Research Article

Prospective study for newborn hearing screening-A experience from tertiary care centre in central India

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Abstract

Background: It is crucial to timely diagnose hearing impairments in infants as early intervention can lead to decrease in morbidity and better prognosis. This study was conducted as an attempt to find the incidence of hearing loss among high risk neonates, normal neonates and associated risk factor that can impair hearing in newborn. **Aims & Objective:** Screening of normal newborn delivered in our hospital to assess hearing. **Material & methods:** It was a descriptive study. A total no. of 1052 babies delivered in our hospital were screened for hearing assessment by 2 staged OAE screening and those who failed the second stage OAE were subjected to diagnostic Brain Stem Evoked Response Audiometry. The data was analyzed and results were compiled. These results were compared with other studies to identify the most likely risk factor associated with childhood hearing impairment. Results: Among 1052 babies, 254 babies had risk factors for hearing impairment and 20 babies (7.8%) showed hearing impairment, while out of 798 patients without risk factors 9 babies (1.12%) showed hearing impairment. **Conclusion:** OAE can be used as a neonatal screening tool as well as for the evaluation of a suspected pediatric population to help diagnose childhood hearing impairment at a very early stage, allowing for the rehabilitation the child within the critical period for speech and language development.

Key words: Hearing loss, Evoked Oto-acoustic Emissions, Brain Stem Evoked Response Audiometry, Cochlear implant.

Introduction

WHO estimates that globally the number of people with hearing loss, defined as a loss of more than 40 dB on the hearing loss scale (> 40 dB HL), has more than doubled from 120 million in 1995 to at least 278 million in 2005, thus making this condition the most prevalent sensory deficit in the population [1-3]. There are 360 million persons in the world with disabling hearing loss (5.3% of the world's population). 32 (9%) million of these are children [2].

Recent surveys indicate that, world-wide, hearing loss is the most common cause of moderate and severe disability and a leading cause of disability in low- and middle-income countries [4]. Significant hearing loss is one of the most common major abnormalities present at birth. If undetected, it will impede speech, language and cognitive development. Children with a disabling hearing loss are at risk of delayed speech and language development with consequent poor academic performance [5].

Significant bilateral hearing loss is present in 1 to 3 per 1000 newborns in well baby nursery population and in 2 to 4 per 100 infants in intensive care unit population and when permanent unilateral hearing loss is included, the incidence increases to 8 per 1000 live births [6-7].

It is an established fact that if hearing loss is present it should be detected and remediated before the baby is 6 month old. Such infants can develop essential language and cognitive skills if the condition is detected early and they are provided with appropriate intervention services within the first year of life [8-10].

Material & Methods

It was a descriptive study conducted on newborn delivered in Chirayu Medical College & Hospital, Bhopal. Informed consent was taken from

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parents/guardians. A total no. of 1052 newborn babies (with or without risk factor) delivered in our hospital from January 2015 to June 2015 were included in the study. This screening is done by the pediatricians and audiologist using 2 stage screening protocol with OAE (otoacoustic emission) test between 24 and 72 hours after birth as the first screen followed by auditory brain stem response for those who fail the first screen (refer). Newborn admitted in Neonatal Intensive care unit (NICU) are screened prior to discharge from the NICU (once their general condition is stable).

Parents of babies who failed (refer) the screening test were counseled and ask to return back after 1 week for second screening. These babies underwent a second texting in a quiet room. Those who passed on the second screening were discharged from the study while those who failed second time were referred for further BERA testing. GSI audio screener SN 20008P^{TM} is completely automated analysis system that gives PASS or REFER result. Absence of emission for 2 out of 3 frequencies tested (2 KHz, 3 KHz and 4 Khz) was given a REFER result. Repeated phone calls and letters were used to contact parents who failed to return for follow up. Otoacoustic emissions are the most sensitive tests for screening although it may have to be combined with other tests for complete diagnosis. Four types of otoacoustic emission test (OAE), Transient OAE, Distortion product OAE and Sustained - frequency OAE (SFOAE) are available. For infant hearing screening, both DPOAE and TOAE are used. We have used DPOAE in our study, Babies with the following risk factors were identified as high risk newborn: birth weight (<1.5 kg), maturity <34 weeks, birth asphyxia hyperbilirubinemia (>20mg/dl), sepsis, kept on ventilator for more than 48 hours, NICU stay >2 days, babies who received ototoxic drugs and hypoglycemia.

We excluded newborn with purulent ear discharge, external and middle ear abnormalities, refusal by parents or guardian for OAE and tympanic membrane perforation.

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. The study was approved by institutional ethics committee and study subjects were informed about this study and consent of parents/guardians obtained.

Results

Table No 1: Distribution of cases according to risk factors for hearing loss.

Risk Factors	Hearing impairment in risk factor group (n=254)	Hearing impairment in non risk factor group (n=798)	P value
Birth weight <1.5 kg	2 (43)	1 (1009)	0.02
Gestation age ≤ 34 weeks	1 (31)	0 (1021)	0.031
Asphyxia	3 (47)	1 (1005)	0.0001
family history of hearing impairment	2 (23)	1 (1019)	0.0001
NNH requiring exchange transfusion	2 (54)	1 (998)	0.0001
Meningitis	1 (32)	1 (1020)	0.021
Ototoxic drugs	4 (56)	2 (996)	0.0001
Requiring ventilator	3 (32)	1 (1020)	0.0001
Hospital stay > 2 days	2 (76)	1 (976)	0.0001

The total number of infants included in the study were 1052 (562 males and 490 females) out of which 254 babies had risk factors for hearing impairment and 20 babies (7.8%) showed hearing impairment, while out of 798 patients without risk factors 9 babies (1.12%) showed hearing impairment. On applying X2 test, the P value between the difference of hearing found between the above group is highly statistically significant. The infants with high risk factors for hearing impairment are at a significantly higher risk than those infants who have no risk factors for hearing impairment present. In this study of 1052 patients, 29 (2.75%) showed hearing impairment.

Table No 2: Distribution of cases according to the number of risk factors and hearing loss.

No. of risk factors for hearing impairment	Hearing Impairment		Total
	Present	Absent	
1	2	84	86
2	3	64	67
3	3	35	38
4	6	29	35
>4	6	20	26
Total	20	234	254

Out of total 86 infants with a single risk factor only 2 infants were detected for positive hearing impairment. Followed by 67 infants who had two risk factors 3 infants were detected positive for hearing impairment. Among 26 infants with more than four risk factors only 6 infants were detected positive for hearing impairment (Table no.2).

Discussion

It is well recognized that identification and remediation of hearing loss when done before six months of age for newborn infant enable them to perform significantly on vocabulary, communication, intelligence social skills and behavior necessary for success in later life. Total number of infants included in our study were 1052 (562 males and 490 females) out of which 254 babies had risk factors for hearing impairment of which 20 babies (7.8%) showed hearing impairment, while out of 798 patients without risk factors 9 babies (1.12%) showed hearing impairment. In our study the incidence of hearing impairment among newborn with no risk factor is 1.12% while incidence is 7.8% with risk factors. Study done by Sudhir et al found the incidence of hearing impairment in high risk newborn was 22% [12].

In the risk factor group, maximum no. 76 (29.9%) infants had a hospital stay of 2 or more days, followed by the use of ototoxic drugs in 56 (22%) infants. Family history of hearing impairment was only present in 23 (9%) infants. Maximum 4 infants had a positive hearing impairment out of total 56 infants who had given ototoxic drugs, followed by 3 infants who had asphyxia and those who required ventilator out of 47 and 32 infants respectively. In an another study conducted by Kumar A et al, they found that hearing loss is more common in babies with risk factors like NICU admission, LBW, Hypoxia and jaundice [11].

In the non risk factor group, there were total 798 infants and out of total 798 infants 9 (1.12%) infants had a significant hearing impairment. Similar findings were observed by Rughanin et al [12] and by Abraham K Paul et al [13].

On application of chi square test the incidence of hearing impairment was statistically significant in group of newborn with risk factors which was similar to the study done by Paul et al [13]. In our study, there were maximum total 86 infants who had only a single risk factor and out of 86 infants only 2 infants were detected for e significant hearing impairment. Followed by 67 infants who had two risk factors and out of total 67 only 3 infants were detected positive for hearing impairment. There were 26 infants who had more than four risk factors and out of total 26 only 6 infants were detected positive for hearing impairment. This shows that as the number of risk factors for hearing impairment increases the risk of hearing impairment also increases, this was also seen in study by Rughanin et al [12].

Conclusion

This study would provide the basis for an economic analysis of the programme and would guide the systematic implementation of this vital public health intervention within the stepwise framework. It is pertinent to note that a universal newborn hearing screening programme should be carried out along with routine immunization. The continuum of care from birth to adolescence set out in WHO strategic directions for improved maternal and child care in developing countries already acknowledges the need for hearing screening in the first year of life. Failure to screen, therefore, can no longer be considered an option for a developing country.

The newborns with high risk factor for hearing loss should be identified and should be screened in time so that proper interventions can be made before it give rise

to permanent disability. Follow up is required for those patients who are found to have hearing impairment – for further evaluation and management in the appropriate center.

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References

1. Primary Ear & Hearing Care Training Resource. Advanced Level. Geneva: WHO; 2006. Available at: www. who. int/pbd /deafness/ activities/ hearing_care/ advanced. pdf. [Accessed on 20 March 2016].

2. WHO global estimates on prevalence of hearing loss Mortality and Burden of Diseases and Prevention of Blindness and Deafnessn WHO 2012.

3. Resnikoff S, Pascolini D, Etya'ale D, Kocur I, Pararajasegaram R, Pokharel GP, Mariotti SP. Global data on visual impairment in the year 2002. Bull World Health Organ. 2004 Nov; 82(11):844-51. Epub 2004 Dec 14.

4. World Health Organization. The World Bank. 1. World Report on Disability. Geneva: World Health Organization; 2011.

5. Newborn and infant hearing screening. Current issues and guiding principles for action. Geneva: World Health Organization; 2010.

6. Abraham K.P. Early identification of a hearing loss and centralized Newborn Hearing Screening Facility-The Cochin Experience. Indian Paediatrics. 2011;48 (17): 355-359.

7. Augustine AM, Jana AK, Kuruvilla KA, Danda S, Lepcha A, Ebenezer J, Paul RR, Tyagi A, Balraj A. Neonatal hearing screening--experience from a tertiary care hospital in southern India. Neonatal hearing screening--experience from a tertiary care hospital in southern India.

8. Watkin P, McCann D, Law C, Mullee M, Petrou S, Stevenson J, Worsfold S, Yuen HM, Kennedy C. Language ability in children with permanent hearing impairment: the influence of early management and family participation. Pediatrics. 2007 Sep;120(3):e694-701.

9. Kennedy CR, McCann DC, Campbell MJ, Law CM, Mullee M, Petrou S, Watkin P, Worsfold S, Yuen HM, Stevenson J. Language ability after early detection of permanent childhood hearing impairment. N Engl J Med. 2006 May 18;354(20):2131-41.

10. Moeller MP. Early intervention and language development in children who are deaf and hard of hearing. Pediatrics. 2000 Sep;106(3):E43.

11. Kumar A, Shah N, Patel KB, Vishwakarma R. Hearing screening in a tertiary care hospital in India. J Clin Diagn Res. 2015 Mar;9(3):MC01-4. doi: 10.7860/ JCDR/2015/11640.5698. Epub 2015 Mar 1

12. Rughani S, Vyas B, Sinha V, et al: Hearing screening in newborns (a cross sectional study), WAENT. com vol (4)1. 2011.

13. Abraham K Paul. Centralized Newborn Hearing Screening in Ernakulam, Kerala – Experience Over a Decade. Indian Pediatrics. 2011:May (48):355-59.

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