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Original Article

Comparative study of brainstem evoked response audiometry in developmental delayed infants and normal healthy infants

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ABSTRACT

Abstracts To compare the Brainstem Auditory Evoked Response analyzer (BERA) obtained using stimulations in normal infants and developmental delayed infants. Methods: This case control experimental study was conducted on 60 children out of them 30 were apparently healthy and 30 having developmental delayed. Database was collected after assessing threshold level in both the subjects. Brainstem Evoked Response Audiometry (BERA) was used as a tool for assessment of hearing loss. Results: Results showed that there was a significant difference between developmental delayed subjects and normal healthy subjects. The thresholds obtained by developmental delayed subjects presentation were lower than that by normal subjects. Conclusion: Overall it was concluded that, interpeak latencies were prolong in the subjects having delayed milestone as compare with normal healthy infants. The study promotes the use of delayed milestone activity shows sensory neural hearing loss presentation by neurophysiologists as it not only saves valuable clinical time but also improves the diagnostic accuracy for delayed milestone activity in infants.

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1. Introduction

The assessment of hearing is the primarily is a subjective test and no test other than a properly done pure tone audiometry test can tell us the exact hearing threshold level of the patient. Brain stem evoked response audiometry test is useful to the audiologist & physiologist in the following condition. 1. Detection of deafness in the difficult to test patients like infants and mentally retarded or malingering subject. 2. Assessment of the nature of deafness. 3. Identification of the site of lesion in retrocochlearpatholies. 4. Study of central auditory disorders 5. Study of maturity of the central nervous system in newborns.[1] The brainstem auditory evoked response (BAER) is an effective and noninvasive means of assessing the functional status of the auditory nerve and the brain

stem auditory sensory pathway.[2] The purpose of BAER assessment is to quantify and qualify hearing in terms of screening and estimating the degree of hearing loss, the type of hearing loss and the configuration of the hearing loss, especially in difficult to test population like premature newborns, mentally retarded child, child with delayed milestones, attention deficits and other sensory or motor impairment.[3]

The auditory brainstem response (ABR) is a series of electrical potentials that can be recorded from the scalp during the first 10 to 20 milliseconds following the onset of a transient stimulus. First described by Jewett et al [4] in 1970, it was soon demonstrated that the ABR could be reliably obtained in infants at intensity levels

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suggesting normal peripheral auditory function [5,6]. Generated by the auditory nerve and brainstem [7], the ABR is not a measure of hearing per se, in that it does not reflect conscious perception of sound. In the absence of neurologic pathology, however, ABR thresholds are closely associated with behavioral thresholds for similar stimuli in both adults [8] and young children [9,10]. The ABR has been detected in human neonates as early as 25 weeks' gestational age [11] and is not affected by sleep, sedation, or attention [12, 13]. Thus, the BAER is well suited to estimation of auditory sensitivity in infants and children who, because of developmental stage or handicapping conditions, cannot be tested reliably using conventional behavioral techniques.

Aim

To assess the Brainstem Evoked Response Audiometry in developmental delayed infants and normal healthy infants

Objectives

- To evaluate the Brainstem Auditory Evoked Response in developmental delayed subjects
- To assess the Brainstem Auditory Evoked Response in healthy normal infants
- To compare different interpeak latencies of BAER in developmental delayed infants with control group

Material and Method

The study was carried out in the department of physiology JNMC, Wardha. For this study 60 subjects were investigated in Acharaya Vinobha Bhawe Rural Hospital. The department of paediatrics, send subjects for Brain Stem Evoked Response Audiometry test in physiology. This test was carried out in all the subjects using a computerized Audiometer (16 channel RMS Polygraph AD). The equipment will be calibrated daily before the test. The different parameters of Brain Stem Evoked Response Audiometry was assessed like the highest value of inter peak latency in I-V, I-III, and III-V. Then, the correlation of developmental delayed subject with normal subject (control group) was studied. Also, the correlation between the severities of deafness in developmental delayed subject was assessed.

Method of recording BERA

Brainstem Evoked potentials were recorded after sedating to the patients with oral Pacyclorile syrup and testing them in quiet and relaxed test environment. [14] The procedure used in this study has already been reported. [15, 16, 17] The recording was made in a soundproof room. We used unfiltered rarefraction clicks (110 μs) in both right and left monaural stimulation (TDH-39 earphones; Telephonic, Farmingdale) at a rate of 11.1 clicks per seconds for 2000 sweeps on the test and the retest. Prior to recording, the

hearing level of both ears was tested in every subject. We used sensation level (SLs) instead of normalized hearing level to maximize the comparability of the data across subject and between ears for the same subject. We used an 80 dB SL intensity level along with 30 dB contralateral white noise masking.

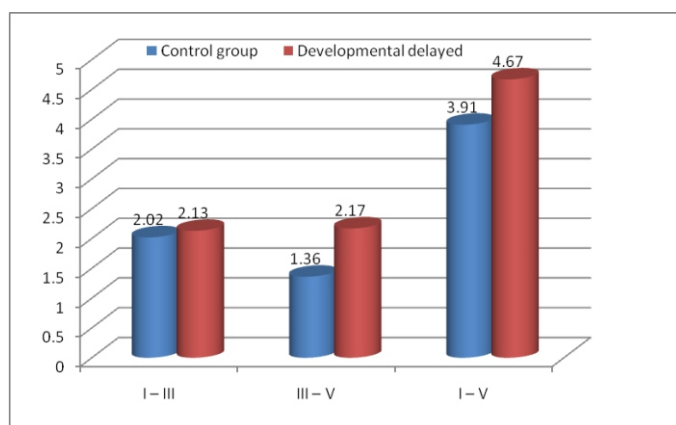
The auditory evoked potential is elicited by a click stimulus having an intensity of approx 50dB above the average pure tone hearing level of the subject and is recorded with the active electrode placed over the vertex of the other electrode is placed on the mastoid and the ground electrode is placed over the forehead.[18]

Result & Observation : Table 1 – showing inter peak latency of RIGHT EAR at 80 dB

| Interpeak latency | Control group (n=30) | Developmental delayed (n=30) | P value | Test of Significance |
|-------------------|----------------------|------------------------------|---------|----------------------|
| | Mean ± SD | Mean ± SD | | |
| I - III | 2.02 ± 0.41 | 2.13 ± 0.48 | 0.0001 | Significant |
| III - V | 1.36 ± 0.38 | 2.17 ± 0.37 | 0.001 | Significant |
| I - V | 3.91 ± 0.39 | 4.67 ± 0.19 | 0.0001 | Significant |

p value has been derived by Student 't' test.

Figure 1-comprasion of interpeak latencies in normal & Developmental delayed Subjects of right ear.



| Interpeak latency | Control group (n=30) | Developmental delayed (n=30) | P value | Test of Significance |
|-------------------|----------------------|------------------------------|---------|----------------------|
| | Mean ± SD | Mean ± SD | | |
| I - III | 2.28 ± 0.38 | 2.32 ± 0.38 | 0.03 | Significant |
| III - V | 1.86 ± 0.33 | 2.2 ± 0.25 | 0.002 | Significant |
| I - V | 4.08 ± 0.35 | 4.23 ± 0.32 | 0.0004 | Significant |

P<0.05 statistical significant and they are given as mean ± SD (n=30).

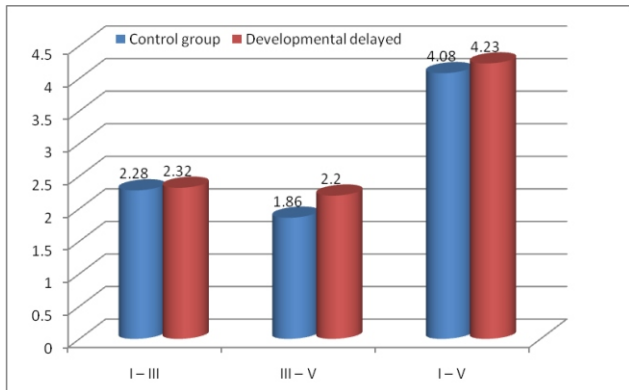


Figure 2- comparison of interpeak latencies in normal & Developmental delayed subjects of left ear.

In this study 82 subjects were recruited out of these 60 were included in the study, 15 participants were excluded from the study due to noncooperation during the study. 7 could not visit to the department of Physiology for the BERA testing. In the following table, the results pertaining to the two groups of subjects were presented. All the parameters pertaining to BERA recordings were evaluated and compared for right and left ear separately.

In the control group, I-V Inter-peak latency values were 3.91 ± 0.39 msec for the right ear; 4.08 ± 0.32 msec for the left ear; III-V inter-peak latency values were 1.36 ± 0.37 msec for the right ear; 1.86 ± 0.33 msec for the left ear, and I-III inter-peak latency values were 0.02 ± 0.41 msec for the right ear; 2.28 ± 0.38 msec for the left ear, respectively. As compared with the values of the control group, I-V, III-V and I - III inter-peak latency values were 4.67 ± 0.19 , 2.17 ± 0.37 , 2.13 ± 0.48 msec for the right ear and 4.23 ± 0.32 , 2.2 ± 0.25 , 2.32 ± 0.38 msec for left ear significantly prolonged in the developmental delayed subject group ($p < 0.05$).

Statistical analysis

All values are expressed as mean \pm SD. We used the student t test to assess significant variations in all of the studied parameters. Comparisons were considered to differ significantly when $p < 0.05$. All statistical computations were performed using SYSTAT for Windows statistical software version 12.0 & SPSS (statistical Package for social science) for windows statistical software version 13. (SPSS Inc., Illinois, USA).

Discussion

In this study, we investigated the mean values of the Interaural difference of absolute interpeak latencies for wave I, III and V by using developmental delayed subjects & normal healthy infants

The study conducted by Ilknur Kilic observed in the neonatal intensive care units have one or more identified developmental delayed infants, their BAER testing is justified for early detection

of hearing impairment. We believe that a follow up by means of the study of BAER potentials in newborn infants at risk may offer valuable information on the state of maturation of the acoustic pathways achieved by these children. [19] Our study shows the similar finding early detection of hearing impairment.

Moore JK et.al found in their study that, interpretation of BAER results in adults and older infants is largely dependent on peak V, which is the clearest and strongest peak. The peripheral to central maturation of the auditory system, results in a weaker projection of peak V in these developmental delayed infants. [20] This was even more clearly observed in our data.

The lower BAER thresholds in delayed milestone infants with more severe prolongation of I-V interval suggest that a severely prolonged I-V interval has impact on hearing sensitivity. This also suggests that a delay in maturation is a more probable cause than major audiological or neural pathology. This is supported by the fact that these infants are among the developmental delayed infants in our population

Conclusion

Overall it was concluded that, interpeak latencies were prolonged in the subjects having delayed milestone as compared with normal healthy infants. The study promotes the use of delayed milestone activity shows sensory neural hearing loss presentation by neurophysiologists as it not only saves valuable clinical time but also improves the diagnostic accuracy for delayed milestone activity in infants.

Parents should be advised that, more than one visit may be required in order to obtain a complete description of the infant's hearing. However, as soon as it is clear that a hearing loss exists (without waiting for all aspects of the examination to be completed) referrals should be made for a medical diagnosis (etiology) and for the initiation of early intervention services.

Recommendation

Intervention and counseling can start before the age of six months in accordance with the screening guideline of the Committee on Infant Hearing to prevent future problems with speech and language development.

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