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Early Identification of Hearing Loss in Neonates & Children-Information to Non-Audiologists

Heramba Ganapathy Selvarajan*, Aravind Kumar Rajasekaran**

Author Affiliation
*Associate Professor, Department of Speech Language & Hearing, Sri Ramachandra University, Porur, Chennai-600116, Tamil Nadu, India. **Speech therapist, Department of Speech Pathology & Audiology National Institute of Mental Health & Neurosciences (Institute of National Importance) Bangalore, India.

Reprint Request
Heramba Ganapathy Selvarajan,
Associate Professor, Department of Speech Language & Hearing, Sri Ramachandra University, Porur, Chennai-600116, Tamil Nadu, India.

E-mail: shganapathy@gmail.com

Abstract

Sprouting of brain happens during critical period. Hearing loss during this period has a devastating effect on the child's development. Early identification of hearing loss is crucial to minimize this impact. Technological improvements have brought in effective identification procedures. However, challenge lies in the execution of efficient programs, especially, in developing countries.

Keywords: Hearing Loss; Early Identification; Universal Hearing Screening; ABR & OAE.

Introduction

Audiologists are the hearing health professionals who are specialized in hearing assessment and providing non medical treatment to improve hearing. Hearing loss in children is a debilitating condition affecting their life beyond measure. Unlike other impairments like visual and orthopedic, it lies hidden for a long period comparatively. Public is ignorant about need for early identification of hearing loss in children, more so in the less developed countries. Hearing loss could occur due to a wide spectrum of causes demanding the screening programs ideally to include all the newborns. In a developing country, the high expenditure towards this universal hearing loss identification program is the biggest roadblock. However, perception towards the early identification of hearing loss should be changed. It is essential to look into the prevalence of hearing loss, advantages/disadvantages of early identification, awareness about early identification & methodologies followed to make the change. Further, the health professionals should remain well informed about all these aspects of identification procedures, thereby early identification of hearing loss would become a reality than remaining idealistic in the developing countries.

Prevalence of Hearing Loss

The most common developmental abnormality at birth is hearing loss [15]. Approximately one in every 200 babies born in India has hearing loss [19]. All over the world nearly 32 million children have a disabling hearing loss (40dB or greater) [6]. In school going children the prevalence of hearing loss is about 15%.

Identification of Hearing Loss-The Current Scenario

To add to the dire nature of the high prevalence is the delay in identification of hearing loss in developing countries [4]. In India, the average age of identification of profound hearing loss is above 2 yrs. The age of identification has wide variation

across India. In a study, in West Bengal (India), involving 209 children it was found that the average age of children with hearing loss first seen by an Audiologist is 9.3 years. Further, 20% of the Doctors whom the parents of hearing impaired children consulted, did not suspect hearing loss and suggested that child would naturally develop language by time [13]. In contrast, in a study carried out in Tamil Nadu (India) the age of identification was 2 years. The identification of mild to moderate or unilateral hearing loss would be even later or may never be found at all. The overall impact of late identification/never identified hearing loss is not extensively studied in India. However, it is not difficult to conclude that it would have a devastating effect on the children, the family and the nation as a whole.

In the developing countries early identification and intervention face obstacle due to lack of awareness, resources & supporting services & accounting hearing loss as a low priority problem [19]. Children with hearing loss are generally identified as having speech and language problem overlooking the cause viz., hearing loss. This is especially true when the child has mild to moderate hearing loss, where, the child would respond to loud sounds and loud speech. Parents and health care professionals often are shocked "How did I miss this out for such a long time?" for the symptoms of hearing loss are often subtle and can be confused with behavior issues. Sometimes, even profound hearing loss with obvious symptoms is missed out in the early childhood. Late identification of hearing loss has a negative impact on the child's development [21]. Children in whom hearing loss was identified later are found to have mismatch in literacy and language levels compared to normal children. The children of 12th grade had a reading level of only III to IV grade & language levels of only 9 to 10 year old [17]. Contrarily, identification of hearing loss before six month of age has a positive impact on the language development of the child and could develop near normal speech and language skill [22].

Tools for Identification of Hearing Loss

Hearing loss may not always a medically untreatable congenital condition. It can be due to treatable medical conditions like otitis media, needing appropriate referral. Identification of hearing loss should focus on both presence of hearing loss and also its type. It would be the guide for the selection of appropriate intervention methods. Various tools are available to identify hearing loss in neonates & children viz., objective methods like oto-acoustic emissions (OAE), auditory brainstem response (ABR) &Tympanometry and, behavioural methods like behavioural response audiometry, visual reinforcement audiometry & conditioning audiometry.

Careful observations of auditory behaviors would provide vital information about the child's hearing. Responses like startle to sound, eye blink, cessation of activity upon hearing sound, searching for the sound source, reciprocation by vocalization and exhibition of pleasure being spoken to are some of the behaviors that can be observed. Though, the observation does not need to be done by a professional but certainly the observer needs to have trained eyes. The knowledge of the auditory behavior is crucial to suspect and refer the child to an audiologist.

Behavioral response, visual reinforcement or the conditioning audiometry is carried out by the professional Audiologists. The specific procedure is decided by taking into account the age of the child and 'testability' of a child using that procedure. These tests are carried out in a sound treated double room. Various sound stimuli are presented via an audiometer and responses are observed.

OAE's are generated by the outer hair cells of the inner ear; incidentally, inner ear damage is the most common cause of hearing loss. OAE testing is the quickest mode to screen for hearing loss. An OAE screening thus would detect for hearing loss both efficiently and rapidly. It is done with a probe placed gently inside the ear canal. The probe has a sensitive microphone and a receiver. Sound is presented via the receiver and the response picked up by the microphone. The response viz., the sound picked up by the microphone is analyzed by the screening unit and displayed as pass or refer [12]. A pass response can be obtained from a normal and healthy ear. When the child is in deep sleep, the total testing time for both the ears including documentation would be just 5 minutes. Though a "fail" response indicates a problem in the hearing mechanism with reference to the cochlea, the results has to be analyzed carefully as a middle ear condition too may render a "fail" result. A referral to the audiologist for a detailed diagnostic evaluation would be appropriate.

The ABR which is otherwise referred as brainstem evoked response audiometry viz., BERA (a misnomer), is an electrophysiological evaluation of hearing. In ABR testing the sound stimuli are presented into the ears through a headphone or an insert earphone. The responses are recorded from electrodes placed on the scalp. The test measures the conduction from the auditory nerve to the level of

upper brainstem. It indirectly provides us with the threshold of hearing, thereby; degree of hearing loss can be arrived to. The test results are displayed as pass or fail in the screening module. If the test results indicate hearing loss it has to be dealt cautiously. A diagnostic audiological test is once again warranted.

Both screening OAE & ABR can be carried out by non- audiologists but qualified health care providers. These tests are advantageous as they are objective and are non invasive [16]. Based on a study involving 4911 newborns, these screening tests, used independently, have a sensitivity of 90%–100% and a specificity of 94% [6]. Screening through these methods are far more effective than the conventional behavioral methods using noise makers. With proper screening and referral of risk babies to audiologists, babies can be detected for hearing loss and intervened as young as few weeks old.

OAE and ABR are currently used even in developing countries for screening as well as diagnostic evaluation [10]. In Iran, a cross sectional study involving around 3 million infants revealed a prevalence rate of 3 per 1000 children. The program used transient evoked otoacoustic emissions (TEOAEs) & automated auditory brainstem responses (AABRs) in varied phases. The study revealed decrease in false referral & increase in the follow up [14]. In a study conducted in china, researchers reported employing a two stage TEOAE measurement followed by DPOAE; Tympanometry & ABR. 11,894 infants were screened by two-stage transient evoked otoacoustic emission testing. Those who failed were diagnosed by distortion product otoacoustic emission, tympanometry and auditory brainstem response.

Otitis Media in Children

Otitis media with effusion (OME) is a significant contributor for transient acquired hearing loss in children [13]. It is characterized by variable, fluctuating, and mild degree of conductive hearing loss [2]. Almost 50% to 60% of the children may have OME before two years of age. In Indian scenario, it would be left unnoticed especially if the children are from a rural or lower socio-economic background. Hence, a "fail" result in either OAE or ABR or in both should be followed by a tympanometry testing. Further a unilateral "pass" result should not be taken as criteria to conclude normal hearing [7]. Children who fail in the hearing screening unilaterally were sometimes found to have bilateral hearing loss in later life, hence there is a need to follow them up.

Universal Hearing Screening

Parents are not aware that the hearing of their new born needs to be screened. Very few hospitals in India have newborn hearing screening facility. Sometimes certainly not always children are referred based on a high risk register (HRR). Screening the infants only based on high risk register (HRR) is not the perfect method, if we intend not to miss any children with hearing loss [9]. The HRR approach may lose around 50% of the children with hearing loss. India is yet to widely screen all the children falling under high risk criteria. Joint Committee on Infant Hearing (2007) recommends a universal hearing program viz., screening every new born. Though there is no national guideline in India, recently the Indian Academy of Pediatrics has embarked on the importance of implementation of Universal hearing screening [20].

A Universal hearing screening program would be the best method to screen children for hearing loss. However, even it would be a failure, if a foolproof follow up program is imbibed within it [11]. There is a real possibility that a significant number of children with hearing loss would be left unidentified in the new born hearing screening. Failure to follow up would lead to many children being left out from early intervention program [3]. Hearing screening is not a one time procedure at birth but to be done from infancy to adolescence. Late onset hearing loss, lately identified and acquired hearing loss stresses the need for the continuous monitoring of children throughout their developmental age as the prevalence increases [3]. The Joint Committee on Infant Hearing, a recommends that a new born screening has to be followed by screening at the age of 4,5,6,8 & 10 other than newborn screening for all the children [18]. It is reported that children with even a minimal degree of hearing loss or unilateral hearing loss face developmental difficulties. In the developing countries like India the problems are manifold. Equipping community level workers and creating the awareness among the parents are the viable options to increase the detection of hearing loss [19]. Further high risk register approach or a testing the children at the immunization clinics are the other viable options for developing countries.

Conclusion

The technological advances and new knowledge acquired in the identification of hearing loss has brought over a positive impact on the lives of children with hearing loss. Many of such advanced practices

are legally mandated in the developed countries. However, implementation of universal hearing screening & follow up program faces many presumed difficulty in developing countries, including India. Nevertheless, those difficulties should not be overemphasized. Policy decisions had to be made considering the advantages of early identification of hearing loss and disadvantages of late identification.

References

1. American Academy of Audiology. Childhood Hearing Screening Guidelines. (2011) http://www.cdc.gov/ncbddd/hearingloss/documents/AAA_Childhood Hearing Guidelines_2011.pdf
2. American Academy of Pediatrics Subcommittee on Management of Acute Otitis Media. Diagnosis and management of acute otitis media. Pediatrics. 2004; 113(5): 1451–65.
3. American Academy of Pediatrics Joint Committee on Infant Hearing. Year 2007 position statement: Principles and guidelines for early hearing detection and intervention programs. Pediatrics. 2007; 120(4): 898–921.
4. Anitha (2015). Factors affecting age of identification and intervention in children with hearing impairment. Unpublished master's dissertation. Sri Ramachandra University.
5. Bess FH, Dodd MJ & Parker RA. Children with minimal sensorineural hearing loss: prevalence, educational performance, and functional status. Ear and Hearing. 1998; 19(5): 339–54.
6. Chan K, Leung S. Infant Hearing Screening in Maternal and Child Health Centres Using Automated Otoacoustic Emission Screening Machines: A One-year Pilot Project. Hongkong J Pediatrics. 2004; 9: 118–125.
7. Chang KW, O-Lee TJ, Price M. Evaluation of unilateral referrals on neonatal hearing screening. J Medical Screening. 2009; 16(1): 17–21.
8. Daly KA, Hunter LL, Levine SC, Lindgren BR, Giebink G.S. Relationships between otitis media sequelae and age. The Laryngoscope. 1998; 108(9): 1306–10.
9. Elsman S, Matkin N, Sabo M. Early identification of congenital sensorineural hearing loss. Hear J. 1987; 40:13-7.
10. Firoozbakht M, Mahmoudian S, Alaeddini F, Esmaeilzadeh M, Rafiei M, Firouzbakht A, Farhadi M. Community-based newborn hearing screening programme for early detection of permanent hearing loss in Iran: an eight-year cross-sectional study from 2005 to 2012. Journal of Medical Screening. 2014; 21(1): 10–7.
11. Fortnum HM, Summerfield A Q, Marshall DH, Davis AC, Bamford JM. Prevalence of permanent childhood hearing impairment in the United Kingdom and implications for universal neonatal hearing screening: questionnaire based ascertainment study. BMJ (Clinical Research Ed.), 2001; 323(7312): 536–40.
12. Gorga MP, Neely ST, Ohlrich B, Hoover B, Redner J, Peters J. From laboratory to clinic: a large scale study of distortion product otoacoustic emissions in ears with normal hearing and ears with hearing loss. Ear and Hearing. 1997; 18(6): 440–55.
13. Kumar, S., & Kurien, A. A. K. and M. Challenges in the detection and intervention of childhood deafness: Experience from a developing country. International Journal of Biomedical Research. 2015; 6(1): 40–45.
14. Liu Z, Liu L. Hearing screening and diagnosis in a large sample of infants in Central China. J Medical Screening. 2013; 20(1): 21–6.
15. Nagapoornima P, Ramesh A, Rao S, Patricia PL, Gore M., Dominic M. Universal Hearing Screening. Indian J Pediatrics. 2007; 74: 29–33.
16. Norton S J, Gorga MP, Widen JE, Folsom RC, Sininger Y, Cone-Wesson B, Fletcher K. Identification of neonatal hearing impairment: evaluation of transient evoked otoacoustic emission, distortion product otoacoustic emission, and auditory brain stem response test performance. Ear and Hearing. 2000; 21(5): 508–28.
17. Pimperton H, Kennedy CR. The impact of early identification of permanent childhood hearing impairment on speech and language outcomes. Arch in Childhood. 2012; 97(7): 648–53.
18. Ross D S, Holstrum WJ, Gaffney M, Green D, Oyler RF, Gravel JS. Hearing screening and diagnostic evaluation of children with unilateral and mild bilateral hearing loss. Trends in Amplification. 2008; 12(1): 27–34.
19. Santana D J, Hernández. Early detection of hearing loss in newborn and preschool children. Community Ear & Hearing Health. 2014; 11(15): 2–3.
20. Sukumaran T U. Newborn hearing screening Program. Indian Pediatrics. 2011; 48: 351–353.
21. Traxler CB. The Stanford Achievement Test, 9th Edition: National Norming and Performance Standards for Deaf and Hard-of-Hearing Students. Journal of Deaf Studies and Deaf Education. 2000; 5(4): 337–48.
22. Yoshinaga IC, Sedy AL, Coulter DK, Mehl AL. Language of early- and later-identified children with hearing loss. pediatrics. 1998; 102(5): 1161-1171.