e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(5); 298-302

Original Research Article

Audiological Screening of High-Risk Infants and Incidence of Hearing Impairment

Mubeez Mustafa Badusha[1], Rupanjita Sangma[2], Malavika Raj[3], Arun T Raj[4]

[1]Post Graduation Trainee, Dept. of Otorhinolaryngology Assam Medical College, Dibrugarh
[2]Professor, Dept. of Otorhinolaryngology Assam Medical College, Dibrugarh
[3]Post Graduation Trainee, Dept. of Paediatrics Assam Medical College, Dibrugarh
[4]Post Graduation Trainee, Dept. of Medicine Assam Medical College, Dibrugarh

Received: 25-02-2024 / Revised: 23-03-2024 / Accepted: 26-04-2024
Corresponding Author: Dr. Mubeez Mustafa Badusha
Conflict of interest: Nil

Abstract:

Background: Child with hearing loss looks normal with no physical characteristics and often achieves normal early milestones. If the hearing impairment remains undetected in the first year of life, far reaching disability of speech and language development will occur. If early detection and timely intervention is executed, hearing impairment is a common treatable disability of childhood.

Aims and Objectives: To study the incidence of hearing impairment in high-risk infants, associated risk factors and degree of hearing impairment.

Materials and Methods: This prospective study was carried out in the Department of ENT and SNCU, Department of Pediatrics in Assam Medical College & Hospital, Dibrugarh from March 2023 to August 2023. Informed written consent was taken from all the parents before the study. As per the proforma, detailed history, clinical examination including local and systemic examination was done, followed by hearing assessment with DPOAE, and BERA [where ever indicated]. OAE was taken at the time of discharge. Whoever has failed in the test was allotted for a repeat test [OAE] at one month of age. In cases that the screening is failed, diagnostic test was done by BAER at 3 months of age.

Results: We found an incidence of 14.53% (n=17) of hearing impairment among high-risk infants. Higher incidence of hearing impairment among female babies compared to male (1.43:1). Bilateral hearing loss was almost two times more than unilateral hearing loss. 52.94% (n=9) babies had severe and profound hearing loss. 7 babies had three or more risk factors and this signifies that as the number of risk factors increase, the chance for hearing impairment also increases.

Conclusion: There is a high incidence of hearing impairment among high-risk infants. NICU stay > 5 days, ototoxic drugs, sepsis, prematurity and low birth weight is the significant risk factors for hearing impairment in neonates. This highlights the importance of neonatal screening in such high-risk infants. In a limited resource setting, at least a targeted approach of screening program should be implemented in neonatal care units.

Keywords: Neonatal Screening, High Risk Infants, Hearing Impairment, Universal Screening, Newborn Hearing Screening.

Introduction

Congenital deafness or hearing impairment may be present in normal neonates or high-risk neonates, where the prevalence is approximately 20 times more in the later. [1-4] According to WHO, 0.5-5 per 1000 newborn and infants have congenital or early childhood onset sensorineural deafness or severe to profound hearing impairment. [5,6]

The Joint Committee on Infant Hearing (JCIH) of American Academy of Paediatrics (AAP) defines target hearing loss as "congenital permanent bilateral, unilateral, sensory, permanent conductive or neural hearing loss (auditory neuropathy/dyssynchrony), averaging 30–40 dB or more in the frequency region important for speech recognition (~500–4,000hertz)". [7,8] Annually 796000 newborn babies suffer from permanent hearing loss and vast majority are from developing countries, where there is no routine neonatal screening for hearing. If early detection and timely intervention is executed, hearing impairment is a common treatable disability of childhood. [8,9]

Child with hearing loss looks normal with no physical characteristics and often achieve normal early milestones, including babbling.[10] If the hearing impairment remains undetected in the first year of life, which is the critical period of language

acquisition, far reaching disability of receptive and expressive speech and language development will occur.[11] Auditory deprivation in early infancy results in loss of precious duration of cerebral plasticity, and leads to structural and functional reorganisation at a cortical level.[12]

There are various risk factors associated with hearing impairment in neonates and infants which comprises maternal, intrauterine, perinatal and postnatal factors. BAER and OAE are the current methods used for hearing screening in newborns. BAER is used for diagnosis as it provides objective, ear specific information which is not altered by sleep or sedation and gives the information regarding the severity of hearing loss.[13]

Joint Commission on Infant Hearing (JCIH) in association with Early Hearing Detection and Intervention (EHDI) programmes recommends screening all the neonates by first month of life, to diagnosis by 3 months of life and proper intervention by 6 months of life. Whoever (nations) has achieved these 1-3-6 criteria, EHDI is targeting to achieve 1-2-3 criteria in the coming years. [5,7]

Aims and Objective: To study the incidence of hearing impairment in high-risk infants, associated risk factors and degree of hearing impairment.

Materials and Methods

This prospective study was carried out in the Department of ENT and SNCU, Department of Paediatrics in Assam Medical College & Hospital, Dibrugarh from March 2023 to August 2023. Informed written consent was taken from all the parents before the study. As per the proforma, detailed history, clinical examination including local and systemic examination was done, followed by hearing assessment with DPOAE, and BERA [where ever indicated].

The audiological screening was done in a quiet room while baby was calm or sleeping. For the purpose of this study, the degree of hearing loss was classified as mild (35–40 dB HL), moderate (41–70 dB HL), severe (71-90 dB HL) and profound (>90 dB HL). The risk factors considered in this study are prematurity [<37 weeks], low birth weight [<2500grams], hyperbilirubinemia, ototoxic drugs, neonatal sepsis, intrauterine infections [TORCH infections], birth asphyxia, mechanical ventilation for >5 days, low APGAR [less than or equal to 4 at one minute and less than or equal to 6 at five minutes], congenital anomalies (craniofacial anomaly), family history and NICU stay >5 days.

All neonates with the risk factors admitted in the SNCU was included in the study and OAE was taken at the time of discharge. Whoever has failed in the test was allotted for a repeat test [OAE] at one month of age. The “PASS” displayed over the screen of DPOAE indicates the subject has normal hearing, and the “REFER” indicates the subject has failed the screening test. In such cases whom the screening is failed, diagnostic test was done by BAER at 3 months of age. The babies who were proven to have hearing loss were further evaluated and rehabilitation was provided. All the infants who were not ready for follow up was excluded from the study. Data was entered and analysed using Microsoft Excel and SPSS version 22.0 software.

Results

A total of 117 babies were included in the study. Among them 59 (50.4%) were males and 58 (49.6%) were female babies. 18 males and 22 female babies had hearing loss in the initial screening test. A total of 17 infants (7 males and 10 female babies) had hearing loss on follow up BAER test. The major risk factors for hearing loss in high-risk infants are enumerated in Table-1. The use of ototoxic drugs in post-natal life, NICU stay for more than 5 days, prematurity, low birth weight, birth asphyxia, neonatal sepsis and hyperbilirubinemia were the major risk factors. Out of the 117 candidates, 36 patients had single risk factor, 49 patients had two risk factors and 32 patients had three or more risk factors. Seven infants with permanent hearing impairment had three or more risk factors. Majority of the infants with hearing impairment had severe to profound hearing loss as shown in Table-2. Among the 17 infants with hearing loss, 12 babies had both ear involvements as depicted in Table-3.

Table 1: Distribution of Risk Factors among High-Risk Infants with and Without Hearing Loss

Risk Factor	Infants With Normal Hearing		Infants With Hearing Loss		Total
	Male	Female	Male	Female	
Prematurity	**19**	**25**	**2**	**5**	**51**
Low Birth Weight	**30**	**29**	**1**	**5**	**65**
NICU >5days	**20**	**24**	**4**	**5**	**53**
Torch Infections	**4**	**5**	**2**	**1**	**12**
Low Apgar Score	**9**	**13**	**2**	**3**	**27**
Neonatal Sepsis	**15**	**20**	**3**	**4**	**42**
Ototoxic Drugs	**25**	**17**	**3**	**5**	**50**
Hyperbilirubinemia	**26**	**25**	**2**	**3**	**56**

Birth Asphyxia	**7**	**7**	**2**	**3**	**19**
Mechanical Ventilation >5days	**3**	**5**	**1**	**2**	**11**
Family History	**2**	**1**	**0**	**1**	**4**
Congenital Anomalies	**3**	**1**	**1**	**0**	**5**

Table 2: Distribution of Severity of Hearing Loss

Severity of Hearing Loss	No. of Infants		Total
	Male	Female	
Mild [35-40 DB HL]	**1**	**4**	**5**
Moderate [41–70 DB HL]	**1**	**2**	**3**
Severe [71-90 DB HL]	**2**	**2**	**4**
Profound [>90 DB HL]	**3**	**2**	**5**

Table 3: Distribution of Unilateral and Bilateral Hearing Loss

Type of Hearing Loss	No. of Infants		Total
	Male	Female	
Unilateral Hearing Loss	**1**	**4**	**5**
Bilateral Hearing Loss	**6**	**6**	**12**

Discussion

Hearing impairment has been considered as a major health problem by NPPCD (National Programme for Prevention and Control of Deafness). In a newborn child, hearing impairment is a hidden disability. Detected late after 2-3 years of childbirth, the adverse effects on the newborn, family and community will be lifelong. Hence early detection and timely intervention is the only solution to alleviate its effect on speech, language and cognitive development.

The incidence of hearing impairment in high-risk infants range from 0.3 to 20.68 % in various studies. [1-4] In our study, we found an incidence of 14.53% (n=17) of hearing impairment among high-risk infants which is similar to Ishika Vashistha et al (15%) and Alwan M Maisoun et al (13.5%). [4,14]

We found a higher incidence of hearing impairment among female babies compared to male (1.43:1); however, Maqbool et al has reported gender does not affect hearing outcome.[13] In the present study bilateral hearing loss was almost two times more than unilateral hearing loss and Van Riper et al also had a similar finding in their study.[15] Among the 17 cases, 52.94% (n=9) babies had severe and profound hearing loss; Christiane Meyer et al in their study had 58% cases with severe and profound hearing loss.[11]

7 babies had three or more risk factors and this signifies that as the number of risk factors increase, the chance for hearing impairment also increases. Similar observation was made by Regina et al in their study. [1]

52.94% (n=9) of hearing-impaired babies had NICU stay for more than 5 days. JCIH 2007 guidelines concluded that, any illness or condition requiring admission of 24 hours or more to the NICU is a risk factor for hearing impairment.[7] Premature babies with hearing impairment constituted 41.17% (n=7); is in accordance with the study conducted by Regina et al. [1] In our study, 5 out of the 6 low birth weight hearing impaired babies were less than 1500grams; Gouri et al, Beswick et al and Regina et al concluded that low birth weight is a significant risk factor for hearing impairment. [1,16,17] 41% (n=7) of hearing-impaired babies had culture positive sepsis.; Christiane Meyer et al, Ashok Kumar Biswas et al have drawn the conclusion that bacterial meningitis is a significant factor for hearing loss in newborn. [11,10] 29%(n=5) of hearing-impaired babies were having poor APGAR scores. Similar findings have been reported by Gouri et al and Regina et al. [16,1]

In the present study, 3 babies with hearing impairment were exposed to TORCH infections. According to JCIH, Regina et al, and various other studies, intrauterine infections are a major risk factor for congenital deafness. [1,17-19]

One of the major risk factors associated with hearing loss in our study was administration of ototoxic drugs (47%; n=8), which is consistent with the study conducted by Muddasir Maqbool et al who reported an incidence of 60% of hearing loss in infants exposed to ototoxic drugs. Babies administered with both vancomycin and gentamycin were prone for hearing loss. Other than antibiotics, no other drugs were found to be ototoxic in our study [13]

In our study 11 babies with birth asphyxia who had undergone mechanical ventilation failed in the initial screening. Later in the follow up, 5 out of 11 babies were diagnosed to be hearing impaired and remaining babies had transient hearing loss. 3 babies who were on mechanical ventilation for more than 5 days had impaired hearing. These findings are in accordance with the study

conducted by Muddasir Maqbool et al, JCIH, and Regina et al. [1,13,18,19]

29.41% of hearing-impaired infant had hyperbilirubinemia as a risk factor. Similar observations were found in the study conducted by Ishika Vashista et al and Ashok Kumar Biswas et al. [4,10] In this study only one baby with congenital anomaly had hearing impairment. Beswick et al, JCIH have marked craniofacial anomaly as a risk factor. [17,18] One out of four babies with family history of deafness were diagnosed to have impaired hearing. Similar incidence was found by Gouri et al, Regina et al in their study. [1,16]

Conclusion

There is a high incidence of hearing impairment among high-risk infants. NICU stay > 5 days, ototoxic drugs, sepsis, prematurity and low birth weight is the significant risk factors for hearing impairment in neonates. This highlights the importance of neonatal screening in such high-risk infants.

In a limited resource setting, at least a targeted approach of screening programme should be implemented in neonatal care units. This should be a team work involving the neonatologist, paediatricians, obstetricians, otolaryngologists, audiologist, psychologist and parents with the coordination at the government administration level to bring up the hearing screening in neonates and for the timely intervention, and rehabilitation to improve the speech language and psychosocial development of the child.

Clinical Significance

Early diagnosis and accurate intervention for development of speech in the prelingual hearing loss cases is utmost important. This study will help the clinician be more vigilant about the new born babies who are exposed to these risk factors.

Further studies with large sample size and more components as risk factors should be done. These babies should be followed up for long term period with regular intervals, so that delayed onset or progressive hearing loss would not be missed.

References

1. Regina M, Moideen SP, Mohan M, Mohammed MT, Afroze KH. Audiological screening of high-risk infants and prevalence of risk factors. Int J Contemp Pediatr. 2017 Mar; 4(2):507-11.
2. Vohr BR. Language and hearing outcomes of preterm infants. In Seminars in perinatology 2016 Dec 1; 40(8): 510-519. WB Saunders.
3. Yoshinagaitano C, Sedey AL, Coulter DK, Mehl AL. Language of early and later identified children with hearing loss. Pediatrics. 1998; 102:1161-71.
4. Vashistha I, Aseri Y, Singh BK, Verma PC. Prevalence of hearing impairment in high risk infants. Indian J Otolaryngology Head Neck Surg. 2015:1-4.
5. Hajare, P., Mudhol, R. A Study of JCIH (Joint Commission on Infant Hearing) Risk Factors for Hearing Loss in Babies of NICU and Well Baby Nursery at a Tertiary Care Center. Indian J Otolaryngol Head Neck Surg. 2022; 74 (Suppl 3): 6483–6490.
6. Newborn and infant hearing screening, Current Issues And Guiding Principles For Action,Outcome Of A Who Informal Consultation Held At Who Headquarters, Geneva, Switzerland, 09–10 November 2009.
7. Joint Committee on Infant Hearing. Year 2007 position statement: principles and guidelines for early hearing detection and intervention programs. Pediatrics. 2007; 120:898–921.
8. Labaeka AA, Tongo OO, Ogunbosi BO and Fasunla JA (2018) Prevalence of Hearing Impairment Among High-Risk Newborns in Ibadan, Nigeria. Front. Pediatr. 6:194.
9. Moeller MP. Early intervention and language development in children who are deaf and hard of hearing. Paediatrics. 2000;106: e43.
10. Biswas AK, Goswami SC, Baruah DK, Tripathy R. The potential risk factors and the identification of hearing loss in infants. Indian Journal of Otolaryngology and Head & Neck Surgery. 2012 Sep; 64:214-7.
11. Meyer C, Witte J, Hildmann A, Hennake KH, Schunck KU, Maul K. Neonatal screening for hearing disorders in infants at risk: incidence, risk factors and follow-up. Paediatrics. 1999; 104:900-4.
12. H Patel, M Feldman; canadian Paediatric Society, community Paediatrics committee. Universal newborn hearing screening. Paediatr child Health 2011; 16(5):301-305.
13. Maqbool M, Najar BA, Gattoo I, Chowdhary J. Screening for hearing impairment in high-risk neonates: a hospital-based study. Journal of clinical and diagnostic research: JCDR. 2015 Jun; 9(6):SC18.
14. Maisoun AM, Zakzouk SM. Hearing screening of neonates at risk. Saudi Medical Journal. 2003; 24(1):55-57.
15. Van Riper LA, Kileny PR. ABR hearing screening for high-risk infants. Am J Otol. 1999; 20(4): 516–521.
16. Gouri ZU, Sharma D, Berwal PK, Pandita A, Pawar S. Hearing impairment and its risk factors by newborn screening in north-western India. Maternal health, neonatology and perinatology. 2015; 1(1):1-7.
17. Beswick R, Driscoll C, Kei J. Monitoring for postnatal hearing loss using risk factors: a sys-

tematic literature review. Ear Hearing. 2012; 33(6):745-56.
18. Joint Committee on Infant Hearing. Joint committee on infant hearing 1994 position statement. Pediatrics. 1995(95):152–156
19. Joint Committee on Infant Hearing, American Academy of Audiology, American Academy of Pediatrics, American Speech-Language-Hearing Association, Directors of Speech and Hearing Programs in State Health and Welfare Agencies. Year2000 position statement: principles and guidelines for early hearing detection and intervention program. Pediatrics. 2000 (106):798–817.