Article *NIMHANS Journal*

Brainstem Auditory Evoked Responses in Infancy - (Normative Data)

Volume: 08 Issue: 01 January 1990 Page: 33-35

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Reprints request

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Abstract

Brainstem auditory evoked responses (BAER) are excellent non-invasive, sensitive diagnostic tools in identifying brainstem abnormalities in infants where clinical examination is difficult and/or may not be rewarding. The technique is simple, does not require the co-operation of the child and can be repeated without difficulty. The normative data of individual waves and interwave latencies of BAER in Indian infants are presented.

Key words -

Brainstem auditory responses,
Infancy,
Normative data

Evoked potentials have become the extension of the clinical neurological examination in the current practice of medicine. They provide accurate objective and completely reproducible data about the sensory pathways. Brainstem auditory evoked responses (BAER) are extremely useful in detecting the functional abnormalities of the brainstem [1], [2]. Their validity increases further as they can detect subclinical dysfunctions of the brainstem much before the clinical manifestations become apparent. They are particularly valuable in identifying brainstem disorders in infants and young children where the clinical neurological examination is difficult.

BAER are known to vary normally in different age groups [1], [2], [3]. Hence it is essential to establish the normative data before one can interpret the BAER abnormalities. Such normative data of BAER is not available for infants in our country. The objective of this paper is to give methodology and the normative data for the absolute latency and interpeak latencies of BAER in infants.

Materials and Methods

BAER was obtained in 11 clinically normal infants, at NIMHANS, Bangalore India. An initial

neurological examination including otoscopy was performed routinely in all the subjects to exclude middle ear disease. All the children were sedated with trichloroethylene syrup in a dose of 50mg/kg body weight. They were made to lie comfortably on the lap of their mothers while the test was being administered.

The signals were recorded using silver disc electrodes placed over the scalp using 10-20 International system of placement of electrodes. Pick-up electrodes were placed over the vertex (CZ), reference electrodes were placed over the right and left mastoids and ground electrode over the forehead.

The electrode impedance was kept below 3 k. ohms. Monoaural auditory stimuli consisting of rarefaction clicks of 0.2 msec square wave pulses were delivered through electrically shielded ear phone. The stimulus rate was 10/sec and its intensity, 60 dh above the sensory threshold. Since the determination of hearing threshold is difficult in infants, the first appearance of wave V when gradually increasing click stimuli were delivered, was taken as the hearing threshold. Masking white noise of 60 db was delivered to the contralateral ear.

Single channel recording was obtained using DISA 15 COI EMG amplifier. The differential input was tested for a band pass of 100 Hz to 2kHz and amplified 500000 to 10000000 times and minimum of 1024 responses were averaged. Atleast two trials were obtained for each ear and responses were superimposed to demonstrate the consistency. Latencies of the individual waves were measured from the onset of the triggering pulse to the peak of the individual waves. Interwave latencies from I-III, III-V and I-V waves were measured. Means and standard deviations for the above mentioned values were calculated. Mean ± 3 SD were used as the normal values

Results

The absolute latencies and the interwave latencies of BAER in eleven normal infants (age ranging from 1-18 months) were measured. The sex difference among the children was not studied as majority of them were males. All waves could be easily recognised (Figure I). Wave V was the most prominent peak with the mean latency of 5.2 ms. The mean and standard deviation for individual I-VII waves and interpeak latencies between I-III, I-V and III-V were measured (Table I). The mean values are 1.86, 2.07, 3.94 on the right side and 1.87, 2.01, 3.88 on the left side respectively.

Normal BAER in infancy

Table IA - BAER in infants (normative data)

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Discussion

Brainstem auditory evoked responses serves as in important noninvasive diagnostic tool in identifying

brainstem abnormalities especially in infants. It is necessary to establish normative data in different age groups as it is known to vary, according to the age [2], [3], [4], [5], [6].

To the best of our knowledge this is the first report of normative data of BAER in infants from our country. The technique of BAER recording is simple and noninvasive. It can be done comfortably while the child is asleep, sedation or anaesthetic agents do not alert the pattern/latency of BAER. Serial recording are useful in evaluating the progression or recovery pattern of any particular disease affecting auditory brainstem pathways.

Neural elements within the auditory pathways from the cochlea, to the medical geniculate bodies can be studied by this investigation. As yet there is no strong primary evidence in humans to define the exact generators of BAER, however they are thought to arrive from the following; wave I- distal eighth nerve, wave II- proximal eighth nerve or cochlear nucleus, wave III- superior oliver complex (lower pons) wave IV- lateral lamniscus and nuclei (upper pons), wave V-inferior colliculi. Waves IV and VII are variable in humans and their origin is not certain. Waves I, III & V are utilized in clinical diagnosis [1].

Since exact generator sources of individual components are not clear and at times it is difficult to recognize individual wave components, the interwave latencies are used to denote the brainstem dysfunction and to study the brainstem conduction time. Abnormality of I-III interwave latency suggests presence of a conduction defect in the caudal brainstem (between the eighth nerve and lower pons). Similarly abnormal III-V latency suggest conduction block in the rostral brainstem (between the superior olivary nucleus and inferior colliculi). When wave I is absent, it is usually due to peripheral hearing disorders.

BAER is extremely useful in testing [1]. Peripheral hearing apparatus in conductive and sensorineural hearing disorders, specially in early detection of congenital deafness [2] and in a variety of CNS disorders affecting the brainstem [1].

Acknowledgement

We thank Ms J. S. Veena for the secretarial assistance

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