

## Frequency of Hearing Impairment among Full-term Newborns in Yazd, Iran

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**Abstract**

**Objective:** Permanent congenital hearing loss, a common congenital anomaly, may affect speech and language acquisition, academic achievement and social development. Current standards emphasize early recognition of congenital hearing loss. This study was conducted to find the prevalence of hearing impairment in term newborns in Yazd, Iran.

**Methods:** This was a descriptive-analytic study conducted in Yazd on 7250 term newborns. Otoacoustic emissions (OAEs) test was performed in all newborns during the first 24 hours after birth. Those who failed to respond at the first step were retested 15 days later. Those who failed to respond at the second step too, were tested by acoustic brainstem responses (ABR) test. Chi square test was used for data analysis.

**Findings:** From 7250 newborns in the first step 598 (8.2%) and 682 (9.4%) ears (right and left, respectively) failed. In the second step 51 (0.7%) and 58 (0.8%) ears (right and left, respectively) failed. Consanguinity and route of delivery had significant effect on the frequency of hearing loss.

**Conclusion:** The overall frequency of congenital hearing loss in this study was found high.

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**Key Words:** Hearing Loss; Congenital; Screening; Auditory Brainstem Responses

**Introduction**

Permanent childhood hearing impairment (PCHI), an occult disorder, is one of the most frequent congenital disorders and may affect speech and language acquisition, academic achievement and social development<sup>[1]</sup>.

Early recognition and intervention is very effective in improvement of hearing rehabilitation programs and gaining successful results. Nevertheless, most children with hearing impairment will be identified lately due to lack of relevant symptoms and signs, and lack of physicians' knowledge. Current standards

emphasize early recognition of congenital hearing loss especially before age 3 months<sup>[2]</sup>. Considering this issue, programs for early detection of hearing loss among newborns are established in different parts of the world<sup>[3-6]</sup>.

This study was conducted to find the prevalence of hearing impairment in term newborns in Yazd.

**Subjects and Methods**

This was a descriptive-analytic study which was conducted in Yazd, a central province in Iran, from

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March 2010 until September 2011. All full-term newborns (n=7250) except for those who were admitted to neonatal intensive care unit (NICU) who were born in governmental and private hospitals in Yazd city entered the study (2 governmental and 4 private hospitals). The subjects entered the study by census method. A questionnaire about demographic data (gender, parents' educational status, mother's job, consanguinity, and medical history of newborns and their parents, history of congenital or inherited hearing loss, and type of delivery) was filled for each subject. An informed consent was obtained from the parents. Then OAE test was performed in all newborns (device: Accuscreen, Madsen, Denmark) during the first 24 hours after birth. OAE is a simple, non-invasive, and objective test which includes a series of transient clicks with wide-frequency range. It takes about 1-3 minutes to perform the test for both ears. Some studies investigated the accuracy of OAE for screening; the sensitivity, specificity, positive predictive and negative predictive values of OAE in one of these studies were 77.9% (71.3-83.4%), 80.6% (68.8-88.9%), 92.1% (86.6-95.6%), 55.7% (45.2-65.6%) respectively [7].

Screening was performed at newborn bed in the presence of his/her mother. The tests were performed by 5 audiologists who were similarly trained for this screening study. The result of test was recorded as passed or failed. Those who failed to respond at the first step were retested 15 days later. Those who failed to respond at the second step too, underwent complementary electrophysiologic tests (auditory brain stem responses). Data were analyzed by SPSS (ver. 19) using chi square test. Level of significance was set at  $P=0.05$ .

The study was approved by the ethics committee of Shahid Sadoughi University of Medical Sciences, Yazd.

## Findings

This study was conducted on 7250 full-term newborns consisting of 3345 (46.1%) females and 3905 (53.9%) males. No newborn was admitted to ICU. 79.4% of mothers were housewives and 20.6% were employed. Only 56 newborns (0.8%) suffered from low birth weight.

55.2% of newborns were born by cesarian section and 44.8% by normal vaginal delivery. From 7250 newborns (14500 ears), in the first step 598 (8.2%) and 682 (9.4%) ears (right and left, respectively) failed. In the second step 51 (0.7%) and 58 (0.8%) ears (right and left, respectively) failed. Table 1 shows the comparison of the frequency of results according to different variables.

In the next step ABR was employed to confirm the hearing impairment. According to the results of this test, 1, 8, 13, and 32 right ears suffered from mild, moderate, severe and profound hearing loss, respectively. For the left ear these measures were 2, 6, 17, and 33.

Considering both ears, 30 newborns (0.42%) suffered from bilateral profound sensorineural hearing loss (SNHL), other 10 newborns (0.13%) and 6 newborns (0.08%) suffered from bilateral severe and moderate SNHL, respectively. Only 1 newborn (0.014%) was diagnosed with mild SNHL.

All newborns with severe or profound hearing loss were referred for cochlear implant and hearing aid was prescribed for newborns with moderately severe hearing loss.

## Discussion

The prevalence of newborn and infant hearing loss was different in various studies from 1 to 6 in 1000 live births[8-10]. Kennedy and McCann observed hearing impairment in 133 per 100.000 persons, most of which were congenital[11]. Langagne et al estimated it to occur in 1/1000 infants in medium to profound form.

Early diagnosis of hearing loss and proper intervention may cause a considerable change in the quality of life of hard-hearing or deaf children. The aim of EHDI (Early Hearing Detection and Intervention), a program from The American Speech-Language-Hearing Association (ASHA) is to maximize children's competition power and educational development. Without enough opportunity for language learning, the hard-hearing or deaf child will delay in lingual, cognitive, and socio-emotional skills compared to his/her contemporaries. Therefore, newborn's hearing should be evaluated by proper methods

**Table 1:** Characteristics of the research subjects and result of Otoacoustic Emissions

| Variables                          |                                   | Result of Otoacoustic Emissions |                        |          |
|------------------------------------|-----------------------------------|---------------------------------|------------------------|----------|
|                                    |                                   | Total number                    | Referral Frequency (%) | P. value |
| <b>Gender</b>                      | Male                              | 3905                            | 26                     | 0.4      |
|                                    | Female                            | 3345                            | 28                     |          |
| <b>Parent's educational status</b> | No high-school certificate        | 84                              | 2                      | 0.1      |
|                                    | High-school certificate or higher | 7166                            | 52                     |          |
| <b>Consanguinity</b>               | Yes                               | 1474                            | 29                     | <0.001   |
|                                    | no                                | 5776                            | 22                     |          |
| <b>Mother's employment</b>         | Employed                          | 1491                            | 5                      | 0.04     |
|                                    | Unemployed                        | 5759                            | 49                     |          |
| <b>History of seizure</b>          | Yes                               | 5                               | 2                      | 0.001    |
|                                    | No                                | 7245                            | 52                     |          |
| <b>Route of delivery</b>           | Cesarian Section                  | 4006                            | 39                     | 0.01     |
|                                    | Normal Vaginal Delivery           | 3244                            | 15                     |          |
| <b>Low birth weight</b>            | Yes                               | 7194                            | 53                     | 0.3      |
|                                    | No                                | 56                              | 1                      |          |
| <b>Congenital malformation</b>     | Yes                               | 7217                            | 48                     | <0.001   |
|                                    | No                                | 33                              | 6                      |          |
| <b>History of hearing loss</b>     | Yes                               | 98                              | 7                      | 0.03     |
|                                    | No                                | 7152                            | 47                     |          |
| <b>Preterm labor</b>               | Yes                               | 36                              | 2                      | <0.001   |
|                                    | No                                | 7214                            | 52                     |          |

OAE: Otoacoustic Emissions C/S: Cesarian Section, NVD: Normal Vaginal Delivery

in order to find congenital hearing loss early after birth. Mankowitz and Larson in a study on 646 children with hearing loss, found that the lower child's age at diagnosis of hearing impairment the better child's lingual skills<sup>[12]</sup>. Yoshinaga-Itano et al found that if deaf or hard-hearing children who are normal regarding cognitive skills, are diagnosed before 6 months old, after appropriate therapeutic intervention, their lingual skills can reach normal range, and their cognitive skills will be appropriate for their lingual skills<sup>[13]</sup>. In infants' hearing screening program and intervention of joint committee of infant hearing (JCIH), the best age for diagnosis of hearing impairment and therapeutic and rehabilitation intervention is 3 months and 6 months, respectively<sup>[14,15]</sup>.

Various studies have shown that hard-hearing and deaf children with normal cognitive skills diagnosed before 6 months old with early and proper intervention can gain near normal lingual skills, but these skills were much lower in other children<sup>[13,16,17]</sup>. Hearing-impaired children diagnosed before 6 months old and received in-time therapeutic intervention (e.g. sound amplification devices, and family-centered rehabilitation programs), will have better function in oral language, receptive vocabulary, expressive

vocabulary and communication behavior for speech recognition and number of vowels and consonants<sup>[15]</sup>.

In this study we assessed newborns' hearing by OAEs and ABR. The coverage of newborn hearing screening was 100%. This coverage was higher than that found in the study of Amirozi et al which was 98%<sup>[18]</sup> and the study of Abdullah et al which was 89.2%<sup>[19]</sup>.

The prevalence of hearing loss in this study was 6.5 in 1000 newborns, which is more than that in most of the previous studies<sup>[7-10,20]</sup>. This measure was 0.9/1000 in Amirozi et al<sup>[18]</sup>, 4.2/1000 in Abdullah et al<sup>[19]</sup>, 1.5/1000 in Parving<sup>[8]</sup>, and 11.8/1000 in Watkin et al<sup>[21]</sup>. This shows a high prevalence of congenital hearing loss among the newborns of our population.

The factors which significantly affected the prevalence of hearing loss included: consanguinity, mothers employment, route of delivery, history of hearing loss in the family and history of mother's seizure. So newborns of mothers with consanguinity, employment and cesarean section showed significantly higher hearing loss than other newborns, and those newborns with congenital malformation, and low birth weight showed higher prevalence of hearing

loss. Taghdiri et al found hyperbilirubinemia, asphyxia and low birth weight as the most common risk factors for hearing loss studying newborns admitted to ICU<sup>[22]</sup>.

This study had some limitations. Some newborns did not continue the follow-up visits. We did not assess the newborns who were admitted to NICU, so some risk factors such as hyperbilirubinemia, and asphyxia could not be evaluated.

## Conclusion

This study showed a high frequency of congenital hearing loss in Yazd population in comparison to other studies even in other parts of Iran, so necessity of hearing screening for infants in this area is emphasized.

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**Conflict of Interest:** None

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