Comparing the Incidence of Hearing Impairment in Normal to High-risk Newborns

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ABSTRACT

Objectives: 1) Screening by otoacoustic emission (OAE), to study the incidence of hearing impairment in newborns; 2) to compare the incidence of hearing impairment in normal to high-risk newborns and 3) to study if the risk of hearing impairment increases as the number of risk factors increase. **Material and methods:** This was a prospective nonrandomized observational cohort study from November 2011 to December 2013. All newborns born in the hospital were included. Detailed history (pre- and postnatal) of each newborn pertaining to risk factors for hearing loss was taken and a detailed examination was done. Relevant serological tests were done. Newborns were screened for hearing impairment by OAEs and the result of the test was noted as PASS/REFER (FAIL). **Results:** Overall incidence of hearing impairment in newborns: 1.8%, incidence of hearing impairment in normal newborns: 0.7% and hearing impairment in high-risk newborns: 6.3%. Incidence of hearing impairment was significantly higher in high-risk newborns compared to normal newborns ($p < 0.01$). **Conclusion:** Though, the incidence of hearing impairment is significantly higher in high-risk newborns, targeted screening of high-risk newborns will result in missing a significant number of normal newborns with hearing impairment. Hence, there is a necessity for universal newborn hearing screening program.

Keywords: Hearing impairment, otoacoustic emissions, high-risk newborns

This study was done for identification and remediation of hearing loss in newborn infants who are hard of hearing before the age of 6 months to help them perform significantly higher on vocabulary, communication, intelligence, social skills and behavior.

MATERIAL AND METHODS

This study was done in the postnatal ward of neonatal intensive care unit (NICU) of MediCiti Institute of Medical Sciences, Hyderabad. An informed consent was obtained from the parents or guardians of the infants.

A total of 1,050 neonates were enrolled into the study. Five hundred sixty-two were male and 488 were females. Eight hundred forty-six were normal neonates and 204 were found to be with high-risk factors. They were studied and compared (Table 1).

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RESULTS AND ANALYSIS

A total of 19 neonates failed the otoacoustic emission (OAE) test among the 1,050 enrolled neonates (Table 2). Of the 19 neonates who failed the OAE test; six were from them normal newborn group and 13 from the high-risk newborn group.

The overall incidence of hearing impairment among the enrolled neonates in this study was 1.8%. The

Table 1. Distribution of Newborns by Risk Factor for Hearing Impairment

Risk factor	Total no. (N)
Absent	846
Present	204

Table 2. Result of Otoacoustic Emission Test

Total no. of newborns screened	No. of newborns with 'pass' result	No. of newborns with 'refer' result
1,050	1,031	19

incidence of hearing impairment in normal newborn group was 0.7% and the incidence of hearing impairment in high-risk newborn group was 6.3%. This study showed a significantly higher incidence of hearing impairment in the high-risk newborn group as compared to the normal newborn group with a p value of <0.01.

The overall incidence of hearing impairment in various studies ranges from 0.56% to 8.2% and this comes within the range of the present study of 1.8%. Of the 69 neonates with a birth weight of <1.5 kg enrolled, a total of 8 neonates failed the OAE test. With a p value of <0.01 for difference in incidence of hearing impairment between the normal and very low-birth-weight neonate groups, birth weight of <1.5 kg stands as a significant risk factor for hearing loss in this study. With no neonate in the group with history of intrauterine infection failing the test, there was no statistical significance for this risk factor as an independent risk factor for the hearing impaired.

Statistical significance could not be established for family history of childhood sensorineural hearing loss as an independent risk indicator for hearing impairment in newborns. Eighty-one among the studied newborns had a history of use of ototoxic medications during hospital stay. Six had impaired hearing. The calculated difference in incidence of hearing impairment between this group and the normal newborn group had a p value of <0.01 making use of ototoxic drugs a significant risk factor.

Apgar was significantly associated with hearing impairment. Five of 59 neonates failed the test with p value of <0.01. Four out of 24 newborns with a history of meningitis failed OAE with p value of <0.01. With a p value for difference in hearing impairment between normal and this group of neonates <0.01, mechanical ventilation of ≥5 days significantly increases the risk of hearing impairment.

Neonatal hyperbilirubinemia at a level requiring exchange transfusion is significantly associated with risk of hearing impairment. Three out of 15 failed this test at p value of <0.01. Statistical significance could not be established for craniofacial abnormalities and syndromic stigmata as risk factors for hearing impairment (Table 3).

Prematurity (gestational age ≤37 weeks) was also associated with a risk of hearing impairment ($p < 0.01$).

Table 3. Individual Risk Factor Distribution in High-risk Neonates

Risk factor	No. of cases
Body weight <1.5 kg	69
Intrauterine infection	3
Family history of childhood hearing loss	4
Use of ototoxic medications	81
Apgar 0-4 (1 min), 0-6 (5 mins)	59
Meningitis	24
Mechanical ventilation ≥5 days	20
Neonatal hyperbilirubinemia at a level requiring exchange transfusion	15
Craniofacial abnormalities	2
Syndromic stigmata	0

DISCUSSION

Rughani et al studied a total of 100 neonates with risk factors for hearing impairment. Newborns having the following risk factors were at higher risk of developing hearing impairment: Hyperbilirubinemia requiring exchange transfusion, birth asphyxia, gestational age ≤34 weeks, administration of ototoxic drugs, requirement of mechanical ventilation, NICU stay for ≥2 days, septicemia, birthweight ≤1.5 kg.

Khairi et al from Malaysia suggested craniofacial malformations, very low birth weight, ototoxic medications, stigmata/syndromes associated with hearing loss and hyperbilirubinemia at a level of exchange transfusion were independent significant risk factors for hearing impairment, while poor Apgar scores and mechanical ventilation of >5 days were not.

Hess et al from Germany suggested dysmorphism, prenatal rubella or cytomegalovirus (CMV) infection, family history of hearing loss, severe pre- and postnatal complications to be probable causes for hearing loss.

Weichbold et al from Austria suggested that family history of hearing loss, meningitis, craniofacial malformations, persistent pulmonary hypertension, congenital CMV infection, extracorporeal membrane oxygenation, ototoxic therapy, gestational age <33 weeks increased the risk of hearing impairment.

In this study, birth weight <1.5 kg, history of use of ototoxic medications, Apgar 0-4 (1 min) 0-6 (5 mins), meningitis, mechanical ventilation, neonatal hyperbilirubinemia at a level requiring exchange transfusion significantly increased the risk of hearing impairment.

Risk of hearing impairment was higher in multiple risk factor group compared with single risk factor group. With single factor - 2.56%, 2 risk factors - 16%, with 3 risk factors - 14.2%, 4 risk factors - 33.3%, 5 risk factors - 100%.

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SUGGESTED READING

1. Yoshinaga-Itano C, Apuzzo ML. The development of deaf and hard of hearing children identified early through the high-risk registry. Am Ann Deaf. 1998;143(5):416-24.
2. Ruben RJ. Effectiveness and efficacy of early detection of hearing impairment in children. Acta Otolaryngol Suppl. 1991;482:127-31; discussion 132-5.
3. Erenberg A, Lemons J, Sia C, Trunkel D, Ziring P. Newborn and infant hearing loss: detection and intervention. American Academy of Pediatrics. Task Force on Newborn and Infant Hearing, 1998-1999. Pediatrics. 1999;103(2):527-30.
4. Kliegman RM, Stanton BMD, St. Geme J, Schor N, Berham RE. Nelson Textbook of Pediatrics. 19th Edition, Elsevier; 2011. p. 2189.
5. Early identification of hearing impairment in infants and young children. NIH Consensus Statement. 1993;11(1):1-24.
6. Joint Committee on Infant Hearing 1994 Position Statement. American Academy of Pediatrics Joint Committee on Infant Hearing. Pediatrics. 1995;95(1):152-6.
7. Yoshikawa S, Ikeda K, Kudo T, Kobayashi T. The effects of hypoxia, premature birth, infection, ototoxic drugs, circulatory system and congenital disease on neonatal hearing loss. Auris Nasus Larynx. 2004;31(4):361-8.
8. Robinshaw HM. Early intervention for hearing impairment: differences in the timing of communicative and linguistic development. Br J Audiol. 1995;29(6):315-34.
9. Norton SJ, Gorga MP, Widen JE, Folsom RC, Sininger Y, Cone-Wesson B, et al. Identification of neonatal hearing impairment: a multicenter investigation. Ear Hear. 2000;21(5):348-56.
10. Lin HC, Shu MT, Lee KS, Lin HY, Lin G. Reducing false positives in newborn hearing screening program: how and why. Otol Neurotol. 2007;28(6):788-92.
11. Clarke P, Iqbal M, Mitchell S. A comparison of transient-evoked otoacoustic emissions and automated auditory brainstem responses for pre-discharge neonatal hearing screening. Int J Audiol. 2003;42(8):443-7.
12. Nagapoornima P, Ramesh A; Srilakshmi, Rao S, Patricia PL, Gore M, Dominic M; Swarnarekha. Universal hearing screening. Indian J Pediatr. 2007;74(6):545-9.
13. Rughani S, Vyas B, Sinha V, Shah M, Kapileshwar Y, Shah S. Hearing screening in newborns: a cross sectional study. World Articles in Ear, Nose and Throat. 2011; Vol. 4-1.
14. Jewel J, Varghese PV, Singh T, Varghese A. Newborn hearing screening - experience at a tertiary hospital in northwest India. Intern J Otolaryngol Head Neck Surg. 2013;2:211-4.
15. Khairi MD, Din S, Shahid H, Normastura AR. Hearing screening of infants in Neonatal Unit, Hospital Universiti Sains Malaysia using transient evoked otoacoustic emissions. J Laryngol Otol. 2005;119(9):678-83.
16. Hess M, Finckh-Krämer U, Bartsch M, Kewitz G, Versmold H, Gross M. Hearing screening in at-risk neonate cohort. Int J Pediatr Otorhinolaryngol. 1998;46(1-2):81-9.
17. Weichbold V, Nekahm-Heis D, Welzl-Mueller K. Universal newborn hearing screening and postnatal hearing loss. Pediatrics. 2006;117(4):e631-6.

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Vitamin D Levels

Formula of 20/40

- Optimum serum 25-hydroxyvitamin D [25(OH)D] level for patients with bone disorders like osteoporosis is 30 ng/dL *(*IOF 2010, Endocrine Society 2011*)*.
- A serum 25(OH)D level of 30 ng/mL is also preferable for older adults (>50 years), who are at risk for osteoporosis *(*IOF*)*.
- For other patient groups or population, 25(OH)D values of 20 ng/mL may be considered adequate. Many Indians may require supplementation to achieve this level *(*IOF 2010*)*.
- Levels above 40 ng/mL do not provide any additional benefit.
- 25(OH)D levels between 20-40 ng/mL are optimum for most of the population.

Formula of two digits

- If vitamin D levels are in two digits, there is no need to treat aggressively. Give monthly maintenance dose.

IJCP SUTRA 596: Instead of processed snacks, opt for dry fruits in between meals or add them to food items. They generate heat in the body and are rich in nutrients.

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