American Journal of Medicine and Medical Sciences 2020, 10(4): 209-211
DOI: 10.5923/j.ajmms.20201004.07

Experience with the Visual Evoked Potential Method in Children with Cognitive Impairment

Mirdjurayeva Nargiza[1,*], Shamansurov Shaanvar[2], Gulyamova Maktuba[3]

[1]A Researcher at the Tashkent Institute of Postgraduate Medical Education
[2]Professor, Doctor of Medical Sciences, Head of the of Children's Neurology Department of the Tashkent Institute of Postgraduate Medical Education
[3]Associate Professor of Neurology Department at the Tashkent Institute of Postgraduate Medical Education

Abstract The article is devoted to the study of cognitive functions in preschool children with cognitive disabilities. The study examined the anamnesis and neurophysiological characteristics of preschool children with attention deficit hyperactivity disorder, mental development disorders and mental retardation. We analysed 108 children aged 5-7 years. The data obtained in the study make it possible to focus the attention of children's neurologists, pediatricians and psychiatrists on the diagnostic value of the VEP method.

Keywords Visual evoked potentials, Attention deficit hyperactivity disorder, Mental development disorder, Mental retardation

1. Relevance

Cognitive impairment is an actual problem in pediatric neurology and is found in 20% of children and adolescents [1]. Cognitive functions are understood as the most complex functions of the brain, with the help of which the process of rational cognition of the world is carried out and purposeful interaction with it is provided [2,3]. The results of numerous studies on the assessment of mental health in preschool and school-age children are very worrying [4,5]. On a background of adverse changes of an ecological situation, social and economic problems, narrow specialization of medicine, dynamics of increase in receipt in preschool and school establishments of children with difficulty of adaptation to educational activity, development of school significant functions, concentration of attention and performance of educational tasks is brightly traced [6].

Evoked Potentials (EP) is a method of detecting weak and superficial changes in brain electrical activity in response to a stimulus of different modality. The method allows obtaining objective information about the state of peripheral and central links of various sensory systems such as vision, hearing, etc. It is a non-invasive and objective method of testing CNS functions, for which there are no contraindications [7].

* Corresponding author:
nargiza.mirdjuraeva@gmail.com (Mirdjurayeva Nargiza)
Published online at http://journal.sapub.org/ajmms

The International Society of Clinical Neurophysiologists recommends conducting electrophysiological studies (the technique of visual evoked potentials) to assess the functional state of the central nervous system. [7,8]. However, to date, there are no clear criteria based on experimental material sufficient for the diagnosis and localization of pathological processes in the visual sensory system.

2. Materials and Methods of Research

We examined 108 children whose parents combined complaints about not being ready for school, not paying attention, not assiduous and not remembering information. According to the degree of exposure to etio-pathogenetic factors, different clinical picture and results of paraclinical methods of study, and psychological testing assessments, the children examined were divided into four groups:

The 1st group included 29 children with hyperactivity and attention deficit syndrome. In the study group, 12 (41.4% of this group) boys and 17 (58.6% of this group) girls were studied. In accordance with clinical and neuroimaging signs, the group was formed:

The 2nd group included 32 patients with psychological disorders. In the study group, 22 (68.8% of this group) were boys and 10 (31.2%) were girls.

The 3rd group included 29 children with a preliminary diagnosis of "mental retardation, mild degree", including 20 (66.7%) boys and 10 (33.3%) girls.

The control group 4 consisted of 17 healthy children. Of these, 10 (37.1%) were boys and 7 (25.9%) were girls. The

group characteristics and age subgroups of patients included in the study are presented in Table 1.1.

Table 1.1. Distribution of patients in the studied groups by sex and age

Gender, age	ADHD (n=29)	MDD (n=32)	MR (n=30)	Healthy (n=17)
Boys	12 (41.4%)	22 (68.8%)	20 (66.7%)	10 (37.1%)
Girls	17 (58.6%)	10 (31.2%)	10 (33.3%)	7 (25.9%)
Aver/age (min, max)	5.5 (5-6.5)	5.5 (5-6.6)	5.5 (5-6.8)	5.5 (5-6)

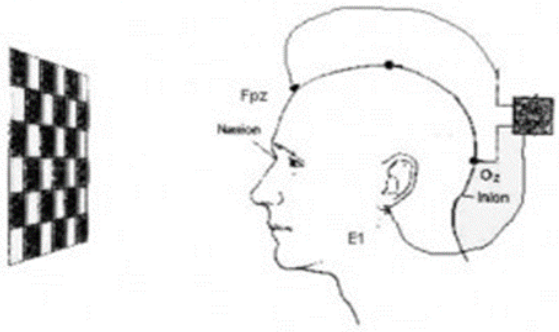
It can be seen from the presented data that in almost all groups with the consequences of perinatal nervous system lesions boys prevailed.

The examination was carried out in the conditions of outpatient and inpatient visits. All the examined patients had a standard somatic and psycho-neurological examination. Close attention was paid to the "perinatal" anamnesis: how pregnancy took place in the mother, whether there were risk factors for the development of this or that pathology. The course of delivery, whether it was a physiological, caesarean section or the use of other obstetrical aids. Weight at birth to the child's psycho-emotional and physical development, parents' complaints, changes in the clinical picture of the disease, and whether the child underwent psychological or pedagogical correction.

The responses of the visual cortex to stimulation of the respiratory stimulus are recorded using the VEP. The visual pathways from the retina to the occipital cortex of large hemispheres were studied.

Registration of the VEP was carried out with the help of a 4-channel electroneuromyograph "Neuro-MPV-4" produced by the company "Neurosoft" (Ivanovo) and the corresponding software. Electrodes for fiberglass recording were installed according to the international system 10-20 on points Oz (active electrode), Cz (reference electrode) and Fpz (grounding electrode). The impedance under the electrodes did not exceed 5 kOhm. For stimulation, a flash from a matrix of LEDs was used, inserted into special glasses tightly fitted to the face and excluding the second eye from illumination during monocular stimulation. Stimulus duration was 5 ms, frequency - 1 Hz, wavelength of flash generated was 640 nm (red light), epoch of registration - 400 ms, filtering band 2-100 Hz. The light was supplied binocularly or monocularly.

The generator of the main component of evoked potentials is located in the ocypital cortex, but its characteristics can change due to an affection at any part of the optical pathway. As a rule, there are several fluctuations: negative with a latency of 61 ms (P1); positive 73 ms. (N1); negative 103 ms (P2); positive 128 ms (N2); negative 141 ms. (P3); positive 150 ms. (N3).



We measured the peak latency of waves (PL) - the time from the moment the stimulus was applied to the top of the wave, which characterizes the speed of the pulse through the visual analyzer.

3. Results of the Study and Their Discussion

Based on the results of numerous studies previously carried out using the visual evoked potential technique, the appearance of peak P1 is the result of yellow spot stimulation. Component N1 is detected by the striatum. The peak latency of component P2 is generated in the cortex at 18-19 Brodman's field. Negative peaks of N2 and N3.

Thus, during the examination of VEP in children, we identified the following deviations. In children of the 1st group, the component N1 67.6 ± 6.91 and the successive peak P2 57.1 ± 10.8 were decreased, which indicated the disturbance of subcortical system connections with the cortex. A decrease in the latency of component N2 103 ± 8.36 and the following P3 90.7 ± 9.41 generated in the cortex of the striatum was observed in children of the 2nd group with NPR, which characterized the disturbance of the primary processing of the incoming signal at the cortical level (17-18 Broadman fields). In children of the 3rd group with mild mental retardation, an increase in latency N3 166 ± 7.30 was noted, which is the result of associative cortical activity - fields 18-19 for Brodman, which reflects the stage of visual information analysis.

Table 1.2. VEP indices in the surveyed groups

VEP component	ADHD (n=29)	MDD (n=32)	MR (n=30)	Healthy (n=17)	p-value*
P1=61 (cp ± CO)	61.7 ± 2.62	60.6 ± 4.22	59.8 ± 9.14	57.1 ± 14.5	0.3
N1=73,0 (cp ± CO)	67.6 ± 6.91	72.0 ± 4.30	71.6 ± 4.77	73.1 ± 6.78	<0.01
P2=103 (cp ± CO)	57.1 ± 10.8	101 ± 3.84	102 ± 6.65	105 ± 3.41	<0.01
N2=128 (cp ± CO)	127 ± 5.21	103 ± 8.36	126 ± 5.30	127 ± 4.77	<0.001
P3 =103 (cp ± CO)	96.7 ± 12.8	90.7 ± 9.41	102 ± 3.92	101 ± 10.5	<0.001
N3=150 (cp ± CO)	152 ± 5.46	146 ± 9.37	166 ± 7.30	150 ± 4.17	<0.001

Based on the above, in patients with cognitive impairment, changes in these parameters are observed, which are expressed in the form of lengthening the time of reaction (response delay).

The conclusion is written on the recommendations of the International Societies of Clinical Electrophysiology of Vision, Hearing (ISCEV) (2003 Nagoya, Japan), where it is necessary to turn on in printed form: the wave itself with averaging overlap (trend line); Tables with latency data, deviations.

4. Conclusions

1. The analysis of the data obtained during the VEP methodology revealed reliable results, which should be taken into account in cognitive disorders in pre-school children.
2. Changes in the above parameters were observed in the examined children in the form of lengthening the reaction time (response delay).
3. The increase in the latency of visual evoked potentials indicates a slowdown of the nerve impulse conduction, at different stages of the visual analyzer, which may serve as an additional diagnostic criterion in assessing cognitive functions in preschool children.

REFERENCE

[1] Alyoshina E. D. Cognitive evoked potential of P300: technique, application experience, clinical value / E.D. Alyoshina. (in Russian) // Journal of neurology and psychiatry. -2009. - № 8. - pp. 77-83.

[2] Batysheva T.T., Kvasova O.V., Klimov Y.A. Correction of cognitive disorders in children and teenagers. "Methodological recommendations" Moscow. 2016 – p.2.

[3] Badalyan, L.O. Manual for early childhood neurology (in Russian) / L.O. Badalyan, L.T. Jurba, N.M. Vsevolzhskaya. Kiev. // Zdorovie, 2008. - p. 527.

[4] Zavadenko, N.N. Attention deficit syndrome with hyperactivity: diagnostics, pathogenesis, treatment principles // Journal "Issues of practical pediatrics". - – 2012. - – T. 7. №1. - pp. 54–62.

[5] Clinical and psychophysiological characteristics of children of teenagers with chronic ticks / L.S. Chutko, S.Y. Surushkina, E.A. Yakovenko et al. // MPEI Vestnik. Sev. (Arctic.) Feder. university. Ser.: Med.-biol. of science. 2013. № 1. - pp. 91–99.

[6] Shmakova O. P. School adaptation of children and teenagers with mental disorders: PhD. of medical sciences / O.P. Shmakova. - M., 2004. - p.24.

[7] Gnezditsky V.V. Evoked Potentials of the Brain in Clinical Practice. "MEDpress-Inform", Moscow. P.43. 2003 г.

[8] Kojevnikova I.S. Cognitive induced potentials of RZOO in children with a high level of anxiety/I.S. Kojevnikova, Y.S. Joy//Human Ecology. - 2011. - № 5. - pp. 49-54.