International Journal of Contemporary Pediatrics
Gupta A et al. Int J Contemp Pediatr. 2019 Mar;6(2):338-342
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: http://dx.doi.org/10.18203/2349-3291.ijcp20190681

Original Research Article

Finding out incidence of deafness among neonates at a tertiary care centre of western Rajasthan, India using otoacoustic emission

Ashish Gupta*, Vinod Kumar

Department of Pediatrics, Dr. S. N. Medical College, Jodhpur, Rajasthan, India

Received: 22 December 2018
Accepted: 31 January 2019

***Correspondence:**
Dr. Ashish Gupta,
E-mail: doctorash21@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Newborn hearing screening is conducted to identify suspected hearing loss and not to confirm the presence/absence of hearing loss or define features of the loss. Speech and hearing are interrelated, i.e., a problem with one could mean a problem with the other as speech and language is acquired normally through auditory system.
Methods: A descriptive study conducted in the Department of Paediatrics, Dr. S. N. Medical College, Jodhpur, from June 2016 to December 2017. 5000 neonates were screened using otoacoustic emissions (OAE) in 2 stages at birth during 3rd to 7th day and 15-30 days respectively, followed by BERA at 3 months of age.
Results: 1.4 infants per thousand infants had hearing loss. Presence of high-risk factors was seen to be associated be associated with hearing loss more than normal infants on screening with distortion product otoacoustic emissions (DPOAE) tests. However, on testing with BERA no such association was seen.
Conclusions: 1.4 per 1000 infants had hearing loss. This study has shown that two stage distortion product otoacoustic emissions (DPOAE) hearing screening followed by british educational research association (BERA) to confirm the hearing deficit, can be successfully implemented as new born hearing screening method in a hospital set-up, for early detection of hearing impaired, on a large scale, to achieve the high-quality standard of screening programs in a resource limited and developing nation like India.

Keywords: Brainstem evoked response audiometry **(**BERA), Distortion product otoacoustic emissions (DPOAE), Hearing screening

INTRODUCTION

Communication is the 'key to life'. Hearing is a vital part of a newborn's contact with his environment. The ability to communicate, acquire skills, and perform academically is all greatly dependent on the ability to hear; especially in the present era. Newborn hearing screening is conducted to identify suspected hearing loss and not to confirm the presence/absence of hearing loss or define features of the loss. Speech and hearing are interrelated, i.e., a problem with one could mean a problem with the other as speech and language is acquired normally through auditory system. The prevalence of mild to profound hearing loss is reported to be between 1.1- 6 per 1,000 live-births and with prevalence of hearing loss is estimated to be between 2.5%-10% among high-risk infants.[1]

In most countries, newborn hearing screening programmes that screen only high-risk infants have been in existence for more than 20 years. However, this group of infants with hearing loss comprises only 50% of newborn population with hearing loss, therefore, missing out 50% of hearing-impaired newborn, who are from infants without any risk factors. As hearing impairment is a hidden disability, it is usually detected after 2 years, by which time there is irreversible stunting of the language development potential. Yoshinaga-Itano et al, compared

the receptive and expressive language abilities of 72 children with hearing loss who had been identified by six months of age with 78 children whose hearing losses were identified after six months and showed that early-identified children demonstrated significantly better language scores than the later-identified children.[2] Watkin et al, investigated the attitudes of parents of deaf children to newborn hearing screening.[3] If such a procedure had been available to them when their child was born, 89 percent said they would have wanted it. It is also known that early identification tends to avoid the parental anxiety and anger that may be associated with delayed detection.[4]

A number of infants identified through early universal newborn hearing screening programmes provided the evidence to demonstrate that early identification and intervention of children who were deaf or hard of hearing could actually achieve nearly normal language acquisition by three years of age. Six months of age was the critical cut-off period for early identification that would achieve normal speech and language development.[5]

Newborn and infant hearing screening in the south-east Asia region-sound hearing 2030. In almost all of the countries in this region, there has been no serious organized effort to set up newborn and infant hearing screening programmes.

METHODS

This study was a hospital based observational descriptive study conducted on new born babies born and admitted in Department of Pediatrics at Dr. S. N. Medical College and associated hospitals, Jodhpur, carried out from June 2016 to December 2017.

Inclusion criteria

- All babies delivered in or admitted to the Department of Paediatrics, Dr. S.N. Medical College, Jodhpur were included in the study.

Exclusion criteria

- Those babies who required intensive care were not included in the study during the acute phase.

However, they were included after stabilization or before discharge. The babies were tested within one week of birth. Babies whose mother (parent) did not give consent and babies with acute illness admitted to NICU, could not be included in the study.

After obtaining a written informed consent from the mothers, the babies underwent a routine ENT examination consisting of inspection of the pre-aural, pinna, and post aural region. Occluding wax or debris was gently cleaned using cotton tipped swab Using a pretested questionnaire, potential risk factors were identified with complete clinical examination including anthropometry and general examination. The enrolled subjects were grouped into “at risk” and “no risk” group based on the presence or absence of the risk factors included in the “high risk registry” of joint committee on infant hearing, 2007 respectively.[6] Both the normal and high-risk neonates underwent hearing assessment after 48 hours of birth using DPOAE as the first level of screening. The results of audiological evaluation were recorded in a standardized proforma.

The test was done using distortion product otoacoustic emissions. As it has been shown that transient evoked otoacoustic emissions are used primarily in the linear protocol mode with an eliciting stimulus of 75 dB SPL. On the other hand, DPOAEs are elicited by symmetrical protocols (75-65 dB SPL) testing the frequencies 2kHz, 3kHz, 4kHz and 6kHz. The DPOAEs are found to be more immune to noise than TEOAEs and therefore, are very useful in pass borderline cases. Neonates were tested at 3rd to 7th day of life with distortion product otoacoustic emissions.

Those babies who passed this test were considered passed. Those babies who had REFER in this test were re-screened with DPOAE after one month. Babies who had REFER in the second stage test also underwent a diagnostic brainstem evoked response audiometry and workup for the aetiology of congenital hearing loss. Those babies who passed this were not re-screened and were considered PASS. The machine used for this test was the “Echo Lab” by Labat Asia.

Stastical analysis

The system was calibrated using the calibration mode in the software. Collected data from the questionnaire and the results of the testing were tabulated in Microsoft EXCEL™ and analysed using Chi square test. Significance level was set at $p < 0.05$.

RESULTS

The present study was conducted on 5000 newborn babies among whom 50.22% (2511 babies) were males and 49.78% (2489 babies) were females. 4430 infants (79.7%) were without risk factors and 570 infants (20.3%) had risk factors.

First DPOAE screening was done on infants aged between 3rd and 7th day of life. 4605 infants passed the first DPOAE screen and 395 had “refer” result for the first test. On re-screening with second DPOAE screen at 15-30 days, 362 out of 395 infants who had failed the initial screen were screened of which 40 failed and were subjected to BERA testing.

Thirty-three infants were drop-outs from the study; five with high risk factors and 28 with no-risk factors. BERA

was conducted on 36 infants at three months of age of the infant. Four infants were lost to follow-up out of which two were in high risk category and two in no risk category (Figure 1).

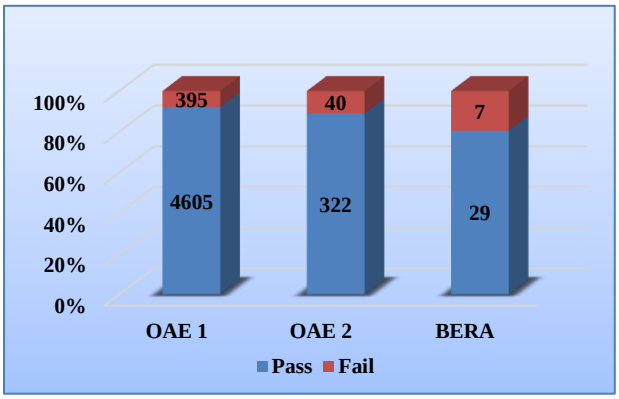

Figure 1: Results of OAE and BERA.

The incidence of hearing loss in no risk group was 0.45/1000; incidence of hearing loss in high risk group was 8.77/1000; overall incidence of hearing loss was 1.4/1000. No significant difference in hearing loss based on gender was seen. Presence of prematurity, low APGAR score, very low birth weight and neonatal hyperbilirubinemia was seen to be associated with hearing loss more than normal infants on screening with DPOAE tests. However, on testing with BERA no such association was seen (Figure 2).

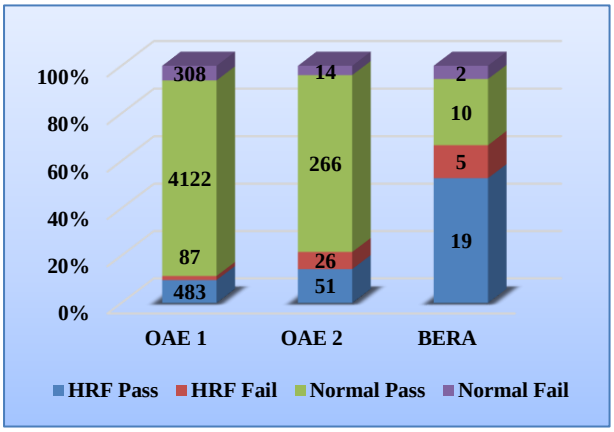

Figure 2: Results in high risk infants.

Presence of high-risk factors was seen to be associated with hearing loss on initial screen with a p value of <0.05. However, on re-screen no such association was seen (Tables 1, 2 and 3). This study has shown that two-stage DPOAE hearing screening followed by BERA to confirm the hearing deficit, can be successfully implemented as newborn hearing screening method in a hospital set-up, for early detection of hearing impaired, on a large scale, to achieve the high-quality standard of screening programs in a resource limited and developing nation like India.

Table1: High risk factors in infants and 1st OAE screen.

First OAE	High risk infants	Normal infants	Total
Failed	87 (15.26%)	308 (6.95%)	395 (7.90%)
Passed	483 (87.7%)	4122 (93.05%)	4605 (92.10%)
Total	570	4430	5000

χ^2=47.93; p <0.05

PPV of first DPOAE screen of 10.12% was documented and on second DPOAE testing PPV of 17.5% was obtained.

Table 2: High risk factors in infants and 2nd OAE screen.

Second OAE	High risk infants	Normal infants	Total
Failed	26 (33.76%)	14 (5%)	40 (11.04%)
Passed	51 (66.23%)	266 (95%)	322 (88.96%)
Total	77	285	362

χ^2=51.34; p <0.05

The incidence of hearing impairment and other findings of the study are consistent with previous researches, indicating hearing loss to be one of the most frequently occurring birth defect requiring an early identification and intervention.

Table 3: High risk factors in infants and BERA.

BERA	High risk infants	Normal infants	Total
Failed	5 (20.83%)	2 (16.66%)	7 (19.44%)
Passed	19 (79.16%)	10 (83.33%)	29 (80.56%)
Total	24	12	36

χ^2=0.088; p >0.05

DISCUSSION

Hearing loss is referred to as the silent, overlooked epidemic of developing countries because of its invisible nature which prevents detection through routine clinical procedures. In India, it is estimated that 18.49 million persons have disability that equivalents to 1.8 percent of the total population of the country where 10 percent of this figure are likely to have hearing disability of moderate to profound degree. Moreover, this number is likely to go up if authors add lower degree of hearing disability.[7]

Screening for hearing loss in infants should be done with a screening test that is simple, cost effective, quick, sensitive, efficient and reliable. Therefore, this study was undertaken to document the importance of using distortion product otoacoustic emissions (DPOAE) as a screening tool for evaluating hearing loss and cochlear function and to screen for hearing loss in infants.

According to this study an incidence of hearing loss of 1.4 per thousand infants was detected which is in line with the published literature. The incidence in the high-risk group was 8.77/1000 and in the no risk group was 0.45/1000.

In an infant hearing screening programmed conducted in the whole district of Ernakulam reported a prevalence rate of 1.6/1000 population.[8] The command hospital air force, Bangalore survey done on a sample size of 800 showed a prevalence of 6.25/1000 population, incidence of hearing impairment in the no risk group was 3.96/1000 whereas incidence of 46.5/1000 was seen high risk group.[9]

Postnatal complications observed during our study included VLBW babies, birth asphyxia, neonatal hyperbilirubinemia, and others like meningitis and sepsis. Of the 5000 infants, 570 had one of the above high-risk factors. Of these 87 gave refer on 1st DPOAE screen. On subsequent screening with DPOAE, 26 infants with risk factors only gave refer results. On subsequent testing with BERA, five patients had hearing loss. However, no significant association could be demonstrated. It's worthwhile to note that among the seven babies with hearing impairment detected in the study, two didn't have any risk factor. Hence, just an at-risk hearing screen would have missed detection of two of the seven hearing impaired (30% of total hearing impaired in the study cohort would be missed). Although the incidence of hearing impaired in no risk group (0.45/1000) is much less than the incidence in the at-risk group (8.77/1000), the magnanimity of newborn population in no risk group is huge, leading to a large number hearing impaired missed by high risk screening. In the study by Paul AK et al, out of 1,01,688 babies screened, 16,914 were in the high-risk group and 84,774 were not in high-risk group. 48 infants (29.6%) had no risk factors and 114 babies had one or more risk factors after BERA testing.[8]

In our study, PPV of first DPOAE screen of 10.12% was documented and on second DPOAE testing PPV of 17.5% was obtained. This is in concordance with the study of Torrico P et al, that concluded that if the first OAE screen is a refer, the probability of having hearing loss is 3.05%, while a refer on second OAE testing clinical suspicion rises to 85.7%.[10] Hence the importance of repeating OAE screen cannot be overlooked.

The newborn hearing screening is being accepted, at a faster growing pace, by an increasing number of health systems in the whole world.[11] As with other infant screening studies, our study also identified that screening with DPOAE is a cheap, cost effective, quick non-invasive method that can be successfully implemented as newborn hearing screening method in a hospital set-up, for early detection of hearing impaired, on a large scale, to achieve the high-quality standard of screening programs in a resource limited and developing nation like India. This study has also brought out the fact that, universal hearing screening is essential to detect the large number of hearing impaired in the large no risk newborn population. This study also has limitations of its own. Four dropouts for ABR out of 40 who failed the second OAE screen is a matter of concern. Other problem authors faced was getting a noiseless surrounding in the nursery setting. The babies had hence to be transported to a separate room for testing which increased the discomfort. Also, random method of sampling used hence association between risk factors could not be demonstrated.

ACKNOWLEDGEMENTS

Authors would like to thank Department of Pediatrics and Department of Otorhinolaryngology, Dr. S. N. Medical College, Jodhpur for their efforts in maintaining the data which made this analysis possible and Dr. Vinod Kumar.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Adams DA. The causes of deafness. In: Gleeson M, eds. Scott Brown's Otolaryngology. 6th ed. Butterworth: Heinemann International; 1997:1-19.
2. Yoshinaga-Itano C, Sedey AL, Coulter DK, Mehl AL. Language of early-and later-identified children with hearing loss. Pediatr. 1998;102(5):1161-71.
3. Watkin PM, Beckman A, Baldwin M. The views of parents of hearing-impaired children on the need for neonatal hearing screening. Brit J Audiol. 1995;29(5):259-62.
4. Magnuson M, Hergils L. The parents' view on hearing screening in newborns: Feelings, thoughts and opinions on otoacoustic emissions screening. Scandinavian Audiol. 1999;28(1):47-56.
5. Ewing IR, Ewing AW. The ascertainment of deafness in infancy and early childhood. J Laryngol Otol. 1944;59(9):309-33.
6. Joint Committee on Infant Hearing. Year 2007 position statement: Principles and guidelines for early hearing detection and intervention programs. Pediatr. 2007;120(4):898-921.
7. National Sample Survey Organization. Disabled Persons in India, NSS 58th Round, Ministry of Statistics and Programme Implementation, Govt. of India, 2003.
8. Paul AK. Early identification of hearing loss and centralized newborn hearing screening facility-the Cochin experience. Indian Pediatr. 2011;48(5):355-9.
9. Anil Kumar AYC, Chandrashekar, Sodhi K et al. Universal Hearing Screening in Newborn. Int J Basic Applied Med Sci.2013;3(2): 116-12.
10. Torrico P, Gómez C, López-Ríos J, de Caceres MC, Trinidad G, Serrano M. Age influence in

otoacoustic emissions for hearing loss screening in infants. Spanish Otorhinolaryngol Act. 2004;55(4):153-9.
11. Saurini P, Nola G, Lendvai D. Otoacoustic emissions: a new method for newborn hearing screening. European Review Med Pharmacol Sci. 2004; 8:129-33.

Cite this article as: Gupta A, Kumar V. Finding out incidence of deafness among neonates at a tertiary care centre of western Rajasthan, India using otoacoustic emission. Int J Contemp Pediatr 2019;6:338-42.