Incidence of Hearing Impairment in High Risk Infants

Dr. Lakshmi T *, Dr. Zaheera Sultana*, Dr. Brid S.V **

*, ** Assistant professor of Physiology, Chamrajnagar Institute of Medical Sciences, Chamarajanagar- 571313

***Professor and Head of Physiology, Sri Nijalingappa Medical College Bagalkote-587102

Abstracts: Background: Hearing is the means by which the new-born comes into contact with the world of sound and with language. The first three years of life are the most important period for speech and language acquisition. Reduced hearing acuity of any severity in infancy or early childhood may prevent the child from receiving adequate auditory, linguistic and social stimulation required for speech and language development. Hearing loss is one of the most common abnormalities present since birth. The prevalence of hearing loss is reported to be 1.5 to 6 per 1000 new-born in the well-baby nursery population. Several risk factors associated with hearing loss during early infancy have been described by Joint Committee on Infant Hearing which includes hereditary cause, in utero infection, prematurity, asphyxia, hyperbilirubinemia and ototoxic medications. Brainstem evoked response audiometry is a simple, non-invasive way of evaluating the hearing function and has been widely used for early detection of hypoacusis and neural conduction irregularities in the auditory pathway. **Objectives:** To assess the incidence of hearing impairment in high risk infants by using Brainstem evoked response audiometry. **Methods:** 100 high risk infants having one or more risk factors attending Pediatric OPD of Bapuji hospital and Chigateri General Hospital satisfying the inclusion criteria were subjected to BERA. **Results:** The incidence of hearing impairment was 64.9% in the high risk infants. [Laxmi T NJIRM 2014; 5(5):44-47]

Key Words: Brainstem Evoked Response Audiometry (BERA), hearing impairment, high risk infants, incidence.

Author for correspondence: Dr. Lakshmi T, Assistant professor of Physiology, Chamrajnagar Institute of Medical Sciences, Chamarajanagar- 571313. **Email:** jenydrlaks@gmail.com

Introduction: Auditory evoked responses are electrophysiologic recordings of responses from within the auditory system that are activated by sounds. The evoked transient responses can be recorded upto 500 milliseconds from time of onset of the sound stimulus. The evoked potentials of the first 10 milliseconds i.e. Short Latency Response (SLR) is popularity known as Brain Stem Evoked Response Audiometry (BERA)[1] Auditory Brainstem Response (ABR) is a far – field recording of the synchronized response of numerous neurons in the auditory pathways within the brainstem. As per WHO report, there are about 250 million deaf people in the world and is the second most common cause of disability. WHO estimates that every year 38,000 deaf children are born in South – East Asia. India has 6.3% prevalence rate of moderate to severe hearing impairment [2]. Hearing impairment has a devastating detrimental and invariable adverse impact on the development of children. Late detection causes irreversible stunting of the language development potential of the child. Joint Committee on Infant Hearing (JCIH) [3] promulgated a list of specific risk factors to identify infants at risk for hearing impairment for careful follow – up and assessment. Later the consensus recommended screening of all newborns. Most of the neonatal facilities in the United States and European Union have enforced mandatory screening of all newborns. In a developing country like India, newborn hearing screening is yet to be implemented. According to Centre for Disease Control (CDC), Hearing screening and follow – up survey 2009, 1.4 per 1000 babies screened (Range 0 – 4.6 per 1000 babies screened) have hearing impairment. Prevalence and incidence rate of hearing loss in India is quiet alarming. Studies show varying prevalence rates from 1% to as high as 40%[4]. Hecox and Galambos[5] first reported about successful application of ABR in the audiological evaluation in children. JCIH recommends the use of ABR and Oto Acoustic Emission (OAE) for screening of newborns. These electrophysiological methods are efficient, cost effective and accurate for identifying the degree of hearing loss. The present study was conducted to know the incidence of hearing impairment in high risk infants.

Methods: In this study 100 high risk infants having one or more risk factors, according to the criteria stated by American Academy of Pediatrics, JCIH 2007 were selected from Bapuji Hospital and Chigateri General Hospital, attached to J.J.M.

Medical College, Davangere. Inclusion Criteria includes: Babies < 1 year, Family history of permanent childhood hearing loss, Neonatal intensive care of more than 5 days or any of the following regardless of length of stay. Extracorporeal membrane oxygenation (ECMO), assisted ventilation, exposure to ototoxic drugs or loop diuretics (furosemide) and hyperbilirubinemia that requires exchange transfusion, In utero infection such as cytomegalovirus, herpes, rubella, syphilis and toxoplasmosis, Craniofacial anomalies, Birth weight < 1500g, Bacterial meningitis, Gestational age < 37 weeks, Apgar scores < 4 at 1 minute or < 6 at 5 minutes. Exclusion Criteria: Severe multiple anomalies, Incompatible with life, Atresia or stenosis of external ear canal, Untreated otitis externa, Babies more than one year of age. 100 high risk infants satisfying the inclusion criteria were included in the study. Written informed consent was taken from the parents after explaining them the procedure and its significance in their vernacular language. Detailed history and thorough ENT examination was done before the procedure. The infants were subjected to BERA testing on RMS EMG EP MARK-II machine manufactured by the RMS RECORDERS and MEDICARE SYSTEM, CHANDIGARH. Infants were sedated with syrup Trichlofos (pedichoryl) 20mg/kg body weight. The skins at the point of placement of electrodes were cleaned with 'abrasive strip. Recording of BERA was carried out in a quiet and semi-darkened room. Surface electrodes were placed at the vertex (C_z), both mastoids (Ai and Ac) and forehead (ground). The resistance was kept below 5K. Monoaural auditory stimulus consisting of rarefaction clicks of 100 microseconds were delivered through electrically shielded earphones at the rate of 11.1/sec. Contralateral ear was masked with pure white noise of 40dB. A band pass of 150-3000Hz was used to filter out undesirable frequencies in the surroundings. Responses to 2000 click presentations were averaged. The existence of Wave V – most prominent peak appears 5.5 milliseconds after the stimulus was considered as sound stimulus heard and perceived by auditory mechanism. BERA threshold for each ear was confirmed.

Table 1: Grading of hearing sensitivity

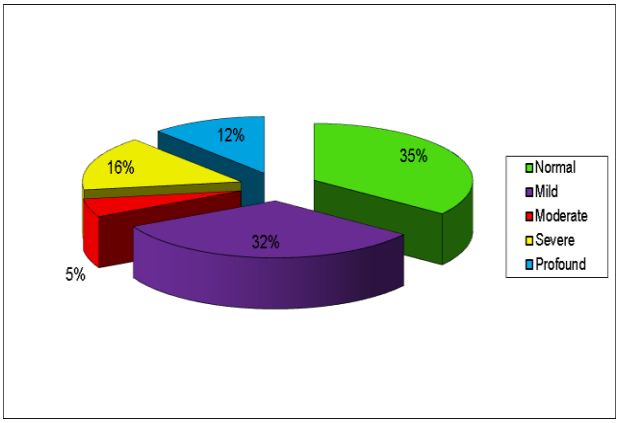
Normal hearing sensitivity	Wave V threshold up to 30dB and below
Mild hearing impairment	Threshold between 40dB and 60dB
Moderate hearing impairment	Threshold between 60dB and 70dB
Severe hearing impairment	Threshold between 70dB and 90dB
Profound hearing impairment	Threshold above 90dB

Results: Of the 100 cases with one or the other risk factors, BERA response was not obtained from 23 babies , 27 (35.1%) babies had normal hearing 25 (32.5%) had mild, 4 (5.2%) moderate, 12 (15.6%) severe and 9 (11.7%) profound hearing impairment(Table No.2, Graph No.1).

Table No -2 Incidence of hearing loss in high risk infants.

		N	%
BERA Grading	Normal	27	35.1%
	Mild	25	32.5%
	Moderate	4	5.2%
	Severe	12	15.6%
	Profound	9	11.7%

Graph 1: Incidence of hearing loss in high risk infants



In this study the incidence of hearing impairment in the infants who had at least one risk factor was 64.9%. These results are comparable with Aiyer [6] but very high in comparison to other studies [7,8,9,10] . This difference was perhaps due to referral nature which provides care to highly complex cases. Other factors which might have been significant in this difference were lack of good prenatal care and delay in referral of sick and high risk babies to our hospital.

Discussion: The incidence of hearing impairment in high risk infants according to different statistics [4,11,12] varies from 1% to 40%. There are several risk factors which are important as precipitatory events, causing hearing impairment in new-born and young infants. The following are among these risk factors- prematurity, low birth weight, asphyxia, use of aminoglycosides, hyperbilirubinemia, prolonged mechanical ventilation, bacterial meningitis, intrauterine infection and craniofacial anomalies [3]

Fakhrace et al studied 388 patients, of which 28% had mild to profound hearing impairment most common (11.3%) being mild hearing loss. All of the patients with asphyxia had hearing impairment, 25.6% of patient with aminoglycoside treatment had hearing impairment [8]. Ira Bergman studied the hearing loss in low birth weight infants upto 9.7% and the survivors of neonatal seizures as 16.7%.[13].

Galambos [14] in his recent follow up study found the incidence of hearing loss of 4 to 9%. Gupta [15] found 19.2% at risk neonates to have hearing impairment using BERA, and also found hyperbilirubinemia and low birth weight significantly contributing to hearing loss.

In concern with recommendations of the JCIH and the National Institute of Deafness and other communication Disorders (NIDCH) Early Hearing Detection and Intervention (EHDI) programs must use physiological screening measures of the auditory system and eliminates behavioural measures. Current physiological measures include Auditory Brainstem Responses (ABRs) and / or Evoked Otoacoustic Emission (EOAEs) either Transient (TEOAE) or Distortion Product (DPOAE).

Although the ABR is not a direct test of hearing sensitivity, it has earned a strong clinical reputation as a tool to evaluate the integrity of the auditory pathway from the external ear to the lower brainstem. OEAs are sounds generated in the inner ear that can be recorded by sensitive microphones in the external ear canal. These sounds are most likely generated by the outer hair cells in the cochlea and serve as an indirect measure of these hair cells. OAEs are not themselves, necessary for hearing, but rather they reflect the status of structures that are necessary for hearing. Thus, OAEs reflect the status of the peripheral auditory system extending to the cochlear outer hair cells. In contrast, ABR measurements are obtained from surface electrodes that record neural activity generated in the cochlea, auditory nerve, and brainstem in response to acoustic stimuli delivered via earphone.

We have used BERA for assessing hearing impairment which has important characteristics- it gives the electrophysiological response of hearing without any need for assessment of the newborn behaviour, the result of this study are not affected by anaesthetics or sedatives, which may be used during the test, BERA is rapid, easy and relatively cheap test. The reported sensitivity of BERA for hearing assessment was 100% and specificity around 97% (16). According to JCIH (2007), the goal of screening new-born for hearing impairment is to identify and initiate treatment by 6 months of age.

Conclusion: The present study indicates that hyperbilirubinemia contributes significantly for hearing impairment. The most common risk factors for hearing loss being prematurity, hyperbilirubinemia, birth asphyxia, parental consanguinity and convulsions which may have synergistic effect. Therefore it is essential to screen all the infants at the earliest, to prevent adverse effect on the developing auditory pathway. High risk infants have a substantially higher incidence of hearing loss as compared to normal infants. Though transient hearing impairment is not uncommon in these infants, the incidence of persistent severe to profound hearing loss is considerable. Ideally in a given situation, hearing loss should be identified early enough in order to treat and prevent squeal of speech delay.

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Conflict of interest: None
Funding: None