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ORIGINAL ARTICLE

Auditory Screening Program of Newborns with Risk and Well Babies in Turkey

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Objective: Every 1 to 3 newborn babies out of 1000 is born with a hearing loss. It is known that certain risk factors increase the risk of hearing loss. In this study, in respect to congenital hearing loss, it is aimed to identify the babies in risk with hearing impaired individuals in family, consanguineous marriage, low Apgar scores etc. and well babies through the auditory screening programme of newborns, and to determine whether the risk factors have a statistical significance or not in babies who failed in screening.

Materials and Methods: One thousand five hundred sixty six newborns were included in this research. Following the measurements made by immitancemetry on all, babies without risk were tested through Transient Evoked Otoacoustic Emissions (TEOAE) and Distortion Product Otoacoustic Emissions (DPOAE) while the babies at risk were further tested through Automatic Auditory Brainstem Response (AABR). The babies who failed at these tests were applied diagnostic ABR and behavioral tests.

Results: The difference between the groups of at-risk and without risk was significant (p<0,001) that was not similar as compared with several studies in literature. This difference might be due to the fact that 48 babies (92.30%) out of 52 who failed at screening were born in countryside.

Conclusion: Auditory screening should be performed on all newborn babies whether they have risk or not. Even if the babies at risk do not fail in screening, their families should be informed about this matter and warned to continue on with the follow-ups.

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Introduction

Congenital hearing loss may affect mental, emotional, and social developments as well as speech and language developments if it is not diagnosed early and rehabilitated. Although it varies in countries, every 1 to 3 newborn babies out of 1000 are born with a hearing loss. The early diagnosis and rehabilitation of these babies are possible now with the help of technological advancements, hence the ability of speech and language using of children with hearing loss have been reached to the level of their peers. As a result, it is suggested to make auditory screening programs for newborns [1-8].

In our country, the first newborn auditory screening began in 1996. The national newborn auditory screening was launched as a pilot project in Ankara. The countrywide newborn auditory screening project was set into run in 2004. In our university, we started the newborn auditory screening in January 2008 by offering services for screening as well as for audiological habilitation.

Prenatal, natal and postnatal risk factors on congenital hearing loss have already been indicated by many studies [9-15]. In current study, we aimed to identify the babies with risk and without risk through the newborn auditory screening program, and to determine whether the risk factors have a statistical significance or not in babies who failed in screening.

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Materials and Methods

One thousand five hundred sixty six babies who were born at hospitals in Eskisehir and cities around between February 2008 and August 2010 were included in this study. Sixty-five percent of them (1019 babies) were either born in the University Hospital or transferred to the newborn division of the Pediatric Clinics. The remaining births (547 babies) were existed in other hospitals having screening programs or outside without auditory screening programs which referred to our center for advanced screening, and rehabilitation. 24 babies which included in the screening program were not brought for further evaluation even they were invited; and 4 babies who died during the study were not included in this study.

Before screening, ear-nose-throat examination was performed on all babies. Each family was informed about both the screening protocol and the outcomes if the procedure is not applied. They were also provided brochures and follow-up forms which all the family background, prenatal, natal, and postnatal information regarding the babies were recorded. The risk factors considered in the study is shown in Table 1.

Table 1. Risk factors for sensorineurol hearing loss in newborns

Hearing impaired individuals in family
Consanguineous marriage
Disease like TORCH in pregnancy
Craniofascial anomaly
Low birth weight
Usage of ototoxic medicine in pregnancy
Low Apgar scores
Blood exchange or transfusion
Enfections like menengitis /sepsis
Mechanical ventilator / intensive care needs
Syndrome with sensorineurol hearing loss
Blood incompatibility
Mother with systemic diseases
Trauma/difficult delivery (aspiration of meconium)
History of febril convulsion

Following the measurements made by immittancemetry, the risk-free babies were submitted to TEOAE and DPOAE while the babies at risk were examined AABR additionally. Diagnostic ABR and behavioral tests were applied to babies who failed through the mentioned screening program TEOAE was performed with a click sound stimulus at non-linear 60 Hz while DPOAE was measured at 2000-2500-3200 and 4000 Hz. The measurement of AABR was made by using a narrow band click stimulus at 35 dB nHL. The measurement results were evaluated as "pass" or "refer (failed/suspicious)". The parents of babies without risk and passed through screening program were informed about the language development. The babies being in the risk group and passed through the screening program were followed in every 6 months until the age of 3, and then once a year until the age of 7. During each visit, TEOAE, DPOAE, and AABR screenings were performed as well as ear-nose-throat examination and immittancemetry tests and advanced audiological evaluations if necessary. (Figure 1).

Study proposal has been approved by Eskisehir Osmangazi University Ethical Committee with the number of PR-09-10-15-14.

Results

Fifty two babies (3.32%) out of 1566 were failed in auditory screening program. 22 babies (1.40%) were detected to have a hearing loss in one ear. 501 babies (31.99%) were evaluated in the risk group where 469 (29.94%) of them passed through the screening program while 32 (2.04%) of them were failed. The difference between the groups of at-risk and without risk was significant ($p<0.001$). The pass and fail numbers and ratios in screening programs of the babies who were fallen into the risk group in respect of sensorineural hearing loss are given in Table-2. The "fail" incidence of the babies having families with hearing impaired individuals or with consanguineous marriage was high ($p<0.001$). The babies fell in the risk group but passed in screening in 36 months follow-ups did not have hearing loss. The follow-up of the patients are still on-going.

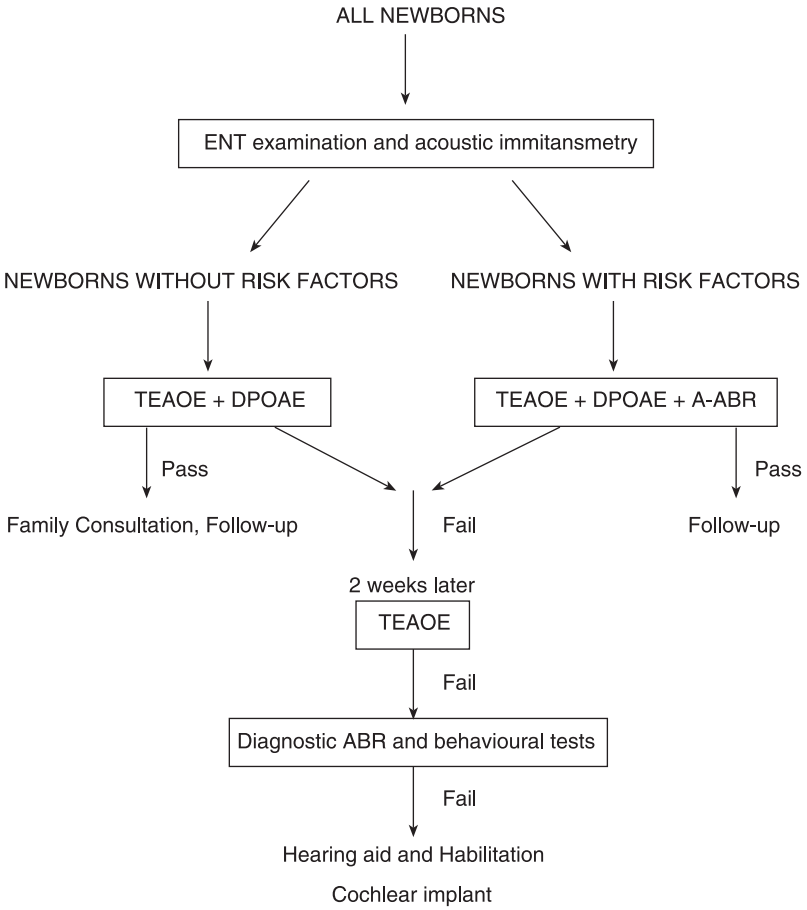

Figure 1. Algorithm of newborn auditory screening programme in our institute

Table 2. The pass and fail numbers and ratios in screening programmes of the babies who have one or a few risk factors in respect of sensorineural hearing loss

	Pass (n/ %)	**Fail (n/ %)**	**Total (n/ %)**	**p value**
Hearing impaired individuals in family	13/0.83	9/0.57	22/1.40	p<0.001
Consanguineous marriage of family	84/5.35	14/0.89	98/6.25	p<0.001
Diseases like TORCH in pregnancy	1/0.06	0	1/0.06	p>0 .001
Craniofascial anomaly	16/1.02	1/0.06	17/1.08	p>0 .001
Low birth weight	90/5.74	2/0.12	92/5.87	p>0 .001
Usage of ototoxic medicine in pregnancy	13/0.83	0	13/0.83	p>0 .001
Low apgar scores	31/1.97	3/0.19	34/2.17	p>0 .05
Blood exchangeor transfusion	18/1.15	0	18/1.15	p>0 .05
Enfections like menengitis/ sepsis	29/1.85	0	29/1.85	p>0 .05
Mechanic ventilator/ intensive care needs	119/7.59	4/0.25	123/7.85	p>0 .05
Syndromes with sensorineural hearing loss	5/0.32	1/0.06	6/0.38	p>0 .05
Blood incompatibility	97/6.19	2/0.12	99/6.32	p>0 .05
Mother with systemic diseases	35/2.23	3/0.19	38/2.42	p>0 .05
Trauma /difficult delivery	48/3.06	2/0.12	50/3.20	>0 .05
History of febril convulsion	57/3.63	2/0.12	59/3.76	p>0.05

Moderate sensorineural hearing loss was detected in 23 out of 52 babies failed in screening and this was calculated to be 1.46% of the whole set. These babies were proposed to use hearing aids and referred to the rehabilitation centre. Cochlear implantation was performed in 10 babies (0.63%) at age one, who were detected to have profound hearing loss and used hearing aids. 19 babies (1.21%) who are still under the age of 1 were given hearing aids and accepted as a cochlear implant candidates.

Discussion

The hearing screening programs started at the second half of 1900s. Initially only the babies at risk in respect to hearing loss were screened. Later [13,14], only the 50% of the babies with congenital hearing loss was detected to be at risk. In 2000, American Academy of Pediatrics suggested that the auditory screening should be performed on all newborns [16]. Universal newborn hearing screening has been started in 2004 in Turkey. Unfortunately, recent data shows that, auditory screening could be performed on approximately 60 % of the newborn population. This ratio, when compared with some countries, is still low. In our study, sensorineural hearing loss was detected in 52 babies (3.32%) out of 1566 screened. This ratio is well-matched with the finding of Turkish Disabled People Investigation but higher than those of other countries.

In the literature, the risk factors of hearing loss in newborns have already been reported [9-15, 17] and we have not realized any additional factor in our study. As mentioned in Table-3, consanguineous marriage and hearing impaired individuals in family background were the two main risk factors. This finding may be related with the fact that both factors are common in our country especially in the countryside. Beyond these two specific factors, the highest incidence of risks is related with the needs of using mechanical ventilator / intensive care, and low Apgar score. Although the risk factors were reported to elevate the risk of hearing loss in newborns, no significant difference between the “risk” and “non-risk” groups was determined [17, 18]. In our study, the difference between the “risk” and “non-risk” groups that were “failed” through screening was significant ($p<0,001$).

The number of babies who were born within the University Hospital and screened was very low. 48 (3.06%) out of 52 babies who failed in screening and born in rural areas and transferred from other healthcare institutions for screening could have affected the statistical results of our study.

The screening procedures, except for the early diagnosis of hearing losses, should also aim to evaluate the follow-ups, intervention and screening results. Especially the babies at risk, even if they passed in screening, are required to follow up due to the risk of late-onset hearing losses. For the babies failed in auditory screening, on the other hand, the audiological diagnosis and rehabilitation centers are required where advanced examinations can be made, easy to access, and expert audiologists provide efficient help [16,19-23]. Our institute offers services for screening as well as for audiological diagnosis for the babies born at our university as also being the final audiological rehabilitation center for the babies born in other centers and failed in screening. The algorithm of newborn auditory screening programme in our institute is mentioned in Table-2. There are no sufficient resources in the literature about the long term follow-up of the babies passed in screening and having at least one risk factor, and the possible incidence of hearing losses. The babies at risk passed in screening in our institute are followed up in every 6 months until the age of 3, and then once a year until the age of 7. During each visit, OAE and OABR screenings are performed as well as ear-nose-throat examination and immittancemetry tests, and if needed, advanced audiological evaluations. In 6-36 (average) months follow-up, no late onset hearing loss was identified in the babies at risk; however, the periodical follow-ups are still on-going.

Auditory screening should be performed on all newborn babies whether they have risk or not. Even if the babies being at risk do not fail in screening, their families should be informed about this matter and warned to continue the follow-ups. The public awareness should be raised about the risks of consanguineous marriages and marriages of hearing impaired individuals. Additionally, within the scope of

newborn auditory screening, the babies who failed in tests should not be ignored to transfer to well-equipped centers for the purposes of advanced diagnosis, examination, and rehabilitation. If any disorder or defect is common in population, possible to treat and to prevent or decrease with the help of early diagnosis and treatment, it should be screened.

Conflict of interest

None to declare.

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