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EVALUATION OF BRAINSTEM EVOKED RESPONSE AUDIOMETRY IN DEVELOPMENTALLY RETARDED CHILDREN IN A RURAL TERTIARY HOSPITAL OF CENTRAL INDIA

ENT

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ABSTRACT

Introduction- Hearing loss and deafness are global issues that affect at least 278 million people worldwide. Two-thirds of these people live in developing countries. **Method-** Cross sectional, comparative study, 20 normal and 20 DR children were selected. Parameters for interpretation were Hearing threshold in decibles(dB) of each ear seperately and Interpeak latencies. All the parameters were compared at 80 dB stimulus intensity level. **Result -** 35% cases had a hearing threshold of 90 dB. 20% cases had a hearing threshold of 80dB and ≥100dB. 25% of the subjects had a hearing threshold of 70dB. Interpeak latencies in Right & Left ear namely I-V, III-V and I - III inter-peak latency values were significantly prolonged in the developmental delayed children group. **Conclusion-** Interpeak latencies are prolonged in the children having developmental retardation as compared with normal children.

KEYWORDS

Brainstem Evoked Response Audiometry, Developmentally Retarded Children.

INTRODUCTION-

Hearing loss is a major public health issue and is the third most common such affliction after arthritis and heart disease.[1]. The prevalence of hearing loss is 0.5-6/1000 neonates across the globe [2]. Hearing loss and deafness are global issues that affect at least 278 million people worldwide. Two-thirds of these people live in developing countries[3].

Hearing loss can affect the development of children's ability to engage in age-appropriate activities, their functional speech communication skills, and their language skills[4].

A hearing loss occurring early in life can have a major impact on speech and language development. Even a mild hearing loss during the first 3 years of life can adversely affect a child's development in areas that rely on auditory input[5].

Brainstem Evoked Response Audiometry (BERA) is an objective test to understand the transmission of electrical waves from the VIIIth cranial nerve to the brainstem, in response to click sounds given through the ear. BERA is an effective tool that can be used for various screening for hearing loss in newborns, infants and other young children. There are no known risks of undergoing Brainstem Evoked Response Audiometry.

In a developmentally retarded child, sustaining the child's attention is even more challenging. Response assessment is further hampered by concomitant motor disability like spasticity and involuntary movements. When results using these tests are inconsistent after two or three trials, it may become necessary to abandon further testing in favour of BERA[6].

Hence this study was planned to compare the interpeak latencies in normal children and DR children.

Methodology.

1. Setting- Electrophysiology dept, AVBRH, Sawangi, Meghe, Wardha.
2. Design- Cross sectional, comparative study.
3. Research plan- As detailed below, the study was undertaken, after Institutional ethical committee IEC clearance.

Sample size –20

Procedure Of BERA.

A. Instrument used- Polyright using Neuro-MeP.NET (Version 3) software.

A1- Technical specification used for the procedure-

- Channels - single channel BAEP.
- Sensitivity - 0.5 µV / div.
- High cut filter – 2000 Hz.
- Low cut filter – 100 Hz.
- Sweep speed – 2 ms/div.
- Input impedence - < 5 K ohms.
- Number of averages -2000.

A2- Auditory Stimulator-

- Type – TA01 Headphone.
- Stimulus –click.
- Frequency- 2000 Hz.
- Intensity used – 30 dB SPL to 110 dB SPL.
- Presentation – Lt &Rt ear monaural.
- Click duration – 100 µs square wave clicks of alternating polarity.
- White noise – contralateral masking by 30 dB less than stimulus intensity.

A3- Placement Of Electrodes-

The monaural montage i.e.Cz – M1 / M2 was used:

- Cz (vertex) = Reference or positive electrode.
- Fpz/Fz (nasion) =Ground.
- M1/M2 (mastoid) = Active or Recording electrode.

Electrical activities were recorded with silver electrodes (Ag/Agcl) placed on vertex C2 & Mastoid M1 or M2 after clearing the area with acetone alcohol & applying conductive paste over there. Ground electrode were placed at the nasion (F2). Potentials were evoked during resting and in few cases by sedation with Pediclory l (Trichofos), by means of monaural stimulation with clicks of alternating polarity (ABR result is not affected by sedation or general anesthesia).

The stimulation was first applied during a 2 min period of adaptation, preceeding the recording. Then intensity was decreased from 110dB down by 10 dB at each step until wave V formation was clearly seen . This was usually upto 90dB and in some cases upto 70dB. Rate of stimuli was 11.1/sec. The clicks were released from earphone of Neuro-MeP.NET, in an isolated room. The ear not being tested was masked with white noise 30dB below the intensity of stimulus. A total of 2000 stimulations was averagedand the process was repeated at least once to ensure reproducibility of the responses.

Parameters for interpretation were Hearing threshold in decibles(dB) of each ear seperately (Based on appearance of wave V at minimum stimulus intensity) and Interpeak latencies. All the parameters were compared at 80 dB stimulus intensity level.

Statistical Analysis-

Statistical analysis was done by using descriptive and inferential statistics using Kolmogorov Smirnov Z Test and Mann Whitney U test and software used in the analysis were SPSS 22.0 version and GraphPad Prism 6.0 version. $p<0.05$ was considered as level of significance.

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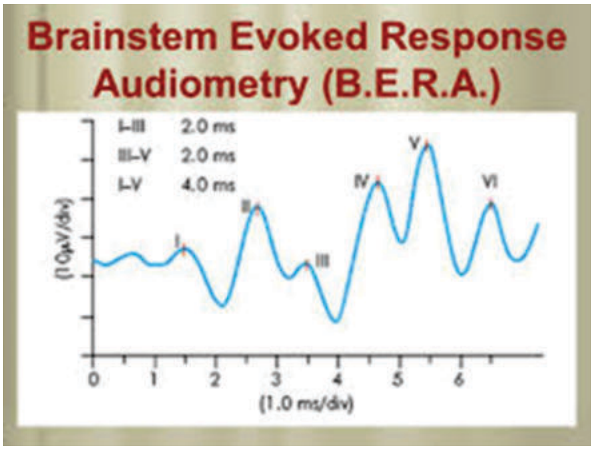

Observation-

Table1- Interpeak Latency Of Right Ear At 80 dB

Interpeak latency	Normal children (n=20)	Developmentally retarded children (n=20)	P value	Test of significance
	Mean±SD	Mean±SD		
I-III	2.06 ± 0.45	3.13 ± 0.42	0.0001	Significant
III-V	1.34 ± 0.37	2.12 ± 0.32	0.001	Significant
I-V	3.82± 0.32	5.62 ± 0.18	0.0001	Significant

Table 2 - Interpeak Latency Of Left Ear At 80 dB.

Interpeak latency	Normal children (n=20)	Developmentally retarded children (n=20)	P value	Test of significance
	Mean±SD	Mean±SD		
I-III	2.22 ± 0.35	3.18 ± 0.40	0.04	Significant
III-V	2.02 ± 0.22	2.35 ± 0.28	0.002	Significant
I-V	3.84± 0.38	5.84 ± 0.36	0.0004	Significant

RESULT

In this study 55% of the study subjects were female. 40% of the subjects were in the age group of 6 – 8 years & 60 % were in the 9 – 12 years age group. Majority of them (80%) were from low socioeconomic class. The associated conditions were cerebral palsy, mental retardation, history of birth asphyxia, history of seizure and stunted growth.

The hearing threshold was detected by BERA. Maximum number of cases (35%) had a hearing threshold of 90 dB. Equal percentage of subjects (20%) were seen having a hearing threshold of 80dB and ≥100dB. 25% of the subjects had a hearing threshold of 70dB.

Table 1&2 shows interpeak latencies in Right & Left bear respectively.I-V, III-V and I - III inter-peak latency values were significantly prolonged in the developmental delayed subject group ($p<0.05$)

DISCUSSION

A person with hearing in the normal range can hear sounds ranging from 0 to 140 dB. A whisper is around 30 dB. Conversations are usually 45 to 65 dB. Hearing loss severity is based on how well a person can hear the "speech range"[7].

It is known that the electrophysiological threshold depends on the electric potential record, which has close relation to the number of stimulated fibers, synchronism and size of electric activity. Thus, the subject may detect a piece of sound in weak intensity without necessarily registering corresponding electric potentials [8].

Maximum children were females in our study. Similarly, Mohammad Shamim Ansari and MA Hafiz Ansari studied hearing impairment in 110 children of 2-10 years of age of both genders with cerebral palsy, respectively[9]. Majority of the subjects in our study (80%) were from low socioeconomic class. It is also reported in the literature that socioeconomic status has a role in the prevalence of hearing impairment. Niskar et al. (1998) described the prevalence of hearing loss among US children by socioeconomic characteristics. Children from families whose incomes at or below the US national poverty line were significantly more likely to have a hearing impairment when tested [10].

In our study 70% of the subjects had cerebral palsy as an associated condition. Delayed cry, birth asphyxia, cerebral palsy, and neonatal seizures can cause brain hypoxia [11,12] affecting central auditory pathways leading to hearing loss. Mohammad Shamim Ansari, MA Hafiz Ansari reported mild, moderate, and severe degree of hearing impairment in 52%, 26%, and 22% of the 110 children of 2-10 years of age of both genders with cerebral palsy, respectively [9].

Mohammad Shamim Ansari et al also found a significant difference in the ABR latencies between the children with cerebral palsy and a typical children. Abnormal ABR measures in children with spastic CP demonstrated a correlation with the presence of moderate to severe developmental delay and they concluded that ABR measures of CP group revealed a statistical difference with that of the typically developing children and it has demonstrated a statistically significant correlation with the presence of neurological deficits [13].

Milind A. Nisargandha et al in their study also found delayed interpeak latency(IPL) values in both ears in developmentally delayed children[14].

As is known that , interpretation of BAER results in adults and older infants is largely dependent on peak V, which is the clearest and strongest peak. Moore JK et.al found in their study that, the peripheral to central maturation of the auditory system, results in a weaker projection of peak V in these developmental delayed infants [15].

CONCLUSION

This study concludes that interpeak latencies are prolonged in the children having developmental retardation as compared with normal children. Hence for measuring sensory neural hearing loss by neurophysiologists , this information shall save valuable clinical time and assist in diagnostic accuracy.

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