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ASSESSMENT OF HEARING LOSS IN HIGH RISK NEONATES IN A TERTIARY CARE HOSPITAL

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ABSTRACT **BACKGROUND:** Hearing loss of various degrees is a common and growing health issue with approximately 5% of the population. Significant hearing impairment at birth is one of most common disorder with a prevalence of 1-2 per 1000 in normal population and it is far more common in neonates with risk factors. Hearing loss in neonates is multifactorial and can be genetic or non genetic. This study was done to identify the common risk factors causing hearing loss and their contribution for the overall cause. **METHODOLOGY:** The study was done at ENT opd of a tertiary care institute for duration of 2 years where 1134 neonates included in the study with a set inclusion criteria. Then the babies were tested for hearing impairment in two stages first using OAE then the babies whose test result showed refer were tested with BERA. **RESULTS:** Among risk factors hyperbilirubinemia found to be most prevalent (330) .923 subjects passed the initial screening test of OAE and 211 failed the test and subjected to BERA test. Out of them 123 neonates including 66 male and 57 females were diagnosed to be having impaired. Highest number was from the hyperbilirubinemia(47) group followed by meningitis(28) , hypoxic ischemic encephalopathy(18), ototoxic drug exposure(13), craniofacial anomaly(13) and low birth weight babies and those born to either parent having early onset SNHL. Among the results, birth weight ≤2kg babies and those who suffered meningitis have highly significant association. Ototoxic drug exposure and hyperbilirubinemia also found to be significant as risk factors for hearing. **CONCLUSION:** The early detection and treatment of hearing impairment in newborns and infants has a beneficial effect on overall development of the child. Hence it is imperative to define the common risk factors responsible for the neonatal hearing loss and to make rational strategy to diagnose the hearing loss at earliest so as to make necessary intervention to prevent permanent disability.

KEYWORDS : Oae, Bera. Neonates

INTRODUCTION

Hearing loss of various degree is a common and growing health issue with approximately 5% of the population about 466 million people worldwide have disabling hearing loss and among them 34 million are children. Prevalence of deafness in south East Asia varies from 4.6 to 8.8%. In India percent of population suffering from significant hearing loss is 6.3. Significant hearing impairment at birth is one of most common disorder with a prevalence of 1-2 per 1000 in normal population. It increases about 50 times in high risk group that is up to 10%[1].

Hearing loss in neonates is multifactorial and can be due to defect in either conductive apparatus or sensorineural pathway or it can be mixed. It can be of genetic or non-genetic in origin. It can be syndromic or non syndromic. Non syndromic congenital hearing loss accounts for70% of congenital hearing loss. Autosomal recessive (AR) inheritance is the most common form (80%) of hearing loss whereas autosomal dominant contribute for 15%[2].

Maternal infection like CMV, Rubella, Herpes, toxoplasma and foetal condition like meningitis contribute to the cause. Metabolic abnormality like hyperbilirubinemia, ototoxic medications play some role. Hence it is imperative to study and know about various risk factors that are associated with hearing loss in neonates so that high risk population can be identified and can be subjected to hearing assessment. Hearing assessment of newborns has come a long way from behavioural audiometry to use of OAE and BERA.

AIMS AND OBJECTIVES

Aim of the study primarily has two parts.

1. To determine the prevalence of hearing loss in high risk newborns
2. To assess various risk factors associated with neonatal hearing loss

The primary objective of the study is to determine the hearing loss in newborns using two steps testing using OAE and BERA.

MATERIALS AND METHOD

A. Place of study: Department of E.N.T. , VIMSAR, Burla

B. Period of study: November 2018 to October 2020

C. Study design: Hospital based observational study

D. Study population: High risk neonates from the SNCU ward, department of paediatrics, VIMSAR, Burla fulfilling the following set of inclusion criteria

E. Inclusion criteria

- Birth weight less than 2 k.g.
- Hypoxic ischemic encephalopathy grade II,III
- Hyperbilirubinemia (>15mg/dl in 1st 48 hours and> 20mg/dl in neonate more than 48 hours)
- Bacterial meningitis
- Craniofacial malformation except cleft lip/palate
- Mother treated with ototoxic drugs like aminoglycosides
- Family history of childhood sensorineural hearing loss

We excluded the neonates with anotia and microtia.

Study subjects were selected from the SNCU ward after careful study of their diagnosis from bedhead tickets and also from the obstetrics ward based on their birth weight and history of mothers those had been treated with ototoxic medications. Parents were involved in the study and proper consent was taken. The neonates then called to audiology room of E.N.T. department for complete history taking and complete E.N.T. examination.

After complete clinical examination and cleaning of the ear canals, first TOAE was done using 3 frequencies 2 kHz, 3 kHz and 4 kHz after cleaning the ear canals of debris preferably after 48 hours of life or when they were clinically stable. Those who failed TOAE subjected to BERA. Absence of emissions from 2 out of 3 frequencies was given REFER. The results of BERA are set at 30 DB as cut off threshold for normal hearing. Persistent V wave in the BERA finding was taken as

normal finding.

The data collected were spread over excel sheet and analysed using the SPSS software. Statistical tests like chi-square test was applied as required. Significant level set at p value <0.05.

OBSERVATION AND RESULTS

A total of 1134 high risk neonates were included in the study. Among them 620 were males and 514 were females. The distribution of the prevalent risk factors is found to be as follows.

Table1 Distribution of the risk factors in the study group

RISK FACTOR	NUMBER OF BABIES	PERCENTAGE
HYPERBILIRUBINEMIA	330	29.1
BIRTH WEIGHT≤2 KG	312	27.5
HIE (GR II/III)	176	15.5
MENINGITIS	86	7.6
FAMILY H/O SNHL	42	3.7
OTOTOXIX DRUG EXPOSURE	72	6.3
CRANIOFACIAL ANOMALY	116	1.4

TOAE showed REFER in 211(18.6) babies including 118 males and 93 females. Among them 16 were males and 10 were females. BERA performed on them and 123 of those babies failed in BERA (10.8%) among them 66 are male and 57 are females.

Out of 123 babies those failed the BERA test, 47 babies had hyperbilirubinemia, 2 babies had birth weight less than 2 kg, 18 babies suffered hypoxic ischemic encephalopathy, 28 babies were diagnosed to be having meningitis.

13 neonates whose mothers were treated with ototoxic drug had hearing impairment. 13 babies with craniofacial anomaly and 2 neonates with family history of SNHL also found to be having hearing impairment.

Table2 BERA results of neonates with individual risk factors

Risk Factor	Number Of Neonates With Risk Factor	Bera Normal	Bera Abnormal	Percentage Of Bera Abnormal	P value
Hypearbilirubi-nemia	330	283	47	14	0.014 S
Birth Weight <2kg	312	310	2	0.6	<0.0001 HS
HIE(GR II/III)	176	158	18	10.2	0.77 NS
Meningitis	86	58	28	32	<0.0001 HS
Ototoxic Drug Exposed	72	59	13	16	0.042 S
Family H/O SNHL	42	40	2	4.7	0.19 NS
Craniofacial Anomaly	116	103	13	11.2	0.89 NS

DISCUSSION

Most prevalent risk factor in our study is found to be hyperbilirubinemia that is around 29.1% of the total subjects. Botelho MS, Silva VB, Arruda Lda S et al in their study in 2010 showed that hyperbilirubinemia was the most prevalent risk factor found in the group of hearing impaired children and the prevalence of hearing loss was of 2 in 1,000 newborns[3]. Most common causes of pathological hyperbilirubinemia were breast feeding, non feeding jaundice and prematurity as evident from the paediatric case sheet and history.

Out of 123 BERA abnormal neonates, 66 were males and 57 were females. With calculated p value at p=0.81 there is no statistical significance of gender association with failed BERA results.
Mukherjee SS, Mukherjee S, Sarkar KD. In their study named 'Prevalence of Hearing Loss in High Risk Infants of Mediocre Socio-economic Background at Around One Year of Age and Their Correlation with Risk Factors' while taking BERA threshold for 'Pass' as ≤40 dBnHL, out of 87 high risk infants 10.34 % had bilateral severe to profound hearing loss, 17.24 % had bilateral mild to moderate hearing loss and 12.64 % had impaired hearing in one ear[4].

Another study done by Labaeka AA, Tongo OO, Ogunbosi BO, Fasunla JA. showed prevalence of Hearing Impairment Among High-Risk Newborns in Ibadan, Nigeria showed that 15.9% high-risk newborns failed at discharge screening[5].

Out of 330 neonates with hyperbilirubinemia, 47 had abnormal results(14%). With calculated p value 0.014, this association is statistically significant. This result in our study is similar to results of the study done by Carlos F. Martínez-Cruz shows that about 15 % of the neonates suffering from pathological hyperbilirubinemia requiring exchange transfusion suffer from auditory impairment[6].

Out of 312 neonates who weighed less than 2kg only 2 had impaired hearing that is 0.6%. With a p value set at ≤0.0001 this association though small it has high statistical significance. Ari-Even Roth D, Hildesheimer M, Maayan-Metzger A, et al. in their study also described similar results of 0.3% of low birth weight babies suffering from auditory impairment. This type of impaired auditory function recovers within months as described by them[7].

The number of neonates with HIE who had abnormal V wave in BERA is 18 out of 176. But with an estimated p value at 0.77 this correlation is statistically not significant. Among the abnormal BERA results, meningitis is a significant contributor with 28 out of 86 neonates having impaired hearing. Bacterial meningitis is a potent enough to destroy the cochlear microstructure rapidly unless promptly managed. With p value≤ 0.0001 association of bacterial meningitis with hearing impairment is highly significant. Kutz JW et al quoted similar results that are 35% of their study subjects suffered hearing impairment[8].

Out of 72 neonates whose mothers were treated with ototoxic drugs 13 had auditory impairment as evident from the study and this stands statistically significant at p value 0.042.

13 out of 116 neonates (11.2%) who had craniofacial anomalies found to be hearing impaired. With p value 0.89 this may not be a statistically significant factor deciding hearing outcome[9]. Auditory impairment was found in 2 subjects out of 42 those had parental history of early onset hearing loss which is statistically insignificant with p value 0.19. Allen SB, Goldman recently in 2020 published similar result in their study syndromic sensorineural hearing loss where he found around 3% of the subjects of this category had SNHl that is close to 4.7% in our study[9].

CONCLUSION

The early detection and treatment of hearing impairment in newborns and infants has a beneficial effect on language acquisition and overall mental development of the child. Escobar-Ipuz FA et al showed that, confirming the diagnosis of hearing loss within the first six months of life and making timely referrals to benefit the newborns with hearing impairment by way of treatment and follow-up in the early stages of development, avoid future disabilities[10].

Hearing impairment is significantly more in the high risk groups and about 50 times more than the normal neonates. Also as of now neither the screening tools like OAE or diagnostic tool like BERA nor the adequate manpower are currently not available in every district in our country. Hence considering the limited infrastructure in developing country like India rational strategy must be made out screen the vulnerable group of neonates and to detect maximum number of hearing impaired neonates. And it can be achieved by defining some more common risk factors that can affect hearing adversely and screening all those neonates who have these risk factors.

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