Original article

Prevalence of deafness and hearing screening in newborns in Isfahan

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BACKGROUND: Hearing impairment screening in newborns is a prompt action to identify those who suffer from deafness or hearing loss disorder. This procedure is aimed at early diagnosis of those cases in which quick intervention could prevent subsequent defects and impairments. Evoked otoacoustic emissions (EOAE) test is a screening test which is used to identify patients with hearing problems. This study was conducted to timely diagnose hearing disorder among newborns in order to prevent their verbal disorder through early interventions. **METHODS**: This was a descriptive cross-sectional study which was carried out on 1232 newborns in Baharestan Hospital, Isfahan, in 2009-2010. Newborns were enrolled during their first month and they were evaluated by EOAE test. **RESULTS:** The prevalence of hearing loss in this study was 4.8 per 1000 newborns. Those newborns whose responses to the test were more than 60% were accepted in the test. Results of the tests in 50% of newborns who were studied in 2 phases were found negative without risk factors but the rest of subjects had risk factors. **CONCLUSIONS:** According to prevalence of hearing impairment in this study which could affect infant's verbal skill**,** hearing screening and efficiency evaluation of hearing screening centers in Iran seems to be necessary.

KEYWORDS: Hearing Loss, Mass Screening, Newborns, Prevalence

BACKGROUND

The importance of early diagnosis of hearing loss and deafness has been found many years ago. Hearing is a key sense to develop communication and communication is the basis of learning and education. The child who cannot communicate cannot learn. As a result, failure to diagnose the congenital hearing loss at an early age avoids verbal, language and perception as well as social and emotional character development.[1] Hearing loss is a communicative problem due to the fact that it limits suckling's ability to start verbal and this matter is problematic not only to the child but also to their family.[2]

It is worth mentioning that even children who do not have severe hearing loss are at risk of facing educational problems. Interventions such as cochlear implant in patients with severe sensorineural hearing loss at early ages will follow their improvement in verbal and verbal skills as well as the hearing. This is indirectly in favor of psychological and physical health of society.[3] In a study, it has been shown that parents who have children with risk factors, find out their children hearing loss in 8th month and parents who have children without risk factors, will notice it in 15th month for the first time. Furthermore, in another study it has been approved that parents with children without risk factors doubt in 22th month and parents who have children with risk factors feel uncertainty in 12th month.[4]

For long years, there have been obstacles of various kinds to reach the point to perform available, simple and inexpensive tests. Screening hearing tests needs facilities; for example, measuring instruments must be non-invasive, fast operating, accessible, trustable and practical for each ear individually.[5]

The National Institute for Deafness and the Communicative Disorder (NIDCD) announced that the first study to assess hearing loss must be done during first three months after birth, particularly before discharging from the hospital. In fact, it is attempted to detect the hearing loss at one month old, to confirm the diagnosis at 3

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months old and to take appropriate early interventions at 6 months old. Public hearing screening for newborns began in 1999 for the first time.[5] Thirty percent of the children who have learning problems suffer from some kind of hearing loss. Unfortunately, if an infant does not hear any sounds during their first month, there is no sign to help about this problem. Thus, attentions are frequently paid to hearing loss with a delay or after suitable general period for language and verbal.[6]

Final growth in verbal and language ability is under the influence of receiving a suitable hearing stimulus during first years of birth.[7] Previously, newborns who were at risk were tested just by behavioral tests such as ear reflex and eyelid-ear reflex while waking up. Because of their poor accuracy (just moderate to severe hearing loss was diagnosed) and having so many false positive cases, new methods like electrophysiological tests such as auditory brainstem response (ABR) and evoked otoacoustic emission (EOAE) were substituted.[8]
ABR does not measure hearing directly but it evaluates the hearing sensitivity that relates to 8th nerve and auditory brainstem. EOAE tests cochlear status, which evaluates the sensory parts of the sensorineural hearing loss. In fact, the existence of EOAE depends on the approximately normal performance of curti organs and middle ear.[7]

Regarding the significance of hearing in an infant's development and diagnosis failure of hearing loss in newborns by parents, screening seems necessary. In addition, evaluation of the efficiency of screening hearing-loss centers in Iran is of paramount importance.

Hearing screening of newborns should be widespread in Iran so that the suspected cases are referred to the secondary and tertiary health care levels. Therefore, parents and health care providers will be trained to deal with this disorder. Eventually, the promotion of the level of social health will become feasible.

METHODS

This was a cross-sectional study conducted in audiology ward of Baharestan Hospital in Isfahan. Our samples were all the newborns that were born from February of 2009 to March of 2010. All the newborns that were one month old were undergone TEOAE test by audiologists for hearing screening. TEOAE was performed by an automatic machine (made by Germany) and data as well as charts were recorded in a computer via a program called Homoth. Data were collected using a questionnaire including newborns and pregnancy duration information. Test duration was less than 3-4 minutes for every infant. If the ratio of signal to the noise were over 3 decibel, the test would be reliable. In the questionnaire, some questions were related to parents' profile, the use of harmful medications for fetus during pregnancy, history of x-rays during pregnancy, history of familial hearing impairment, TORCH infectious disease during pregnancy, delivery type, gender, birth weight, newborn's age, newborn malformations and hospitalization records. Data were analyzed using SPSS software, version 14.

RESULTS

Among 1232 newborns, 1138 (92.3%) subjects left the hospital after 36 hours without any needs to be hospitalized in pediatric ward. Parents were obligated to come to the hospital at the average age of 10 ± 2 days in order to screen hearing loss. 94 (7.6%) of the children needed to be hospitalized for some reasons and after discharge from the hospital at the average age of 27 days old, they were taken to the hospital again to be screened for the hearing loss.

In this study, 3.8% of the newborns were low birth weight (LBW). 17 (1.4%) newborns were premature. TOAE was done for all the newborns (hospitalized and non-hospitalized). 1220 newborns (99.0%) were accepted in the first phase of the test. In 12 remained newborns (0.97%), in the first phase, no response was received and the test was reported as abnormal or negative.

The second phase was performed 2 to 3 weeks after the first phase in 12 participants among which 6 cases were reported as normal and 6 cases were negative again. Half of those who had hearing impairment were females and half of them were males. All of them were referred to an otolaryngologist for more examinations. By studying the questionnaires filled by parents through interview, each of 3 cases (50%) whose test was reported negative in both screening phases, simultaneously had risk factors such as family history of deafness, bacterial meningitis, mechanical ventilation and prematurity. However, 3 other newborns had no risk factors.

The cause of hospitalization were hepatitis in 47 (3.8%) cases, prematurity in 17 (1.38%) cases, sepsis in 14 (1.13%) cases. The use of antibiotics including aminog-

lycosides, 10 (0.8%) cases with hypoxia, one case (0.08%) kernicterus, one case (0.08%) meningitis, one case (0.08%) intrauterine growth retardation (IUGR), one case (0.08%) hydrocephaly, one case (0.08%) premature rupture of membrane (PROM) and one case (0.08%) TORCH were recorded for mothers.

In this study, the prevalence of hearing loss in the newborns with hepatitis, sepsis, respiratory distress syndrome, hydrocephaly, kernicterus, TORCH in mother, PROM and IUGR was reported zero for each one. The spread rate of hearing loss for premature newborns was 5.9% and for those who had meningitis was 100 percent.

Six newborns in the first phase had abnormal screening test but their second test was normal. Two cases had no risk factors, 3 cases were delivered normally with forceps and one case simultaneously had 3 risk factors (family history of deafness, LBW and normal delivery with forceps). In this study, no newborns had malformation and their mothers had no records of taking ototoxic medicines during pregnancy or received no x rays.

DISCUSSION

In this study, the time of performing screening test was in line with previous studies.[9] In 2009, Schaefer pointed out that hearing impairment is a serious problem in newborns and the frequency is five out of each 1000 birth[10] but if the severe forms is concerned, the frequency will be two cases out of 1000 births. In 2005, Cumming estimated that sensorineural hearing loss occurs in approximately one to three cases out of each 1000 live birth and about one case in every 1000 birth suffers from bilateral or severe hearing loss [70 decibel (db) or more].[11] It was indicated that three children out of each 1000 suffer from hearing loss of 30 db or more.[11]

Out of six newborns (4.8%) whose screening test indicated a hearing impairment, three cases (50%) had no risk factors. Other three cases (50%) had some risk factors such as deafness history, bacterial meningitis and prematurity following mechanical ventilation (every one formed 16.7 % of hearing impairment). According to our findings, only 50% of newborns with hearing impairment had risk factors. Therefore, if screening test was only conducted on high risk patients, about 50% could be missed.

In some studies, it has been mentioned that 90% of deaf children were born in families that had no history of deafness.[10] As a result, the role of positive family history of deafness which were 16.7% in our study is acceptable.

In a study which was done by Sininger et al., general screening of all newborns revealed hearing problems to be as much as 80%. Consequently, it was concluded that a widespread screening is more effective than screening just based on risk factors.[3] In our study, 96 newborns had risk factors and three cases had more than one risk factor. Therefore, 3.1% of newborns with one risk factor or more were at risk of hearing loss and 96.8% of newborns with one risk factor or more had normal hearing that confirms the findings of the previous study.

In Cumming's study, only 2-5% of newborns with one risk factor or more were at risk of moderate to profound hearing loss. However, 95-98% of newborns with one risk factor or more had normal hearing.[1] As a result, 50% of children with moderate to profound hearing loss had no risk factors. If the presence of risk factor was an individual indication for patient finding, 50% of the newborns with congenital hearing loss would be ignored.

Risk factors specified in NIDCD committee and Joint Commention include positive family record, hyperbilirubinemia with blood replacement,[11] TORCH,[12] birth weight less than 1500 gram,[13] low Apgar scores, bacterial meningitis, aminoglycosides and mechanical ventilation.[14]

One of the complexities of patient-finding tests is false positive cases. Repetitive case finding has been devised to eliminate this problem. In fact, poor response does not necessarily mean deafness. Because the response received is under the influence of restless condition of the newborn, crowded room and presence of fluid in their ears because of delivery.[15] As a result, OAE test was repeated for those newborns that had negative response in the first phase; nevertheless, 4.8 in every 1000 newborns had a negative OAE test again. According to the previous studies, negative responses of TOAE in Red Island in 1990 were 27% and in 1993 was six percent.[16] In this study, 4.8 in every 1000 newborns (0.48%) were reported as false positive that was in accordance with the other studies. Forceps was used for delivery in 66% of the newborns who had abnormal results in the first phase but their second test was normal. Therefore, it is not a risk factor for hearing impairment.

Finally, as risk factors were detected in 50% of newborn with hearing impairment, screening tests seems to be necessary.

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