International Research Journal of Pharmacy and Medical Sciences
ISSN (Online): 2581-3277

Brainstem Auditory Evoked Potentials in the Diagnosis of Sensoroneural Hearing Loss in Children with Perinatal Pathology of Central Nervous System

Doina Chiaburu- Chiosa[1], Mihail Maniuc[2]
[1, 2]Department of Otorhinolaryngology, "N.Testemiţanu" State University of Medicine and Pharmacy

I. ACTUALITY

Children hearing loss is far beyond the scope of otology, since audition is the basis of developing speech and cognitive abilities, as well as the child's personality. Due to its incidence and severe consequences that often lead to disability, hearing loss remains an acute issue for scholars and specialists of various fields. According to worldwide-specialized literature, the occurrence of this disorder remains quite common and differs from one source to another. Statistical data provided by the National Institute of Deafness and Other Communication Disorders (NIDCD) show that deafness occurs in 1-3 cases per 1,000 healthy newborns and in 2-4 cases per 100 newborns admitted to Neonatal Intensive Care Unit. The prevalence of neonatal deafness increases by 10-50 times in newborns with risk factors. 9 out of 10 newborns with congenital deafness come from families with hearing-impaired parents. Numerous sources of literature reveal that one child per 1,000 is born deaf and one per 1,000 acquires deafness during the childhood. The incidence of hearing impairment is 60 times higher than the incidence of congenital metabolic diseases , which currently involves a universal screening program, such as phenylketonuria with an incidence of 1/20000 live births.

II. PURPOSE OF THE STUDY

This study aims at investigating the particularities of ECG response and limitations of brainstem auditory evoked potentials in the diagnosis of sensorineural hearing loss in children with perinatal pathology of the central nervous system.

III. MATERIALS AND METHODS

The audiologic examination was carried out by recording the brainstem auditory evoked potentials at the Republican Center of Audiology, Institute of Mother and Child. The study included 110 children (study group) with a variety of neurological disorders and sensoroneural hearing impairment and 30 children (control group) with normal hearing. The groups were divided according to their age and gender, and involved children aged 1 to 36 months.

TABLE I. Distribution of patients by gender and age.

Patients	110 children
Boys	43 (39,09%)
Girls	67 (60,90%)
Age (years)	1-36 months

Depending on the degree of deafness, children in the study group were divided into three groups: 29 children with moderate hearing impairment, 51 severely deaf and 30 profoundly deaf children. Evoked potential recording was performed according to the conditions and parameters required for this method. Children were under a physiologic or medication-induced sleep.

TABLE II. Distribution of patients type of deafness.

Patients	110 children
Moderate hearing loss	29 children
Severe hearing loss	51 children
Profound hearing loss	30 childen

IV. RESULTS AND DISCUSSIONS

The auditory threshold value measured by V-wave of hearing potential within group of moderately deaf children was 61.69 dB ± 1.09 dB; in children with severe deafness - 76.92 ± 0.64 dB; in the group of children with profound hearing loss was 97.69 ± 0.96 dB. The brainstem auditory evoked potentials recorded in children from the study group were determined mostly by the pathological pathway that did not have all the components. In most cases it was determined only by waves I and V, whereas the wave III was the most unstable. Wave I was mostly detectable in moderately deaf children -84.03%; it was absent in cases of severe deafness - 16.67% and 53.33% in the profoundly deaf group. The study group exhibited absence of wave I or III, as well as a completely atypical pathway response due to the lack of all the components or blurry, non-reproducible waves I, III and V. For these reasons, 15.45% (34 ears) of children in the study group presented absent potentials. The obtained data analysis reveals changes of the electrophysiological pathway response, as well as a prolonged latency of waves I, III, V and I-V interval compared to the control group. The results of our study recorded a prolongation of latency for wave I, III, V and IV with an increased risk of hearing loss. Our findings confirm the conclusions of the other researchers regarding the impact of auditory and neurological lesions on the morphology of the auditory evoked potentials pathway and component latency, the latter, however, do not interfere with the functional hearing assessment that is based on.

We have studied in dynamics the auditory evoked potentials in 43 deaf children with moderate deafness, 22 with severe deafness and 12 with profound hearing loss after a neurological treatment. We found an improvement of the

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morphological pathway that allowed identifying waves I and III in most cases, compared to the initial examination. The initial examination identified wave III in 25% of moderately deaf children compared to 50% found on longitudinal examination, 35.71% of severe deaf children compared to 16.67% at the initial control and 41.67% compared to 16.67% in the group of children with profound hearing loss. Longitudinal control proved an improvement in the identification of the waves as well as of the entire pathway, which made it possible to record the auditory evoked potentials in cases where these hot been revealed at first. Therefore, the auditory potentials were absent in 22.73% (10 ears) of severely deaf children at the initial examination, whereas the dynamic examination confirmed their absence only in 4.55% (2 ears). The profoundly deaf group exhibit even more impressive results such as 75% of cases (18 ears) which did not record PEATC at first examination, the absence was confirmed in 8.33% (2 ears) at a repeated control. It should be noted that the absence of potentials at a repeated examination was defined by a flat curve, characteristic of a rather significant hearing loss, compared to a completely atypical pathway at the initial examination. These results confirm that the auditory evoked potentials are sensitive to CNS disorders.

V. CONCLUSIONS

The brainstem auditory evoked potential is an objective and reliable method in the diagnosis of deafness in children with perinatal pathology of the central nervous system that remains a reference approach in complex hearing assessment.

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