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Original Article

ASSESSMENT OF RISK FACTORS AND FOLLOW-UP OUTCOMES FOR HEARING LOSS IN HIGH-RISK NEONATES

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ABSTRACT

Objective: Hearing loss in neonates, particularly those in high-risk categories such as NICU graduates, can significantly impede speech, cognitive, and psychosocial development. Early detection and management are pivotal to mitigating these risks.

Methods: A prospective observational study was conducted on 425 neonates at SDM Medical College and Hospital, utilizing Otoacoustic Emissions (OAE) for initial auditory screening. This study assessed the incidence of hearing loss in relation to neonatal risk factors, including birth weight, ABO incompatibility, and maternal health conditions.

Results: A majority of the neonates (58.82%) were screened within 3-7 d post-birth. Notable risk factors impacting hearing outcomes included low birth weight, with 11.53% of neonates weighing between 1.0 and 1.50 kg. The initial failure rates in OAE screenings were low, with 2.59% failing in the right ear, 1.18% in the left, and 0.94% in both ears.

Conclusion: The study underscores the efficacy of early hearing screenings in identifying potential hearing loss in neonates, especially those exposed to multiple risk factors. Continuous and comprehensive monitoring is crucial for these high-risk groups to facilitate timely and effective interventions.

Keywords: Neonatal hearing loss, High-risk neonates, Early hearing screening, NICU, Otoacoustic emissions, Risk factors

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INTRODUCTION

Hearing loss in neonates, particularly those categorized as high-risk, constitutes a pivotal concern within pediatric audiology and neonatal medicine due to its profound implications on the developmental trajectory of affected individuals. High-risk neonates, including those with a history of neonatal intensive care unit (NICU) admission, are disproportionately susceptible to auditory deficits, underscoring the need for meticulous assessment of risk factors and vigilant follow-up protocols [1, 2].

The etiology of hearing loss in this vulnerable population is multifactorial, with risk factors ranging from genetic predispositions and congenital infections to environmental insults such as ototoxic medication exposure and prolonged mechanical ventilation. The Joint Committee on Infant Hearing (JCIH) identifies a spectrum of such factors and recommends targeted surveillance and early auditory screening to intercept and mitigate the potential for long-term sensory deficits. This approach is crucial as early detection facilitates timely intervention, which is instrumental in optimizing communication outcomes and overall neurodevelopment [3-5].

Moreover, the auditory system's critical period of maturation accentuates the urgency for early identification and management. Delayed diagnosis often translates into missed opportunities for early intervention, which can have cascading effects on speech and language acquisition, cognitive function, and psychosocial development. Therefore, understanding the specific risk factors inherent to high-risk neonates is essential for implementing appropriate screening strategies and ensuring comprehensive follow-up care [6, 7].

Current methodologies in auditory assessment have evolved, with Otoacoustic Emissions (OAE) and Automated Auditory Brainstem Response (AABR) serving as the cornerstone technologies for initial screening. However, while these tools offer critical early insights, they do not supplant the need for ongoing evaluation due to the potential for late-onset or progressive hearing loss. Consequently, longitudinal follow-up through repeated auditory assessments and continuous monitoring of developmental milestones is advocated to capture the dynamic nature of auditory pathology in this group [8, 9].

Furthermore, the integration of multidisciplinary care teams, including audiologists, neonatologists, and pediatric otolaryngologists, is pivotal in the holistic management of these infants. This collaborative approach not only enhances the accuracy and efficacy of diagnostic and intervention strategies but also provides a support framework for families navigating the complexities of potential hearing impairment in their children [10].

In light of these considerations, this paper aims to dissect the risk factors contributing to hearing loss in high-risk neonates and evaluate the outcomes of established follow-up protocols. Through a comprehensive review of contemporary literature and longitudinal data, we strive to illuminate the pathways through which early audiological intervention can alter the developmental prospects of this fragile population, thereby advocating for refined screening processes and enhanced follow-up care strategies. This endeavor not only addresses a significant public health issue but also enriches our understanding and management of neonatal hearing loss, ultimately fostering improved quality of life for affected individuals and their families.

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 and 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 and 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 min and 0-6 at 5 min 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 encompassed a cohort of 425 neonates stratified based on age, presence of risk factors, birth weight, and outcomes of initial hearing screening. The data analysis provided comprehensive insights into the distribution and potential influences impacting the auditory health of these high-risk neonates.

Age distribution

The age distribution of the neonates at the time of their initial hearing screening revealed that a majority were screened within the first week of life. Specifically, 250 neonates (58.82%) were tested between 3-7 d of age, highlighting the efficacy of early screening protocols. Additionally, 78 children (18.35%) were screened between 8-14 d, and 97 children (22.82%) were tested at or beyond 15 d of age.

Presence of risk factors

Regarding additional risk factors, 31 neonates (7.29%) exhibited ABO incompatibility, which can be a precursor to conditions like hyperbilirubinemia that potentially affect auditory health. Asymptomatic hypoglycemia was noted in 4 children (0.94%), and congenital pneumonia was present in 2 neonates (0.47%). Furthermore, 7 infants (1.65%) were born to mothers who tested positive for COVID-19, which recent studies suggest may contribute to various neonatal complications, including sensory deficits.

Weight distribution

The birth weight analysis showed that 215 neonates (50.59%) weighed more than 2.51 kg, 161 (37.88%) were between 1.51 and 2.50 kg, and 49 neonates (11.53%) weighed between 1.0 and 1.50 kg. This distribution underscores the importance of considering birth weight as a potential indicator of health risks, including auditory impairment.

Hearing screening outcomes

The outcomes from the initial Otoacoustic Emissions (OAE) screening indicated that 20 neonates failed the test. Of those who failed, 11 (2.59%) failed in the right ear, 5 (1.18%) in the left ear, and 4 (0.94%) in both ears. This suggests a relatively low incidence of detected hearing impairment in the initial assessment, which is crucial for early intervention.

The integration of age, additional risk factors, and birth weight into the analysis of hearing screening outcomes provides a nuanced understanding of the factors contributing to auditory health risks in neonates. These results substantiate the need for targeted screening and tailored follow-up strategies, especially considering the varying degrees of risk associated with different neonatal profiles.

Table 1: Age-wise distribution

Age (in days)	No of children	% of children
3-7 d	250	58.82%
8-14 d	78	18.35%
>=15 d	97	22.82%

Table 2: Presence of other risk factors in children

Risk factor	No of children	% of Children
ABO incompatibility	31	7.29%
Asymptomatic hypoglycemia	4	0.94%
Congenital pneumonia	2	0.47%
Maternal covid positive	7	1.65%

Table 3: Weight-wise distribution of children

Birth weight (in kg/s)	No of children	% of children
1.0-1.50 kg	49	11.53%
1.51-2.50 kg	161	37.88%
>=2.51 kg	215	50.59%

Table 4: Number of babies failing the first screening

OAE side	No of children	% of children
Right side	11	2.59%
Left side	5	1.18%
Both	4	0.94%

DISCUSSION

The findings from this study at SDM Medical College and Hospital emphasize the critical nature of early screening for hearing loss in high-risk neonates, aligning with current guidelines that advocate for early auditory assessments. The data reveal a significant proportion of neonates tested within the first week, underscoring the benefits of early detection in facilitating timely interventions. The presence of risk factors such as ABO incompatibility and maternal COVID-19 status, while in smaller percentages, highlights the multifactorial etiology of neonatal hearing loss described and necessitates comprehensive risk assessment protocols [11, 12].

Particularly noteworthy is the relationship between lower birth weights and increased risk of hearing loss. This association may be indicative of the vulnerability of the auditory system in preterm and low birth weight infants, who are often subjected to multiple risk factors, including ototoxic medications and prolonged NICU stays. The relatively low percentages of neonates failing the initial OAE screening are encouraging, yet they also call attention to the need for ongoing surveillance to capture late-onset or progressive hearing impairments [13, 14].

Additionally, the varying rates of hearing screening failure across different auditory channels suggest asymmetrical auditory pathologies, which may require differentiated follow-up strategies. These findings should be integrated into the NICU's routine follow-up practices, ensuring that all neonates, particularly those with identified risk factors, receive comprehensive auditory evaluations over time [15].

CONCLUSION

This study reaffirms the importance of integrating comprehensive risk assessments and early hearing screenings within the NICU settings to promptly identify and manage hearing loss in high-risk neonates. The evidence for early screening effectiveness, coupled with the need for continuous monitoring, supports the enhancement of neonatal care protocols to include regular follow-up auditory assessments, ensuring that interventions are timely and tailored to the individual needs of these vulnerable infants.

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AUTHORS CONTRIBUTIONS

All authors have contributed equally

CONFLICT OF INTERESTS

Declared none

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