Original Research Article

Screening the new born for hearing loss - An experience at tertiary care hospital

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Abstract

Background: If the hearing loss in new born is identified at a very early period of life before plasticity sets in, proper rehabilitation can be done so that child will have a good and prosperous adult life. The screening strategies of young infants, specifically, universal screening versus selective screening is a debate especially in resource limited setting. **Aim:** To estimate the incidence of neonatal hearing loss in a tertiary care setting, and assessing the associated risk factors in those identified with hearing loss. **Material and Methods:** A total of 1000 neonates born and intramural admission to NICU over a study period were studied. A three-stage hearing screening protocol with TEOAE testing for stage one and two and Brainstem Evoked Response Audiometry, which is the gold standard test for hearing assessment for babies, was conducted as stage three. **Results:** An incidence of hearing loss was 0.7%, incidence in ICU was 1.85% and incidence in well-baby was 0.27%. The risk factors associated with hearing loss which were statistically significant were family history of hearing loss, maternal drug intake, VLBW, ICU admission, intubation and systemic findings. **Conclusion:** Universal neonatal hearing screening (UNHS) is a feasible practice. The identification of all new borns with hearing loss before 6 months of age is now a realistic and attainable goal.

Key Word: Newborn, hearing loss, screening, TEOAE testing, BERA

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INTRODUCTION

Hearing is a special sense needed for proper mental development, speech, language development and academic performance. Hearing Loss is most common problem. If this hearing loss is identified at a very early period of life before plasticitysets in, proper rehabilitation can be done so that child will have a good and prosperous adult life.[1] Various methods are available for assessment of neonatal hearing loss. Among them, Transient Evoked Otoacoustic Emissions is a screening technique that helps to detect the output from outer hair cells of cochlea. Emissions from cochlea are obtained after giving acoustic stimuli like click or tonus and output is received with microphone. If emissions occur, probable result we get is "Pass", which implies no hearing loss for the child. If there are no emissions, then result is taken as "Refer" and child is suspected to have some hearing loss. Child needs to be further reassessed by repeat Otoacoustic emissions and if the result is still "Refer" child is subjected to Auditory Brainstem response Audiometry.[2] Although the otoacoustic emission (OAE) is acceptable for routine screening of low-risk infants, the AAP recommends the ABR over the OAE in high-risk infants including NICU patients and graduates. This is because the ABR tests the auditory pathway beyond the cochlea and picks up neural hearing loss including auditory dyssynchrony. The screening strategies of young infants, specifically, universal screening versus selective screening (high risk targeted approach) is a debate especially in resource limited setting. The fact that selective screening may miss considerable number of cases is the justification for universal screening in less developed countries also. However, choosing any option needs realistic assessment of magnitude of the problem in terms of prevalence of

specific type of hard of hearingas well as the risk factors operating in that specific context. The present study was undertaken to estimate the incidence of neonatal hearing loss in a tertiary care setting, and assessing the associated risk factors in those identified with hearing loss.

MATERIAL AND METHODS

This hospital based cross sectional study was conducted on neonates born as well as intramural admissions to a tertiary care hospital over a period of two years.

Inclusion Criteria

- All neonates born and intramural admission to NICU over a study period
- Only Sensory-neural hearing loss were considered, as the early intervention by hearing aids and cochlear implants will prevent permanent hearing loss.

Exclusion Criteria

- Congenital anomalies of External Ear.
- Consent not obtained.
- Active Ear Infections.
- Hearing loss due to middle and external ear conditions.

METHODOLOGY

The parents were counseled regarding congenital hearing loss and the need for early diagnosis and intervention prior to the test. Informed consent as obtained from the parent. A detailed history of the neonate was elicited. Special emphasis was given to prenatal, natal and postnatal risk factors that may predispose to hearing impairment. Family history of deafness was also asked for. A detailed clinical examination was done including inspection of the preauricular, pinna and postauricular regions. Debris was gently cleaned using cotton tipped swab and otoscopic examination of the tympanic membrane was conducted using Welch Allyn otoscope with plastic speculums. All the relevant details were entered in the proforma prepared of the purpose.

Audiological Testing

A three stage hearing screening protocol with TEOAE testing for stage one and two and Brainstem Evoked Response Audiometry, which is the gold standard test for hearing assessment for babies, was conducted as stage three.

Stage 1: All babies born and intramural admission were screened for hearing loss by TEOAE testing by audiologist. The test was carried out in a quiet room in the Audiometry Lab using Interacoustics TEOAE 25 for eclipse machine. The babies were tested in a supine position, preferably on the guardian's lap, and preferably when child was asleep. They were tested from 24 hours of birth to 7 days of birth or any time before discharge in the neonatal period. All babies who failed (Test result - REFER) the initial screening were subjected to Stage 2 screening.

Stage 2: Babies who failed the initial test were subjected to repeat TEOAE testing after ENT examination during the follow up in a sound proof room; in the Audiology Department. Interacoutic TEOAE machine was used. Babies who failed the second test were subjected to stage three testing.

Stage 3: Babies who failed first and second test were subjected to BERA, as soon as possible, using Seimens BERA machine, by a qualified Audiologist in the Audiology Department.

Statistical Analysis

Data was entered into Microsoft Excel (Windows 7; Version 2007) and analyses were done using the Statistical Package for Social Sciences (SPSS) for Windows software (version 22.0; SPSS Inc, Chicago). Descriptive statistics such as frequencies and percentages were calculated for categorical Variables were determined. Association between variables was analyzed by using Chi-Square test and Fishers exact test (when appropriate) for categorical Variables. Level of significance was set at 0.05.

RESULTS

A total of 1000 babies were subjected to first stage screening by TEOAE. The babies, who failed this test in either ear, were subjected to a second stage screening procedure after 1 month by same test. The babies who failed a second time were subjected to the BERA test as soon as possible, to confirm hearing loss. Out of the 1000 babies, 276 babies were tested at 1-2 days of life, 538 at 3-5 days, 186 at more than 5 days. Among 1000 babies, 56 babies had Apgar score less than 7 at one min, 55 babies had Apgar score less than 7 at 5min. 269 babies were admitted in ICU and 95 babies among 1000 had icterus during their stay in ward or NICU.

Table 1: Three Stage Screening

Screening	First Stage-OAE	Second Stage-OAE	Third Stage-BERA
No Babies Tested	1000	102	18
Refer/Hearing Loss	102	18	7

Among 1000 screened in first stage, 102 babies got referred. Among 102 babies screened in second stage, 18 babies got referred. Among 18 babies who undergone BERA, 7 babies had hearing loss. In multistage testing of 1000 neonates for haring loss, 102 babies, 18 babies, 7 babies got referred in first second and third staging. Thus, an incidence of hearing loss was 0.7% in our study.

Table 2: Associated risk factors

Risk factor	Hearing loss		P value
	No hearing loss	Hearing loss	
Sex			
Female	538 (54.2%)	04 (57.1%)	0.875 (NS)
Male	455 (45.8%)	03 (42.9%)	
Mode of delivery			
Normal	633(63.75%)	3(42.86%)	0.252 (NS)
LSCS	360(36.25%)	4(57.14%)	
Gestational age			
Preterm	148(14.90%)	01(14.28%)	0.963 (NS)
Term	845(85.09%)	06(85.71%)	
Birth weight			
>2.5 kg	856(86.20%)	06(85.71%)	0.004 (S)
1.5-2.5kg	126(12.69%)	00(0%)	
<1.5kg	11(1.11%)	01(14.28%)	
Consanguinity			
Consanguinous	47 (4.73%)	01 (14.28%)	0.238 (NS)
Non-Consangiunous	946 (95.26%)	06 (85.71%)	
Family H/o Hearing Loss			
Yes	00 (0%)	01 (14.28%)	<0.001 (S)
No	993(100%)	06(85.71%)	
Maternal Drug Intake			
No	850(85.60%)	05(71.43%)	0.009 (S)
Thyroxine	32(3.22)	02(28.57%)	
Other drugs	111(11.17%)	00 (0%)	
Admission			
Ward	729(73.41%)	02(28.57%)	0.007 (S)
ICU	264(26.59%)	05(71.43%)	
Systemic findings			
Yes	844(84.99%)	3(42.86%)	0.002 (S)
No	149 (15%)	4(57.14%)	

In our study, out of 1000 babies 542(54.2%) were female babies and 458(45.8%) were male babies. We found to have females (57.14%) with more incidence of hearing loss than males (42.86%) in this study but it not statistically significant (p value=0.0875). Four (57.14%) babies born out of LSCS has hearing loss compared to 3(42.86%) of babies born out of normal vaginal delivery but the result was not statistically significant (p value=0.252). In our study 851 and 149 are term and preterm babies respectively. One (14.28%) and 6(85.71%) among preterm and term babies has hearing loss. The result was not statistically significant (p value=0.963). In our study, one (14.28%) among 12 babies in <1.5 kg group has hearing loss which was statistically significant (p value=0.004). Out of 1000 babies, 48 were born out of consanguineous marriage and 1 among 48 babies has hearing loss (p value=0.238) (not significant). One baby has family history of hearing loss and baby itself has hearing loss, proving that it is one of the risk factor which was statistically significant (p value=<0.001). In our study 2 among 7 hearing loss babies has significant maternal history of hypothyroidism and mothers taking thyroxin replacement therapy (p value=0.009). In our study 18 among 1000 babies required intubation at birth and 3(42.86%) among them developed hearing loss which is statistically significant (p value<0.001). which states that there is strong association with intubation at birth and hearing loss.

DISCUSSION

In our study, an incidence of hearing loss was 0.7%, incidence in ICU was 1.85% and incidence in well-baby was 0.27%.A study done by Arslan *et al*[3] found that incidence of hearing loss in well baby nursery as 0.19% and in ICU as 2.9%.Sukumaran[1] states that prevalence of hearing loss to be 1.5 to 6 per 1000 new borns. A study done by Stein LK *et al*[4]found that prevalence varies from 0.9-3.24 per 1000 babies for permanent bilateral hearing

loss of more than 35dB, 5.95 per 1000 babies when unilateral and moderate hearing loss infants are counted. The incidence of hearing loss in NICU or at-risk population is 2-4% or 20-40 in 1000 babies. A study done by De Capua *et al*[5] found 3.8 per 1000 live births had bilateral hearing loss and 1.9 per 1000 live births had unilateral hearing loss. Incidence in our study is comparable to the other studies. In our study, we found risk factors associated with hearing loss which were statistically significant were family history of hearing loss, maternal drug intake, VLBW, ICU admission, Intubation and Systemic findings. In our study, 3 hearing loss cases had birth asphyxia, in that 2 required mechanical ventilation, one case had VLBW with sepsis, one case had hyperbilrubinemia requiring exchange transfusion and two cases did not have risk factors. A study done by Abraham Paul[6] found that VLBW, familial deafness, mechanical ventilation and hyperbilirubinemia as major risk factors. A study done by John Jewel *et al*[7] found that 3 out of 4 cases of hearing loss had identifiable risk factors like VLBW, Birth asphyxia, Hyper bilirubinemia requiring exchange transfusion and meningitis and 1 baby had no risk factors. A study done by Jaleh Yousefi *et al*[8] found that hyperbilirubinemia, family history of hearing loss, drug consumption during pregnancy as risk factors for hearing loss. A study done by F Declau *et al*[9] found that Genetic factor(Cx26/Cx0), syndromal deafness, non-syndromal deafness, CMV infection, peripartal factors are the risk factors associated with hearing loss. A study done by Abraham Paul[10] studied family history of hearing loss, In utero infection, cranio fascial anomalies, VLBW, Hyperbilirubinemia requiring blood transfusion, Ototoxic medication, Bacterial meningitis, Apgar score 0 to 4 at 1 min, or 0 to 6 at 5 min, Mechanical ventilation lasting 5 days or more, Stigmata associated with hearing loss as risk factors for hearing loss. Our studies risk factors have many comparable risk factors with the studies mentioned above, but few risk factors vary from these studies. As the risk factors vary from study to study due to many factors like region, genetic makeup, awareness etc, this variation in risk factors are acceptable. In our study, 2 cases of hearing loss had no risk factors comparable to study done by John Jewel. As in our study we did not reach into genetic level this study, this may be one of reason as supported by study done by Declau *et al*.[9]

CONCLUSION

In our study incidence of hearing loss was found to be 0.7%. family history of hearing loss, maternal drug intake, VLBW, ICU admission, intubation, systemic findings are the factors associated with hearing loss. 3 cases among the 7 cases of hearing loss have profound hearing loss or deafness. Universal neonatal hearing screening (UNHS) has become a national practice in most developed countries. The identification of all new borns with hearing loss before 6 months of age has now become a realistic and attainable goal. There is need for further studies of higher magnitude and accuracy than our study so that a guidelines alternative to universal screening can be formulated without missing single case of hearing loss.

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