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Neuropsychological study of children with attention deficit disorder in the process of beta-stimulating biofeedback.

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This article analyzes the clinical and electroencephalographic effects of EEG beta training in treating children with attention deficit disorder.

Presents the results of neuropsychological examination of 68 children diagnosed with attention deficit / hyperactivity (ADHD) by the method of Luria's in the rehabilitation course of EEG beta training. Analysis of the results suggests that in the most children with ADHD, the primary cause of the characteristic symptom is a dysfunction of subcortical-stem structures of the brain, but there are children with clear symptoms of ADHD, but no signs of dysfunction of subcortical structures.

Key words: Attention Deficit Disorder, neurobiofeedback, neuropsychological tests.

1. Introduction.

Complex demographic situation in Russia currently is compounded by the deterioration of physical and mental health of children of all ages - from infants to teens. Of particular concern is the increase in the incidence of prenatal pathology and birth injury, which will inevitably have a negative impact on the development of the nervous system. Normally flowing pregnancy and childbirth, the last with no abnormalities, are no exception. This leads to an increase in the prevalence of abnormalities of the morph functional development of all parts of the nervous system. At the same time affected sections of brain, whose sensitive period of development falls on prenatal and early postnatal periods - sub cortical-stem structures of the brain.

Dysfunction of these parts not only by themselves in a specific way affect the course of mental ontogenesis, but also lead to further modifications maturation of the cerebral cortex and, consequently, the subsequent development of higher mental functions.

Attention deficit hyperactivity disorder (ADHD) in 1987 is regarded as an independent nosological unit. The frequency of attention deficit disorder with hyperactivity (ADHD), but varies according to different authors from 5 to 20% of children in the general population (Badalian LO, Zavadenko NN, Assumption TY, 1993, Kuchma, VG , Platonova AG, 1997; Mickle, NV, 2001), and the boys this syndrome occurs 2-3 times more often than girls (Trzhesoglava 3. 1986; Bryazgunov IG, 1994). Abroad, the prevalence of ADHD is 2-20% (Hensen CR, Cohen DJ, 1984; Augusst GJ, Brasvvell L., Thuras P., 1998). The attitude of some doctors and psychologists to the problem of ADHD is controversial. Some researchers deny the existence of such a diagnosis. According to the American Psychiatric Association, attention deficit hyperactivity disorder affects about 5% of school-age children. (Dixit SP, Pandey MN, Dubey GP, 2002) [1 , 4].

The presence of ADHD is a risk factor for school maladjustment, violation of child-parent relations, and proved that children with ADHD are predisposed to the emergence of addictive disorders (alcoholism, drug abuse, antisocial behavior, etc.) [1].

The **study aims** to refine the stages formation of syndrome (accordance with Luria's terminology).

2. Materials and methods.

The work was done on the basis of the branch clinic number 1 of Yakutsk. Examined 68 children aged 7 to 11 years with a diagnosis of ADHD (ICD-10), right-handers, the ratio of girls to boys about 1:1. All were surveyed as part of the rehabilitation of the complex course of neurobiofeedback by "stimulation of beta / theta suppression" protocol, developed by the Institute of MBB (Novosibirsk) on the software and hardware complex BOSLAB-012 [9], sports and wellness facilities (gym, massage, bath), vitamins.

The study used the following standard procedures:

- questioning the parents and class teachers in all subjects,
- EEG - research (diagram 10-20, 21 channel monopole montage) [7]

- Tests on the parameters of attention - a proof test (test Burden) and Schulte's tables [3]
- neuropsychological testing by the method of Luria (a modification for child's age) [2,6].

Neuropsychological test system "Battery of Luria" is a standardized version of the complex psychological techniques developed by the Russian neuropsychologist Alexander Luria, and subsequently reorganized, C. Golden and his colleagues in a standardized battery, designed for clinical neuro diagnostics. Luria, AR examined the behavior as a result of the interaction of all regions of the brain, and preferred to use simple test methods that reflect the relatively simple patterns of brain interactions that can more accurately examine the functional brain systems.

This system tests covered the major areas of neuropsychological functioning:

1. Motor function

2. Rhythm (acoustic-motor) functions

3. Tactile (higher tactile and kinesthetic) function

4. Visual (spatial) functions

5. Understanding speech

6. Expressive speech

7. Function letter

8. Reading skills

9. Arithmetic skills

10. Memory

11. Intellectual processes.

It was found that this test system can be an effective tool for the diagnosis and lateralization and localization of brain disorders. Luria test data are also extremely useful in planning the rehabilitation of patients with brain injuries [5,6].

It should be noted that the controversy over the inability to quantify the test battery Luria, as well as the appropriateness of discriminant analysis are to this day [2].Because we also did not carry out accurate statistical calculations, and limited joint general description of the results.

3. Results and discussion.

Conducted starting sessions of neurobiofeedback allowed to allocate a special group of children which have a high theta / beta ratio (greater than 5) due to the dominance of the EEG slow

oscillations of theta range (4-7Hz) and deficiency of beta range (subrange beta-1 [18-20 Hz]). Otherwise, this parameter is quite variable, but we can say that the beta rhythm in the majority of subjects have low values of power level.

Test on the parameters of attention - the volume, concentration, stability, switchable (selectivity) - have shown a considerable amount of memory at very low indicators of stability of attention in all subjects. Boys showed higher results for switchable attention than girls (**). The curve of fatigue of attention and analysis of two-minute EEG epochs with eyes closed showed a weak correlation with the initial power level of the beta rhythm (*).

Analysis completed by researchers protocols of tests from the battery Luria, allowed us to divide examinees into two groups.

The first group of 68,3% were children, who clearly had signs of functional impairment of subcortical-stem structures of the brain symptoms of prefrontal units, weighed down by the perinatal history. The children in this group had a history of birth trauma (90.1%), 84.3% of mothers say the priority development.

In the second group were children with unstable or to a lesser extent, signs of dysfunction of subcortical-stem structures, there are signs of disorders of the prefrontal regions of the brain, is not burdened by the prenatal history, and easier to overcome the **game**-based forms of biofeedback.

Neuroscientists have identified the first group of children as a group whose primary violated subcortical and brainstem structures of the brain, and dysfunction of the cerebral cortex are secondary. A second group as a group whose primary dysfunction of the cerebral cortex, namely the prefrontal of the frontal lobes.

That is, surveyed **the first** group can be attributed to children with a primary violation of the I-th functional unit of the brain, subsequently led to the dysfunction of higher mental functions.

They are characterized by a very strong attention to exhaustion, lack of voluntary control of attention, volume, concentration, stability of attention also greatly reduced. After 5-6 sessions of biofeedback they have a complete denial of focus, even refusing to play forms of aggression. All parents in this group was especially burdened by pregnancy, severe birth, large fetus.

Also, these children were observed somatic or psychosomatic disorders. The EEG was attended predictors of violations of subcortical-stem structures (flash slow waves "stem-type", etc.), although in fairness it should be noted that this type of EEG may occur in healthy children.

Typical symptoms:

- Sleep Disorders: 100% of the parents of this group reported that the child is very difficult to fall asleep, the evening very tired, “his eyes closed, yet cannot concentrate and sleep”,
- Emotional lability,
- Tics. Most often in the eyes and face,
- Muscular hypertonicity,
- Speech disorders
- Aggressiveness.

The following tests provoked most difficulty:

1. Dynamic movement, hardly, but performed by children in both groups equally. Marks the transition to synkineses, big pauses between movements. This is attributed to the delay in the development of the premotor area. Test was carried out "FIST-EDGE-PALM".
2. Test for kinesthetic praxis: when performing even the simplest of species as a sequential scan finger-type "OK" - "GOAT" - "PALM" shows a completely different order, and helped the other hand, laughed and turned your attention. However, children of the second group, though heavily concentrated sometimes missed a show and memorize the order. These violations relate to dysfunction of the parietal regions of the brain.
3. Violations of the tactile and visual-spatial gnosis in the 2 groups to exercise more frequently (98.1%) than in the first. Localization of touch of a finger could not identify 99.0% of children. Test of Luria's "noisy image" on the computer the children of the second group performed at 100%. In general, children receive 6-7 points. This symptom indicates inadequate development of the occipital and occipital-parietal regions.
4. Oral-aural memory. Laboratory tests for "Remembering the 2-groups of 3 words." The restriction of the volume, breaking the order, paraphrases, defects in the regulation and control in general were more common in the second group of subjects (48.7%). However, parental encouragement (like "last job") and the simplification of the semantic level of the material rather markedly improved performance. This is caused by a deficit of goal-setting and regulation, voluntary control, ie, the insufficiency of the prefrontal regions of the brain.
5. Speech. Laboratory tests for sensory, motor and speech function nominative. In the second group caused the most difficulty. For example, a paraphrase of the text, writing, repetition did not work out in 99% of children. Agrammatism, errors in articulation, dialogue, speaking generally absent in 78%. In children, the first group with repeated visits and addiction researcher reproduction of letters, words, phrases, succeeded in 50%, appeared dialogic speech. These functions are provided by the premotor, prefrontal divisions and “area TRO” of the left hemisphere.

All these data indicate disorder of subcortical-stem structures during the period of active maturation. With further ontogeny as a consequence there is dysfunction and II blocks, which characterizes the clinical picture of ADHD, then, with a deficit of activating influences of subcortical structures in the cerebral cortex, as a compensatory mechanism appears hyperactivity. As well as multiple symptoms of dysfunction of the prefrontal cortex of the brain. Later hyperactive behavior, antisocial disorders, impaired adaptation come to the fore. Manifested all the clinical signs of ADHD. But with detailed diagnosis of the presence of symptoms such as severe illness neurodynamics, burdened by pregnancy, low levels of power of beta-rhythm EEG analysis suggests that "the prefrontal symptoms" of higher mental functions (HMF) by primary dysfunction of subcortical-stem structures of the brain of the child.

In children, **the second** group, such characteristic features of dysfunction I-th block were absent or occurred less pronounced. However, these common symptoms of ADHD as a violation of attention (all 4 parameters, to a greater or lesser degree each), lack of voluntary control, motor disinhibition, restlessness, motor hyperactivity, inappropriate situations were recorded. Emotional and behavioral disorders and psychosocial dis-adaptation prevalent among children in this group. More noticeable are expressed in this group of *speech disorders.* *You* should also note the big "trainability" of the group, less exhaustion. In promoting or more

hard controlling their level of beta rhythm grew, and the child was quite capable of performing tests or cognitive tasks, which children first group was not observed.

4. Conclusion.

Proceeding from the above we can conclude: violation of subcortical-brainstem structures **is a primary mechanism** of clinical picture of ADHD for most children with this desease.

However, also possible to say: there are children (18-20%), and theirs "prefrontal symptoms" are primary. And development of ADHD **is not associated** with early damage of subcortical-stem structures..

Thus, for the diagnosis of ADHD is appropriate use of neuropsychological techniques that will allow children to **differentiate by the nature of the primary defect** for **optimal selection** of therapeutic and rehabilitative tactics.

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Development of data base`s structure for biobanks.

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Summary: Collection, preprocessing and use of biological samples cause many organizational problems, which are successfully resolved with help of biobanks. Among the components of successful work of biobank is a practical, functional and reliable database for storage of information. In the paper, principals and problems of database development for biobanks are considered, taking example the biobank of the Institute of Medical genetics SB RAMS.

Keywords: biobank, database, multifactorial diseases, genes.

Introduction: The intensification of genetic studies of the basis of complex diseases has allowed to formulate basic propositions concerning study design, and also concerning qualitative and quantitative composition of the groups under investigation [8, 10, 12, 13]. Requirements to the size, uniformity and description of the samples become more strict [1, 7], and this leads to