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New Born Hearing Screening Test in A Tertiary Care Center

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Abstract

Introduction: To find out how often newborns receiving care in a tertiary hospital have hearing impairment. In many industrialized nations, hearing screening is mandated for everyone. However, neither high risk nor universal screening is practiced in India. According to studies conducted in India, there are 1 to 6 hearing loss cases for every 1000 births [1-3]. Only high-risk neonates are screened, which misses 50% of infants with hearing loss [4,5].

Objective: this clinical audit aims to assess the new-born hearing screening program being performed in Apollo Cradle Hospital for Women and Children, estimate the use of various screening tools and tests, assess the risk factors associated.

Recommendation: The first screening should be done before the newborn is let out of the hospital; if it "fails," it should be done again in four weeks or at the first immunization appointment. If it 'fails' once more, Auditory Brainstem Response (ABR) audiometry ought to be done. ABR screening should be performed on all newborns admitted to the intensive care unit. Before the age of six months, every infant with an abnormal ABR needs to undergo a thorough evaluation, a hearing aid fitting, and auditory rehabilitation

Keywords: Hearing Screening, Auditory Brainstem Response, audiometry, auditory rehabilitation

Introduction

A newborn's ability to hear is a crucial aspect of his contact with his environment. The capacity to hear is crucial for communication, skill development, and academic performance—especially in the modern day, which is heavily reliant on audio-video technologies.

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The most prevalent sensory impairment in modern people is hearing loss. According to WHO estimations, there are over 63 million Significant Auditory Impairment sufferers in India, putting the estimated prevalence at 63% of the population [15]. For economic stability, our nation's less fortunate youth heavily rely on businesses that are outsourced to other nations. Even for the poor urban slum dweller in this scenario, hearing and language abilities are of utmost importance. Due to the fact that hearing impairment is a hidden handicap, it is typically discovered after 2 years, by which time the potential for language development has already been irreversibly stunted [4]. Numerous developed nations have well-established programs for universal newborn hearing screening. To ensure the viability of this initiative given India's limited infrastructure, it is essential to employ a low-cost method of identifying hearing loss. One of the five main senses that enables us to interact with other people effectively is hearing. Unfortunately, people sometimes take their sense of for granted and do not appreciate how important it is until it is lost or compromised. The issue of hearing loss was not recently given importance by the Indian government. The National Program for the Prevention and Control of Deafness (NPPCD) has, however, rekindled attention in this enormous public health issue. [5].

A number of Numerous factors, including congenital atresia, wax, foreign bodies, trauma, external otitis, and stenosis, can control hearing loss in newborns. Causes of middle ear/conductive otitis media include tympanic membrane perforation, congenital defects, and familial or inherited abnormalities. Ototoxic medications, stays in neonatal intensive care units owing to jaundice or other conditions, neonatal infections, head injuries, and noise are some of the causes of the cochlea and cochlear. Through prevention, early diagnosis, and management, half of all occurrences of deafness and hearing impairment can be avoided. A child's ability to hear is essential for their brain development. Early detection of hearing loss will stop the issue from becoming out of control. This will lessen the strain of hearing loss and prevent the loss of numerous ostensibly useful years. The most economical strategy to lessen the burden of hearing loss is to screen newborns and babies. Any program for the prevention of deafness should have the mantra "catch them young" as its core message. The goal of the current evaluation is to assess how India is doing with regard to screening newborns for hearing impairment and to offer suggestions for how to include it in the national program. (5) Globally, hearing loss is the most prevalent sensory impairment in people. There are various degrees of hearing loss, from mild to severe. [6] According to 2012 World Health Organization estimates, 360 million individuals worldwide suffer from moderate to profound hearing loss, a disabling ailment.[7] Hearing loss accounts for 4.7% of all years lived with disability (YLD) and is the second most common cause of YLD.[8] According to the often cited prevalence data for India, 6.3% of Indians have substantial auditory loss.[9] Compared to metropolitan regions, hearing loss is more common in rural communities.[10] According to the 58th round of the National Sample study Organization study conducted in 2002, there are presently 291 people per 100,000 people who have severe to profound hearing loss. Among them, children ages 0 to 14 make up a sizable portion. According to the survey's findings, 7% of people have congenital hearing loss.[11]

Childhood deafness has a significant negative impact on a person's ability to function in the social, economic, and productive spheres of life. In order to address this health issue, there is a significant human resource shortage in the healthcare industry. Primary health care (PHC) is still the preferred approach for the supply and implementation of deafness prevention by the Indian government. Initiated by the Union Government in 2006, the NPPCD. [11].

Congenital deafness is one of the conditions to be included for early identification and remediation in the Child Health Screening and Early Intervention Services Program (Rashtriya Bal Swasthya Karyakram) under the National Rural Health Mission launched by the Ministry of Health and Family Welfare of the Government of India. It entails the screening of newborns and young children by a mobile team and the provision of suitable care at District Early Intervention Centers (DEICs). This ambitious plan should simplify the management of hearing impairments. [12]

Lack of stimulation brought on by speech and language impairments has a negative impact on the synaptic junction's structure. The cell body and axon

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undergo retrograde degeneration as a result of lack of auditory stimulation.

The data on congenital disability, in addition to the scientific facts, show that hearing loss has a significantly high incidence, with congenital hearing loss affecting 30 out of every 10,000 children (13). The most prevalent illness affects 1 to 2 babies per 1000 in the general population and 24% to 46% of infants admitted to neonatal critical care units.

In view of the above, standard guidelines for screening newborns for hearing loss are urgently needed.

Causes of hearing loss are summarized as follows:

1. Causes in ear canal/Conductive (e.g., congenital atresia, wax, foreign body, trauma, external otitis, stenosis
2. Causes in middle ear/Conductive (e.g., acute and chronic otitis media, perforation of tympanic membrane, congenital defects, trauma, malformations either hereditary or familial)
3. Causes in the cochlea/Cochlear (e.g., ototoxic drugs, stay in neonatal intensive care unit due to jaundice or other causes, neonatal infections, head injury, noise); and
4. Causes in auditory nerve/Retrocochlear (e.g., problems in cochlear nerve, auditory pathway or cortex like tumors, trauma, de myelination).
5. Intrauterine infections (tetanus, toxoplasma, rubella, cytomegalovirus and herpes or TORCH group of infections) can be classified as cochlear or retrocochlear causes of Sensorineural hearing loss.

These can be classified as: Conductive, Cochlear (i.e., Sensory: defect in the cochlea and Neural: defect in the 8th cranial/ auditory nerve), Retro cochlear (i.e. defect at the level of auditory nerve, brainstem auditory pathway or both) and Central (i.e. defect in the auditory area in cerebral cortex). With respect to current guidelines, sensorineural hearing loss is most relevant and cochlear causes of sensorineural hearing loss are more common.

Many risk factors for hearing loss have been identified and are summarized as follows:

Birth weight less than 1500 grams; Intrauterine infection (TORCH); Craniofacial abnormalities; Family history of genetic childhood sensorineural hearing impairment, Serum-level hyperbilirubinemia necessitating exchange transfusion, Multiple courses of ototoxic drugs or their usage in conjunction with loop diuretics, Meningitis caused by bacteria, APGAR scores range from 0 to 4 at 1 or 5 minutes, A five-day minimum duration of mechanical ventilation, Other symptoms that are stigmatized by a syndrome that is known to include sensorineural and/or conductive hearing loss.

This clinical audit was undertaken to evaluate the possible burden of hearing loss among the neonates born in a tertiary care center in southern India using cost effective and appropriate technology.

Screening of neonates was done using Transient Evoked Oto Acoustic Emissions (TEOAE) and Automated Auditory Brainstem Response (ABR). This clinical audit was undertaken in order to detect the frequency of congenital hearing loss among neonates in a tertiary care center.

Material and Methods this clinical audit was conducted prospectively on all neonates born in **Apollo Cradle Hospital for Women and Children**, Bangalore from Jan 2022 to Aug 2022. The data form was made available and filled out in the labor room, ward, and NICU, so the degree of accuracy is being maintained.

Parents or the grandparents of the neonates were informed about the audit and motivated to undergo the screening program. An informed consent was taken from the parent/guardian and approval of research and ethics committee was obtained.

Using a pretested questionnaire, potential risk factors were identified. Both the normal and high-risk neonates underwent hearing assessment after 48 hours of birth using OAE as the first level of screening.

Otoacoustic emissions (OAE): Probe was kept in the ear and the machine was switched ‘on’ when click sounds are produced. The outer hair cells of the cochlea move in response to sound waves traveling from the external ear to the inner ear, producing sound that is picked up by the machine probe at the external ear canal. This demonstrated that the infant's cochlear (inner ear) function was normal.

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Neonates who failed the initial screening were subjected to repeat testing with OAE after one month.

Auditory brainstem response (ABR) screening was performed on infants who do not pass the OAE.

ABR uses disposable surface electrodes placed high on the forehead, mastoid, and nape of the neck to monitor the electrophysiology of hearing from the eighth nerve through the auditory brainstem.

Infants with abnormal ABR underwent a thorough evaluation, hearing aid fitting, and auditory therapy.

Data from the questionnaire and the results of the testing were tabulated in Microsoft EXCEL™ and subjected to analysis using student t-test and coefficient of correlation.

Results –

The clinical audit was conducted prospectively on all neonates born in **Apollo Cradle Hospital for Women and Children**, Bangalore from January 2022 to August 2022. Approximately, 535 Neonates were screened for Hearing Screening Test using OEA and ABR tests.

Among the 535 neonates that were screened initially, 32 babies failed the first screening (6%). 28 out of the failed neonates came for follow up, out of which 4 babies failed in the second screening as well. Hearing loss in these 4 babies was confirmed using ABR. Three neonates out of the 4 who failed to have identifiable risk factors, which were low birth weight < 1.5 kg (1 baby), severe birth asphyxia (1), NNH requiring exchange blood transfusion (1), and meningitis (1). 1 baby had no risk factor for hearing loss. The babies who were screened positive for hearing loss were confirmed using ABR. Two of them had severe Sensorineural hearing losses and the other two were diagnosed with moderate to severe hearing loss. All the babies were referred to an Audiologist for further interventions.

Table 1. Screening algorithm.

	Total Neonates	**Test Passed**	**Failed Test**
Screening	535	503	32
Second Screening	28	24	4
(4 lost Follow up)			

Confirmation with ABR: Moderate to profound sensorineural hearing loss— 4; At risk infants—2; Neonate with no identifiable risk factor—1

Table 2. Distribution of cases according to risk factors

Risk Factors	**PASS**	**FAIL**	**TOTAL**
Birth weight less than 1.5 kg	34	1	35
Asphyxia	4	1	5
Family history of hearing impairment	6	0	6
NNH Requiring Exchange Transfusion	73	1	74
Meningitis	1	1	2

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At risk neonates	136	0	136
Neonates with no risk factors	277	0	277

Discussion: Unidentified hearing loss can adversely affect optimal speech and language development, acquisition of literacy skills, academic, social and emotional development. There is robust evidence that the identification and remediation of hearing loss, when done before six months of age for newborn infants who are hard of hearing, enable them to perform significantly higher on vocabulary, communication, intelligence, social skills and behavior necessary for success in later life. Several studies have suggested that up to 50% of all the children with congenital hearing loss have no risk factors and would be missed by screening only those at high risk [8-11]. American Academy of Pediatrics (AAP) in 1999 advocated universal newborn hearing screening programme (UNHSP) and remedial

The AAP Task Force on newborn and infant hearing recommends UNHS by three months of age with intervention by six months of age. The Joint Committee on Infant Hearing (JCIH) position statement provides guidelines that include Newborn Hearing Screening (NHS) soon after birth, before discharge from hospital, or before one month of age, diagnosis of hearing loss through audiological and medical evaluation before three months, and intervention through interdisciplinary programs for infants with confirmed hearing loss before six months of age.

Conclusion

Recommendations on Screening

Communication difficulties start very early in life, much like hearing loss does. Only via comprehensive early detection

programs may infants with hearing loss be assured a chance to realize their full potential and grow into fully engaged, contributing, and integrated members of society.

Regardless of when the problem first manifests, all children with hearing loss require prompt identification and assistance by trained professionals.

This audit strongly recommends to screen for hearing loss before the first month of life instead than focusing on "high risk" screening, universal neonatal screening is preferable. ABR testing should be performed on all NICU infants to rule out auditory desynchrony or auditory neuropathy.

Newborn hearing screening, which will help diagnose hearing loss at an earlier age, would decrease the double tragedy of being unable to hear and talk. Early intervention is crucial for the best prognosis outcomes.

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