

Hearing Abnormality in Neonate Intensive Care Unit (NICU), Yazd-Iran

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Abstract

Introduction:

Hearing impairment and hearing loss are kinds of latent handicap in children. Any abnormality in hearing can affect different aspects of life. Otoacoustic emissions have been accepted as an appropriate method for screening of hearing loss in neonates. In this study we assessed the hearing status of infants admitted in Intensive Care Unit (ICU) wards in Yazd.

Materials and Methods:

This was a cross-sectional study on hearing status of infants admitted in ICU wards of Yazd hospital in 2012-2013. Data was collected using a questionnaire involving demographic data of the infants and their parents. Data was gathered from infants' medical files and interview by their parents. Data was analyzed by SPSS- 20, using chi square test.

Results:

514 infants were introduced for primary screening. 82 subjects were referred for the second step of Otoacoustic Emissions (OAE) test. Seventy subjects referred for second OAE. Among all 25 infants with hearing impairment, there was no family history of hearing loss, but among the subjects with normal hearing, 5 subjects showed hearing loss.

Conclusion:

Hearing loss in neonates admitted to Neonatal Intensive-Care Unit (NICU) is more common than general population. Early diagnosis of hearing impairment is essential for prevention of future disabilities and development of their life quality which explains the need to screen all neonates for hearing impairment.

Key words:

Hearing Impairment, Neonate, NICU, OAEs.

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Introduction

Hearing impairment and hearing loss are kinds of latent handicap in children. Any abnormality in hearing can affect different aspects of life. It has been shown that from each 1000 live neonates, 1-3 will suffer from hearing impairment (1-3). This frequency is increased to 40-60 hearing impaired neonates out of 1000 neonates admitted in Neonate Intensive Care Unit.

Average age when hearing impairment is usually diagnosed is 2.5 years old (3). The golden period for a child to learn language is from birth till 12 months and detection of hearing impairment and its treatment in the first 6 months after birth will result in the best outcome (1, 3, 6). A neonate suffering from moderate hearing impairment can say only 50-60 words in 6 years which is 300 words in a healthy child (1, 3, 6). Almost 90% of parents with hearing impaired children have normal hearing without any risk factors (1-4). Fifty percent of neonates with congenital permanent hearing impairment may have one of the following risk factors: admission at NICU, family history of hearing impairment, peri-natal infection, very low birth weight, facial malformation, asphyxia, chromosomal abnormality, and jaundice (1-5,7).

Hearing impairment among NICU-admitted neonates is increasing (1-3). The prevalence of neonate hearing impairment is variable based on its definition. Diagnostic criteria for hearing impairment are different (from 40 dB to 90 dB loss in audiometry) which also depends on this fact that hearing loss is unilateral or bilateral. Most studies have assessed hearing thresholds at 500, 1000, 2000 and 4000 Hz and have defined 40 dB as the cut-off point for hearing loss. (1-3,6,8-10).

Although Acoustic Brain stem Responses (ABR) test is an acceptable method for evaluation of hearing system, most studies have precluded this test because it is time-consuming and expensive (6-8,11-15).

Otoacoustic Emissions (OAEs) have been accepted as an appropriate method for screening of hearing loss in neonates. This is a rapid, non-invasive, sensitive and inexpensive method. In most screening studies transient evoked-OAEs have been used as the first method and those neonates who have failed twice have been referred for ABR (8,11,13,16).

In Australia, there were 253673 live births in 1997, so there were between 254 and 507 cases of congenital hearing loss (considering the prevalence of 0.1 to 0.2 percent) (15). In the US, the economic cost of life for those with congenital hearing loss was 1 million dollars (18). In the past it was supposed that unilateral hearing loss has a little effect on the subject's development, but recently it has been shown that any degree of unilateral hearing loss may lead to behavioral problems or learning deficiency. Oyler et al showed that educational failure among children with congenital hearing loss was 10 times more than normal children (19). In the study conducted by Brookhouser et al, 59% of children with unilateral hearing loss suffered from behavioral problems and 17% of them showed speech delay (20).

Davis et al showed the beneficial effect of early treatment in neonatal hearing screening program. Those who were diagnosed and used hearing aid before 3 months, their speech deficiency was 13% comparing those who were diagnosed between 3-12 months with 34% speech deficiency (21).

Robinshaw et al found that 5 patients with congenital hearing loss who were diagnosed before 6 months and used hearing loss could reach to speech skills comparable to their contemporaries (22). Markides and Ramkalawan also found similar results about early intervention to gain better speech skills (23). Now, in most developed countries, infants hearing screening is performed as a comprehensive

program in most hospitals. These screening programs are advocated by National Institute of Health (NIH) and Joint Committee on Infant Hearing (JCIH) (18). In this study we assessed the hearing status of infants admitted in ICU wards in Yazd.

Materials and Methods

This was a cross-sectional study on hearing status of infants admitted in ICU wards of Yazd hospital in (Apr 2012-Apr 2013). Data was collected using a questionnaire involving demographic data of the infants and their parents. Data was gathered from infants' medical files and interview by their parents.

Evaluated variables included: age, gender, presence of risk factors in the family, asphyxia, meningitis, sepsis, type of delivery, 5th minute Appearance Pulse Grimace Activity Respiration (APGAR) number, and jaundice. Then all infants were assessed using Transient-Evoked Otoacoustic Emission (TE-OAE) (device: Madsen-Accuscreen ILO88) in both right and left ears. TE-OAEs include several transient sounds as clicks or impulses in a wide range of frequency. In this test a large area of basilar membrane is stimulated and all hair cells in this evoked area will respond. TE-OAE test lasts 1-3 minutes (6,8,10,11,14). The result of test was recorded as pass or fail. Those who failed to respond to OAEs were retested after 15 days. If they failed to respond again, ABR was performed. Those with impairment in ABR were referred for treatment and rehabilitation. Data was analyzed by SPSS-20 using chi square test. ($P < 0.05$) was considered significant.

Results

At last 514 infants (201 females and 313 males) were introduced for primary screening. In this step 82 subjects (164 ears) were referred for the second step of

OAE test. Seventy subjects referred for second OAE (8 subjects were died and 4 subjects were lost to follow-up). Among these infants, 19 boys and 24 girls were normal and 25 subjects (4.7%) showed abnormal hearing (5 girls and 16 boys). From 25 subjects (18 boys and 7 girls) with abnormal hearing, 4,5,4, and 2 subjects showed mild, mild to moderate, moderate to severe, and severe to profound hearing loss and 8 subjects suffered from hearing neuropathy. Two subjects were not assessed due to lack of their parents consent.

Among all 25 infants with hearing impairment, there was no family history of hearing loss, but among the subjects with normal hearing, 5 subjects showed hearing loss. Among 56 cases suffered from sepsis, 4 (12.5%) had hearing loss. Eleven subjects suffered from meningitis among whom 2 (14.5%) had hearing loss. The difference between the variables was not significant. In this study 94 subjects suffered from asphyxia among whom 4 (2.9%) had hearing loss which was not statistically significant as well.

Among all subjects, the parents of 345 neonates (with 18 cases of hearing loss) were not relatives, but in 169 cases (with 3 cases of hearing loss) the parents were relatives, but the difference was not significant. Among 514 neonates, 4 cases suffered from congenital infections, but all of them had normal hearing. Among 19 cases with hearing loss none of them had a history of congenital infection. Among all cases in 19 subjects, 5 minute APGARE score was 5, among whom 4 subjects (18.1%) suffered from hearing loss. Among 35 cases, 5 minute APGARE was 7, among whom 4 cases (11.1%) suffered from hearing loss (Table1).

From 25 neonates with hearing loss 2 cases were Very Low Birth Weight (VLBW) and the parents of 2 cases were relatives. Hearing loss was observed in

11.36% and 3.1% of neonates with and without jaundice, respectively and the difference was statistically significant ($P=0.001$).

Table 1: Status of APGARE score in Neonates

5-minute APGARE score	Hearing loss (Number, %)		Total
	Positive	Negative	
5	4 (18.1)	15 (81.9)	19
7	4 (11.1)	31 (88.9)	35
8	9 (5.1)	147 (94.9)	156
9	7 (2.7)	217(97.3)	224

Discussion

In this study 514 hospitalized neonates were assessed. Among these neonates 4.7% of cases (18 boys and 7 girls) suffered from hearing loss which was consistent with the results of the previous studies (1-5). Because only half of the neonates with congenital hearing loss showed risk factors, recently general screening of neonates has replaced screening based on risk factors. This is a rule in 41 states of America (18).

Conclusion

Hearing loss in neonates admitted to NICU is more common than general population. Without timely diagnosis of this disorder, these neonates may suffer from some disorders and delays in speech, behavior, and education, so it may impose a high economic-psychological cost to the family and society.

Early diagnosis of hearing impairment is essential for prevention of future disabilities and development of their life quality which explains the need to screen all neonates for hearing impairment.

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