Targeted Newborn Hearing Screening: A Hospital based Observational Study

Ankur Gupta[1], Vidya Sukumar[2]

ABSTRACT

Introduction: Hearing is an important factor in the process of learning to talk. Speech and hearing is important for development of interpersonal relationships. Index study aims to screen high risk newborn for hearing loss by Transient evoked oto-acoustic emission (TEOAE) and Auditory brain-stem evoked Response (ABER) technique and to identify the risk factor associated with hearing loss in neonates.

Material and Methods: A total of 105 high risk neonates were randomly selected from NICU of this hospital after stabilizing their clinical condition. All the neonates have undergone Transiently evoked otoacoustic emissions. Neonates who passed transiently evoked otoacoustic emissions test were subjected to Auditory Brainstem Evoked Response (ABER) test for confirming the diagnosis of hearing loss.

Results: Hearing assessment done in all 105 neonates and a total of 9 neonates were reported to be having hearing abnormalities, out of these 5 newborns had conductive hearing loss and 4 had sensorineural hearing loss. Low Birth weight and mechanical ventilation were observed significantly associated with diagnosis of hearing loss. No significant association of hearing loss was reported with gestational age, sex, infection, and associated diseases.

Conclusion: Low Birth weight and mechanical ventilator support were significantly associated with hearing loss.

Keywords: Hearing Loss, Neonates, Low Birth Weight, Transiently Evoked Otoacoustic Emissions, Auditory Brain Stem Evoked Response

INTRODUCTION

Hearing is an important component in the process of learning to speak. Speech and hearing plays an important role to maintain interpersonal relationships.[1] In comparison with children having normal hearing, those with hearing loss have noticed to be having more difficulty in learning vocabulary, grammar, word order, and other aspects of verbal communicative skills.[2] Hearing disorder increases the incidence of psychosocial, behavioral problem, adaptive skills in children.[3] It has been reported that 1-3 per 1000 infant suffers from congenital and perinatally acquired hearing disability.[4] In India 4 out of every 1000 children reported to have hearing loss with varying severity.[5] High risk newborns were reported to be having 10-50 fold increase prevalence of hearing problems.[6] Various screening programmes have been implemented in many developed countries by the advent of reliable screening techniques. Mainly, the introduction of two objectives, rapid and physiological tests of auditory function oto-acoustic emission recording and automatic auditory brain response measures have made newborn hearing screening widely adopted. In many developed countries newborn screening with one of these tests is now mandatory prior to hospital discharge.[7] Universal newborn hearing screening has helped in significantly reduction of hearing disabilities.[8]

However, for hearing care professional in India, there is global shortage of skilled maternal and newborn health workers mainly in rural areas.[9] With advanced technological resources identification of hearing loss in all newborns before 6 month of age will become an attainable target.

There are two methods of screening hearing loss in neonates, first is transient evoked otoacoustic emission (TEOAE) and second is auditory brainstem evoked response (ABER) technique.[10] TEOAE having sensitivity of 85-99% and ABER 80-92%, respectively.[11] Harbi et al has reported that both ABER and TEOAE are reliable tools in high risk newborns hearing screening.[12] Universal hearing screening is a two stage testing process of all newborns. It has been found that universal screening increases the direct as well as indirect cost by increasing the cost of expenditure on false positive cases.[13] Hearing loss should be recognized on time and appropriate audiological rehabilitation should be done early to give full advantage to children in terms of social adoptive, better carrier opportunities and quality of life.[14] This study was conducted to evaluate the value of targeted hearing screening of high risk newborn by TEOAE and ABER technique admitted in our neonatal intensive care unit (NICU).

MATERIAL AND METHODS

This hospital based observational prospective study was conducted over the period of 12 months from august 2017 to July 2018 in Neobless (NICU) Moulana hospital, Perinthalamanna, Kerala,India. 105 high risk neonates were randomly selected from NICU after clinical stabilization as per joint committee on infant hearing (JCIH) criteria 2000 position statement.

[1]Specialist in Department of Neonatology, Aster Medcity, Kochi, Kerala, [2]Senior Resident in Department of Pediatrics, Sree Narayana Institute of Medical Sciences, Chalakka, Kochi, Kerala, India

Corresponding author: Dr. Ankur Gupta, Specialist in Department of Neonatology, Aster Medcity, Kochi, Kerala 682027, India

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	Normal	Hearing Loss	P value
Age	5.7	2.71	
Gender			
Male	53 (55.2)	5 (62.5)	0.930
Female	43 (44.7)	4 (44.4)	
Preterm	56 (58.3)	7 (77.7)	0.2058
Term	40 (41.6)	2 (22.2)	
Appropriate for gestational age	80 (83.3)	7 (77.7)	0.259
Small for gestational age	12 (12.5)	2 (22.2)	
Large for gestational age	04 (4.1)	0 (0)	
Weight			
<999gm	5 (5.2)	5 (50)	0.0029
1000-1499 gram	47 (49.4)	4 (50)	
1500-2499 gram	24 (25.2)	0 (0)	
> 2500 gram	19 (20)	0 (0)	
Problems			
Hypoxic ischemic encephalopathy	22 (23)	2 (25)	0.7839
Ventilator support	16 (16.8)	5 (62.5)	0.0057
Respiratory distress syndrome	18 (18.9)	3 (37.5)	0. 399
Neonatal sepsis			
Present	45 (46.8)	3 (25)	0.7640
Absent	50 (52.08)	6 (75)	
Neonatal jaundice	51 (53.1)	4 (44.4)	0.7019

Table-1: Birth parameters in normal and diseased neonates

OAE was done on all healthy neonates by the OAE technician before discharge from hospital. All included babies were evaluated for various risk factors as preterm delivery, perinatal asphyxia, neonatal jaundice needed phototherapy, Congenital infections, family history of deafness, neonatal sepsis, ototoxic medications. Babies were screened by a portable equipment. Babies who were failed in the first OAE procedure underwent second OAE on routine follow up visit at 6 weeks of age. Babies who failed the second OAE testing had undergone Brainstem Evoked Response Audiometry (BERA).

RESULTS

During the study period a total of 105 newborn (58 male, 47 female) were recruited for the study. The mean age of newborns was 3.09± 2.9 days. Out of these 105 newborns, we observed 14 newborns were small for gestational age, 87 were appropriate for gestational age, while 4 were large for gestational age. Ten were extremely low birth weight, 51 were very low birth weight, 24 were low birth weight and 19 babies were born with normal weight (>2.5kg) (Table 1). Neonatal hyperbilirubinemia was most common cause of admission of newborn in NICU which was observed in 51 cases. Out of these 51 babies 9 babies required exchange transfusion due to hyperbilirubinemia. The second common disorder was hypoxic ischemic encephalopathies which were 22 newborns. 18 newborns were admitted with the diagnosis of Respiratory distress syndrome out which 16 required ventilator support. Pneumonia was diagnosed in 4 patients while 7 were Meconium Aspirated syndrome and 2 babies were diagnosed as Down syndrome after Karyotyping. Out of these 105 newborns, 45 were blood culture positive and from these, 17 were Klebsiella positive, 8 were methicillin resistant Staphylococcus aureus (MRSA), 9 were Enterococcus faecalis positive, 8 were Pseudomonas aeruginosa while 3 were E. coli positive sepsis. Hearing assessment done in all 105 patients, which is suggestive of total 9 babies had hearing abnormalities, out of these 9 newborns 5 babies had conductive hearing loss and 4 babies had sensorineural hearing loss. Six babies affected their bilateral ears, 1 babies affected their left ear and 2 affected right ear. We analyzed distribution pattern of different birth parameters in two groups and found: as the birth weight of neonate is inversely proportional to the incidence of hearing loss significantly. We also found that babies who required ventilator support had higher prevalence of hearing loss. Gestational age, gender, neonatal sepsis and other associated diseases were observed to be having no significant association with hearing loss.

DISCUSSION

There is a team based approach to hereditary hearing loss which includes an otolaryngologist, an audiologist, a clinical geneticist, and a pediatric specialist, a pediatric neurologist, and a pediatric ophthalmologist. For children over age 12 months with severe-to-profound hearing loss treatment includes finding out the appropriate option for habilitation such as hearing aid / vibrotactile devices; cochlear implantation. Declau et al, published data on confirmatory diagnostic evaluation after positive Universal neonatal hearing screening (UNHS) in a large group of children: Of 170 children with a positive UNHS result (corresponding to ca. 87 000 newborns screened), 5 had a tympanic effusion that was resolved while period of observation. Permanent hearing impairment was reported in 116 children, bilateral in 68 cases and unilateral in the other 48 neonates. The average absolute threshold of hearing was recorded as 70 to 80 dB

HL. The initial (screening) AABR result was confirmed in 60.4% of cases. Surprisingly, 11.6% of neonates thought to have a unilateral hearing impairment on UNHS were reported to be having bilateral hearing impairment when assessed in detail.[15]

Conolly et al observed that 1 out of 75 high risk neonates had hearing loss.[16] Study from Saudi Arabia emphasized that 13.5% of their NICU graduates reported to have hearing loss using TEOAE.[17] Chadha et al, have shown a significant auditory impairment in 18% of high risk neonates.[18] In 1989, Epstein et al investigated the incidence of the known risk factors for hearing loss among all babies born in the USA and found that 10-12% of all babies had at least one established factor. The rate of sensorineural hearing loss among patients with one or more risk factors was 2-5%, which is at least tenfold greater than in the general population of children.[19] However, VLBW was not specifically listed as a risk factor in the statements in 2000 and 2007. This indicates the growing understanding that VLBW by itself probably does not cause hearing loss.[20] A NIH-sponsored multi-centre study conducted by Norton et al observed the performance of newborns on OAE and ABR hearing screening and also found the incidence of risk factors for neonatal hearing loss.[21] A total of 4478 NICU graduates, 353 well neonates with one or more of the risk factors for hearing loss established by the joint committee on Infant Hearing in 1994 (which included VLBW), and 2348 well babies with no risk factors were assessed. One risk factor was reported in 33.2% of NICU children, and two or more in 26.2%. Within the NICU population, the commonest risk factors were aminoglycoside use (44.4%), VLBW (17.8%), mechanical ventilation for more than 5 days (16.4%), and low Apgar scores (13.9%).[22] In our study, we also reported that very low birth weight babies and babies on mechanical ventilator support are on higher risk for hearing loss.

CONCLUSION

Congenital hearing loss can be considered as the commonest birth defect with an incidence of 1-2/1000 live births, more than combined incidence of congenital hypothyroidism and Phenylketonuria. Early identification and rehabilitation of hearing impairment is the cornerstone for the development of speech, language and cognitive ability in affected children.

The present study reveals that the ELBW and neonates required mechanical ventilator support were the significant risk factor for hearing loss whereas gestational age, neonatal sepsis, gender, neonatal jaundice and other disease conditions did not affect hearing impairment in index study.

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