PERSPECTIVE

Centralized Newborn Hearing Screening in Ernakulam, Kerala – Experience Over a Decade

ABRAHAM K PAUL

Convenor, Newborn Hearing Screening Programme-IAP, Kochi, Kerala.

Correspondence to: Dr Abraham K Paul, Pediatrician, Cochin Hospital, Cochin-16, Kerala. abrahamkpaul@gmail.com.

A two-stage centralized newborn screening program was initiated in Cochin in January 2003. Infants are screened first with otoacoustic emission (OAE). Infants who fail OAE on two occasions are screened with auditory brainstem response (ABR). All Neonatal intensive care unit babies undergo ABR. This successful model subsequently got expanded to the whole district of Ernakulam, and some hospitals in Kottayam and Thrissur districts. Over the past 11 years, 1,01,688 babies were screened. Permanent hearing loss was confirmed in 162 infants (1.6 per 1000). This practical model of centralized newborn hearing screening may be replicated in other districts of our country or in other developing countries.

Keywords: *Disability, Hearing loss, Neonate, Prevention, Universal newborn hearing screening*.

Hearing loss is one of the most common anomalies, occurring in 1-2 per 1000 infants [1]. The incidence is considerably higher in infants in the Neonatal intensive care unit (NICU) (1-2 cases per 200 infants) [2]**.** Left undetected, hearing impairment in infants can negatively affect speech and language acquisition, academic achievement and social and emotional development. These negative effects can be diminished and even eliminated through early intervention at or before 6 months of age [3]**.** Neonatal hearing loss and its developmental consequences are measurable before the age of 3 years [4-6]. It is an established fact that language development is positively and significantly affected by age of identification of hearing loss and age of initiation into intervention services.

Reliable screening tests that minimize referral rates and maximize sensitivity and specificity are available. The goal of Universal neonatal hearing screening is to maximize linguistic and communicative competence and literacy development for children who are hard of hearing or deaf.

American Academy of Pediatrics (AAP) in 1999 advocated Universal new born hearing screening programme and remedial intervention which is being practiced in most of the developed countries. In a developing country like India, the risk of infants to develop these difficulties is obviously more [8,9]. In interventional programs, the Indian studies mostly cite the screening facilities available to newborns brought in to tertiary referral hospitals [10-12]. A hearing screening equipment facility in every hospital with maternity units today may not be a viable proposition. In this background, a practical interventional model was conceived for the city of Cochin (which has 20 hospitals with maternity units) in January 2003.

CENTRALIZED NEWBORN HEARING SCREENING

A two-stage screening protocol with Otoacoustic emission (OAE) as the first screen, followed by Auditory brainstem response (ABR) for those who fail the second OAE screen was introduced. All NICU babies underwent ABR. With three portable screening machines and three screeners, 20 hospitals in the city of Cochin became partners in the program. This practical interventional model of centralized newborn screening was found to be a cost-effective solution to the newborn hearing screening of Cochin city [13]. After a decade of successful operation, it was decided to expand the program to whole of Ernakulam District with 91 hospitals, and part of hospitals in neighboring Kottayam and Thrissur districts. Thirteen hospitals had their own inhouse screening facility. Five more machines were procured and another five personnel trained and appointed. The program became operational in August 2014. The programme is co-ordinated by a speech and language pathologist and weekly assessment meeting is convened with the staff by the convenor.

Screening facility operates out of Child Care Centre, which is also the secretariat of IAP Cochin Branch. Personnel with basic knowledge in computer and good communication skills were chosen, given basic training in

Copyright of Indian Pediatrics 2016
For personal use only. Not for bulk copying or unauthorized posting to listserv/websites

hearing screening and also skill to gather information of high risk criteria, if any, from parents/hospital staff/ hospital records. The screening personnel visit each hospital daily/alternate days/twice-a-week/weekly depending upon the number of births in that particular hospital. Daily screening was carried out in hospitals which had more than 200 births, alternate day screening in hospitals with 100-200 births and twice weekly or weekly screening in hospitals with births less than 100 per month. On an average, each staff screen about 10-20 babies per day depending upon the hospital delivery rate. If abnormal OAE, it is repeated at 6 weeks on the 1st immunization visit. If again abnormal, ABR is done for confirmation followed by full audiological evaluation and remediation. All NICU babies undergo ABR testing. In babies with abnormal ABR, detailed enquiry is made to identify and record any risk factors [14]. Any baby missing screening before hospital discharge is called for OAE test on the first immunization visit [13]. The salary for staff, cost of equipments and consumables are met from the testing fees (Rs.150 per baby) collected.

There were a total of number of 1,20,630 births in 78 hospitals over the period from January 2003 to January 2015, out of which 82,268 babies underwent screening before discharge and 19,420 babies at 6 weeks. The number of births in individual hospitals varied from 15 per month to 275 per month. Two hospitals had births more than 200, 9 had between 100 – 200 and 67 hospitals below 100. A total of 18,942 babies missed screening and the majority were from hospitals where screening was done on a weekly basis.

In 13 major hospitals that had in-house OAE screening facility, the screening was done by audiologists and they had their own ABR facility. Out of 78 hospitals where screening was done by our team, 11 had ABR facility and the others were depending on nearby private hospitals or ENT/Audiology centers for the same. Out of 1,01,688 babies screened, 16,914 were in the high-risk group and 84,774 were not in high-risk group. Out of 84,774 babies in the non-high risk group, 339 were dropouts for second OAE Screen and 72 for ABR screening. They failed to return even after repeated phone calls. In the high-risk group, 245 were dropouts for second OAE screen and 32 were dropouts for ABR screening (***Fig.* 1**). The mean interval between OAE fail and ABR testing was four weeks.

48 infants (29.6%) had no risk factors and 114 babies had one or more risk factors. Risk factors for hearing loss were identified by using the guidelines of the Joint Committee on Infant Hearing 2000 position statement [14]. The distribution of different risk factors are presented in ***Fig.* 2**.

The most common risk-factor was low birth weight (13%) followed by familial deafness (11%). Low birth weight coupled with mechanical ventilation contributed to 10.5% and mechanical ventilation alone accounted for 8.8%. Hyperbilirubinimia alone contributed to 5.3% cases.

Ernakulam District Experience

Out of 1,01,688 cases screened over the past 11 years, 84,774 were the well-baby nursery group. Out of that, 10,275 failed the first OAE screen. This 12% failure may be an acceptable figure because of early screening on Day 2 or 3 of delivery in view of the early discharge practice.

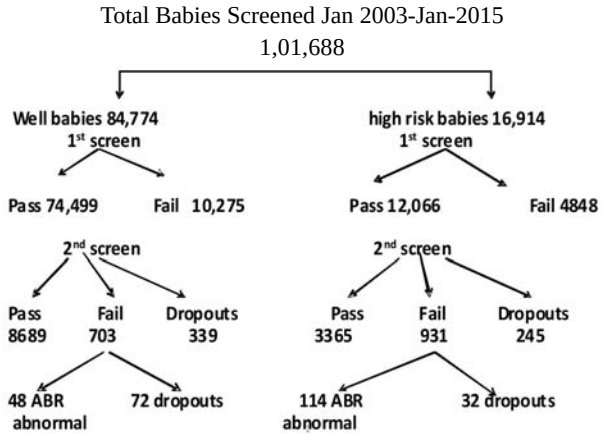

FIG. 1 *Result of newborn hearing screening for high-risk and well babies.*

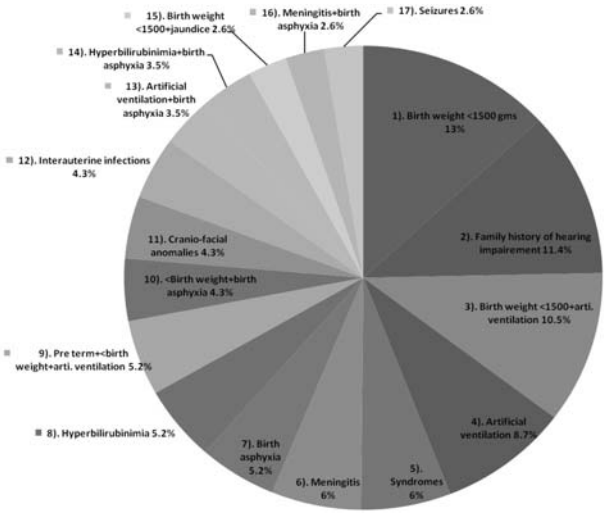

FIG. 2. *Distribution of risk factors according to guidelines of Joint Committee on Infant Hearing 2000 position statement.*

Copyright of Indian Pediatrics 2016
For personal use only. Not for bulk copying or unauthorized posting to listserv/websites

72 dropouts for ABR out of 703 who failed the second OAE screen is a matter of concern. A matter of more concern is the drop-outs in the high risk group even after repeated reminders (245 out of 4848 who failed the first OAE screen and the 32 dropouts after the second OAE screen). The incidence of congenital deafness in well baby nursery in our study is 0.6 per thousand as compared to 1 in 1000 in the literature [1]. In the high-risk population of 16,914 babies screened, 114 babies were detected to have congenital hearing loss with an incidence of 0.7 per 100 as compared to 1-2 cases per 200 [2].

The most common cause of congenital deafness in our series was birth weight <1500 gms (13%) followed by familial deafness in 11%. This is in contrast to observation by Declau, *et al*. [7] screening 87,000 newborns in a tertiary care center in Belgium, where the most common etiological factor was familial deafness accounting for 10.6%. 35 out of 114 cases of permanent congenital hearing loss had more than 1 risk factors (30%).

CONCLUSION

Universal Newborn Hearing Screening (UNHS) has become a standard practice in most developed countries. The identification of all newborns with hearing loss before six months has now become an attainable and realistic goal, as our program of universal newborn hearing screening in Ernakulam District crosses one lakh babies. The concept of a centralized new born hearing screening model to cater to all hospitals in the districts is worth replicating. It takes away the financial burden of each hospital investing for the screening equipment. Follow up of positive cases and drop-outs is made easier with the central reporting and monitoring system. With unified strength of pediatricians, IAP city/district branches could take initiative to replicate this model in their respective towns or districts.

REFERENCES

1. Parving A, Hauch AM, Christensen B. Hearing loss in children: epidemiology, age at identification and causes through 30 years [in Danish]. Ugeskr Laeger. 2003;165:574-9.
2. Van Straaten HL, Tibosch CH, Dorrepaal C, Dekker FW, Kok JH. Efficacy of automated auditory brainstem response hearing screening in very preterm newborns. J Pediatr. 2001;138:674-8.
3. Yoshinaga-Itano C, Coulter D, Thomson V. Developmental outcomes of children with hearing loss born in Colorado hospitals with and without universal newborn hearing screening programs. Semin Neonatol. 2001;6:521 -9.
4. Yoshinaga-Itano C, Apuzzo ML. Identification of hearing loss after age 18 months is not early enough. Am Ann Deaf. 1998;143:380-7.
5. Yoshinaga-Itano C, Apuzzo ML. The development of deaf and hard of hearing children identified early enough through the high risk registry. Am Ann Deaf. 1998;143:416-24.
6. Fortnum HM, Summerfieled AQ, Marshal DH, Davis A, Bamford M. Prevalence of permanent childhood hearing impairment in United Kingdom and implications for universal neonatal hearing screening: Questioner based assertainment study. BMJ. 2001;323:536-40.
7. Declau F, AA Boudewayns, Jenneke Van deu Ende, Peters A. Etiologic and audiologic evaluations after universal neonatal hearing screening: analysis of 170 referred neonates. Pediatrics. 2008;121:1119-1126.
8. Report of the Collective Study on Prevalence and Etiology of Hearing Impairment. New Delhi: ICMR and Department of Science; 1983.
9. Kacker SK. The Scope of Pediatric Audiology in India. *In*: Deka RC, Kacker SK, Vijayalakshmi B, eds. Pediatric Audiology in India, 1st ed. New Delhi: Otorhinolaryngological Research Society of AIMS; 1997.p.20.
10. Nagapoonima P, Ramesh A, Srilakshmi, Rao S, Patricia PL, Gore M. Universal hearing screening. Indian J Pediatr. 2007;74:545-8.
11. Vaid N, Shanbag J, Nikam R, Biswas A. Neonatal hearing screening – The Indian experience. Cochlear Implants Int. 2009;10:111-4.
12. Ramesh A, Nagapoornima M, Srilakshmi V, Dominic M. Swarnarekha. Guidelines to Establish a Hospital-based Neonatal Hearing Screening Programme in the Indian Setting. JAIISH. 2008;27:105-9.
13. Paul AK. Early identification of hearing loss and centralized newborn hearing screening facility-The Cochin experience. Indian Pediatr. 2011;48:356-9.
14. Joint Committee on Infant Hearing; American Academy of Audiology, American Academy of Pediatrics; American Speech-Language-Hearing Association; Directors of Speech and Hearing Programmes in State Health and Welfare Agencies. Year 2000 Position Statement: Principles and Guidelines for Early Hearing Detection and Intervention Programmes. Pediatrics. 2000;106:798-817.

Copyright of Indian Pediatrics 2016
For personal use only. Not for bulk copying or unauthorized posting to listserv/websites