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TÍTULO: Bases neurofisiológicas de los trastornos relacionados con el desarrollo intelectual de los niños en edad escolar.

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RESUMEN: Este artículo contiene los resultados del estudio teórico-práctico de las bases neurofisiológicas de los trastornos relacionados con el desarrollo intelectual de los niños en edad escolar. Sobre la base del análisis comparativo de los datos sobre el estado funcional del sistema nervioso central (SNC) de los escolares con desarrollo intelectual normal y discapacidad intelectual (retraso mental leve - F70), obtenidos en el curso de estudios prácticos, se determinan los indicadores indicativos altamente informativos de los trastornos del desarrollo intelectual de los escolares.

PALABRAS CLAVES: desarrollo intelectual deteriorado (retraso mental); indicadores de actividad bioeléctrica cerebral; tasas de circulación cerebral; ritmo α; Onda REG.

TITLE: Neurophysiological basis of disorders concerning intellectual development of school-age children.

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ABSTRACT: This article contents the results of theoretic-practical studying of neurophysiological basis of disorders concerning intellectual development of school – age children. On the basis of the comparative analysis of the data about the functional state of schoolchildren's Central nervous system (CNS) with normal intellectual development and intellectual disability (mild mental retardation – F70), obtained in the course of practical studies, the indicative highly informative indicators of intellectual development disorders of schoolchildren are determined.

KEY WORDS: impaired intellectual development (mental retardation); indicators of brain bioelectric activity; cerebral circulation rates; α-rhythm; REG-wave.

INTRODUCTION.

Children with intellectual disabilities are a very special category of persons with disabilities (PWD). Today, the advancement of such a child in social development does not reach the pace that would allow it to exist comfortably in modern society.

This is largely due to the fact that the neuro- and psychophysiological status of mental retardation has not been fully studied, and indicative high-information indicators of this version of dysontogenesis have not been fully determined (Lapshina, 2016, 2018).

Consequently, the leading positions of studying children, adolescents and young people in general (Tomiline, 2016), children, adolescents and young people of different categories of PWD, in particular (Romanova, 2016), come out the medical and biological aspect (Makunina, 2017).

Thus, the study of mental retardation at the neurophysiological level should be one aspect of solving its problems at the social level. Therefore, the topic of this study is very relevant.

DEVELOPMENT.

Purpose and objectives of the study.

The aim of this study was the empirical identification and theoretical justification of neurophysiological highly informative indicators, the specifics of the functioning of the Central nervous system in children with mild intellectual impairment (diagnosis F70). The main goal is specified in the following tasks:

1. In the course of comparative analysis of cerebral circulation (CC) indicators of schoolchildren with normal mental development, detection and with intelligence impairment detection of a description of highly informative indices of blood circulation features in nervous tissues of the brain in case of mental retardation.
2. In the course of comparative analysis of bioelectric activity (BEA) indicators of schoolchildren with normal mental development and intellectual impairment, detection and description of highly informative characteristics of α-rhythm features (as the main rhythm of CNS functioning in school age) in the brain in case of mental retardation.

3. Consideration of the possibility of combining mechanisms of violation of CC and BEA brains of schoolchildren with mental retardation as a single mechanism of intelligence reduction.

Materials and methods.

Achievement of the main objective of the study was due to the use of a set of adequate and highly informative methods of research - a method of analysis of the obtained data: retrospective analysis of scientific and periodic literature, results of own, earlier neurophysiological study (Lapshina, 2009; 2016); content analysis of scientific activities at various levels from international to regional (scientific and practical conferences, symposia and research meetings); primary mathematical processing methods; free description method; diagnostic methods of data collection.

The methods of analysis were applied to the results of the neurophysiological survey of the state of the CNS of younger schoolchildren, divided into two groups:

- EG (experimental group) were made up of students of MBEI «S (C) OSH № 119 of Chelyabinsk» (correction school for students with intelligence violation), number of 52 people; the schoolchildren were diagnosed with F70 (mild mental retardation).

- CG (control group) were made up of students of MBEI «SOH 112 of Chelyabinsk» (general education school), number of 48 people; the schoolchildren examined had a level of mental development within the age norm (according to the results of the psychological examination).

Such a sample of the participants of the experiment and the set of analytical methods used allow to identify the main neurophysiological indicators of the features of the functioning of the CNS of students with a deviation in mental development.

Discussion and results.

Analysis of the results of the cerebral circulation study was carried out during the review of the REG-wave data. This made it possible to identify several specific characteristics that distinguish their cerebral hemodynamics from the cerebral circulation of general education students.

As the main feature of the REG-wave of younger schoolchildren with intelligence impairment, on which we emphasize in the course of this study - is a form of REG-summit. According to modern criteria estimates of this diagnostic indicator, the shape of the main peak of the REG-wave should be slightly rounded or sharp, which was revealed in the vast majority of students of the CG.

In students of correction school such a pronounced unidirectional indicator was not revealed. Moreover, it can be said that almost all the possible spectrum of data of REG-wave top typology is revealed. It should be noted that in the reliable majority of EG schoolchildren, it is shifted to that part of the corridor of specific numerical and descriptive values, which in the evaluation plan are characterized as "signs of the hypoxia picture" (Lapshina, 2009; 2016). It should be noted that in contrast to children of EG, in KG there is a great individuality of indicators. This may be due to an individual picture not only of the location of the blood vessel network, but also of the individual picture of brain hemodynamics failure. This fact can be considered as a neurophysiological justification for one of the basic didactic principles of working with children with HIA - the principle of individual and differentiated treatment in education and upbringing (Lapshina, 2008). The analysis of the EEG study data in the survey teams also revealed the distinctive features of the individual BEA indicators of the brain of the participants in the experiment.

The α-rhythm characteristics were analyzed. The selection of the EEG survey object is not accidental. According to leading specialists of the Institute of Age Physiology, junior school age is an important stage of age registration of BEA (Besrukikh, Farber; 2010). At this stage there are those changes in the brain organization of the child which neurobiologists refer to "a critical stage of development of

central nervous system" (Farber, Dubrovinskaya, 1991), and experts of the psychology and pedagogical direction carry to the most important period of mental development - to the period of functional registration of logical thinking (Semago, Semago, 2010).

These fundamental changes in the biological and psychological maturation of the nervous system are associated with a pronounced trend in the age design of the brain maturation itself - the design of the α-rhythm as the leading rhythm of the BEA (Kostina, 2002).

In the course of EEG-survey all main characteristics of α-rhythm were analyzed both quantitative: amplitude, frequency, and qualitative: regularity, localization, modulation and spatial distribution.

From the quantitative indicators, special attention was drawn to the data of amplitude of α-rhythm: the analysis showed a significant variation of individual values of the participants of the experiment. This can certainly be due to the continuing process of maturation of cortical structures in the younger school age. That is why quite large variability of absolute values and quite large variation of them were observed in both groups: both in EG and in CG.

However, it should be noted that in CG for all schoolchildren the amplitude indicator met the "corridor" of values of age and functional norm, while in EG 13 children (25.00%) on this indicator entered the zone "border with norm," exceeding the scale of values of 100 mcV (Lapshina, 2016; Farber, Dubrovinsky, 1991; Kostina, 2002.).

Of the qualitative indicators of the α-rhythm, its regularity deserves special attention (Kostina, 2002). Research shows (Besrukikh, Farber, 2010; Farber, Dubrovinsky, 1991; Kostina, 2002) that the younger school age is not the age of the final design of the α-rhythm in general and its regularity in particular. According to a number of authors (Lapshina, 2016; Farber, 2010; Farber, Dubrovinsky, 1991; Kostina, 2002), at the age of 7-9, the tendency to replace a disorganized rhythm with a regular one is increasing, but not ending. In both groups - both in EG and in CG, children with both disorganized and regular α-rhythm were identified. However, the number of children with regular α-

rhythm in CG is 1.7 times higher compared to EG. Therefore, in this study, the regularity of the α-rhythm can be considered indicative; This fact is confirmed by the use of methods of mathematical statistics (Lapshina, 2009) and is statistically significant, correlate of α-rhythm in mental retardation. The combined analysis of the results of the study of the functional state of the CNS of younger schoolchildren with normal and impaired development (at the level of mental retardation) allows to state that in a particular child with intellectual disorder, as a rule, there is a specificity of separate indicators of the brain BEA and some parameters of brain hemodynamics. This fact can be seen as an indication that one of the possible neurophysiological mechanisms of mild mental retardation is the peculiarities of the functioning of the CNS, manifested in the combination of its characteristics BEA and CC (Isaev, 2003).

Within the framework of this study, the purpose was not to identify the determinant and priority of a specific indicator of the specificity of the functioning of the nervous system in the general structure of the mechanism of developmental impairment in case of mental retardation (Lapshina, 2009, 2016).

CONCLUSIONS.

One of the priorities of modern society is the formation of harmonious development of personality and health among the younger generation (Romanova, 2016; Dugnist, Mal'hin, Golovin, Romanova, 2017). This question is viewed from the position of different branches of sciences and various approaches are used, translating the question from the broad sense of the word into the category of General humanitarian and philosophical issue (Romanova, 2017) which is requiring immediate solutions by specialists in various fields of knowledge (Tomilin, 2017); that is why, the increase in the number of children with disabilities is nowadays noted as one of the worrying trends in reality. The number of students and pupils who have intellectual disabilities is steadily growing – this is not

just a kind of nosological group of children with disabilities, this is the category of people whose socialization in a highly intellectual and technological social space is becoming increasingly difficult. Despite the fact that serious changes are taking place in the education of such children (a special educational standard has been adopted and realized, teachers are implementing new approaches and innovative methods, as well as, techniques in teaching students with intellectual disabilities), still a child's progress with mental retardation in social development does not reach the pace that would allow him to comfortably exist in modern society and to have self-realization in all spheres of human life at an affordable level for him.

This socio-psychological characteristic of intellectual disability at the level of mental retardation largely due to the fact that the neuro- and psychophysiological status of this condition has not been fully studied and the indicative highly informative indicators for this type of dysontogenesis have not been fully determined. It is their description and interpretation, understanding the mechanisms of disorders, induced by the presence of indicators that allows a deeper understanding of the essential content of the phenomenon of mental retardation at the neurophysiological level. Therefore, this means more competently and effectively organized psychological and pedagogical support, if it is necessary also a medical impact, the cumulative result of which will be social integration and socialization of people with intellectual disabilities.

Consequently, the medical and biological aspects (Makunina, 2017) have gained leading positions in the study of children, adolescents and young people in general (Tomilin, 2016), in particular children, adolescents and young people from different categories of disabilities (Romanova, 2016; Lapshina, 2009, 2016, 2018).

Thus, the study of mental retardation at the neurophysiological level should be one of the aspects of solving its problems at the social level. That is why the topic of this study is very relevant.

Modern trends in the study of the phenomena of social distress (Antipova, 2019) and impaired development (children shift the main semantic emphasis of their study in the field of neurophysiology. Understanding the neurophysiological mechanisms of such phenomena as mental retardation will allow more effectively to organize other aspects of support and assistance, in particular, psychological, pedagogical and social rehabilitation.

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