Original Article

HEARING ASSESSMENT OF THE HIGH RISK NEONATES ADMITTED TO MOFID HOSPITAL FOR CHILDREN DURING 2001 – 2002, USING AUDITORY BRAINSTEM RESPONSE (ABR)

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BACKGROUND—*Hearing impairment is one of the most important causes of speech problems in children. If the diagnosis and treatment of hearing impairment is delayed, it could cause developmental, emotional, and social problems for the child and his family. We aimed to assess the hearing impairment in a group of high risk infants in Tehran.*

MATERIALS AND METHODS—*Auditory brain-stem response (ABR) was performed in 150 high-risk newborn infants who had at least one risk factor for hearing impairment. These patients were followed up after discharge from the hospital for 3 months and were reevaluated for assessment of hearing.*

RESULTS—*The mean age of the patients was 22 ± 14 days. One hundred and eight patients (72%) had normal hearing and 42(28%) had different levels of hearing impairment. Seventeen (11%), 16 (10.7%), 4(2.7%), and 5(3.3%) of the patients had mild, moderate, severe, and profound hearing impairment, respectively.*

CONCLUSION—*All high-risk neonates should have hearing assessment. ABR, is a sensitive procedure for detection of hearing impairment in the newborns and young infants.*

Keywords: ***hearing impairment; high-risk neonates; auditory brainstem response (ABR).***

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INTRODUCTION

Hearing impairment is one of the important causes of developmental delay in children and, if not diagnosed and treated promptly, it could result in speech delay.[1 – 3] If hearing impairment could be detected and treated before six months of age it will result in a better speech performance in the patients.[2, 4]

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According to different studies, the incidence of hearing loss in normal newborn population is 1 – 2 in 1,000 live births.[1, 2, 5] According to one study, the speech performance of the infants whose hearing problem was detected and treated before they were six months old, was the same as normal age-matched children.[1]

In another study performed in the Netherlands the prognosis of children whose hearing impairment was diagnosed before they were 3 months old, and treated before the age of 6 months, was very good.[2] In other studies done in Norway and Germany it was found that the prognosis was good if hearing impairment was diagnosed and treated before the age of six months.[3, 6]

All of these studies show the importance of early detection and treatment of hearing impairment in children. Unfortunately the age of detection of hearing loss is delayed even in developed countries if the screening for hearing impairment is not performed during the first few months of life.[7] For example, in the United States the age of the detection of severe hearing loss is 20 to 24 months of age and for mild to moderate hearing loss is around 4 years of age.[8]

In one study done in Spain on 78 children with a mean age of 21 months, it was found that although 57% of these children were among high risk infants for hearing loss, the assessment was performed only in 7 of them.[4] The assessment of the hearing in the newborn is very critical not only in high-risk groups but also in normal newborn infants.

In one study performed in Norway it was shown that the hearing impairment will be missed in about 50% of the infants if the global screening is not performed.[6] There are several risk factors which are very important as precipitating events causing

hearing impairment in the newborn and young infants. The following are among these high risk factors: prematurity and low birth weight, asphyxia, use of aminoglycosides, hyperbilirubinemia, prolonged mechanical ventilation, bacterial meningitis, intra-uterine infections, craniofacial anomalies, etc.[9 – 12] In places such as Iran where global hearing screening is not performed, the high-risk population should have hearing assessment by ABR as soon as possible in order to detect and treat hearing impairment at an early age.[7]

MATERIALS AND METHODS

ABR was performed in a group of high-risk infants hospitalized in neonatal ward and neonatal intensive care unit of Mofid Hospital for children from February 2001 to October 2002.

The purpose of the study and detail of protocol was discussed with parents and a written consent was obtained. All of the following information were recorded by a pediatric resident at the time of discharge of the infant from the hospital: gestational age, sex, birth weight, admitting diagnosis, the period of hospitalization, the age, and possible risk factors for hearing impairment, before ABR. ABR was performed, and interpreted by an audiologist. The hearing impairment was graded as: mild (25 – 30 db), moderate (30 – 50 db), severe (50 – 70 db), and profound (more than 70 db).[1] All of the risk factors, which are known to be associated with hearing impairment were studied.

We defined the risk factors as follows: the family history of neurosensory hearing loss; intrauterine infections; congenital craniofacial anomalies; birth weight below 1500 g; hyperbilirubinemia requiring exchange transfusion; use of autotoxic medications for at least 5 days; bacterial meningitis; asphyxia (the APGAR scores, 0 – 4 in one minute or 0 – 6 in 5 minutes); mechanical ventilations for 5 days or more; and the syndromes, which were known to be associated with neurosensory hearing loss.

From February 2001-October 2002, one hundred and fifty infants who had at least one of the above criteria participated in the study. These patients were followed up after discharge from the hospital for 3 months and were evaluated by ABR for assessment of hearing. The data were analyzed using SPSS soft ware.

RESULTS

During the study, 388 patients were admitted in the ward. One-hundred and fifty of these patients who had at least one of the risk factors participated in the study. The age of the study group ranged between 6 to 80 days (mean, 22 ± 14). Ninety-five patients (63.3%) were male and 55 patients (36.7%) were female.

The gestational age of the study group ranged between 26 to 38 weeks (mean, 35.2 ± 3.4). Weight at birth varied between 800 to 4,250 grams (mean, 2,472 ± 824 grams). One hundred and eight (72%) patients had normal hearing and 42 (28%) patients had mild to profound hearing impairment. The most common degree of hearing impairment was mild hearing loss, which was detected in 17 (11.3%) of the infants.

None of these patients had the family history of hearing loss, intrauterine infections, history of bacterial meningitis, or syndromes which are known to be associated with neurosensory hearing loss. The association of risk factors for hearing impairment is shown in Table 1. All of our patients with asphyxia had hearing impairment which could be due to the severity of asphyxiated insult.

Eighteen patients had hyperbilirubinemia requiring exchange transfusion. Eight of the patients had hearing impairment. The level of bilirubin was 30.6 ± 5.1 in the patients with hearing impairment and 25.1 ± 8.3 in patients with normal hearing. One hundred and twenty five infants received aminoglycosides for more than five days. Thirty-two (25.6%) of these patients had hearing impairment.

Table 1. Association of risk factors and hearing impairment.

Risk factors	Numbers	With hearing impairment	Without hearing impairment
Asphyxia	6	6	0
Hyperbilirubinemia needing exchange transfusion	18	8	10
Birth weight less than 1,500 g	27	11	16
Aminoglycosides more than 5 days	125	32	93
Mechanical ventilation more than 5 days	28	11	17
Cranio-facial anomalies	5	2	3

DISCUSSION

The incidence of hearing impairment in high-risk neonates, according to the different statistics, is from 5 to 50 in 1,000 live births.[5, 6] There are several risk factors which are very important as precipitating events, causing hearing impairment in the newborn and young infants. The following are among these high risk factors: prematurity and low birth weight, asphyxia, use of aminoglycosides, hyperbilirubinemia, prolonged mechanical ventilation, bacterial meningitis, intrauterine infections, and cranio-facial anomalies.[9 – 12]

In this study the incidence of hearing impairment in the infants who had at least one risk factor was very high in comparison to studies from other countries.[2,5] This difference was perhaps due to the referral nature of our center, which is one of the main units for admission of the high-risk neonates in Tehran. Other factors which might have been significant in this difference were the lack of good prenatal care, inadequate facilities for measurement of serum drug levels such as aminoglycosides, and delay in referral of sick and high risk babies to the hospital.

We used ABR for hearing assessment, which has three important characteristics:[5, 9] (1) it gives the electrophysiological response of hearing without any need for assessment of the newborn behavior; (2) the results of this test are not affected by the anesthetics or sedatives, which may be used during the test; and (3) ABR is a rapid, easy, and cheap test. The reported sensitivity of the ABR for hearing assessment was 100% and the specificity, around 97%.[3]

In this study, we showed there was a high rate of hearing impairment among the high risk population of infants. Although we can not make a definite conclusion concerning the outcome of the present study, it seems that all the high risk neonates and young infants will benefit from hearing assessment by using ABR at an early age. In conclusion, hearing screening in many countries is performed in all infants below 3 months of age. In Iran the global screening is not performed, therefore we recommend the performance of the ABR in high-risk infants in order to detect and treat hearing impairment in this population at an early age.

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