Original Research Article

Hearing Evaluation in high-risk neonates at tertiary care teaching hospital

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Abstract

Background: For the early diagnosis of hearing loss, screening of high-risk neonates is important. It is recommended that the screening of neonates should be done within three months of birth. **Aim:** To assess the hearing status of high-risk neonates. **Objective**: To estimate the incidence and risk factors for hearing impairment in high risk neonates admitted in tertiary care teaching hospital. **Materials and methods -**An observational study was performed in pediatric dept in collaboration with ENT dept to evaluate all high-risk neonates who were hospitalized from October 2019 to February 2020. **Result-** Out of 207 high-risk neonatal cases, 15 (7.25%) had sensorineural hearing loss. **Conclusion**- There is a need of high-risk new-born screening and early detection of hearing impairment before significant handicap occurs. The screening provides the best opportunity to initiate early and effective interventions.
Key words: Hearing loss, Neonate screening, BERA

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INTRODUCTION

For the early diagnosis of hearing loss, screening of high-risk neonates is important. The incidence of hearing loss in neonates is 2 - 4 cases in every 1000 live births. It is recommended that neonates to be checked for hearing loss after birth or at the most during their first three months of life (1). Half of the neonates with hearing loss show no risk factors[1,2]. Half of these neonates do show risk factors (1), but neonates with high risk factors must be screened. In this study, the neonates with high risks were send to ENT Dept for screening for first DPOAE (Distortion Product Oto Acoustic Emission) and if required second DPOAE and confirmed by BERA (Brainstem Evoked Response Audiometry) test. BERA is the confirmatory test for screening of hearing loss in neonates. These tests are having high sensitivity and specificity[3,5]

MATERIALS AND METHODS

A cross-sectional study was performed in pediatric department in collaboration with ENT department to evaluate all neonates (28 days) who were hospitalized from October 2019 to February 2020. High-risk neonates were referred to ENT Dept for performing the DPOAE test and if required second DPOAE. Those who failed DPOAE, required BERA test for confirmation before the age of 3 months. The following were considered as inclusion and exclusion criteria (1,2,6,7)

Inclusion Criteria

All neonates with following risk factors were screened

a) *Birth Weight less than 1500 grams (3.3 lbs)*
b) APGAR Score 0-4 at 1 min, 0-6 at 5 min. [4]
c) Any illness/Condition requiring admission of 24 hrs or more in NICU
d) Hyperbilirubinemia requiring phototherapy or exchange transfusion
e) Patient on Ototoxic medications
f) Neonates on Mechanical Ventilation
g) Meningitis
h) In utero TORCH infection
i) Family history of permanent childhood sensorineural hearing loss

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Exclusion Criteria

a) Neonates whose parents did not give written and informed consents for enrolment in the study.
b) Neonates having ear discharge, abnormalities of pinna and external auditory canal, (Bilateral anotia, Canal atresia)

Statistical Analysis:

The data was entered into MS-Excel worksheet and further analysis was done using statistical package IBM SPSS Statistics 26.0. The data was presented using descriptive statistics such as frequency, percentage, mean, SD and SEM. Chi-square test was done to assess the association between variables. The level of significance was set at 5%. All p-values less than 0.05 were treated as significant.

RESULTS

Table 1: Stepwise distribution of patients for Screening

Screening	Pass		Fail	
	n	%	n	%
First OAE	113	54.59%	94	45.41%
Second OAE	67	71.28%	27	28.72%
BERA	12	44.44%	15	55.56%

Table 2: Relationship between hearing loss and risk factors

Hearing loss risk factors	Abnormal ABR	
	n	%
Hyperbilirubinemia	5	33.33%
Craniofacial anomalies	1	6.67%
Meningitis + Antibiotics	1	6.67%
NICU + Aminoglycosides + Icterus	1	6.67%
Icterus + Low birth weight + Aminoglycosides	2	13.33%
Aminoglycosides + Icterus	2	13.33%
NICU +Aminoglycosides + Low birth weight + Mechanical Ventilation	3	20.00%
Total	**15**	**100.00%**

Chi-square = 10.667, df= 4, p-value = 0.031, Significant

Table 3: Incidence of hearing loss based on age

Age (in days)	BERA					
	Abnormal		Normal		Total	
	n	%	n	%	n	%
<7 days	10	10.87%	82	89.13%	92	44.44%
7-14 days	3	2.86%	102	97.14%	105	50.72%
>14-28 days	2	20.00%	8	80.00%	10	4.83%
Total	**15**	**7.25%**	**192**	**92.75%**	**207**	**100.00%**

Chi-square = 7.227, df= 2, p-value = 0.027, Significant

Table 4: Incidence of hearing loss based on gender

Gender	BERA					
	Abnormal		Normal		Total	
	n	%	n	%	n	%
Male	7	7.95%	81	92.05%	88	42.51%
Female	8	6.72%	111	93.28%	119	57.49%
Total	**15**	**7.25%**	**192**	**92.75%**	**207**	**100.00%**

Chi-square = .114, df= 1, p-value = 0.735, Not Significant

RESULTS

Out of 207 high-risk neonatal cases, 15 (7.25%) had sensorineural hearing loss. Relationships between hearing loss and risk factors are shown in Table 2. From 88 boys, 7 (7,95%) and from 119 girls,8(6.72%) had hearing loss. Hearing loss had no significant statistical significance relationship with sex. Table 4 Out of 15 cases having abnormal ABR, there were 5(33.33%) cases of hyperbilirubinemia which is showing statistically significant relationship between hearing loss and hyperbilirubinemia (*p-value = 0.031*). Table 2 There was 1(6.67%) case of craniofacial anomalies who had sensorineural hearing loss. So there is a significant statistical relationship between craniofacial abnormalities and hearing loss. (*p-value = 0.031*). There were 5(33.33%) cases of low birth weight babies out of 15 cases who had abnormal ABR, so there is statistical significant relationship between hearing loss and low birth weight (*p-value = 0.031*). Table 2 There were 10(10.87%) cases out of 15; having age less than 7 days, had sensorineural hearing loss. So there is a significant statistical relationship between hearing loss and early detection by these screening tests.
(*p-value = 0.027*). Table 3

DISCUSSION

Early detection of neonatal hearing loss by doing the screening at birth is very important. Screening of neonates by DPOAE and BERA tests are the main step in this process. Early detection before significant handicap occurs, provides the best opportunity to initiate early and effective interventions. When primary prevention is difficult, early screening and treatment with the appropriate and early rehabilitation of hearing loss is the key factor, rather to correct disability at a later stage. Downs and YoshingataItano have reported in their studies the effects of early diagnosis of hearing loss in neonates on the normal development of speech. They showed that it is critically important to diagnose hearing loss before six months of age, and this can be done by the Universal New born Hearing Screening[4]. Screening for hearing loss in neonates is crucial, and universally accepted. Welzel-Muler *et al.*; in there survey in which they compared healthy nursery neonates and those who were hospitalized in NICU, it was reported that screening all neonates is more valuable than screening just those who were hospitalized in the NICU[8]. In the study performed by Hess *et al.*, 942 neonates who were at risk for hearing loss were studied by ABR from 1990 to 1997.They found 17 (1.9%) cases of hearing loss, 14 (1.4%) of whom had bilateral hearing loss of more than 30 db. Aminoglycoside use was not an important risk factor in this study, and 4 of the 13 patients with hearing loss had malformations[9]. In our

study, use of alone aminoglycoside was not important as a risk factor for hearing loss, but neonates with other risk factors like low birth weight, on mechanical ventilator are important risk factor for hearing loss. which is statistically significant in our study. So multiple factor plays a role for hearing loss in NICU. There were 5(33.33%) cases of hyperbilirubinemia out of 15 cases having abnormal ABR so there is statistically significant relationship between hearing loss and hyperbilirubinemia. There was 1(6.67%) case of craniofacial anomalies who had sensorineural hearing loss. Therefore, a significant statistical relationship between hearing loss and craniofacial abnormalities is present. Hyperbilirubinemia is the important causative factor for hearing loss. When indirect bilirubin passes the blood brain barrier, which is deposited in the basal ganglia, and also in the vestibulo-cochlear nucleus and results into the sensorineural hearing loss. In Amin *et al.* study, ABR was performed for immature neonates (28-32 weeks) during their first week of life, and total and indirect bilirubin were tested 48 and 72 hours after birth. Increasing indirect bilirubin was more sensitive in predicting abnormalities in ABR and encephalopathy of hyperbilirubinemia than total bilirubin. In fact, there was a direct significant relationship between hearing loss and indirect hyperbilirubinemia[10] In our study we also had the same findings. There were 5(33.33%) cases of hyperbilirubinemia out of 15 cases having abnormal ABR so there is statistically significant relationship between hearing loss and hyperbilirubinemia.

CONCLUSION

This study shows that OAE and BERA are the important screening test for the early detection of hearing loss in neonates. New-borns screening and early detection of hearing impairment before significant handicap occurs provides the best opportunity to initiate early and effective interventions.

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