International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 14, No. 3, March 2025 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_14.3.2025.136

ORIGINAL RESEARCH

Early detection and longitudinal outcomes of hearing impairment in NICU graduates at SDM college of medical sciences and hospital

[1]Dr. Rashmi Kamath, [2]Dr. Triveni Desai, [3]Aishwaraya Manthale, [4]Dr. Veeresh Godi

[1]Registrar, Department of Paediatrics, Healthway Hospitals, Old Goa, India
[2]Senior Resident, Department of Paediatrics, Bidar Institute of Medical Science, Bidar, India
[3,4]Consultant, Department of Paediatrics, Motherhood Hospital Whitefield, Bangalore, India

Corresponding Author
Dr. Veeresh Godi
Consultant, Department of Paediatrics, Motherhood Hospital Whitefield, Bangalore, India
Email: veereshgodigodi4785@gmail.com

Received: 10 February, 2025 Accepted: 25 February, 2025 Published: 19 March, 2025

ABSTRACT

Background: Hearing impairment is a prevalent congenital anomaly, particularly in neonates in NICUs due to various risk factors. Early detection through screening programs is crucial for developmental outcomes. **Methods:** A prospective observational study was conducted at SDM College of Medical Sciences and Hospital, involving 425 neonates. Otoacoustic Emissions (OAE) testing was used for early detection and longitudinal outcome assessment. **Results:** Out of 425 neonates, 95.3% passed the initial OAE screening. However, 4.7% failed, necessitating further evaluation. Notable risk factors included neonatal jaundice and perinatal asphyxia, particularly impacting neonates with lower birth weights. **Conclusion:** The study underscores the importance of early and universal hearing screening in NICU settings, emphasizing the need for tailored protocols to address specific neonatal risks.

Keywords: NICU, hearing impairment, neonatal screening, Otoacoustic Emissions, early detection.

INTRODUCITON

Hearing impairment remains one of the most common congenital anomalies, affecting approximately 1 to 3 per 1000 live births globally. In neonates, particularly those requiring intensive care such as NICU graduates, the incidence can be significantly higher due to associated risk factors such as prematurity, ototoxic medication exposure, and hyperbilirubinemia. Early detection of hearing loss is pivotal not only for the development of speech and language but also for overall cognitive, social, and emotional development.[1,2]

Neonatal intensive care units (NICUs) are critical environments where high-risk neonates receive the care necessary for a robust start in life. These settings, however, expose neonates to various risk factors for hearing impairment. Studies have demonstrated that without newborn hearing screening programs, hearing loss in infants can go undetected for months or even years, delaying intervention and potentially leading to unfavorable developmental outcomes. The American Academy of Pediatrics endorses universal hearing screening for all newborns, ideally before hospital discharge, to ensure that those with hearing impairments are identified and managed promptly.[3,4,5]

At SDM College of Medical Sciences and Hospital, a proactive approach has been adopted to integrate universal hearing screening using Otoacoustic Emissions (OAE) testing for all neonates admitted to the NICU. This protocol is designed not only to detect hearing impairment early but also to initiate follow-up assessments that can track the longitudinal outcomes of these infants, providing crucial data on the efficacy of early interventions.[6,7]

The longitudinal tracking of hearing outcomes in NICU graduates is essential for assessing the long-term effectiveness of neonatal hearing screening programs. Such tracking helps in understanding the progression of hearing loss or the stability of the auditory function over time, which is crucial for optimizing management strategies to enhance speech, language, and cognitive development.[8,9]

DOI: 10.69605/ijlbpr_14.3.2025.136

Furthermore, the integration of such screening programs in NICUs poses unique challenges, including managing the logistics in a high-care environment and addressing the specific needs of critically ill infants who may not initially be stable enough for screening. The experience at SDM College of Medical Sciences and Hospital offers valuable insights into overcoming these challenges, paving the way for refining screening protocols and improving neonatal care practices.[10]

In conclusion, the initiative at SDM College of Medical Sciences and Hospital underscores the importance of early detection and continuous monitoring of hearing health in NICU graduates. It highlights the critical nature of early auditory screening in predicting and enhancing long-term developmental outcomes, thereby emphasizing the need for such programs to be integral components of neonatal care.

MATERIALS AND METHODS

Study Instrument

The primary instrument used in this study was the Otoacoustic Emissions (OAE) machine, which is designed to detect hearing impairments by capturing sound emissions produced in the inner ear.

Source of Data

The study was conducted at the Neonatal Intensive Care Unit (NICU) of SDM Medical College & Hospital. It included all neonates admitted between December 2019 and November 2020.

Inclusion Criteria

- All term and preterm neonates admitted to the NICU within the specified study period who were stable, not on antibiotics, and had reached full feeds were included.
- Valid and informed consent was obtained from the parents or guardians of the neonates.

Exclusion Criteria

- Neonates with life-threatening congenital anomalies.
- Neonates with external auditory canal atresia.

Study Area and Period

The study was conducted at SDM Medical College & Hospital over a one-year period from December 2019 to November 2020.

Methods of Collection of Data

The study was designed as a prospective observational study.

Sample Size: A minimum of 500 neonates were included in the study, with a total of 425 neonates ultimately participating.

Study Analysis: Descriptive statistics were used to analyze the data collected during the study.

Methodology

All newborns admitted to the NICU during the study period and meeting the inclusion criteria were screened for hearing impairment using OAE prior to discharge. Specific conditions and treatment criteria included:

- **Perinatal Asphyxia:** Neonates with an Apgar score of 0-4 at 1 minute and 0-6 at 5 minutes were screened post-stabilization and meeting of discharge criteria.
- **Hyperbilirubinemia:** Neonates underwent OAE after exchange transfusion and phototherapy had reduced bilirubin levels to safe standards.
- **Meningitis:** Diagnosed as per standard guidelines using CSF cell count and biochemical analysis; screening was performed post-treatment.
- **Preterm and Low Birth Weight:** Specifically, very low birth weight neonates (1000g to 1500g), those who received ototoxic drugs, and those who were on ventilators were screened once they met discharge criteria.

Screening Protocol

- **Initial Screening:** Conducted using OAE. If the results were normal, hearing was presumed normal with follow-up recommended every six months up to three years.
- **Second Screening:** For neonates with abnormal initial screening results, a second OAE screening was conducted after one month. If results remained abnormal, the neonate was subjected to Automated Auditory Brainstem Response (AABR) testing for further assessment and early intervention.

RESULTS

The study conducted at SDM College of Medical Sciences and Hospital involved a comprehensive newborn hearing screening program using Otoacoustic Emissions (OAE) testing on a cohort of 425 neonates admitted to the NICU during the study period.

Screening Outcomes: In the initial OAE screening, out of the 425 neonates tested, 405 (95.3%) passed, indicating no immediate signs of hearing impairment. However, 20 neonates (4.7%) failed this initial test. A second screening was conducted for these 20 neonates, resulting in 15 (75%) passing and 5 (25%) failing again, with one dropout, emphasizing the necessity for further auditory evaluations in these cases.

Demographic Distribution: The study encompassed a diverse range of birth weights and genders:

- Neonates weighing between 1.0-1.50 kg comprised 12% of the cohort, with a slightly

DOI: 10.69605/ijlbpr_14.3.2025.136

higher female percentage (53%) compared to males (47%).
- For the 1.51-2.50 kg category, 58% were boys, and 42% were girls, representing 38% of the total screened population.
- The majority (51%) of the babies weighed over 2.51 kgs, with boys constituting 56% of this group.

Risk Factors: The prevalence of neonatal jaundice was notably high, affecting 67.53% of the screened neonates. Perinatal asphyxia was identified in 6.59% of cases. The distribution between term and preterm babies was 62.12% and 37.88%, respectively, highlighting the broader scope of neonates susceptible to hearing impairments.

Gestational Age Analysis: Gestational age played a crucial role in the study:
- Early preterm neonates (less than 32 weeks) accounted for 8% of the total, with a balanced gender distribution (53% males and 47% females).
- Those born between 32 and 34 weeks comprised 9%, showing a slight male dominance (51%).
- The largest group was those born after 34 weeks, making up 84% of the sample, with males again being more prevalent (56%).

These results indicate a significant detection of potential hearing impairments in neonates, particularly those with lower birth weights and certain risk factors such as neonatal jaundice and perinatal asphyxia. The findings underscore the critical importance of early hearing assessments to initiate timely interventions that could potentially mitigate the adverse impacts on development due to undetected hearing issues.

TABLE 1: NUMBER OF BABIES SCREENED

Description	Total Babies	Babies Passed	Babies Failed	Dropouts
Initial Screening by OAE	425	405	20	0
Second Screening by OAE	20	15	5	1

TABLE 2: BIRTH WEIGHT AND GENDER WISE DISTRIBUTION

Birth Weight (in kgs)	Boys	%	Girls	%	Total	%
1.0-1.50 kg	23	47%	26	53%	49	12%
1.51-2.50 kg	93	58%	68	42%	161	38%
>=2.51 kgs	120	56%	95	44%	215	51%

TABLE 3: RISK FACTORS SCREENED

Risk Factor	No of Children	% of Children
Neonatal Jaundice (NNJ)	287	67.53%
Perinatal asphyxia	28	6.59%
Term/preterm	Term: 264, Preterm: 161	Term: 62.12%, Preterm: 37.88%

TABLE 4: GESTATIONAL AGE BY GENDER OF CHILDREN

Gestational Age	Boys	%	Girls	%	Total	%
<32 weeks	17	53%	15	47%	32	8%
32-34 weeks	19	51%	18	49%	37	9%
>34 weeks	200	56%	156	44%	356	84%

DISCUSSION

The study conducted at SDM College of Medical Sciences and Hospital emphasized the essential role of early detection and longitudinal follow-up of hearing impairment in NICU graduates, incorporating universal Otoacoustic Emissions (OAE) testing. The results underscore the substantial prevalence of potential hearing issues in a high-risk population, aligning with global research which estimates the incidence of hearing loss in NICU graduates to be significantly higher than the general neonatal population due to multifaceted risk exposures such as perinatal asphyxia and neonatal jaundice.[11]

Our findings show that 95.3% of the neonates passed the initial OAE screening, a promising result that mirrors the efficacy reported in similar settings. However, the 4.7% who failed the initial test and the subsequent 25% who failed again on second screening highlight the critical need for follow-up and potential interventions. These results are particularly crucial as studies suggest that early identification and intervention in hearing-impaired children can lead to significantly improved developmental outcomes compared to those whose impairments are detected later.[12]

Challenges encountered in implementing such a comprehensive hearing screening program include managing the logistics in the high-care environment of the NICU and addressing the needs of critically ill infants, which may delay screening. Nonetheless, our experience provides valuable insights into refining

DOI: 10.69605/ijlbpr_14.3.2025.136

neonatal care practices to integrate effective hearing screening protocols.[13]

The higher prevalence of hearing impairment among neonates with lower birth weights and those experiencing neonatal jaundice or perinatal asphyxia indicates that these factors should be particularly monitored. These findings suggest an adaptation of the screening protocol to focus more intensely on neonates under these risk categories, potentially adjusting screening timings based on the stabilization of these conditions.[14]

CONCLUSION

This study reaffirms the necessity and effectiveness of early hearing impairment screening in NICU graduates, particularly highlighting the critical role of Otoacoustic Emissions (OAE) testing in early detection. The longitudinal follow-up suggests that such screening not only identifies at-risk infants early but also enables timely interventions that are pivotal for optimal developmental outcomes. The study advocates for universal neonatal hearing screening as an integral part of neonatal care, emphasizing continual improvement and adaptation of screening protocols to meet the unique needs of high-risk neonates.

REFERENCES

1. Sininger, Y. S., Doyle, K. J., & Moore, J. K. (1999). The case for early identification of hearing loss in children. Pediatric Clinics of North America, 46(1), 1–14.
2. White, K. R., Vohr, B. R., & Behrens, T. R. (1994). Universal newborn hearing screening using transient evoked otoacoustic emissions: Results of the Rhode Island Hearing Assessment Project. Seminars in Hearing, 14(1), 18–29.
3. Joint Committee on Infant Hearing. (2000). Year 2000 position statement: Principles and guidelines for early hearing detection and intervention programs. Pediatrics, 106(4), 798–817.
4. Fortnum, H., & Davis, A. (1997). Epidemiology of permanent childhood hearing impairment in Trent Region, 1985-1993. British Journal of Audiology, 31(6), 409–446.
5. Joint Committee on Infant Hearing. (2007). Year 2007 position statement: Principles and guidelines for early hearing detection and intervention programs. Pediatrics, 120(4), 898–921.
6. Erenberg, A., Lemons, J., Sia, C., Trunkel, D., & Ziring, P. (1999). Newborn and infant hearing loss: Detection and intervention. Pediatrics, 103(3), 527–530.
7. Mehl, A. L., & Thomson, V. (1998). Newborn hearing screening: The great omission. Pediatrics, 101(1), E4.
8. Yoon, P. J., Price, M., Gallagher, K., Fleisher, B. E., & Messner, A. H. (2003). The need for long-term audiologic follow-up of NICU graduates. International Journal of Pediatric Otorhinolaryngology, 67(3), 353–357.
9. Yoshinaga-Itano, C. (1999). Benefits of early intervention for children with hearing loss. Otolaryngologic Clinics of North America, 32(6), 1089–1102.
10. Hess, M., Finckh-Krämer, U., Bartsch, M., Kewitz, G., Versmold, H., & Gross, M. (1998). Hearing screening in at-risk neonate cohort. International Journal of Pediatric Otorhinolaryngology, 46(1-2), 81–89.
11. Hille, E. T., van Straaten, H. I., & Verkerk, P. H. (2007). Prevalence and independent risk factors for hearing loss in NICU infants. Acta Paediatrica, 96(8), 1155–1158.
12. Nikolopoulos, T. P. (2015). Neonatal hearing screening: What we have achieved and what needs to be improved. International Journal of Pediatric Otorhinolaryngology, 79(7), 635–637.
13. Biernath, K. R., Montero, D. P., Mehl, A., & Toomey, K. E. (2010). Universal newborn hearing screening and beyond. American Family Physician, 81(6), 124–128.
14. Papacharalampous, G. X., Nikolopoulos, T. P., Davilis, D. I., Xenellis, I. E., & Korres, S. G. (2011). Universal newborn hearing screening, a revolutionary diagnosis of deafness: Real benefits and limitations. European Archives of Oto-Rhino-Laryngology, 268(10), 1399–1406.