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Original Research

Frequency of Hearing Impairment in Neonates Delivered in A Tertiary Care Hospital

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Abstract: **Objective:** To determine the frequency of hearing impairment in neonates delivered in a tertiary care hospital. **Methodology:** A cross sectional study was conducted at the Department of Pediatrics, Sir Ganga Tam Hospital, Lahore, over a period of five months from June 2025 to October 2025. Neonates (1–12 hours old) were recruited in informed consent, excluding the congenital diseases, ear infection or emergency presentation. The participants underwent OAE, ABR and BERA screening. Descriptive statistics were used for the analysis of data in SPSS 25 and Chi-square test with p values ≤0.05. **Results:** Of 250 neonates, 24 (9.6%) were diagnosed with hearing loss. The previous history of an affected child was significantly associated with hearing impairment (p<0.001) and was an independent predictor (Adjusted OR=0.05, 95% CI: 0.02–0.21). Other factors were not significant (p>0.05), but birth weight was (adjusted OR=0.42, 95% CI: 0.18–0.96, p=0.042). **Conclusion:** According to this study hearing impairment was detected in 9.6% of high-risk neonates admitted to the NICU. Most demographic, maternal, neonatal, and delivery-related factors were not significantly associated with hearing impairment.

Keywords: Hearing Impairment, Neonates, NICU

INTRODUCTION

Hearing is essential for the normal development of speech, language, learning, and social communication in children. Hearing impairment during the neonatal period may remain unnoticed because newborns cannot communicate their difficulty in hearing. If it is not identified early, it may adversely affect language development, cognitive abilities, academic performance, and social interaction. Therefore, early identification of hearing impairment is an important part of newborn care.[1, 2] With an approximate prevalence of 1.5 per 1,000 births, it is also the most prevalent congenital sensory deficiency.[3]

Congenital CMV infection is the primary environmental factor causing congenital hearing loss, but genetic reasons are said to be present in as many as 80% of cases.[4] In many industrialized nations, early identification and treatment of hearing loss have been made easier by the use of automated auditory brainstem response and/or automated otoacoustic emission neonatal hearing screening.[5]

Nearly all levels of hearing loss can be treated with modern auditory rehabilitation options like cochlear implantation, which uses state-of-the-art technologies. This emphasizes how important early hearing detection and treatments are. The future management of hearing loss in newborns and infants will be clarified by rapidly evolving genetic testing technology and innovative treatment alternatives, such as gene therapy.[6]

To reduce the negative impacts of hearing loss, newborn hearing screening is crucial for early detection of the condition.[7] In an Iranian study, the frequency of hearing impairment was reported in 0.44% neonates.[7] Another research found that there were 0.46 cases of unilateral hearing loss and 1.23 cases of bilateral hearing loss for every 1000 children.

Moderate (0.47), profound (0.21), and severe (0.06) hearing loss are the most prevalent types in children with bilateral hearing loss. Children with unilateral hearing loss had higher prevalence rates of profound hearing loss (0.21), moderate hearing loss (0.16), and severe hearing loss (0.09).[8]

The purpose of the study is to determine how common hearing impairment is among newborns born in tertiary care hospitals. Research has indicated that prevalence of hearing impairment in newborns is extremely low, in international studies as well as in a national study. But one study, conducted locally published a very high rate of hearing impairment on assessment. Therefore, to confirm the extent of problem in local population, we want to conduct this. This will help us to improve our knowledge regarding better diagnostic and management protocols to improve the prompt diagnosis and treatment for hearing impairment in neonates.

METHODOLOGY

A cross-sectional study was conducted in the department of Pediatrics, Sir Ganga Tam Hospital, Lahore, over a period of five months, from June 2025 to October 2025. Total 250 sample size was calculated using the WHO sample size calculator with a 95% confidence level, 6% margin of error, and an expected frequency of hearing impairment of 35.7% in neonates delivered in a tertiary care hospital.

Neonates aged 1–12 hours of either gender who presented for routine examination in the neonatology unit were included. Neonates with congenital disorders, including congenital heart disease, active ear infection, or those presenting in the emergency department were excluded. After obtaining written informed consent from the parents, relevant demographic and clinical information was recorded on a structured proforma. The recorded information included age, gender, birthweight, gestational age, Apgar score, mode of delivery, consanguinity, maternal diabetes, maternal hypertension, family history of congenital hearing impairment, and history of a previous child with hearing impairment.

All enrolled neonates underwent hearing screening using Otoacoustic Emissions (OAE) with the ERO-SCAN device by MAICO. Neonates who did not pass the OAE screening underwent Auditory Brainstem Response (ABR) testing using the MB-11 device by MAICO. Neonates who did not pass the ABR test were referred for Brainstem Evoked Response Audiometry (BERA), which was performed by a trained audiologist. The BERA reports were assessed, and neonates with positive findings were labeled as having hearing impairment according to the predefined operational definition. Diagnosed neonates were managed according to the standard hospital protocol.

Data was entered and analyzed using SPSS version 25. Quantitative variables, including age, birthweight, gestational age, and Apgar score, were expressed as mean ± standard deviation. Categorical variables, including gender, mode of delivery, consanguinity, maternal diabetes, maternal hypertension, family history of congenital hearing impairment, previous child with hearing impairment, and hearing impairment, were presented as frequencies and percentages. The frequency of hearing impairment was calculated as the primary outcome. Associations between hearing impairment and demographic or clinical factors were assessed using the Chi-square test. Fisher's exact test was applied when expected cell frequencies were small. A p-value ≤0.05 was considered statistically significant.

RESULT

The mean age of the patient was 42.48 ±17.63 years. There were 138(55.2%) male and 112(44.8%) female. Among 250 neonates, the mean age at screening was 42.48 ± 17.63 hours, with a mean birth weight of 2.88 ± 0.56 kg and mean gestational age of 38.04 ± 1.72 weeks. Hearing impairment was detected in 24 (9.6%) neonates, whereas 226 (90.4%) had no hearing impairment.

No statistically significant differences were observed between neonates with and without hearing impairment regarding age at screening, birth weight, gestational age, or Apgar score (all p>0.05). Although the mean birth weight was somewhat lower among neonates with hearing impairment, this difference did not reach statistical significance (p=0.173). Table: 1

The table 2 shows that hearing impairment was present in 14 (10.1%) male and 10 (8.9%) female neonates. Regarding mode of delivery, hearing impairment was observed in 11 (9.7%) neonates delivered by spontaneous vaginal delivery, 11 (10.1%) by cesarean section, and 2 (7.1%) following induced delivery. Among neonates born to consanguineous parents, 8 (10.7%) had hearing impairment and Hearing impairment was found in 4 (17.4%) neonates of mothers with diabetes. Similarly, 5 (14.7%) neonates born to mothers with hypertension had hearing impairment and family history of hearing impairment was reported in 9 neonates, of whom 1 (11.1%) had hearing impairment. Overall, none of these variables showed a statistically significant association with neonatal hearing impairment; however, only previous history of a child with hearing impairment showed a highly significant association (p<0.001), indicating that neonates with a previously affected sibling had a substantially higher likelihood of hearing impairment. Table: 2.

In the multivariable logistic regression model, previous history of a child with hearing impairment remained a significant predictor of hearing impairment in the newborn (adjusted OR=0.05, 95% CI: 0.02–0.21, p<0.001; reference category was having a previous affected child). Birth weight was also statistically significant (adjusted OR=0.42, 95% CI: 0.18–0.96, p=0.042). Other examined maternal, neonatal, and delivery-related factors were not statistically significant predictors. Table: 3

Table: 1 Comparison of continuous variables according to hearing impairment

Variable	Hearing impairment Present (n=24) Mean ± SD	Absent (n=226) Mean ± SD	p-value
Age at hours	41.54 ± 18.09	42.58 ± 17.59	0.791
Birth weight (kg)	2.70 ± 0.67	2.90 ± 0.55	0.173
Gestational age (weeks)	38.32 ± 1.71	38.01 ± 1.72	0.418
Apgar score	8.33 ± 1.55	8.42 ± 1.05	0.801

Table: 2 Association of categorical variables with hearing impairment

Variable	Hearing impairment Present n (%)	Absent n (%)	p-value
Gender			0.913
Male	14 (10.1%)	124 (89.9%)	
Female	10 (8.9%)	102 (91.1%)	
Mode of delivery			0.892
Spontaneous vaginal	11 (9.7%)	102 (90.3%)	
Cesarean	11 (10.1%)	98 (89.9%)	
Induced	2 (7.1%)	26 (92.9%)	
Consanguinity			0.888
Yes	8 (10.7%)	67 (89.3%)	
No	16 (9.1%)	159 (90.9%)	
Maternal diabetes			0.337
Yes	4 (17.4%)	19 (82.6%)	
No	20 (8.8%)	207 (91.2%)	
Maternal hypertension			0.438
Yes	5 (14.7%)	29 (85.3%)	
No	19 (8.8%)	197 (91.2%)	
Family history of hearing impairment			1
Yes	1 (11.1%)	8 (88.9%)	
No	23 (9.5%)	218 (90.5%)	
Previous child with hearing impairment			<0.001

Table: 3 Multivariable binary logistic regressions for predictors of hearing impairment

Predictor	Adjusted OR	95% CI	p-value
Age at screening	1.0	0.98–1.03	0.938
Female gender	0.97	0.40–2.35	0.946
Cesarean delivery	0.87	0.44–1.73	0.786
Induced delivery	0.62	0.13–2.91	0.575
No consanguinity	0.64	0.25–1.64	0.372
No maternal diabetes	0.49	0.13–1.82	0.295
No maternal hypertension	0.57	0.19–1.67	0.362
No family history	1.64	0.17–15.68	0.687
No previous child with hearing impairment	0.05	0.02–0.21	<0.001
Birth weight	0.42	0.18–0.96	0.042
Gestational age	1.09	0.93–1.43	0.543

Apgar score	0.86	0.67–1.09	0.451

DISCUSSION

The present study was conducted to assess the frequency of hearing impairment among neonates delivered at a tertiary care hospital. Among the 250 neonates included in the study, 24 (9.6%) were identified with hearing impairment, while 226 (90.4%) had no hearing impairment. This finding indicates a considerable burden of neonatal hearing impairment in the study population and highlights the importance of hearing screening during the neonatal period. Early identification of hearing impairment is essential because delayed diagnosis may adversely affect speech, language, communication, cognitive development, and later educational outcomes.

The present study found hearing impairment in 9.6% of neonates, which is similar to the 9.5% reported by Halder et al. (2025) among high-risk neonates in Bangladesh. This close similarity suggests that hearing impairment may be an important concern among neonates receiving care in hospital-based settings. The authors screened 282 high-risk neonates and reported hearing impairment in 9.5% of neonates, including 7.4% with unilateral and 2.1% with bilateral hearing impairment. The almost identical frequency observed in the present study (9.6% vs. 9.5%) suggests a similar burden of hearing impairment among hospital-based neonatal populations. However, the Bangladesh study specifically included high-risk neonates admitted to a special care baby unit, whereas the present study included neonates delivered in a tertiary care hospital; therefore, differences in the underlying risk profile of the populations should be considered when comparing the two estimates.[9]

In contrast, Sabbagh et al. (2021) reported a considerably lower prevalence of hearing loss in their study entitled *"Neonatal Hearing Screening: Prevalence of Unilateral and Bilateral Hearing Loss and Associated Risk Factors."* Among 5,500 newborns, only 24 newborns were confirmed to have hearing loss, corresponding to a prevalence of 4.36 per 1,000 newborns (0.44%). This frequency is substantially lower than the 9.6% observed in the present study. The difference may be explained by variations in study population, inclusion criteria, healthcare setting, screening methodology, and the proportion of high-risk neonates. The study by Sabbagh et al. evaluated a large newborn population, whereas hospital-based tertiary-care populations may include a greater proportion of neonates with underlying medical or perinatal risk factors.[10]

In a study, conducted in Combined Military Hospital, Abbottabad, according to a survey, 1.3% of newborns born in a tertiary care hospital had hearing impairment.[11] But in another study, conducted in Indus hospital, Karachi, it was reported that frequency of hearing impairment was 35.7% in neonates delivered in a tertiary care hospital.[12]

In comparison, a Malaysian study conducted among NICU neonates reported a lower prevalence of hearing loss (1.5%) than the 9.6% observed in the present study. Mild hearing loss was the most common degree of impairment in their study (55%), which is consistent with the pattern observed in our findings. The higher prevalence in our study may be related to differences in the study population, risk factors, and screening protocols used. [13] A study from northeastern India reported hearing impairment in 12.5% of high-risk neonates, which was slightly higher than the 9.6% prevalence observed in the present study. Birth asphyxia, prematurity, low birth weight, sepsis, and ototoxic drug exposure were among the common risk factors, while neonatal meningitis showed a significant association with hearing loss. The comparable prevalence supports the importance of routine hearing screening among high-risk neonates for early identification and timely intervention. [14]
The relatively high frequency observed in the present study supports the need for systematic neonatal hearing screening in tertiary care hospitals. Importantly, hearing impairment may occur even in neonates without obvious clinical risk factors; therefore, relying solely on clinical identification or selective screening may result in missed cases. [15,16] The findings of the present study reinforce the value of early hearing screening as part of routine neonatal care, followed by appropriate diagnostic assessment and early intervention for neonates who fail screening.

CONCLUSION

The conclusion of the study found that hearing impairment was detected in 9.6% of high-risk neonates admitted to the NICU. Most demographic, maternal, neonatal, and delivery-related factors were not significantly associated with hearing impairment. However, a previous child with hearing impairment was identified as a significant predictor, while birth weight also showed a significant association in multivariable analysis. These findings emphasize the importance of early hearing screening in high-risk neonates, particularly those with a previous affected sibling, to facilitate timely diagnosis and appropriate intervention.

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