



USE OF OTOACOUSTIC EMISSION(OAE) FOR HEARING ASSESSMENT OF NEONATES ADMITTED IN THE NICU (NEONATAL INTENSIVE CARE UNIT) OF A TERTIARY CARE CENTRE

Neonatology

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ABSTRACT

Introduction Hearing is an important component in the process of learning to speak. Hearing loss should be recognised on time and appropriate audiological rehabilitation should be done early to give full advantage to children in terms of social, adoptive, better carrier opportunities and quality of life. This study was conducted to evaluate the value of hearing screening in high risk newborn by Otoacoustic Emission(OAE) technique admitted in NICU, JMCH **Aim And Objectives** To assess the hearing function of neonates admitted in NICU by OAE test. To identify the neonatal risk factors associated with abnormal OAE test. **Material And Methods:** The current study was a cross sectional study conducted in the newborns admitted in the NICU of a tertiary care hospital by using OAE for screening of hearing impairment in the newborns. **Results:** In this study among 186 screened newborns, incidence of hearing impairment was 11.8% by OAE screening. Of the various risk factors, the presence of prematurity, low birth weight, birth asphyxia and hyperbilirubinaemia were significantly associated with hearing impairment. **Conclusion:** The present study shows that OAE is a simple, cost effective screening test which should be used for early detection of hearing impairment among high risk newborns admitted to the NICU. The current study shows that hearing impairment is found to be a common morbidity in the NICU population.

KEYWORDS

Oae, Hearing Screening

INTRODUCTION

Hearing is one of the most vital of all senses in human beings. It is an important element in the intricate process through which children learn to speak. Hearing impairment is the most common congenital birth defect.¹ Hearing impairment not only affects the speech and language development but also the social, cognitive and personal development of children.^{2,3} Auditory stimulation is required in early months of life for preservation of neural connections in auditory pathways.⁴

Children with hearing loss have difficulty in learning vocabulary, grammar, word order, and other aspects of verbal communicative skills compared to children with normal hearing.⁵ Thus, hearing and speech play an important role to maintain social relationships. It has been reported that 1-2/1000 newborns suffers from congenital and perinatally acquired hearing loss.^{6,7} High risk newborns are reported to be having 10-50 fold increased prevalence of hearing problem.⁸ For holistic development of the child, it is very necessary to detect hearing loss in the neonatal period itself so that early remedial measures can be undertaken. Universal newborn hearing screening has helped in significant reduction of hearing disabilities.⁹ There are two methods of screening hearing loss in neonates, first is Otoacoustic Emission (OAE) and second is Auditory Brainstem Evoked Response (ABER) technique.¹⁰ OAE has been found to have a sensitivity of 85-99% compared to 80-92% with ABER in detection of hearing impairment.¹¹ A consensus statement from the National Institute of Health (NIH) in 1993 recommended universal newborn hearing screening by 3 months of age and stated that otoacoustic emission should be the method used for screening. In 1994, Joint Committee on Infant Hearing (JCIH) recommended and suggested that screening should be done before a newborn is discharged from the hospital where they are born so that most of the newborns could be screened.

As the first year of life is very critical in the development of the brain, lack of auditory stimuli during this period significantly retards the child's overall development. Thus there is a need for early detection of hearing disability through Newborn Hearing Screening Programmes by screening each and every newborn in the neonatal period itself. In India, through the National Program on Women, Children and Youth Health Care, a mandatory early neonatal hearing screening test was introduced on April 24th, 2009. While universal neonatal screening may not be feasible in developing countries due to limited resources, NICU graduates with high risk for hearing impairment need to be screened prior to discharge.

AIM AND OBJECTIVES

- To assess the hearing function of neonates admitted in NICU by OAE test.
- To identify the neonatal risk factors associated with abnormal OAE test.

METHODOLOGY

Place of Study: Department Of Paediatrics, Jorhat Medical College & Hospital

Duration Of Study: 1 year (1st April, 2021- 31st March 2022)

Design Of Study: Cross Sectional Study

Study Population: Neonates admitted in NICU, JMCH

Sample Size: It was calculated using 95% confidence interval and 5% desired precision using EPITOOLS SOFTWARE.

Total sample size: 186

Sampling Type: Consecutive sampling.

Inclusion Criteria:

All newborns admitted in inborn unit of NICU, JMCH and whose parents gave informed written consent.

Exclusion Criteria-

- Neonates whose parents/caregivers were not willing to give consent.
- Neonates with Craniofacial Malformation.
- Syndromic babies.
- Neonates with family history of hearing loss.

Scheme Of Study

The neonates were subjected to OAE test after stabilisation just before discharge from NICU. In this study, the association of non genetic risk factors for congenital hearing loss cited in the IAP Consensus Guidelines, 2017, was studied. A pre structured proforma was used to record the newborn details which included type of delivery, birth weight, resuscitation details, presence of birth asphyxia (APGAR score < 7 at 5 minutes of birth), gestational age by Modified Ballard scoring, indication for NICU admission, use of multiple courses of ototoxic drugs, use of mechanical ventilation and its duration, presence of meningitis (based on clinical and CSF cell count, biochemical, microbiological parameter), presence of hyper

bilirubinaemia and requirement of phototherapy or exchange transfusion(based on AAP NOMOGRAM and NICE guidelines), presence of TORCH infections.OAE screening results of both ears were recorded.

Procedure Of Data Collection:

The neonates were subjected to OAE test prior to discharge from NICU.It was done in a quiet room in the NICU and no sedation was required before the test. OAE was done by using the NEUROSOFT diagnostic OAE machine by an audiologist . To perform the OAE,a tiny flexible plug was inserted into the baby's ear. Specific sounds were generated through the plug. A miniature microphone in the plug recorded the otoacoustic responses of the inner ear in reaction to the transmitted sound .OAE results were noted as either PASS or REFER.

Interpretation Of Oae Results-

- **REFER**-hearing impairment present
- **PASS**-no hearing impairment

Statistical analysis:

1. Microsoft excel was used to prepare the master chart.
2. Data collected were analysed by SPSS 20.0 version software.
3. Statistical tests –Chi square test was used to find the significance of study parameters and p value <0.05 was considered significant
4. Results were expressed in relevant tables and graphs .

RESULTS AND OBSERVATIONS

Out of 186 newborns,164(88.2%) had bilateral pass,8(4%) had bilateral refer,9(5%) had right ear refer and 5(2.8%) had left ear refer.

Out of 22 abnormal (REFER) OAE results, 10 (46%) newborns were between 28 to <34 weeks gestation, 6 (27%) newborns between 34 to <37 weeks of gestation and 6 (27%) newborns were term gestation(≥37 weeks of gestation). There were no newborns with <28 weeks of gestation.P value is 0.002(p value < 0.05) so there is significant association between hearing impairment and gestational age.

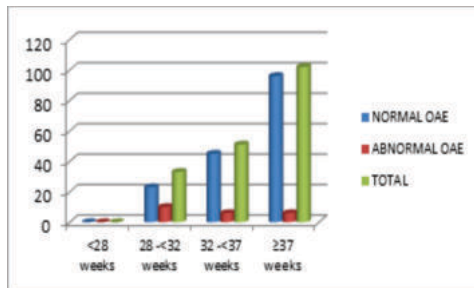


Fig1: Association Of Gestational Age With Abnormal Oae Result

It was seen that a total 9 (46%) newborns who were between 1kg to <1.5kg birth weight, and 7 (27%) newborns between 1.5kg to <2.5kg birth weight and 6 (27%) newborns ≥2.5kg birth weight had REFER result in OAE screening .P value-0.012, (p value < 0.05) so there is significant association between hearing impairment and birth weight.

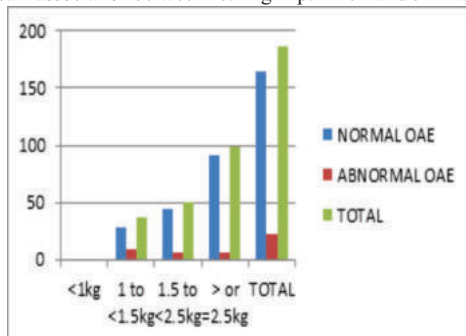


Fig 2: Association Of Birth Weight With Abnormal Oae Result

Among 186 neonates, 95 newborns had hyperbilirubinaemia . Out of total 95 babies with hyperbilirubinaemia, 11 (12%) of them screened with OAE had shown REFER result.P value is 0.0038, (p value <0.05) so there is significant association between hearing impairment and hyperbilirubinaemia.

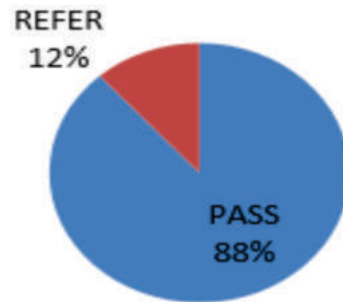


Fig 3: Distribution Of Oae Results Among Babies With Hyperbilirubinaemia

Among 186 neonates, 60 newborns had birth asphyxia based on APGAR score <7 at 5 minutes of birth . Out of total 60 babies with birth asphyxia, 51 (85%) of them screened with OAE had bilateral PASS result and 9(15%) newborns had given REFER result on first OAE.P value is 0.004, (p value < 0.05) so there is significant association between hearing impairment and birth asphyxia.

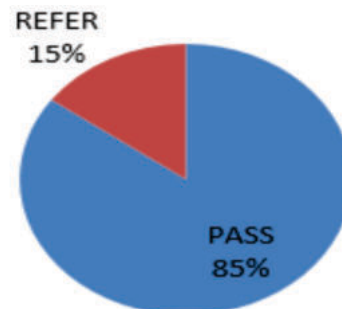


Fig4: Distribution Of Oae Results Among Patients With Birth Asphyxia

Out of 186 newborns, 35 newborns were on mechanical ventilation of which 15 newborn were for > 5 days duration and 20 newborns < 5 days duration. Out of 15 newborns who were > 5 days, 4(26%) had REFER result on OAE. Out of 20 newborns who were < 5 days, 3(15%) had REFER result on OAE. P value is 0.4(p value > 0.05) so there is no significant association between hearing impairment and duration of mechanical ventilation. P value is 0.4(p value > 0.05) so there is no significant association between hearing impairment and duration of mechanical ventilation.

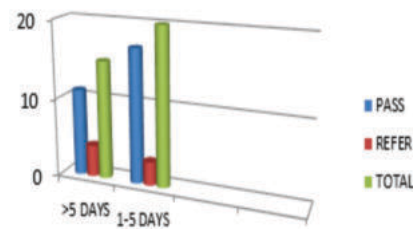


Fig 5: Association Of Duration Of Mechanical Ventilation With Oae Result

Out of 35 babies who had meningitis,3 (9%) babies showed REFER on OAE test.P value is 0.6(p value >0.05) so there is no significant association between hearing impairment and meningitis.

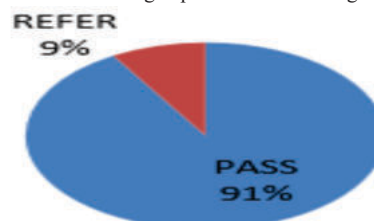


Fig6: Association Of Meningitis With Oae Result

In the present study, 86 babies were treated with aminoglycoside

antibiotic(amikacin) for sepsis for a duration no longer than 7 days and all of these babies had passed the hearing screening.

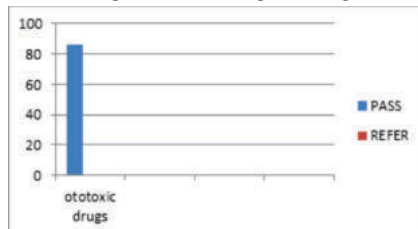


Fig 7: Association Of Ototoxic Drugs With Oae Result

DISCUSSION

Hearing impairment suggested by REFER result on OAE was found in 11.8% of newborns. The incidence of hearing impairment in high risk neonates according to available literature is 2.5% - 15% which is similar to our study.¹¹ There is significant association of hearing loss with gestational age and birth weight. Vos et al. during 2007-2012 in Belgium, found that hearing impairment was seen in 3-14.1% of babies in NICU¹² and hearing loss was associated with lower gestational age and low birth weight similar to the present study.¹³ According to Van Dommelen et al. (2015 in Netherlands), hearing loss in NICU babies is associated with premature birth and low birth weight similar to the present study.¹⁴ There is significant association between hearing loss and birth asphyxia and hyperbilirubinaemia. R.P. Chavan et al conducted a study in Government Medical College, Maharashtra during 2019-2020, which showed hyperbilirubinaemia and birth asphyxia as a risk factor for newborn hearing loss.¹⁵ Maqbool et al. in a study done in Government Medical College, Srinagar from 2009 -2010, found that hearing impairment was associated with hyperbilirubinaemia and birth asphyxia.¹⁶ There is no significant association between hearing loss and duration of mechanical ventilation. M D Mohd Khairi et al conducted a 2 stage hearing assessment in 401 at risk neonates in Malaysia during 2000-2001 and concluded that mechanical ventilation of more than 5 days was not an independent risk factor for hearing impairment similar to the present study.¹⁷

In the present study, 86 babies were treated with aminoglycoside antibiotic(amikacin) for sepsis for a duration no longer than 7 days and all of these babies had passed the hearing screening. Finckh Kramer U. et al. in 1998 in Berlin concluded that aminoglycosides are not an important risk factor. Similar results were obtained by Hess M et al(1990-1997) and the present study also showed aminoglycosides are not a risk factor for hearing impairment.

CONCLUSION

- In this study among 186 screened newborns, incidence of hearing impairment was 11.8% by OAE screening. Therefore hearing impairment is found to be a common morbidity in the NICU population.
- Of the various risk factors, the presence of prematurity, low birth weight, birth asphyxia and hyperbilirubinaemia were significantly associated with hearing impairment. Therefore newborns with these risk factors should definitely be screened for hearing impairment.
- Hearing impairment was not seen in babies who received ototoxic drugs probably due to short duration of therapy and optimal drug dosing.
- The present study shows that OAE is a simple, cost effective screening test which should be used for early detection of hearing impairment among high risk newborns admitted to the NICU.
- On a broader perspective, the country needs to have a national policy of Universal Newborn Hearing Screening so that the benefits of OAE test percolate to all newborns.

Limitations

- Our study focused on high risk infants who constitute only 50% of all neonates with hearing loss. The other 50% will remain undetected at birth by this approach.
- This was a preliminary study and further study for follow up of these high risk newborns are required in future.

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