



Features of unilateral hearing loss detected by newborn hearing screening programme in different regions of Turkey

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ARTICLE INFO

Article history:

Received 1 March 2012

Accepted 27 September 2012

Available online 23 October 2012

Keywords:

Newborn hearing screening (NHS)

programme

Unilateral hearing loss (UHL)

Risk factors

Consanguinity

Familial hearing loss

ABSTRACT

Objective: Newborn hearing screening (NHS) works well for babies with bilateral hearing loss. However, for those with unilateral loss, it has yet to be established some standard rules like age of diagnose, risk factors, hearing loss degree. The aim of this study is to identify the demographic characteristics of newborns with unilateral hearing loss to obtain evidence based data in order to see what to be done for children with unilateral hearing loss (UHL).

Method: Newborn hearing screening data of 123 babies with unilateral hearing loss, 71 (57.7%) male and 52 (42.3%) female, were investigated retrospectively. Data provided from the archives of six referral tertiary audiology centers from four regions in Turkey. Data, including type of hearing loss; age of diagnosis; prenatal, natal and postnatal risk factors; familial HL and parental consanguinity was analyzed in all regions and each of the Regions 1–4 separately.

Result: The difference between data obtained in terms of gender and type of hearing loss was detected as statistically significant ($p < 0.05$). While UHL was significantly higher in females at Region 1, and in males at other Regions of 2–4; SNHL was the most detected type of UHL in all regions with the rate of 82.9–100.0%. There were not significant differences between regions in terms of the degree of hearing loss, presence of risk factors, family history of hearing loss, age at diagnosis and parental consanguinity ($p > 0.05$). Diagnosis procedure was completed mostly at 3–6 months in Region 4; whereas, in other regions (Regions 1–3), completion of procedure was delayed until 6 months–1 year.

Conclusion: This study indicates that the effect of postnatal risk factors, i.e. curable hyperbilirubinemia, congenital infection and intensive care is relatively high on unilateral hearing loss, precautions should be taken regarding their prevention, as well as physicians and other health personnel should be trained in terms of these risks. For early and timely diagnosis, families will be informed about hearing loss and NHS programme; will be supported, including financial support of diagnosis process. By dissemination of the NHS programme to the total of country by high participation rate, risk factors can be determined better and measures can be increased. Additionally, further studies are needed with more comprehensive standard broad data for more evidence based consensus.

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1. Introduction

The introduction of newborn-hearing screening has enabled early childhood hearing loss to be diagnosed and increased the number of children undergoing early care [1]. Newborn hearing screening has great importance for children with congenital hearing loss; and plays an important role in early diagnosis as well

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as reducing the negative effects of hearing loss [2,3]. National newborn hearing screening program makes it possible to diagnose bilateral and unilateral hearing loss in the first months of life in our country, as all over the world [4].

The prevalence of hearing loss in newborns ranged from 1/1000 to 6/1000 [5]. In 1/1000–3/1000 of healthy newborns, and in 2–4% of babies treated in intensive care unit, significant hearing loss was occurred in both ears [4,6,7]. Bolat et al. [4] reported that the incidence of bilateral hearing loss was 417/2136 (19.5%) for Turkey, whereas for one-sided hearing loss, this rate was 320/2136 (14.9%).

According to reports from New York State Universal Newborn Screening Demonstration Project, prevalence of unilateral hearing loss was specified as 0.83/1000; and Directors of Speech and Hearing Programs in State Health and Welfare Agencies indicated that rates of one-sided hearing loss in school age children were 100 times more than the rate of that of infants [8].

Newborn hearing screening (NHS) programme for hearing loss is important for early diagnosis and early treatment or hearing aids applications. The aim of the study is to evaluate the NHS data for unilateral hearing loss (UHL). Data was achieved from six 3rd Step Newborn Hearing Screening Center (3rd SNHSC) from four regions of Turkey. Risk factors, familial hearing loss and parental consanguinity were investigated; and using evidence-based data, precautions and suggestions were demonstrated.

2. Materials and methods

This multicenter study including screening of the children with HL is conducted by six “3rd Step Newborn Hearing Screening Center (3rd SNHSC)” in four regions according to the criteria of Health Ministry of Turkey [4].

2.1. Newborn hearing screening (NHS) programme details of Health Ministry of Turkey [4]

2.1.1. Centers

Newborn hearing screening programme was conducted by screening centers of 1st–3rd step in Turkey. In diagnostic center; it was aimed to diagnose around 3 months by electrophysiological and behavioral tests; and then hearing aid fitting and orientation training started. Sometimes, process of diagnosis are delayed to 5–6 months in practice due to some problems such as an appointment system, families' fail to bring the baby to the center, difficulties on conclusion of the diagnostic tests, etc. These centers are classified as below:

1. *1st step Newborn Hearing Screening Center (1st SNHSC)*: the first screening test was performed before discharge after the birth. These centers may be Maternity Hospital, State Hospitals or University Hospitals.
2. *2nd step Newborn Hearing Screening Center (2nd SNHSC)*: in this center, AABR equipment and ENT doctor (for ENT examination) were present.
3. *3rd step Newborn Hearing Screening Center (3rd SNHSC)*: Clinical audiologist and equipment for audiological diagnosis were present in the comprehensive audiology clinic.

2.1.2. Screening test method in the centers

Screening tests with the sequence of the algorithm are as follows:

1. *At 1st SNHSC*: at the hospital just after 2–3 days of the birth, hearing screening before discharge in the hospital where the birth was performed: automated otoacoustic emission screening (AOAE) was performed initially.

- If the baby passed bilaterally, the family was given information.
 - If the baby cannot pass the A-TEOAE, he/she will be invited to control screening test after 15 days.
 - If there is A-ABR device in 1st SNHSC, A-ABR is done to the baby who cannot pass the second A-TEOAE. If there is not A-ABR device in 1st SNHSC, the baby who cannot pass the second A-TEOAE, will be referred to 2nd SNHSC.
2. *At 2nd SNHSC*: 15-day after the birth: if the baby cannot pass the 15th day-second screening test, A-ABR and ENT examination will be performed at 2nd SNHSC. Babies with risk factors and babies to not have passed A-TEOAE must be screened by AABR and ENT examination before being routed to the center (3rd SNHSC).
 - If the baby passed bilaterally, the family was given information.
 - If the baby cannot pass from one or two ears, he/she will be directed to 3rd SNHSC. The latest time to go to 3rd SNHSC was the babies' 2-month age.
 3. *At the comprehensive 3rd SNHSC*, by using behavioral and electrophysiological test methods, the diagnosis of HL was performed [9,10]. During diagnosis period, it was noticed that auditory stimuli thresholds vary depending on age of the children [10]. On the basis of these criteria, HL of the children were diagnosed and classified.

2.2. Centers in the study

1. *Region 1 – Ankara*: these centers are localized in Ankara, a city and capital of Turkey in Central Anatolia Region. The data was collected by three 3rd SNHSCs, namely Hacettepe University Faculty of Medicine, Audiology Division of ENT Department; Hearing & Balance Disorders, Diagnose and Rehabilitation Center of Atatürk Research and Training Hospital of Ministry of Health; and Ministry of Health, Dışkapı Yıldırım Beyazıt Research and Training Hospital, Audiology Division.
2. *Region 2 – Samsun*: this center is localized in Samsun, a city in Black Sea Region. The data was collected by a 3rd SNHSC, namely 19 Mayıs University Faculty of Medicine, Audiology Subdepartment of ENT Department.
3. *Region 3 – İzmir*: this center is localized in İzmir, a city in Aegean Region. The data was collected by a 3rd SNHSC, namely Dokuz Eylül University, Faculty of Medicine, Hearing Speech and Balance Center of ENT Department.
4. *Region 4 – Adana*: this center is localized in Adana, a city in Mediterranean Region. The data was collected by a 3rd SNHSC, namely Çukurova University Faculty of Medicine, Balcalı Hospital, Audiology Division of ENT Department.

2.3. Subjects

The retrospective data obtained from 123 children being diagnosed as unilateral hearing loss by 3rd diagnostic centers (3rd SNHSC) of newborn screening programme implemented in Turkey by the Ministry of Health [4] were included into this study. The gender distributions of these 123 children with HL was 71 male (57.7%) and 52 female (42.3%).

All children's hearing screening was performed by A-TEOAE and A-ABR; and ENT examination and diagnostic audiological tests were conducted for babies diagnosed with suspected UHL in diagnostic centers. Diagnostic audiological evaluations cover multi frequency (1000 Hz Probe tone) tympanometric measurement, diagnostic ABR and age-appropriate behavioral tests. In behavioral tests, both ears of the baby were also evaluated separately by using insert earphones. During diagnosis period, it was noticed that auditory stimuli thresholds vary depending on age of the children.

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