

Screening of New Born and Infants for Hearing by OAE

Anita Mathur^{1*}, Man Singh¹, Deepika Nagwan²

¹ENT Department, Rajiv Gandhi Govt. General Hospital, Alwar, India

²Rajiv Gandhi Govt. General Hospital, Alwar, India

Email: *dramalwr@gmail.com

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Abstract

The present study was carried out in the department of the otorhinolaryngology at a Secondary health care institute, with the aim of screening of new born (especially high risk) for hearing with OAE (Oto Acoustic Emission test). Loss of impairment of auditory sense is the most prevalent deficit of all sensory organs. Hearing impairment causes a huge impact on one's social, educational, and economic wellbeing. There are about 5 - 6 infants who have hard of hearing out of 1000 neonates. It was carried out over a period of 15 months (April 21 to July 22) in association with department of Paediatrics. 645 new born and infants were screened by DPOAE (Distortion Product Oto Acoustic Emission) test for congenital hearing impairment. 54 new born infants out of 645 neonates screened showed "refer" in our study. To decrease the burden of morbidity of hearing loss in the society, universal new born hearing screening (UNBHS) policy is the concept to diagnose and treat at the earliest age of affected child, because early detection remains the primary element to decrease the associated morbidity.

Keywords

Hearing Loss, Otoacoustic Emission, Screening of New Born for Hearing

1. Introduction

OAE or otoacoustic emission testing is the recording of sound that the ear produces itself. The test is mostly done in new born and infants who may not be able to respond to behavioural test because of their age.

OAE is sound of cochlear origin which can be recorded by a microphone fitted into the ear canal. They are caused by motion of the cochlear sensory hair cells as they energetically respond to auditory stimulation. OAE provides a sim-

ple, efficient, and non-invasive objective indicator of healthy cochlear function and OAE screening is widely used in universal new born hearing screening programmes [1]. OAE is generated only when outer hair cell of cochlea is normal and middle ear system is operating normally.

Human nervous system has plasticity and hence interventions in hearing challenged individuals should be instituted as early as possible to prevent the auditory deficit from causing the speech and language pathology. In the early stage of child development speech and language develops but due to the absence of a routine screening programme many children remain undiagnosed till the age of 3 - 4 years losing the advantages of early “golden period”. It is the health providers who need to develop mechanism to diagnose and institute a timely intervention to prevent menace. Six months of age was the critical cut off period for early identification that would achieve normal speech and language development [2].

Hearing makes us aware of surroundings and hearing-impaired children experience delayed development of speech, language, and cognitive skills, which may result in slow learning and difficulty in progressing in school.

This study was conducted to fulfil the need for screening of new born to diagnose and treat the hearing loss at the earliest.

2. Material and Method

This study was conducted in secondary healthcare unit in the department of Otorhinolaryngology in association with the department of paediatrics over a period of 15 months (April 2021-July 2022). 645 new born and infant were screened for hearing, most of them from high-risk group. Neonates who were born premature (before 37 weeks of gestation), low birth rate (below 2.5 Kg) and the neonates who had delayed cry and asphyxia, neonatal jaundice (hyperbilirubinemia) and family history of congenital hearing loss were selected for screening by OAE. A detailed medical history is taken. Routine ENT examination of inspection of pre aural, pinna, post aural region was done. Wax debris cleaned gently. The procedure performed with a portable hand-held screening unit; small probe inserted in the child’s ear canal. This probe delivers low volume sound stimulus in to the ear. The probe contains both a transmitter and microphone. The microphone picks up the vibration. The hair cell makes in response that will produce echoes. OAE machine will record these echoes. 645 new born were tested with DPOAE. The result was interpreted as either “pass” or “refer”. Those who have referred in first stage were subjected to 2nd OAE testing after 3 months. Those who had “refer” at 2nd OAE were referred for BERA test (further evaluation for hearing).

3. Result

In this study 645 high risk neonates & infants were screened. The study was carried from April 21 to July 22 (15 months) 330 of these were male children and 315 were female children (**Table 1**). All the neonates screened in our study were

Table 1. Sex ratio of new born and infant.

	Total	Male	Female
No. of new born and infant screened	645	330	315
		51.16%	48.83%

from high-risk group. The high-risk factors found in our study were pre maturity (536), birth weight less than 2.5 kg (591), delayed cry and asphyxia (87), hyper bilirubinaemia (510), positive family history (01) (**Table 2**). 581 infants had “pass” and 64 “refer” on 1st OAE test. Follow up 2nd OAE test was done in these 64 children after 3 months. On 2nd OAE 54 infants had “refer”, these were referred for BERA test (**Table 3**).

4. Discussion

Early detection remains the primary element for treatment of hearing-impaired babies. If provided an early support and proper therapy these children can attain a very good level of speech and language. It enables them to reach their maximum potential to establish themselves as a productive member of the society.

The goals and objectives of universal hearing screening of new born is to screen 100% babies for hearing within 1st month of their life, confirmation of diagnosis of hearing loss within 3 month of their life and to begin treatment within first 6 month of life (hearing aid/cochlear implant). They will not be identified till they attain few more years of age, by than irreversible damage would have been done. Universal screening of hearing of new born is the only way to decrease the burden of deafness in the society. Ability to hear is one of the five primary senses which help us to communicate properly. Unfortunately, the sense of hearing is not given importance unless it is lost/impaired. Identification of hearing loss early reduces deafness. Screening of the new born and infants is the cost-effective way to reduce the burden of hearing loss.

Universal new born screening is the concept to diagnose and treat at the earliest age of affected child. This is to bring a change in the treatment of deaf child at the earliest. WHO has described social, mental, professional effect on children.

Permanent hearing loss has a devastating impact on a person’s social, educational & economic wellbeing for whole life. It poses a great burden on the society & people with hearing loss become the least nourished, least healthy, and least educated and least employed, they face neglect, isolation, and poverty.

According to national sample survey organisation (NSSO 2002) Hearing loss was the most common cause of disability in India and over 63 million people are suffering from hearing loss, in their screening it as found that 291/per 100,000 people in India suffering from severe to profound hearing loss. Among those a large percentage of children are between the age of 0 to 14 years. Multiple policies and protocols do exist worldwide in relevance to universal new born hearing screening program. India has ratified the UN convention under the right of person

Table 2. Various risk factor in high-risk group neonates.

Risk Factor	No. of neonates
Pre mature	536
Birth weight less than 2.5 kg	591
Delayed cry and asphyxia	87
Hyper bilirubinaemia	510
Positive family history	01

Table 3. Result of OAE in newborn and infant.

No. of neonates and Infants	Total	Pass	Refer
1 st OAE test	645	581	64
2 nd OAE test (Follow up case of 1 st OAE)	64	10	54
No. of cases referred for BERA			54 (8.37%)

with disabilities act 2016. In 2006 ministry of health and family welfare, Govt. of India launched the national programme for prevention and control of deafness with an aim to diagnose and treat hearing loss at the earliest age to decrease the associated morbidity.

Concept of early identification of hearing loss is the key to success for any rehabilitation programme in the treatment of deafness. We are presently confined to random new born hearing screening that too mainly of high-risk neonates. So, there is an urgent need to screen each baby for hearing loss.

This study was carried out to screen for hearing impairment at the earliest so that the diagnosis and treatment can be started before the permanent loss occur. In our study 645 high risk infant were subjected for screening. Out of these 645,330 infants were male and 315 were female. So, the sex ratio is approximately equal in our study (**Table 1**). Ramchandra Bishnoi *et al.* 2019 Nov. [3] conducted similar screening and 50.5% were female and 49.5% were male children in their study.

Among 645 new born and infant 536 children were born premature (before 37 weeks of gestation). Most of these premature children and some other were having body weight less than 2.5 kg (total 591 new born). 87 new born had history of delayed cry and asphyxia and 510 new born were having high bilirubin level, only one child had positive family history of hearing impairment in parents (mother).

New born hearing screening was conducted by Ramchandra Bishnoi *et al.* in 2000 normal and high-risk children in tertiary care unit. They also conducted BERA test in neonates who were referred in follow up OAE test. In their study 53.84% from high-risk group were labelled as “refer”.

Abraham *et al.* [4] conducted BERA in 159 patients who had “refer” in the

second screen. Out of these 159 patients, 21 patients with risk factors failed and 8 out of 81 without any risk factor failed. Samaddar *et al.* [5] had BERA fail in 0.35% infants in the non-high-risk group and 1.79% in the high-risk group. Jewel *et al.* [6] at a tertiary care hospital screened 1000 new born were screened using (TEOAE) and 28.6% them had risk factors 4/1000 detected hearing loss.

Ramchandra Bishnoi *et al.* conducted similar study at tertiary health care centre. They included normal children along with high-risk children. Tympanometry and BERA test were included in their study. Their result was 13.22% “refer” on 2nd OAE. De Capua and DeFelice C. [7] found 11.65% “refer” on 2nd OAE test in their study. In our study out of total 645 new born and infant, 54 (8.37%) (Table 3) children were found impairment in hearing and were referred for BERA test. Since the OAE is done only to screen the child for hearing ability and if the child shows “refer” in 2nd OAE test, BERA & audiometry test are to be done to confirm the diagnosis.

Kathleen *et al.* [8] studied 301 children, in whom 68.1% had a definite or probable cause of their SNHL identified 18.9% had 1 or more possible causes; 31.9%, no obvious cause. A family history of SNHL or prematurity and/or complicated perinatal course was found in 28.6% of patients. Named syndromes, multiple congenital anomalies, meningitis, or prenatal maternal factors, including maternal prenatal substance abuse was present in another 38.5%. However, syndromes commonly reported to be associated with SNHL, such as Waardenburg syndrome, were seen in less than 1% of patients.

Our study is confined to screen only the high risk new born and study was done in a small scale, so the comparison with other study cannot be done. By OAE test, we can only screen the child and BERA and other tests are to be done for confirmation.

5. Conclusion

Since this study was carried out mainly in high-risk infants and the high incidence of impairment in our study poses the importance of the fact that universal new born hearing screening should be carried out meticulously. At apparently no cost we are getting priceless result. So, the screening should be done in all the new born within one month of life and diagnosis should be done at 3 months so that the treatment can be started within 6 months of life.

Conflicts of Interest

All the authors declare that they have no conflicts of interest.

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