



Review Article

Prevention of Deafness by Early Detection: Improving the Current Scenario

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Received: 22 December 2023

Accepted: 22 January 2024

Published: 08 March 2024

DOI

10.25259/JCH_2_2023

Quick Response Code:



ABSTRACT

The total or partial impairment of auditory sense is one of the most prevalent sensory deficits. It causes an immense impact on a person's daily activities, social, economic, and overall being. Out of every one thousand infants being born, about five to six suffer from hearing loss. Unfortunately, in our Indian scenario, they go undiagnosed immediately after birth. By the time the parents recognize the problem, the children have already crossed two years of age, and the most important time for development of speech and language has passed. The only way to counter this problem is to screen all newborns universally, right after their birth. Trained healthcare personnel can be equipped to screen the infants. The National Program for Prevention and Control of Deafness, India advocated this Universal Newborn Hearing Screening. The only way forward is to diagnose these children with hearing impairment early and give them appropriate means of rehabilitation, to reduce our burden of deafness in society.

Keywords: Deafness, Hearing impairment, Universal newborn hearing screening, National program for prevention and control of deafness, Early detection

INTRODUCTION WITH OBJECTIVES

Our ability to hear helps us develop speech and communicate with our fellow humans. Auditory sense is crucial for the mental development of a child. It is one of the most important of the five primary senses. Unfortunately, this sense of hearing is often taken for granted. Very often people do not realize its importance unless it is lost or impaired. With the advent of National Program for the Prevention and Control of Deafness (NPPCD) by the Government of India, there has been a renewed interest in this huge public health problem.¹ Important causes of hearing impairment are increasing age, exposure to excessively loud noise, head injury, trauma to the ear, use of ototoxic drugs, and infectious diseases such as meningitis, measles, mumps and chronic ear infections, and congenital defects. The majority of these are avoidable through prevention, early diagnoses, and management. Thus, here lies the importance of diagnosing hearing loss early. This will, in turn, decrease the burden of hearing loss in society and help us save many presumptively productive years lost. Screening of newborns and infants is a cost-effective way to reduce the burden of hearing loss. "Catch them young" should be our goal to combat this problem. The objective of the current review is to see the status of screening neonates for hearing impairment in India and the suggesting ways of incorporating it into the national program.²

A person who is not able to hear as well as someone with normal hearing – hearing thresholds of 20 dB or better in both ears – is said to have hearing loss. Hearing loss may be mild, moderate,

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severe, or profound. It can affect one ear or both ears and leads to difficulty in hearing conversational speech or loud sounds.³ Globally, hearing loss is the most common sensory deficit in human beings. Moderate to profound hearing loss is a disabling condition, which affect 466 million people worldwide according to 2018, and this estimate is projected to rise to 630 million by 2030 and to over 900 million by 2050 according to the World Health Organization.⁴

Hearing loss is the second most common cause of years lived with disability (YLD) ranging up to 4.7% of the total YLD. The much-referred prevalence data for India put 6.3% of Indians suffering from significant auditory loss.⁵ Rural areas have a higher prevalence of hearing loss than urban areas due to less awareness and decreased accessibility to healthcare facilities. As per the 58th round of the National Sample Survey Organization survey in 2002, currently, there are 291 persons/100,000 population, who are suffering from severe to profound hearing loss. Of these, a large percentage is children between the ages of 0–14 years. The survey results revealed that about 7% of people have congenital hearing loss.⁶

The deafness acquired in childhood has an enormous impact on the social, economic, and mental development of an individual. The Government of India has retained primary healthcare (PHC) as the strategy of choice for the provision and implementation of prevention of deafness. The Union Government initiated the NPPCD in 2007 on a pilot mode in 25 districts of 11 State/union territories (UTs). The program has been expanded to 192 districts of 20 states/UTs. In the 12th plan, it is proposed to expand the program to additional 200 districts in a phased manner probably covering all the States and UTs by March 2017. The program upholds the long-term objective of preventing and controlling major causes of hearing impairment and deafness to reduce the total disease burden by 25% of the existing burden by the end of the 12th five-year plan. The program has been merged with the ambitious National Rural Health Mission, an umbrella program, both at the state and district levels. The major components of the program are capacity building and manpower development, wherein each level of healthcare provider is sensitized to hearing and ear care, ear health promotion, and prevention where the grassroots workers and health personnel deliver information, education, and communication (IEC) messages on a continuous basis to community members, early detection of ear problems, and management by house-to-house surveys to ascertain hearing problems in all age groups by the Anganwadi Workers and Accredited Social Health Activists, organizing community screening camps regularly at PHC/Community Health Centers/district level to screen the population for deafness and hearing impairment, referral of complicated cases to state medical colleges, rehabilitation, and hearing aid provision. A proper system of monitoring and supervision is in place to constantly evaluate the program with predefined indicators.¹

HEARING LOSS: CURRENT STATUS IN WORLD AND INDIA

By screening, the disease is identified earlier than its usual time of diagnosis. Neonates and infants are not routinely screened for any specific disease in India due to the pressing need to control the infectious causes and deaths due to it. Although India as a country has been successful in lowering mortality rates, the burden of disability has not come down, in fact, it has risen over the years.⁷ Many disabilities can be avoided if we have a proper screening program.

Out of every 1000 children born in India, there may be five to six such children, who cannot hear properly.⁸ Because there are no visual indicators, most hearing-impaired children, who are not screened at birth are not identified until between 1½ and 3 years of age, which is well beyond the critical period for healthy speech and language development. However, with the help of newborn hearing screening, a hearing-impaired child can be identified and treated early. In such a case, the child will most likely develop language, speech, and social skills comparable to his or her normal-hearing peers and, thus, avoid a lifetime of hearing loss related disabilities. There has never been any attempt to screen the neonates or infants for hearing defects on a large scale in India. The Department of Prevention of Communication Disorders of All India Institute of Speech and Hearing (AIISH) located in the Southern India conducts infant screening for hearing disorders on a regular basis in different hospitals attached to it using Behavioral Observational Audiometry, Otoacoustic Emissions (OAE) screening, and administering high risk register (HRR). In the year 2009–2010, a total of 12,416 newborns in ten hospitals associated with AIISH were screened for hearing disorders. Of them, 1010 infants were referred for further check-up.⁹

TIME OF SCREENING

Optimal early hearing detection and intervention (EHDI) programs have been defined as meeting the EHDI 1–3–6 goals.

- All infants should undergo hearing screening before discharge from the birth hospital and no later than one month of age, using physiologic measures with objective determination of outcome.
- All infants whose initial birth-screen and any subsequent rescreening warrant additional testing should have appropriate audiologic evaluation to confirm the infant's hearing status no later than 3 months of age.
- Early intervention services should be offered through an approach that reflects the family's preferences and goals for their child and should begin as soon as possible after diagnosis but no later than six months of age.

To provide appropriate access to language stimulation and intervention services as soon as possible, EHDI programs

have considered setting a new target of 1–2–3 months (screening completed by one month of age, audiologic diagnosis completed by two months of age, and early intervention initiated no later than three months of age).¹⁰

A similar formula can be followed in India with the screening of every child delivered in a health center before discharging the mother and child.

SCREENING TECHNIQUES

The auditory function can be either peripheral (cochlear) or central (brainstem). The available techniques can differentiate the two. No single test can detect all failure patterns in the auditory system. Thus, the use of two tests for the screening of newborns for deafness is recommended. Sequential (two-stage) testing can be done to detect hearing impairment. A less expensive, less invasive procedure (OAE) is performed first, and those who screen positive (that is, OAE – REFER) are recalled for further testing with a more expensive, more invasive test auditory brainstem response (ABR), which may have greater sensitivity and specificity. Two-phase screening using two different electrophysiological measures, OAE and ABR, allows the detection of various failure patterns and provides more complete information about the auditory function.¹¹ The OAE measures whether parts of the ear respond properly to sound. During the test, a plastic probe containing both a transmitter and a microphone is inserted into the infant's ear. The transmitter sends sounds down into the inner ear, and the microphone picks up the vibrations the hair cells make in response. In normal-hearing persons, the ear “echoes” sounds, and this “echo” can be detected by the OAE machine. Since the probe of the OAE machine, which is very soft and comes in different sizes is placed just inside the ear canal of the infant, it does not cause any discomfort in the child.

BEHAVIORAL SCREENING METHOD

Behavioral techniques to detect hearing loss usually give correct results in infants more than six months of age. These tests relying on operant conditioning involve testing an infant's response to specific tones projected within a sound-proof room from different directions. When performed correctly, these tests can yield accurate audiometric thresholds in children as young as six months of age, who have normal neurologic development. However, in younger infants and in those who have a developmental delay or certain physical disabilities, behavioral tests of any type are unreliable and have a low specificity.¹² The behavioral technique for hearing has a sensitivity value of 66.7%, specificity value of 86.9%, positive predictive and negative predictive values of 5.6% and 99.6%, respectively, compared to the evoked OAE test.¹³ The major advantage of

the later behavioral test is the identification of later onset or progressive hearing impairment.¹⁴

RECOMMENDATION

The screening program should cover the whole country to bring out more robust results in the early detection of hearing loss. There needs to be further development of infrastructure for the screening. The only additional financial burden incurred on the system will be the cost of OAE/ABR machines; provision of which is already envisaged under NPPCD. Judicious use of IEC materials developed by NPPCD and by the Society for Sound Hearing (an agency for the hearing care of masses) should be advocated. Properly designed epidemiological studies should be performed to understand the burden, risk factors, knowledge, and practices regarding infant hearing loss. Mechanisms should be developed for communicating the results of follow-up activities with the parents/guardians and the child's physician, audiologist, and speech therapist.

Each district hospital can be made the nodal center where data collection and analysis will be done. Critical performance data including the number of infants born; the proportion of all infants screened; the referral rate; the follow-up rate; and the false-positive and false-negative rates should be collected in a timely manner.

Many times a newborn does not present with hearing loss at the time of birth. Hearing loss may manifest at a later stage. These children should be re-screened periodically. Since screening every normal-hearing infant every three to six months may not be feasible, infants who are at risk of developing hearing loss should be screened every three months for hearing. Some of the high-risk infants are mother infected with rubella or cytomegalovirus during pregnancy, bacterial meningitis in the infant, and head injury. A HRR can be maintained at each health center in which the names and contact details of the infants, who are at risk of developing hearing loss later in life, are written. If any infant fails a screening test, he/she should receive a full audiological and otological examination. Prompt medical management should be done for those with associated ENT pathologies.

CONCLUSION

In the current times, hearing loss is a major public health problem. However, today every individual has a right to choose not to be dumb even if they are born deaf. Systematic early detection of infants with hearing loss can give them a chance to develop their full potential to become fully active, contributing, and integrated members of society. For their sake and ours, we cannot afford to waste any more time. Regardless of the age of onset, all children with hearing loss

require prompt identification and intervention by appropriate professionals.

Ethical approval

The Institutional Review Board approval is not required.

Declaration of patient consent

Patient's consent not required as there are no patients in this study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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How to cite this article: Mandal T, Nandi S, Dutta SK. Prevention of Deafness by Early Detection: Improving the Current Scenario. *J Compr Health*. 2024;12:16-9. doi: 10.25259/JCH_2_2023