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Original Research Article

A study on assessment and analysis of new born hearing screening by otoacoustic emission

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ABSTRACT

Background: Hearing impairment can occur at any age, but the most severe one appears before or immediately after birth. The consequences of these damages can cause speech and intellectual development function disorders. Test like otoacoustic emission (OAE) is required for newborn for early neonatal screening, hence aim of our study is to evaluate the incidence of early hearing loss using OAE in new born.
Methods: This is a prospective study done in new born delivered in PSG medical college and hospital during the study period of one year in 2018. Our sample size was 1040. All new born between 36 hours and 28 days born in this hospital were included. A pre-designed, pre-tested validated semi-structured proforma was used to record the findings.
Results: In our study prevalence of deafness was found to be 0.19%. Out of 48 high risk babies, one baby (2.1%) had hearing impairment (profound hearing loss), similarly out of 992 non-high-risk babies, there was one baby with hearing impairment. Out of 1040 babies, 186 babies have failed OAE test at 36 hours of birth. Out of those 186 babies, test at two weeks of birth 84 failed and 102 passed and at 28 days- 72 babies passing and 12 babies were failing the test. Twelve babies were subjected to brainstem evoked response audiometry (BERA) test where only two babies out of 12 babies turned out to be BERA positive.
Conclusions: Hence, early identification and intervention will allow deaf and hard of hearing children to develop language skills during a period of neural plasticity.

Keywords: Screening, OAE, Newborn

INTRODUCTION

Hearing impairment can occur at any age, but the most severe one appears before or immediately after birth.[1] The consequences of these damages can cause speech and intellectual development function disorders. Congenital hearing loss has recently been recognized as one of the most common birth defects presents in newborn, with a prevalence of permanent hearing loss ranging from 2-3/1000 live births.[2] The reported prevalence of permanent bilateral hearing loss identified by newborn hearing screening programs was 1.61/1000 of at-risk infants in India.[3]

For these reasons, even from past times it absolutely was sought for a particular technique for decisive hearing perform straight off once birth. In our country, by an act on national program on women, children and youth health care from April 24th 2009, a compulsory early neonatal hearing impairment screening test was introduced. Mostly all newborn is screened for hearing impairment with OAE and electrophysiological auditory brainstem response (ABR tests). Reliability of methods of OAE is estimated in the range of 80% to 98%, an automated ABR (AABR) from 84% to 90%.[4]

Recent surveys indicate that, world-wide, hearing loss is

the most common cause of moderate and severe disability and a leading cause of disability in low-and middle-income countries. Significant hearing loss is one of the most common major abnormalities present at birth. If undetected, it will impede speech, language and cognitive development. Children with a disabling hearing loss are at risk of delayed speech and language development with consequent poor academic performance.

It is an established fact that if hearing loss is present, it should be detected and remediated before the baby is 6-month-old. Such infants can develop essential language and cognitive skills if the condition is detected early and they are provided with appropriate intervention services within the first year of life. Hence test like OAE is required for newborn for early neonatal screening,

Sharma et al conducted a study to evaluate BERA test for hearing assessment in icteric babies.[5] Result of the study showed that BERA is a simple, reliable and effective technique for detection of hearing impairment in the neonates. Also, Stone et al found that OAE testing can be carried out easily with an acceptable false-positive rate using the two-stage approach.[6] Based in this aim of our study is to evaluate the early hearing detection and intervention (EHDI) and to find the Incidence of hearing loss in new born.

METHODS

This study is a prospective study to evaluate to find the incidence of hearing loss in a standardized population of new born at the department of otolaryngology, PSG medical college and hospital. This study was conducted between years 2017 to year 2018. Convenient sampling was conducted. All new born in this hospital during the study period. Pre-designed, pre-tested validated semi-structured proforma was used to record thefindings and the confidentiality of the data and results had been assured to the patients.

Study initiated after clearance from institutional ethics committee. Written informed consent was taken from every study participant. The anonymity of study participant maintained. All new born between 36 hours and 28 days born in this hospital, admitted in NICU during the study period included in the study. Whereas neonates having c/o middle ear pathology, meatal atresia. any fatal event before completion of study were excluded from study.

Data collected were analysed by SPSS 20.0 version software. Descriptive statistics was reported as frequencies and percentage for categorical variables. Results were expressed in relevant tables and graphs along with the flow diagrams.

Screening methods

OAE testing, which uses a probe positioned within the infant's ear to assess the inner-ear responses to sound. In order to perform the OAE, a small flexible plug is put into baby's ear. Specific sounds stimuli are generated via plug. A minute microphone in the plug records the otoacoustic responses of the inner ear in reaction to transmitted sounds. The test should be performed when the baby sleep. OAE screen displays the results of the test as 'PASS' or 'REFER'. Refer means either the ear is abnormal or there is false positive result due to debris in the external canal. This test takes between 1-5 minutes to perform.

RESULTS

This study was done at the department of otolaryngology, PSG medical college and hospital. In our study out of 1040 babies were included who satisfied inclusion and exclusion criteria.

Table 1: Demographic factors.

Variables		Percentages (%)
Sex	Male	528 (51)
	Female	512 (49)
High risk factors	Present	48 (5)
	Absent	991 (95)

There is female preponderance in our study with 51% (n=528) being females and rest 512 were male; among 1040 subjects 48 babies are with high risk factors throughout the study, 2 patients had cephalhematoma, 3 was late preterm, 1 was low birth weight, 33 babies had NICU stay of more than 5 days, respiratory distress in 5 patients, and sepsis in two patients.

Table 2: Distribution of subjects according to OAE test at 36 hours of birth, (n=1040).

OAE test	<70 (Fail)	>70 (Pass)	Total
	186	854	1040

Out of 1040 babies, 186 babies have failed OAE test at 36 hours of birth. Rest 854 passed OAE test. These 184 babies further underwent OAE test at two weeks of the birth.

Table 3: Distribution of subjects according to OAE test at two weeks of birth, (n=186).

OAE test	Frequency	Percentage (%)
Fail	84	45
Pass	102	55
Total	186	100

Among 186 patients, who again underwent OAE test at two weeks, majority of the study participants had passed OAE test-102 (55%). Rest 84 babies failed OAE test at two weeks and was further assessed again at the twenty-eight days.

Table 4: Distribution of subjects according to OAE test at one month of birth, (n=84).

OAE test	Frequency	Percentage (%)
Fail	12	14
Pass	72	86
Total	84	100

Among 84 patients, who again underwent OAE test at 28 days, majority of the study participants had passed OAE test-72 (86%). Only 12 babies failed the test at 28 days,

Out of 12 babies screened for BERA, only two babies were BERA positive. The overall prevalence of deafness in our study was found to be 0.19% Among high-risk babies, one case of hearing loss was reported, similarly one case of hearing loss was reported with non-high-risk babies too.

Table 5: Screening of patients with BERA on those who had failed OAE at one month ofbirth, (n=12).

Screening test	OAE fail	OAE pass	Total
BERA positive	2	0	2
BERA negative	1	9	10
Total	3	9	12

DISCUSSION

Study was conducted among 1040 participants with Preponderance of female child, that is 51% (n=527) being females. Similar results were found in the study conducted by John et al in Southern India to screen neonates for hearing loss, where majority that is 51.8% of the participants were females.[9]

Majority of the study participants passed for hearing test on right and left ear that is 88% of the participants and 86% of the participants respectively. In a study conducted by Doyle et al he found that 79% passed the OAE screening.[10]

In this study it was found that among 1040 subjects, majority of them are having no risk factors (95.28%), followed by around 31 babies admitted in NICU for more than 5 days due to sepsis or preterm birth. John et al conducted a pilot study for neonatal screening to detect hearing loss, results of the study showed that 9.2% of newborn had one or more high risk factors. Majority of the study participants had OAE test more than 70 (82 %). In the present study, 55% of the study participants had passed OAE test at 2 weeks of birth. While 86% of the participants had passed OAE test at 1 month of birth.

In our study on screening of patients with BERA on those who had failed OAE at one month of birth it was seen that; out of 12 participants, 2 patients showed BERA positive who failed OAE test and 9 patients were found BERA negative who passed OAE test.

Bhatt et al conducted a study to find out the accuracy of OAE AND BERA to detect the incidence of hearing loss in newborn.[11] In the study OAE screening was done for 100 high risk babies on 1st day of birth, 55% passed the first screening test. The 45% referred in both the ears. Second test were screened again within a period of three month. The second OAE testing was conducted in all 100 babies. The 92%passed the second OAE screening, and 8% failed the second OAE test. Brainstem evoked response audiometery was done at 3 months and 6months showing 9 impaired 91 normal. In 9 hearing impaired neonates, 2 showing normal hearing on FFA and one showing conductive hearing loss on tympanometry.

Kumar et al conducted a study in Banglore, India to screen the hearing defects among the newborn.[12] In this study all the newborn were screened by the trained nurses using BERA phone between 24 hours and 48 hours after birth. Results of the study showed that 58 babies had a false positive result and passed the test after a week. This study also suggests that the false positive rate can be decreased significantly if one uses BERA instead of OAE.

Berg et al conducted a study and found that One 24.1% of the infants failed the ABR in 1 or both ears and passed OAEs bilaterally.[13] Boo et al in his study found that the sensitivity of OAE for detecting SNHL was 15.9%, and its specificity 95.2%.[14]

Doyle et al conducted a study to screen newborn hearing defects.[10] The screening methods used in the study was automated auditory brainstem response (ABR) and click evoked OAEs (EOAE). The mean age of the infant was 24 hours. It was found that overall, 88.5% of ears passed the ABR screen, and 79% passed the EOAE screen. There was no significant difference in the ABR pass rate for infants aged 0-24 hour of age as compared with infants aged >24 hour. though, the EOAE pass rate enhanced significantly in infants >24 hours versus with the infant of 0-24 hours. Our study findings were similar to all above studies and further proves requirement of screening technique at newborn.

Limitations

We selected only babies admitted in NICU, so babies who did not required admission in NICU would be missed in screening, further studies including those neonates will show light on further incidence.

CONCLUSION

In our study out of 1040 babies, prevalence of deafness was found to be 0.19% Out of 48 high risk babies, one baby (2.1%) had hearing impairment (profound hearing loss), similarly out of 992 non-high- risk babies, there was one baby with hearing impairment. Out of 1040 babies, 166 babies have failed OAE test on unilateral ear

and 20 babieshave failed OAE test on both the ears at 36 hours of birth. Out of 186 babies for OAE test at one month birth results in 72 babies passing and 12 babies failing the test. Twelve babies were subjected to BERA test where only two babies out of 12 babies turned out to be BERA positive. Hence, early identification and intervention will allow deaf and hard of hearing children to develop language skills during a period of neural plasticity.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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