Original Research Article

A study of incidence of hearing impairment in NICU graduates in tertiary care institute

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Abstract

Background: Hearing impairment has a devastating, detrimental and an invariably adverse impact on the development of newborns and the psychological well-being of their families. Hearing impairment refers to complete or partial loss of the ability to hear from one or both ears. The level of impairment can be mild, moderate, severe or profound. **Aim and objectives:** To study the study of incidence of hearing impairment in NICU graduates in tertiary care institute **Materials and Methods:** In the present study all NICU graduates who complied with the follow up in the neuro developmental clinic during the Aug 2000 to July 2010 were included in the study. The period of follow up was variable, ranging from 4 months to 18 months. Thus the duration of study was 10 years. A prestructured proforma was used to enter the details of selected NICU graduate. All the NICU graduates in the study population were screened for the presence of hearing impairment at the first follow up after discharge from NICU. The screening method used was Brainstem Evoked Response Audiometry. BERA was performed in these babies in a separate room specially designed for this procedure. Case data was recorded in a predetermined proforma. Appropriate statistical tests were applied wherever necessary (Fisher exact test, Chi square test with or without Yate's correction) **Results:** Hearing impairment in the NICU graduates was diagnosed on the basis of abnormal BERA report. The incidence of hearing impairment in the present study was 10.45%. It was seen that the incidence of hearing impairment was found to be decreasing over the study period of 10 years. The incidence in first group (Aug00-Jul02) was found to be significantly different from last group (Aug 08-Jul10), by Z test for two proportions (z value= 3.068, 99% confidence levels). Sensorineural hearing impairment was more common in NICU graduates as compared to Conductive hearing impairment. Among the cases of Sensorineural hearing impairment severe/ profound impairment (19 cases) was most common followed by moderate impairment (15 cases). **Conclusion:** Thus we conclude that the incidence of hearing impairment in the present study was 10.45%. Sensorineural hearing impairment was more common in NICU graduates as compared to Conductive hearing impairment.
Key Word: hearing impairment, NICU graduates.

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INTRODUCTION

Hearing impairment has a devastating, detrimental and an invariably adverse impact on the development of newborns and the psychological well-being of their families. Hearing impairment refers to complete or partial loss of the ability to hear from one or both ears. The level of impairment can be mild, moderate, severe or profound. According to 2005 estimates by the World Health Organization (WHO), 278 million people worldwide have moderate to profound hearing loss in both ears. The WHO has suggested that there is a minimum incidence of childhood deafness of 2 per 1000 live births (WHO1996). Although estimates vary because of differences in criteria for defining hearing impairment, the age group surveyed, and the testing method used, from[1-2] newborns per 1000 live births have moderate(30-50 dB), severe(50-70dB) or profound (70dB or more) bilateral sensorineural hearing loss (SNHL), including 0.5-1/1000 with bilateral SNHL exceeding 75dB. An additional 1-2/1000 may have milder or unilateral impairments; by age 19 years, prevalence doubles. Unilateral sensorineural hearing loss of 45 dB or more occurs in 3/1000 school children; hearing loss of

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26dB or greater occurs in 13/1000.[1] The department of Otolaryngology and Audiology, Manchester, UK carried out 10 year study to evaluate various etiological factors of sensorineural hearing loss in children. They found the incidence of hearing loss in perinatal age group of 12.8%.[2] Mann et al found that among 1670 children between the ages 12 to 14 years, 6.31% of the urban sample and 32.81% of the rural sample had hearing impairment.[3] In a study by Jacob et al , of 284 children between 6-10 years, hearing loss was detected in 11.9% of the subjects.[4] The prevalence and incidence rate in India is quite alarming. Studies show varying prevalence rates from 1%, to as high as 40%. The Indian Council of Medical Research[5] in 1983, reported the incidence of conductive hearing loss of about 48% in rural areas. However, the National Sample Survey Organization (NSSO) reports of 1986, showed that India had a 3.02 million deaf population, and in 1991 showed 3.24 million in the age group of 5-14 years[6,7]. The Human Development report of 1999, estimates a 0.3 million hearing impaired population between 0-4 years age group and 1.5 million in the age range of 5-12 years.[8] Retrospective studies of large universal newborn hearing screening programs have shown that permanent hearing loss is one of the most common abnormalities present at birth. In 1999, the American Academy of Pediatrics Task Force on Newborn and Infant Hearing stated, "significant bilateral hearing loss has been shown to be present in approximately 1 to 3 per 1000 newborns in the well-baby nursery population, and in approximately 2 to 4 per 100 infants in the intensive care unit population."[9]Data from the newborn hearing-screening programs in Rhode Island, Colorado, and Texas show that 2-4 of every 1000 neonates have hearing loss.[10,11,12] A retrospective study conducted by Connolly et al in 2005 found that 1 of every 811 infants without risk factors and 1 of every 75 infants with risk factors have hearing loss.[13]

MATERIALS AND METHODS

The present study was conducted in the NICU of Department of Paediatric of the tertiary care institute. The study institute is having Level III NICU which meansa unit that provides both specialty and subspecialty care including the provision of life support (mechanical ventilation). All NICU graduates who complied with the follow up in the neurodevelopmental clinic during the Aug 2000 to July 2010 were included in the study. The period of follow up was variable, ranging from 4 months to 18 months. Thus the duration of study was 10 years. For those patients born during August 2008 to July 2010, information details were collected from parents of NICU graduates in the neuro-development clinic and NICU discharge summary. Patients born during Aug 2000 to Jul 2008 were followed up retroprospectively with help of recorded data in neurodevelopmental clinic registers and NICU records. A pre structured proforma was used to enter the details of selected NICU graduate. All the NICU graduates in the study population were screened for the presence of hearing impairment at the first follow up after discharge from NICU. The screening method used was Brainstem Evoked Response Audiometry. BERA was performed in these babies in a separate room specially designed for this procedure. The machine used was a Oxford based Medelac Synergy machine. The stimulus used being Monoaural, Rarefaction Broad band clicks of 100ms duration with contralateral masking. The maximum intensity of stimulus was 105 dB. BERA was recorded in a single channel (ipsilateral mastoid Mi-Cz).Five waves of BERA were recorded; designated as waves I, II, III, IV and V. A detailed evaluation of the neurodevelopmental status was also done. Case data was recorded in a predetermined proforma. Appropriate statistical tests were applied wherever necessary (Fisher exact test, Chi square test with or without Yate's correction)

RESULTS

Table 1: Distribution of NICU Graduates

Duration	Aug00-Jul02	Aug02- Jul04	Aug04- Jul06	Aug06- Jul08	Aug08- Jul10	Total
Total number of deliveries	2319	2136	2015	1667	1470	9607
Total number of NICU admissions	383	350	363	356	286	1738
NICU graduates among the total no. Of deliveries	361	335	347	343	272	1658
NICU graduates who were available for follow up	73	116	78	101	53	421

This study involved period of 10 years, from August 2000 to July 2010. A total of 9607 babies were delivered at this tertiary hospital during the above mentioned study period, with average of 960.7 live births per year. There were total 1738 NICU admissions during this period out of which 1658 babies were survived and discharged i.e. gained the status of NICU graduates. Of these, total 421 babies followed up at neurodevelopmental clinic and were included in the study. Total 10 years of study was divided into 5 groups of 2 years duration each for purpose of analysis.

Table 2: Incidence of Hearing Impairment in NICU Graduates

Duration	No. Of NICU graduates	NICU graduates with hearing loss	Incidence of hearing loss in NICU graduates
Aug 00-Jul 02	73	19	26.03%
Aug 02-Jul 04	116	10	8.62%
Aug 04-Jul 06	78	9	11.54%
Aug 06-Jul 08	101	4	3.96%
Aug 08-Jul 10	53	2	3.77%
Total	421	44	10.45%

Hearing impairment in the NICU graduates was diagnosed on the basis of abnormal BERA report. The incidence was calculated as no. of patients with hearing impairment/ total patients following up for neurodevelopment clinic, for each group. The incidence of hearing impairment in the present study was 10.45%. It was seen that the incidence of hearing impairment was found to be decreasing over the study period of 10 years. The incidence in first group (Aug00-Jul02) was found to be significantly different from last group (Aug 08-Jul10), by Z test for two proportions (z value= 3.068, 99% confidence levels).

Table 3: Type and Severity of Hearing Impairment

Duration	Conductive HL	Mild SNHL	Moderate SNHL	Severe/Profound SNHL
Aug 00-Jul 02	0	4	6	9
Aug 02-Jul 04	1	1	4	4
Aug 04-Jul 06	2	0	4	3
Aug 06-Jul 08	1	1	1	1
Aug 08-Jul 10	0	0	0	2
Total	4	6	15	19

It was observed that Sensorineural hearing impairment was more common in NICU graduates as compared to Conductive hearing impairment. Among the cases of Sensorineural hearing impairment severe/ profound impairment (19 cases) was most common followed by moderate impairment (15 cases).

Table 4: Hearing Impairment and Hearing Aid

Time of starting hearing aid	Total no. Of NICU graduates receiving hearing aid	NICU graduates with speech delay
<6 moths	6	1
>6 moths	7	6

NICU graduates with hearing impairment were given appropriate hearing aid or other intervention and assessment of their language development was done. The occurrence of language developmental delay is lower in those hearing impaired NICU graduates who received hearing aid or other intervention before 6 months age than after 6 months of age. By using Fisher exact test, this difference was found to be statistically significant (p = 0.0297).

DISCUSSION

Advances in medical technology have led to dramatic reduction in mortality in NICU graduates. However, morbidity among survivors is a concern. Hearing loss in neonates is one of the most important disabilities in which any delay in early diagnosis and intervention will cause a great undesirable impact on speech, language and cognitive abilities. The volume of literature on hearing impairment is quite extensive, but many questions continue to remain unsolved. Present study was conducted in a level III Neonatal Intensive Care Unit, over a period of 10 years. It was a cohort of randomly selected newborns, all of which were NICU graduates, born during Aug 2000 to July 2010. Among the 421 NICU graduates who were available for follow up, 44 showed some form of hearing impairment. Thus, the incidence of hearing impairment in our study population was 10.45%. However, a downward trend in the incidence was seen over these years, with the incidence in last 4 years dropping to an average of 3.9%. The incidence during first two years of the study period was significantly different from that in last two years (Z test for two proportions. Z value 3.068 with 99% confidence level). Our data was at par with various studies worldwide including the review of epidemiology and pathophysiology of hearing loss in VLBW done by Cristobal and Oghalai[14]who observed a decrease in the incidence of sensorineural hearing loss among NICU graduates from previous decades (2.1–17.5%).They attributed this fall to the successful preventive management of hearing loss risk factors, including quieter technology used in NICUs, better infection control, improved monitoring of oxygen supplementation and the routine measurement of serum aminoglycoside concentrations. The department of Otolaryngology and Audiology, Manchester UK[2] carried out a ten year study

to evaluate various etiological factors of sensorineural hearing loss in children. They found an incidence of 12.8%. A cross-sectional study was performed on 230 neonates who were at risk of hearing loss in Tehran University of Medical Sciences hospitals between September 2000 and February 2002. Eighteen neonates (8%) in this study had sensorineural hearing loss[15]. In 1999, the American Academy of Pediatrics Task Force on Newborn and Infant Hearing[9] stated, "significant bilateral hearing loss has been shown to be present in approximately 1 to 3 per 1000 newborns in the well-baby nursery population, and in approximately 2 to 4 per 100 infants in the intensive care unit population." The results of this study are based on the evaluation of only a subgroup of NICU graduates who complied with the follow up. This includes 421 babies, i.e. 25% of total number of NICU graduates only. Thus the incidence of hearing impairment in this study may be estimated wrongly high, as the babies who are at higher risk of developing impairment or those who had a stormy course in NICU are more likely to follow up than those with insignificant course in the early life. In this study, we found total 44 patients with hearing impairment out of which only 4(9.09%) had conductive type of loss, rest 40 (90.91%) had sensorineural hearing impairment. Which was again divided into mild – 6 babies (13.64%), Moderate – 15 babies (34.09%), Severe to profound – 19 (43.18%). Thus the incidence of sensorineural hearing loss in our study population is 9.5% (40/421). Our study was at par with Abusaleh S[14], Das V K[2] and A. Zamani[15]. But exceptionally, one study found a low incidence of sensorineural hearing impairment in NICU population while the incidence of conductive hearing loss was more.[16]

CONCLUSION

Thus we conclude that the incidence of hearing impairment in the present study was 10.45%. Sensorineural hearing impairment was more common in NICU graduates as compared to Conductive hearing impairment.

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