The Association between HIV and Auditory Brainstem Neural Responses in Young South African Children

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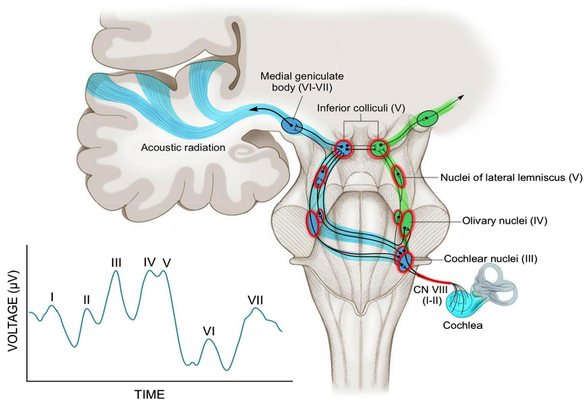
Introduction

- HIV-related central nervous system disease can be a result of untreated perinatal HIV infection (PHIV+)
- It is possible that antiretroviral therapy (ART) 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.
- HIV+ children have decreased ABR peak morphology and low peak amplitude suggesting a lack of auditory neural synchrony.



Aim

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 of ABRs in PHIV+, perinatally HIV-exposed, but uninfected (PHEU), and HIV-unexposed, uninfected (HUU) children.

Methods

Study Sample

- Forty-nine children from ARCH: Cape Town with ABR data were included in this study.
- There were 38 PHIV+ children (22 girls and 16 boys), 2 PHEU children (one girl and one boy), and 9 HUU children (5 girls and 4 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 vertex or high forehead, the right and left earlobes, and the center of the forehead (ground).
- ABRs were obtained using alternating rarefaction/condensation clicks through insert earphones at a rate of 11.1/sec and at 75 decibels (dB) normal hearing level (nHL).

Procedures (cont.)

- The 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.
- ABRs were obtained in each ear and completed twice to ensure waveform repeatability.

Outcome variable

- ABR latencies, in milliseconds (ms), for peaks I, III, and V in each ear were determined. All latencies were determined independently, then discussed between investigators (Torre and Elliott) when there were discrepancies.

Statistical Analyses

- Ear specific ABR peak latency data were analyzed using a repeated measures analysis of variance (ANOVA) (SAS, Version 9.4) with peak latency (I, III, and V) as the repeated measures variable and HIV status as the independent variable.
- Because of the small number of PHEU children and the fact that effects of perinatal HIV exposure are not being reported here, PHEU ABR data were included with the HUU ABR data.

Results

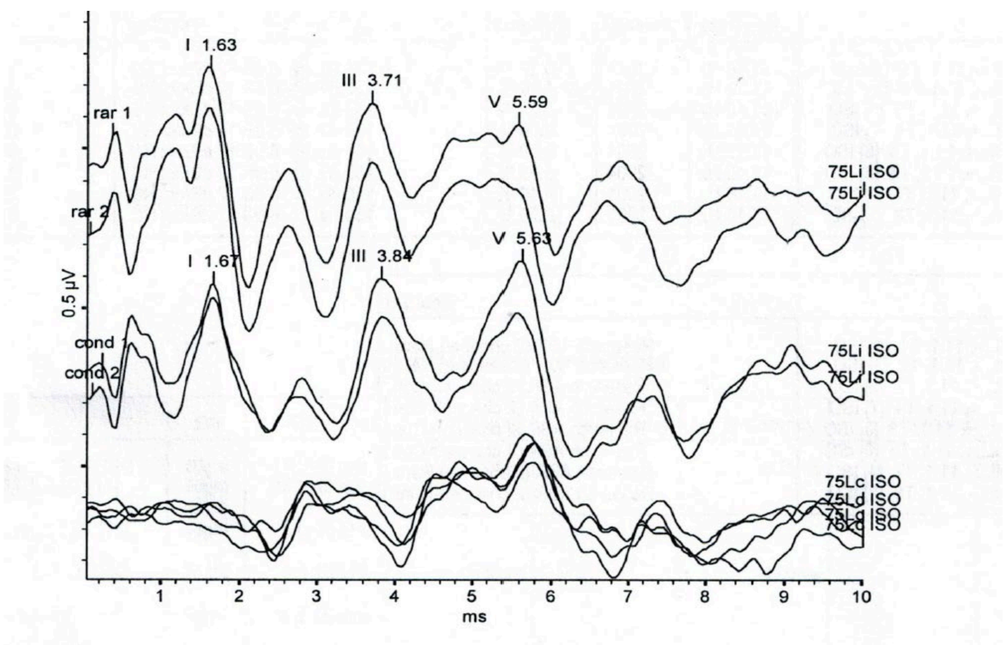


Figure 1. An example of ABR waveforms, for rarefaction (rar) and condensation (cond) stimuli is shown.

- The above ABR waveforms are from a child in ARCH: Cape Town. The top two tracings are evoked from rarefaction stimuli, the middle two tracing are evoked from condensation stimuli, and the bottom four tracings are contralateral recordings that were not analyzed. **(Figure 1)**
- In the first rarefaction waveform, peak I latency, the time from stimulus onset to the 8th cranial nerve, was 1.63 ms.
- Peak III latency, the time from stimulus onset to the cochlear nucleus, was 3.71 ms.
- Peak V latency, the time from stimulus onset to the level of the lateral lemniscus/inferior colliculus, was 5.59 ms.

Table 1. Peak latency means, and standard deviations are shown for PHEU/HUU and PHIV+ children.

	Auditory Brainstem Response Latencies	
	PHEU/HUU (Mean [SD]) (n=11)	PHIV+ (Mean [SD]) (n=38)
Peak I – Right	1.59 (0.11)	1.54 (0.12)
Peak III – Right	3.73 (0.20)	3.68 (0.15)
Peak V – Right	5.63 (0.22)	5.55 (0.18)
Peak I – Left	1.48 (0.09)	1.53 (0.15)
Peak III – Left	3.70 (0.17)	3.73 (0.20)
Peak V – Left	5.52 (0.21)	5.47 (0.25)

- For left and right ears, mean peak I, III, and V latencies were similar, (~1.5 ms, ~3.7 ms, and ~5.5 ms, respectively) between the combined PHEU/HUU group and PHIV+ children. **(Table 1)**
- There were no statistically significant group differences for any peak latencies by HIV status.
- There were three PHIV+ children with poor waveform morphology. (Data not shown)

Conclusions

- There was no significant difference in ABR peak latencies between PHIV+ and PHEU/HUU children.
- Three PHIV+ children had poor ABR waveform morphology which is an indicator of a lack of neural synchrony from the cochlea to the level of the brainstem.
- ARCH: Cape Town is ongoing so more ABR data are being collected and there will be equal numbers of children in the PHIV+, PHEU, and HUU groups in time.

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