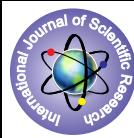


Study of 50 Cases of Brainstem Evoked Response Audiometry



Medical Science

KEYWORDS :

Shashikant Limbachiya

3RD YEAR RESIDENT DOCTOR, Department of ENT SURGERY, SMT.N.H.L. MUNICIPAL MEDICAL COLLEGE & SHETH V.S. General Hospital, Ahmedabad, Gujarat ,India.

Saurabh Gandhi

ASSISTANT PROFESSOR, Department of ENT SURGERY, SMT.N.H.L. MUNICIPAL MEDICAL COLLEGE & SHETH V.S. General Hospital, Ahmedabad, Gujarat ,India.

Nipa Dalal

ASSOCIATE PROFESSOR, Department of ENT SURGERY, SMT.N.H.L. MUNICIPAL MEDICAL COLLEGE & SHETH V.S. General Hospital, Ahmedabad, Gujarat ,India.

Madhavi Raibagkar

PROFESSOR & HEAD, Department of ENT SURGERY, SMT.N.H.L. MUNICIPAL MEDICAL COLLEGE & SHETH V.S. General Hospital, Ahmedabad, Gujarat ,India.

ABSTRACT

Early and accurate diagnosis of hearing loss can significantly improve the management of deaf and hearing-impaired patients. Brainstem evoked response audiometry (BERA) is the method of choice for accurate detection of hearing threshold. The present study consists of 50 cases (100 ears) of all age groups and both sex. This study emphasizes the importance of BERA in high risk neonates & infants as a screening tool for the detection of hearing impairment at an early stage which would have otherwise got unnoticed till about 2-3 years, as well as group of adult patients who gives doubtful response on pure tone audiogram. BERA, because of its accuracy has emerged as a technique of choice in the screening as it is an objective test.

Introduction:

BERA-Brainstem Evoked Response Audiometry is a neurologic test of audiometry function in response to auditory (click) Stimuli. It is an evoked potential generated by precise click transmitted from an acoustic transducer by Earphone or Headphone. The generated response from basilar region of the cochlea travels along the auditory pathway to the midbrain. The elicited waveform response is measured by surface electrodes placed at vertex of the scalp & behind the ear. The amplitude (micro-V) of the signal averaged & charted against the time (milliseconds). The waveform peaks are labeled as I-VII, Each of these waves, represent a neuro electrical activity generated by the neural generators at some place in the auditory pathway in between cochlea & midbrain.¹⁻²

Table: 1 BERA wave pattern and their site of origin in Auditory Pathway

WAVE	SITE
I	Distal end of cochlear nerve
II	Proximal end of cochlear Nerve
III	Cochlear nucleus
IV	Superior Olivary Complex
V	Lateral Lemniscus & Inferior colliculus
VI & VII	Neural generators not definitely known.

By analysis of the wave form & its peaks as regards of their latency, amplitude & wave morphology, we can have fairly accurate diagnosis of abnormal auditory pathway.

Materials & Methods:

The present study consists of 50 Cases (100 ears) of all age groups and both sex.

Table: 2 Age Distribution of 50 Patients

Age	<2 Years	2 to 12 Years	>12 Years
No. of cases	28 (56%)	09 (18 %)	13 (26%)

We have selected only high risk neonates and infants, mentally retarded / uncooperative children as well as group of adult pa-

tients who gives doubtful response on pure tone audiogram to detect malingering if any.

The following were considered as risk factors in neonates:

Hyperbilirubinemia, Birth asphyxia, Low birth weight, Positive family history, Cranio-facial congenital anomaly, Cerebral palsy, Meningitis, Intrauterine infections (TORCH), Usher syndrome, Global developmental delay, Autism.³

Method:

The sound stimulus for BERA is broad band click of 100 microsecond's duration, it has very rapid onset & fall. The BERA recording is best obtained using such a sound for stimulating evoked potential. Before the click is presented to ear it is filtered such that the lowest frequency of sounds in the broad band click is 100 to 150 Hz & highest frequency is 3000-5000 Hz. A total of 2000 to 4000 recordings are done & then averaged & superimposed. The stimulus rate used is between 11 clicks/second or 21 clicks/second. The recording is obtained as a graph plotted with amplitude (in micro-V) & time (in milliseconds). It consists of five to seven waves or peaks appearing within 8 to 10 milliseconds.

Table: 3 Criteria for Abnormal BERA parameters.

Parameter	Normal Value(milliseconds)	Criteria for Abnormality (milliseconds)
I to III IPL	2	>2.4
II to V IPL	2	>2.4
I to IV IPL	4	>4.4
Interaural latency difference of wave V	<0.3	>0.3
Morphology of Wave V	Present	Absent

Results & Discussion:

Threshold estimation was done by starting at 100 dB SPL and then gradually coming down to lower side till wave V was just identifiable with satisfactory morphology. BERA was consider as absent when no response found at 120 dB SPL. Other parameters calculated at the intensity where all waves are present and morphology is satisfactory. Air conduction BERA used with monaural stimulation. Test done at body /room temperature. Patient was made as relax as possible or sedated where required among which following result obtained.

- Total No of cases in which BERA wave absent :
Right 24 (48%)
Left 24 (48%)
- Total No of cases in which BERA wave present :
Right 26 (52%)
Left 26 (52%)
- Total No of cases in which BERA wave absent in both ear:
21 (42%)
- Total no of cases in which BERA wave present in both ear
23 (46%)

- Total no of cases in which BERA wave present in unilateral
06 (12%)

In study BERA wave absent in 48% cases suggestive of sensorineural deafness still these cases need monitoring because few cases may have reversible deafness which may be picked up by BERA waves and presence of BERA wave does not necessarily suggest normal hearing there may be some degree of hearing loss, but presence of BERA wave exclude total deafness.

Table: 4 Results in High risk neonates.

High risk group Present		BERA wave for both ear(No. of cases)	
		Absent	
Hyperbilirubinemia	4(100%)	0(0%)	4(100%)
Low Birth Weight (LBW)	9(100%)	8(88.89%)	1(11.11%)
Birth asphyxia	6(100%)	3(50%)	3(50%)
Bacterial Meningitis	6(100%)	3(50%)	3(50%)
LBW + Hyperbilirubinemia	2(100%)	0(0%)	2(100%)
Head Injury	2(100%)	0(0%)	2(100%)
Hypertension	1(100%)	1(100%)	0(0%)
Hypertension + Diabetes	1(100%)	1(100%)	0(0%)
Positive family history	2(100%)	0(0%)	2(100%)
No significant history	4(100%)	1(25%)	3(75%)
Usher Syndrome	1(100%)	0(0%)	1(100%)
Viral Fever	1(100%)	1(100%)	0(0%)
Global developmental delay	1(100%)	1(100%)	0(0%)
Austim	1(100%)	1(100%)	0(0%)
Bilateral atresia with anotia	1(100%)	1(100%)	0(0%)
LBW + Autism	1(100%)	1(100%)	0(0%)
Cerebral Palsy	1(100%)	1(100%)	0(0%)

The group of patient namely Hyperbilirubinemia, LBW, meningitis and birth asphyxia has history of NICU admission. From the present study it can be said that patient with Hyperbilirubinemia has 100% chances of deafness while birth asphyxia and meningitis patients have 50% chances of having deafness while LBW group have 11.11% chances of deafness.

Table: 5 Average Inter Peak Latency difference of wave I & V

Average Inter Peak Latency difference of wave I to IV	Right ear 4.65ms Left ear 4.74ms	
	<2 years	>2years
Right ear	4.88ms	4.40ms
Left ear	5.08ms	4.23ms

These high IPL difference in < 2 years is either due to deafness or due to delayed maturation of auditory pathway but in > 2 years it may be due to some degree of deafness.

Table: 6 Average absolute latency of wave-I

Average absolute latency of wave- I	Right ear 1.92ms Left ear 1.94ms	
	<2 years	>2years
Right ear	1.93ms	1.90ms
Left ear	1.98ms	2.01ms

In present study the absolute latency of wave I is near normal.

BERA wave in case of bilateral anotia with atresia was present but the threshold was high and absolute latency of wave I & V was also high this finding goes in favour of conductive deafness but still to confirm it, bone conduction BERA must be done.

Conclusion:

The greatest advantage of BERA is that it is used more accurately for screening of high risk newborns and infants where other audiological tool has limited role. BERA is more definitive for detection of sensory as well as neural deafness and gives idea of entire auditory pathway. BERA is gold standard for detection of malingering patient as it is objective test while PTA is subjective test so BERA proves to be superior to PTA in malingering patients. For detection and monitoring of maturation of central nervous system, cochlea, auditor nerve and brainstem, BERA can be reliable and easily available non-invasive method. For pediatrics age group suspected deafness can be early detected by BERA & earlier intervention can improve speech development and conversational abilities.

REFERENCE

1. Ferraro & Durrant in Jack Katz (editor), 1994: " Auditory evoked potentials overview and basic | principles Handbook of clinical audiology(1994), 4th Edition Williams & wilkins, Baltimore, USA | 2. Micheal J. Aminoff et al. Electrodiagnosis in clinical neurology, 5th Edition | 3. Kenna M. The Ear. In: Behrman RE, Kliegman R, Jenson HB, editors. " Nelson textbook of pediatrics. | 16th edition." Philadelphia: Saunders's company; 2000.p.1940 -1949. | 4. Shehata-Dieler WE, et al. 2000: "Universal hearing screening of newborn infants with the BERA- | phone." Laryngorhinootology. 2000; 79(2):69-76. | 5. Van Riper LA, Kileny PR, 1999: "ABR hearing screening for high risk infants." Am J Otol, 1999; 20(4): | 516-521. | 6. Downs MP, Yoshingata-Itano C. 1999: " The efficacy of early intervention for children with hearing | impairment." Pediatr Clin North Am. 1999; 46(1): 79-87. |