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Investigating the prevalence of neonatal hearing loss and its risk factors in Kermanshah

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ABSTRACT

Introduction: Permanent hearing loss is reported to be one of the commonest congenital disorders with a frequency of 1 to 3 in every 1000 kids. The best way to diagnose and prevent this disorder is to screen and recognize its associated risk factors. The present research seeks to identify the risk factors causing hearing loss or deafness in the new born kids after several screening tests in 2014 in Kermanshah province.

Materials and methodology: this is a cross-sectional, descriptive research conducted on 11670 newborn kids in Kermanshah in 2014. After the primary screening, 375 were selected as the case group and another 375 were selected as the witnesses due to possessing the risk factors associated with deafness.

Results: as the results indicate, anomaly risk factors in head and face, kid's weight, and ventilation background increase the possibility of getting afflicted with hearing loss 9.8, 9.1 and 3.5 times respectively among the newborns in Kermanshah. The resulting OR equaled 0.21 meaning that hospitalization in the NHCU for more than 48 hours has a protective influence in getting afflicted with hearing loss.

Conclusion: we may conclude that risk factors such as hearing loss, head and face anomaly, intrauterine infection, the kid's weight, blood transfusion during infancy, ventilation and taking ototoxic medicines by mother during the pregnancy are significant. Further to measuring the hearing of infants before they get three months old and early interventional programs to promote hearing, it is strongly recommended to check every infant before they get three months old for signs of congenital hearing loss.

KEY WORDS: screening, deafness, hearing loss, infants.

1. INTRODUCTION

Nearly half of the infants with hearing loss do not represent any risk factors. The Joint society in US has recommended hearing screening tests for all infants (Zamani, 2010). As of those countries where public screening is not possible, only those infants at risk are studied and these programs are basically based upon using hearing tests before discharge through Otoacoustic emission or Auditory Brain Stem Response (ABR). The goal is to begin interventional treatment before the kid grows to six months old so that language development may remain natural (Association, 2007). The prevalence of bilateral hearing loss in the US is 1 to 2 in every 1000 kids, while this number ranges from 10 to 20 among those kids hospitalized in the NICU (Association, 2007). Early diagnosis and early intervention may help rehabilitate the infant (Pediatrics and Association, 2000). As the results indicate, those kids whose hearing loss has been diagnosed before they grow to be 6 months old and participated in rehabilitation programs had better acquired skills in terms of pronunciation, comprehension, reading, mathematics, social behaviors and effective and good communication with people other than their family (Jahangiri, 2016). They will also be capable of making progress in the consolidated classes of the education bureau and will seldom require special schools: thus they will have less expenditure during their educational years (Farhadi, 2006). Percent of the infants with hearing loss have no signs in their early birth period and suffer from hearing loss while they are in their infancy. Thus, hearing screening programs should be held publicly so that more cases of hearing loss can be diagnosed. As the researches indicate, more than 50% of hearing impaired infants have no risk factors (Vohr, 2001, Yoshinaga-Itano, 1995, Yoshinaga-Itano, 1998, Pediatrics). Some 600 to 700 infants suffering from hearing loss are born in Iran every year. As the best time for language acquisition is from 6 months to 3 years old, diagnosing hearing loss and undertaking the therapeutic measures can be really effective in the intelligence and learning capability of the kid. If the hearing loss of the infant is not diagnosed in the proper time, his learning and language acquisition would deteriorate significantly and this is an important factor that needs to be taken into consideration by parents, especially the mother. Of course it doesn't mean that nothing can be done about the hearing loss if it is diagnosed later, but the important thing is that diagnosis before 6 months old would yield better results. Right now, we have appropriate audiometry and treatments in place for various ages in Iran (Rasolabadi, 2015), but these programs will be more effective if they initiate in earlier ages and will result in better learning capabilities. Currently, there are advanced

equipment and techniques through which hearing loss can be diagnosed in the early age so that the therapeutic procedure could be initiated in the proper moment. The modern progress in the audiometry has made it possible to diagnose hearing loss among the infants in the age of 6 months and even earlier and screening of the infants is conducted with the same goal (Pediatrics, Farhadi, 2006, Watkin, 1991, Finitzo, 1998). No reference has been made to the prevalence and occurrence of risk factors of infants' hearing loss in Iran and other countries, thus the present research aims at identifying the risk factors of hearing loss or deafness among the newly born infants after a few screening tests in 2014 in Kermanshah.

2. METHODS & MATERIALS

Methodology: This is a cross-sectional research conducted on all the newly born infants resorting to social welfare center of Kermanshah in 2013. This study utilized Transient Evoked Otoacoustic Emission (TEOAE) screening method which was used by the audiologist. The information about the newly born infant and the length of mothers' pregnancy was gathered using a checklist prepared for this purpose besides studying the file of the problematic patients and the statistical offices for recording the causes of infants' hospitalization. 11670 infants were studied in this stage. 375 infants came for the second stage of the test and were studied. In each case, one witness infant was selected by natural screening test among 11670 infants through systematic sampling method. For both groups under investigation, the demographic information of the kids and the risk factors associated with deafness such as head and neck anomaly, hospitalization in NICU for more than 48 hours, family background, blood transfusion background, intrauterine infection, taking ototoxic medicine by mother, ventilation, trauma, infant's gender and consanguineous marriage that play a major role in reducing the hearing was collected. Incomplete information in the files and no future visits to the center by parents were set as exclusion criteria. 375 cases were assessed using ABR test and 361 of them visited for a second time. 154 cases were reported to be positive in this stage and 146 of them went to the third stage. Finally, 72 infants were reported to be suffering from certain hearing loss or deafness and managed to enter the therapeutic intervention stage. Our plan in this research was much similar to those which had studied the infants reported as positive by the first stage of OAE test, because they demonstrated this or some other cases of the risk factors associated with deafness. After the full screening using the information in the files based on the previous medical records of the infant, the welfare center staff of Kermanshah helped in extracting the information and entering them in separate checklists for the case and witness groups. Descriptive and inferential statistics were used to analyze the data. The descriptive statistics utilized frequency and percentage, while the Chi-square and logistic regression tests were used for the inferential statistics.

3. RESULTS

We studied the medical files of 750 infants among whom, 375 were in the case and 375 were in the witness groups. As of the case group, 198 (52.8%) kids had the risk factor and 177 (47.2%) had no such factors. As of the witness group, 143 (38.1%) kids had the risk factor while 232 (61.9%) had no such factors (table 1).

Table.1. The time of screening in the case and witness infants

Time of birth	Group	Frequency	Percentage	Total
Early birth	Case	132	35.2	323
	Witness	191	50.9	
The first month	Case	129	34.4	224
	Witness	95	25.3	
The first to the third month	Case	56	14.9	126
	Witness	70	18.7	
The third month onward	Case	58	15.5	77
	Witness	19	5.1	

Concerning the 750 infants studied in the case group, 236 were male and 139 were female. In the witness group, 151 were male and 224 were female. 4.5% and 0.08% of the infants in the case and witness group were suffering from head and face anomaly. 18.2% of the infants in the case group and 3.7% in the witness group were suffering from low weight when they were born.

12.5% of the infants in the case group and 9.3% of the infants in the witness group stayed in the NICU for more than 48 hours. 18.1% of the kids in the case group and 11.2% in the witness group were suffering from hearing loss. 7.5 % of the kids in the case group and 3.7 % in the witness group had a record of blood transfusion during the infancy.

7.2 % of the infants in the case group and 3.7 % in the witness group were suffering from intrauterine infection. 20 % of the mothers in the case group and 13.1 % in the witness group were taking medicines during their pregnancy. 3.7 % of the infants in the case group and 2.4 % in the witness group had a background of trauma. 5.3 % of the infants in the case group and 1.9% in the witness group had a background of ventilation.

The results indicate that risk factors such as hearing loss, head and face anomaly, intrauterine infection, the kid's weight, blood transfusion during infancy, ventilation and taking ototoxic medicines by mother during the pregnancy are significant (table 2).

Table.2.A comparison between the risk factors of hearing in the case and witness group

Variables	Group				Chi-square	P-value
	Case		Witness			
	Frequency	%	Frequency	%		
Family background of hearing loss	68	18.1	42	11.2	11.131	0.001
Trauma background during pregnancy	14	3.7	10	2.4	1/77	0.189
Head and face anomaly	17	4.5	3	0.8	11.862	0.001
Intrauterine infection	27	7.2	14	3.7	6.091	0.014
Hospitalization in NICU more than 48 h	47	12.5	35	9.3	3.821	0.055
Infant weighing less than 2500 g	68	18.2	14	3.7	47.282	0.001
Blood transfusion in childhood	28	7.5	14	3.7	6.803	0.007
Taking ototoxic medicines by mother during pregnancy	75	20	49	13.1	10.600	0.001
Background of ventilation during pregnancy	20	5.3	7	1.9	8.150	0.004

The results indicate that the risk factors such as head and face anomaly, hospitalization in the NICU for more than 48 hours, infant's weight, and ventilation can increase the chance of affliction with hearing loss among the infants born in Kermanshah 9.8, 0.21, 9.1, and 3.5 times respectively (Table 3).

Table.3.The relative comparison between the hearing loss factors among the newborn infants in Kermanshah

Variables	Groups				p-value	OR (CI 95%)
	Case		Witness			
	Frequency	%	Frequency	%		
Head and face anomaly	17	4.5	3	0.8	0.003	9.80(2.16 – 44.4)
Hospitalization in NICU for more than 48 hours	27	12.5	35	9.3	0.001	0.21(0.09 – 0.51)
Infant's weight	68	18.2	14	3.7	0.001	9.17 (4.1 – 20.4)
Ventilation	20	5.3	7	1.9	0.039	3.50(1.06– 1.57)

DISCUSSION

Hearing loss is defined as the reduction in the ability of comprehending sounds (Farhadi, 2006). It is in fact a kind of disability among humans which can never be observed, but it is still a hidden disability (Yantis and Katz, 1994). The prevalence of hearing loss is nearly 28 times more than Phenylketonuria (PKU), 8 times more than Hypothyroidism, 5 times more than cystic fibrosis, and 20 times more than Hemoglobinopathy (Mehl and Thomson, 1998). As a result we may consider it as one of the most common congenital disorders among infants.

We studied the medical files of 750 infants among whom, 375 were in the case and 375 were in the witness groups. The screening time in the case groups was as follows: 132 (35.2%) in early birth, 129 (34.4%) in the first month, 56 (14.9%) in the first to the third months and 58 (15.5%) in the months following the third month. The screening time in the witness groups was as follows: 191 (50.1%) in early birth, 95 (25.3%) in the first month, 70 (18.7%) in the first to the third months and 19 (5.1%) in the months following the third month. As of the case group, 198 (52.8%) kids had the risk factor and 177 (47.2%) had no such factors. As of the witness group, 143 (38.1%) kids had the risk factor while 232 (61.9%) had no such factors. The risk factors diagnosed in the NIDCD committee and Joint Commention included positive family background, Hyperbilirubinemia with blood transfusion, TORCH (Watkin, 1991), weighing less than 1500 grams, low Apgar, bacterial meningitis, Aminoglycosides and mechanical ventilation (Zamani, 2004). Our study took into consideration most of these factors and all of them were significant.

One of the setbacks of the screening test is the false positive cases and the process of re-screening is designed for the same purpose. A poor response does not necessarily mean deafness. Receiving a response when the infant is restless or in a crowded room or when there is a liquid in the ear as a result of delivery will be affected (Barbi, 2006).

The following results were achieved in the research conducted by Vohr et al about the hearing disorder: ototoxic medicines have a share of 44.5%, intense low birth weight has a share of 17.8% and mechanical ventilation has a share of 16.4% among all the risk factors. The share of taking ototoxic medicines is twice as much as the results achieved in our research. The share of low birth weight in our research plays a more important role (19.2) and this is nearly in line with the results of our research (Vohr, 2000). In a research conducted by Soheyl Pour et al on 628 infants, neonatal jaundice and blood transfusion was reported among 13.40 % of the kids, while this frequency was less than 7.9% in our research (Soheilipour, 2012). In the research conducted by the Institute of Health Sciences of

IACECR about the risk factors that contribute to deafness among infants, taking ototoxic medicines was reported among 3.1% of the infants, while our study found a value of 21.1% for this variable. The neonatal jaundice causing blood transfusion had caused 3.3% of the cases, while this level was 7.9% in our study. Mother's trauma during pregnancy was 15.9%, while our research reported a share of 3.9% which was much less than the study conducted by IACECR. The research conducted by IACECR reported a share of 13.8% for the mother's disease during the pregnancy, while our study found a value of 7.6 for the same factor (Eckerle, 2014).

In the research conducted by Chan, 90% of the deaf infants were born in families with absolutely no records of deafness (22). Thus, the role of deafness gene which was 19.2% in our research seems to be acceptable. In another study conducted by Cumming (2005) only 2 to 5 percent of the infants with one or more risk factors were in the danger of average to deep hearing loss; 95 to 98 percent of the infants with one or more risk factor had normal hearing. Thus, 50% of the infants with average to deep hearing loss have no risk factor associated with hearing loss, and this means that the condition of the presence of risk factors as an indication of screening the hearing will result in at least 50% of the infants with congenital hearing loss not diagnosed.

4. CONCLUSION

Based on the results of the present research, screening the infants' hearing and its risk factors (considering the geographical location) is a practical, beneficial and justifiable undertaking in terms of the scientific and economic principles. This can be easily justified by considering the frequency and prevalence of the disease, accuracy of screening tests, ability for early therapeutic and rehabilitating interventions, the favorable results achieved by the early reinforcement of infants' hearing, reduction of all screening costs in order to prevent the later costs associated with rehabilitating intervention, improving the awareness and culture of the families and society about hearing, early diagnosis and therapeutic interventions. Furthermore, the prevalence of congenital bilateral hearing loss in societies is many times as big as the total prevalence of all other forms currently screened among the infants using blood samples. Thus, the presence of this fact is considered to be a serious warning and it is our duty to pay greater attention to it. As the usefulness of recognizing the risk factors as the factors causing deafness based on the geographical location becomes clear and as the share of each one is determined, high levels of these factors can be considered as a warning for families and the authorities who are actively involved in this issue. It is, thus, strongly recommended to screen the infants before they grew to 3 months old for congenital hearing loss.

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