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Original Article

Incidence of hearing loss in infants at risk

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ABSTRACT

The present study was done to know the incidence of hearing impairment in infants at risk. After sedation & preparation of babies with history of preterm delivery, neonatal jaundice, neonatal convulsions, birth asphyxia, low birth weight (<1500gm) & with congential anomalies of ears,they were tested for brainstem evoked responses using RMS EMG. EP MARK –II machine which is a fully computerized machine. Incidence of significant hearing loss was 46.66% & by this study we can observe that infants exposed to risk factors like preterm delivery, neonatal jaundice, neonatal convulsions, birth asphyxia & LBW are prone for some hearing abnormality. Among these risk factors in our study we observed neonatal convulsions, birth asphyxia & neonatal jaundice carry a very high risk of hearing abnormality. So this hearing impairment has to be detected in the early stages & proper rehabilitative measures are taken at the earliest so that further developmental milestones are not delayed . BERA (brainstem evoked response audiometry) as a screening procedure will give an idea of degree of hearing impairment .

1. Introduction

Incidence of severe hearing loss among survivors of neonatal intensive care ranges from 1% to 28%,while mild to moderate deficits are even more prevalent[1]. Although some of these babies have only a transient loss, in a considerable number, hearing loss persists[2].

Deafness in 1st three years of life may impair the full development & maturation of auditory system & it is well known that deafness in infancy & childhood interferes with normal development of speech & language . In the absence of normal speech, child's ability to communicate is restricted & this has a negative impact on child's social, emotional, cognitive & academic development3. Consequently, as a child grows into adulthood, his/her vocational & academic potential is significantly attenuated & family/society is left to bear the cost of the care of an otherwise healthy individual for life.

To prevent this & to initiate rehabilitative procedure as early in life as possible a screening method to detect auditory disabilities in newborns is of great importance. Although many methods like - behavioural audiometry ,impedance audiometry, respiratory & cardiac responses & crib movement systems are evaluated, BERA which yields information on threshold sensitivity of peripheral part of auditory apparatus & on conduction velocity in brainstem[3] is the satisfactory procedure which can be performed with ease in children.

The risk factors according to joint committee on Infant Hearing are family history ,in utero infections ,craniofacial anomalies, birth weight <1500g, hyperbilirubinemia at serum levels requiring exchange transfusion, ototoxic medications , postnatal asphyxia [4,5].

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So the present study is done to know the incidence of hearing loss & to evaluate the relative importance of the various otonoxious risk factors in producing hearing impairment in infants at risk in & around Davangere city.

2. Materials and Methods

In this study, an attempt is made to study the findings of BERA in infants. These children reported to us or were referred to us for the following reasons:

- Inconsistent responses to sound or inability to respond to sound.
- History of high risk factors – pre–term, low birth weight, birth asphyxia, neonatal seizures, hyperbilirubinemia.
- To rule out the extent of malformation anomalies especially in Atresia.

2.1Procedure

All patients were administered the test procedures with prior appointment. An ENT check up was done to rule out the possibility of wax, ear infection, middle ear problems etc. The parents were instructed to wash the scalp of the child thoroughly as a requirement of the test. Prior to the test, each child was examined by the pediatrician and the dosage for sedation was prescribed. Drug used for sedation was syrup Triclofos 20mg/kg body wt. or diazepam 0.1mg/kg body wt.

The instrument used was RMS EMG. EP MARK –II machine which is a fully computerized machine manufactured by RMS RECORDERS & MEDICARE SYSTEM Chandigarh. Test was carried out in pre–cooled, quiet, dimly lit room with subject relaxed in supine position with eyes closed. The skin was cleaned with spirit and OMEN abrasive skin preparatory paste. The silver electrode were placed as follows: Cz–vertex, both mastoid, (Ai & Ac) forehead (ground) . Resistance was not more than 1ohms. Electrode electrolyte gel was used and electrodes were fixed. Acoustically shielded THD 32 ear phones were placed on the ear and head bands were adjusted. Monoaural auditory stimulus consisting of rare faction clicks of 100 microseconds with intencies starting from 30 dB to 110 dB were delivered through electrically shielded earphones at a rate of 11.1/sec. Contralateral ear was masked . The filter settings used were 150Hz–3000Hz. The polarity used was alternate and the analysis time was 10m/sec. About 2,000 responses were averaged. The existence of peak V was considered as sound stimulus heard and 5 perceived by the auditory mechanism. The threshold for each ear was confirmed. The guidelines used for the confirmation of peak V were as follows:

- Peak V occurs around latency of 5.7 m/sec with S.D. of 0.25 (as per our norms).
- With decrease, an intensity level latency of peak V increases and its amplitude decreases..
- Peculiar in shape.

Grading of hearing sensitivity is given in Table 1.

Table 1.Grading of hearing sensitivity

Normal hearing sensitivity	Thresholds up to 30dB level and below
Mild hearing impairment	Thresholds between 40dB to 60dB
Moderate hearing impairment	Thresholds between 60dB to 70dB
Severe hearing loss	Thresholds between 70dB to 90dB
Profound hearing loss	Thresholds above 90dB

3. Results

BERA findings of 147 infants for this study are shown in Table 2.

Out of 147 high risk cases, 50 had profound hearing loss, 18 had severe hearing loss, , 25 had moderate hearing impairment, 6 had mild hearing impairment & 48 had normal hearing sensitivity. Out of 48 patients with normal hearing sensitivity, 8 patients were preterm, 19 had hyperbilirubinemia, 9 had neonatal convulsions ,10 birth asphyxia, 2 LBW. Out of 147 cases 31 patients had mild/moderate hearing impairment.

Table 2 BERA findings

Normal hearing sensitivity	48
Mild hearing impairment	06
Moderate hearing impairment	25
Severe hearing loss	18
Profound hearing loss	50
Total	147

Table 3. Risk factors & severity of hearing impairment

Risk factors	No. of cases	Normal Hearing	Mild H.I.	Mod. H. I	Severe H. L	Profound H.L.	Total no.of cases with Severe /Profound H.L.	Percentage of cases with Severe H.L.
Preterm	25	8	1	6	0	10	10	40
Neonatal jaundice	47	19	1	6	3	18	21	44.68
Neonatal convulsions	25	9	0	2	8	6	14	56
Birth asphyxia	40	10	4	7	7	12	19	47.5
LBW (<1500gm)	10	2	0	4	0	4	4	40

Out of 18 patients with severe hearing impairment 3 had hyperbilirubinemia, 8 had neonatal convulsions & 7 had birth asphyxia. Out of 50 patients with profound hearing loss, 10 patients were preterm, 18 had hyperbilirubinemia, 6 had neonatal convulsions ,12 birth asphyxia, 4 LBW. Along with these risk factors 3 patients with profound hearing loss had microtia.

Out of 25 preterm cases, 7 had mild- moderate hearing impairment & 40% had severe hearing loss. Out of 47 cases of neonatal jaundice 7 had mild- moderate hearing impairment & 44.68% had severe hearing loss. Out of 25 neonatal convulsions cases 2 had mild- moderate hearing impairment & 56% had severe hearing loss. Out of 40 birth asphyxia cases 11 had mild- moderate hearing impairment & 47.5% had severe hearing loss,d hearing impairment , Out of 10 LBW cases 4 had mild- moderate hearing impairment & 40% had severe hearing loss. 6 Out of all 147 risk cases 68 (46.66%) had significant (Severe/Profound) hearing loss. All the above cases were sent for further rehabilitative procedures as per their requirement.

4. Discussion

Incidence of significant auditory impairment was 18% ,on the basis of this study it is suggested that all high risk neonates should undergo screening for hearing impairment [6].

Schulman – Galambos & Galambos[7] studied 325 children with BAEP 1year or more after discharge from their intensive care nursery . They found 8 children (2.14%) with severe hearing loss. Galambos et al [8] in a more recent large follow up study continues to maintain a higher incidence of significant hearing loss of 4-9%. Roberts et al [9] in another recent large follow up study could confirm hearing loss in only 2.3%. therefore this issue remains controversial[10].

Study by Ira Bergman [11] shows that the frequency of hearing loss among surviving & followed LBW infants was 9.7%, among survivors of neonatal seizures it was 16.7% and confirms the high frequency of hearing loss among surviving VLBW premature infants & highlights the fact that 61% of these children are otherwise neurologically & intellectually intact.

BAER was abnormal in22/30 neonates (73.3%) with risk factors[12].

Out of 593 children (0-5 year) from High Risk category subjected to B.E.R.A. over last 5 years, 126 (21.4%) showed hearing loss. 202 children (34.06%) from Birth Asphyxia category formed the largest group[13].

Thirteen (19.2%) of 68 at risk neonates in an intensive care nursery with one or more adverse perinatal clinical factors were diagnosed to have hearing impairment by BERA testing. Among risk factors only 2 factors have been significantly correlated to hearing impairment in the affected neonates (viz;hyperbilirubinemia at level exceeding indication for exchange transfusion & birth weight (<1500gm)[14].7

Since most of the survivors in neonatal intensive care units have one or more identified high risk factors , their BERA testing at the time of discharge is justified as a screening procedure for early detection of hearing impairment[14].

According to Salamy A et al[1] hearing evaluation for high – risk infants throughout the first few years of life is imperative.

Dorothy et al[15] found the sensitivity of BAEP as a scrrening test to be 100% , specificity of the test is 86% . With further experience & technologic advances , BAEP may prove justified for wide-spread clinical utilization in the hearing screening of high –risk newborns.

By this study we can observe that infants exposed to risk factors like preterm babies ,neonatal jaundice, neonatal convulsions , birth asphyxia & LBW are prone for some hearing abnormality which correlates with earlier school of thoughts as quoted below. Among these risk factors in our study we observed neonatal convulsions, birth asphyxia & neonatal jaundice carry a very high risk of hearing abnormality.

Previous studies [16] have found either that many individual neonatal variables such as high serum bilirubin concentration ,low Pao2 or cyanotic attacks were associated with hearing loss.

Bilirubin can deleteriously affect the auditory pathway anywhere along its course in the brain stem ,although the cochlear nucleus is usually most involved[17,18].

Animal studies[19] suggest that acoustic trauma & aminoglycosside antibiotics may act synergistically to produce hearing loss in premature animals.

Hypoxemia has been identified as a possible ototoxin according to Duara S et al[20].

Leech et al [21] concludes that brainstem auditory nuclei are particularly susceptible to acute hypoxic insults in the neonate.

So this hearing impairment has to be detected in the early stages & proper rehabilitative measures are taken at the earliest so that further developmental milestones are not delayed .

BERA as a screening procedure will give an idea of degree of hearing impairment .

5. Conclusion

BERA is the only tool which can confirm the normal sensitivity of hearing whenever required & is very useful in early detection of hearing loss and planning rehabilitative procedures. In case of multiple handicaps, BERA is the only test which can give accurate picture of hearing sensitivity. In case of high risk babies who are exposed to multiple risk factors like preterm babies ,neonatal jaundice, neonatal convulsions , birth asphyxia & LBW & even other multiple risk factors which have chances of impairing hearing ability, BERA should be carried out as a routine procedure to detec thet hearing loss in such babies.

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