings were recorded using condensation stimuli, and the bottom four tracings are contralateral recordings that were not analyzed.
- In the first rarefaction waveform, peak I latency, the time from stimulus onset to the 8th cranial nerve, was 1.50 ms.
- Peak III latency, the time from stimulus onset to the cochlear nucleus, was 3.63 ms.
- Peak V latency, the time from stimulus onset to the level of the lateral lemniscus/inferior colliculus, was 5.54 ms.
- Peak V amplitude, the synchronous response of neurons within the lateral lemniscus/inferior colliculus, was 0.30 μV (Not shown in Figure).

Table 1. Peak latency and amplitude means, and standard deviations, are shown for each ear in PHEU/HUU and PHIV children.

Auditory Brainstem Response Latencies and Amplitudes		
Right Ear	PHEU/HUU (Mean [SD]) (n=55)	PHIV (Mean [SD]) (n=74)
Peak I latency (ms)	1.51 (0.12)	1.54 (0.11)
Peak III latency (ms)	3.74 (0.17)	3.68 (0.14)
Peak V latency (ms)	5.55 (0.21)	5.55 (0.33)
Peak V amplitude (μV)	0.49 (0.17)	0.49 (0.20)
Left Ear		
Peak I latency (ms)	1.50 (0.10)	1.52 (0.16)
Peak III latency (ms)	3.71 (0.16)	3.69 (0.21)
Peak V latency (ms)	5.47 (0.19)	5.48 (0.23)
Peak V amplitude (μV)	0.49 (0.19)	0.50 (0.19)

- For left and right ears, mean peak I, III, and V latencies and peak V amplitudes were similar between the combined PHEU/HUU group and PHIV children.

Conclusions

- There were no statistically significant differences in ABR peak latencies and ABR peak amplitudes between PHIV and PHEU/HUU children.
- Our results are inconsistent with earlier ABR results in children with HIV. It is likely that PHIV children in ARCH: Cape Town are more virologically controlled compared to the children in previous research.
- ARCH: Cape Town is ongoing so more ABR data are being collected that will allow for more advanced statistical analyses, specifically in the PHIV children.

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