INNOVATIVE PUBLICATION
Journal of Effective Learning and Sustainable Innovation
Vol.3 №2 (2025). February
innovativepublication.uz

METHODS FOR DIAGNOSING HEARING LOSS IN CHILDREN IN THE FIRST YEARS OF LIFE

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Abstract: The aim of the study is a comparative analysis of objective methods for studying the auditory function in children and identifying factors influencing the results of the study. Patients and methods. The hearing was studied in 473 children aged 3 months to 5 years suffering from sensorineural hearing loss and deafness. The comparison group consisted of 30 children with normal hearing. Along with the standard clinical examination of the ENT organs, all children underwent tympanometry and reflexometry, a study of delayed evoked otoacoustic emission and otoacoustic emission at the frequency of the distortion product, registration of short-latency auditory evoked potentials and auditory potentials to a continuously modulated tone (ASSR).

Keywords: sensorineural hearing loss, hearing test, deafness, children.

INTRODUCTION. The first years of a child's life are important for the development of speech, cognitive skills and intelligence. Hearing impairment in a child leads to a disruption of his speech development. When speech development is delayed, intelligence development is delayed for a second time [1]. At the same time, according to literature, 82% of children develop hearing impairments in the 1st–2nd year of life, that is, in the pre-speech period or during the period of speech development [1]. Timely and correct diagnosis allows for the earliest possible start of hearing rehabilitation and the child's integration into the speech environment. The introduction of modern diagnostic equipment

into practice, the development and improvement of the latest technologies for electroacoustic hearing correction and cochlear implantation open up new possibilities in the diagnosis and treatment of diseases of the organ of hearing.

MATERIALS AND METHODS. Despite the achievements of modern otolaryngology and surdology, many complex problems arise in diagnosing hearing in young children. At the age of up to 3 years, difficulties arise in diagnosing the hearing level, choosing the parameters of electroacoustic hearing correction, and when deciding on the need for cochlear implantation in young children under 2-3 years old, it is quite difficult to objectively assess the exact hearing thresholds. The peculiarities of hearing research in children under 2 years old are due to the impossibility of conducting audiometry, which requires a certain level of development of the child and his cooperation in the study. In children under 3-4 years of age, objective audiometry methods are widely used, which also do not require the cooperation of the subject [2]. In most children over 3-4 years old, play audiometry can be performed. In addition, there are play audiometry methods that allow you to quickly and reliably examine the hearing of intellectually intact children starting from 2 years of age, for example, the "Pilot Test" (speech audiometry in a playful form) [3]. If, however, a hearing problem is revealed when using this method, it is necessary to use objective methods. In addition, L. V. Neiman also draws attention to the fact that children with hearing impairments lack the skills of listening to sound, and therefore they react only to stimuli whose intensity significantly exceeds the threshold, which leads to overdiagnosis of the degree of hearing impairment [4, 5]. It is believed that the most reliable methods for examining hearing in children are objective methods [2].

A study of hearing was conducted in 473 children aged 3 months to 5 years suffering from sensorineural hearing loss and deafness. The comparison group consisted of 30 children with normal hearing.

RESULTS AND DISCUSSION. The most common risk factors in the history of children with sensorineural hearing loss or deafness were: gestational age less than 37 weeks (17.3%); birth weight less than 1500 g (3.4%); birth injury or asphyxia during childbirth (7.8%); hyperbilirubinemia greater than 200 μmol/l in the neonatal period (2.1%); previous use of ototoxic drugs (5.5%); maternal illnesses in the first half of pregnancy that could lead to hearing loss, such as rubella, scarlet fever, measles, herpes (7.4%); acute meningitis (2.5%) in children; traumatic brain injury (0.6%); aggravated heredity in the form of deafness or hearing loss in parents (12.3%). It is important to note that only 23% of children in the study group had no risk factors for hearing loss, 46% of children had only one risk factor, 25% of children had 2–3 risk factors, and 5% of children had more than 3 risk factors.

The advantages and disadvantages of various objective methods for examining the organ of hearing are analyzed.

1. Registration of delayed evoked otoacoustic emission (DEOAE) and OAE at the frequency of the distortion product (DP-gram) are used as a screening method. Both methods are objective, easy to perform, and take no more than 10–15 minutes.

In the comparison group (children with normal hearing, 60 ears), delayed evoked otoacoustic emission was registered in 56 cases. In 4 cases, we observed false positive results. These were children who did not undergo infant screening and did not have hearing impairment. In 3 cases, the EOAE was not recorded due to dysfunction of the auditory tube, and in 1 case, due to the non-standard structure of the external auditory canal. Thus, a relative disadvantage of the methods for recording various classes of auditory evoked potentials is their dependence on the condition of the outer and middle ear, and therefore they require preliminary cleaning of the ear canal from wax and epidermis; the methods are also uninformative in the presence of middle ear pathology (acute otitis media and exudative otitis).

In the group of children with sensorineural hearing loss and deafness (946 ears), delayed evoked otoacoustic emission was not recorded in 941 cases. In 6 cases, delayed evoked otoacoustic emission was recorded, despite the hearing impairment, based on behavioral thresholds, play audiometry data, and the results of testing the child by a teacher of the deaf. Subsequently, retrocochlear pathology was diagnosed in 3 of these children (2 binaurally and 1 monaurally) after recording ABR and conducting an ASSR test; auditory neuropathy in 2, and central hearing impairment due to organic brain damage, encephalopathy, and multiple cysts of the temporal lobes of the brain in 1.

During the registration of OAE at the frequency of the distortion product (DP-gram) in the comparison group, TEOAE was registered in 57 cases. In 3 cases, we observed false-positive (erroneously detected) results. In the group of children with sensorineural hearing loss, TEOAE was not registered in 942 cases, registered in 4. The methods of registering OAE reflect the state of the hair cells of the organ of Corti, however, they do not reveal retrocochlear pathology. When conducting audiological hearing screening based only on the registration of various classes of OAE, it is possible to obtain erroneous results in children with retrocochlear (central) pathology of the auditory analyzer.

In our study, the sensitivity (Se) of the TEOAE registration method was 99.5%, and the specificity (Sp) was 93.3%. The sensitivity and specificity of the OAE registration method at the distortion product frequency (DP-gram) were 99.6 and 95.0%, respectively.

2. Tympanometry is used to exclude middle ear pathology. The method does not provide an idea of the child's hearing level, but allows excluding latent otitis media (for example, exudative otitis media).

3. Acoustic reflexometry allows indirectly judging the child's hearing thresholds, since in the presence of hearing loss, the reflex thresholds increase and then disappear (with hearing loss of grades III-VI and deafness).

4. Registration of brainstem ABR. This method is used both for in-depth audiological examination and as a screening (if one stimulation level is used - 40 dB normal hearing thresholds). Registration of ABR reflects the activity of the entire auditory pathway and is less dependent on the state of the sound-conducting system.

CONCLUSION. Most children (77%) suffering from sensorineural hearing loss and deafness have a history of various risk factors for hearing loss. The most sensitive (Se = 100%) and specific (Sp = 98.3%) method for diagnosing hearing levels in children is the recording of short-latency auditory evoked potentials of the brainstem.

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