THE STATE OF VISUAL ANALYZER WHEN USING THE DRUG THIOGAMMA AT TYPE I DIABETES

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31 patients were examined with a diagnosis of Type I diabetes with use of clinical- somatic and neurological examination. The authors attempted to analyze the visual analyzer, its functional state and the response to the stimulus of cortical structures. In this regard, all patients underwent neuropsychological examination using visual induced potentials alternated on a chess type pattern. In order to evaluate the effectiveness of the drug Thiogamma, evoked potentials were examined before and after the treatment. The study allowed to assert that the structures of the visual analyzer develops an increase in the latent period with Type I diabetes, which corresponds to demyelination processes. During the use of the drug Thiogamma, these changes are reduced significantly, as reflected in the reduction of latency and increase the amplitude of the response evoked potentials.

Keywords: diabetes, evoked potentials, visual analyzer

Among the pathological conditions of the nervous system, resulting in diseases of the endocrine glands, there is a special place for neurological disorders with diabetes (D). This is due not only to the prevalence of these disorders and their severity, a significant influence on the prognosis and a quality of life. Diabetes is one of the most common diseases in the world. According to experts, by 2025, the total number of people with diabetes will reach 324 million people [8]. Currently in Russia there are about 8 million people suffering from diabetes and the number is continuously growing [2]. Despite the fact that the proportion of type I diabetes from all diabetes forms is not more than 10–15 % [2, 3], this form is the most important medical and social health problem because it often occurs during childhood and adolescence and is might bring severity, disability and often early death [2].

Vascular lesions are observed in all forms of diabetes. However, type I diabetes when the main cause of disability is high is microangiopathy which leads to diabetic retinopathy (DR) [6, 7]. It is noted that diabetes is one of the first places as a cause of blindness and low vision in all age groups. Patients with diabetes have 25 times higher risk of blindness than people without diabetes [4, 5]. In this regard, the study of the visual analyzer state with type I diabetes is particularly important.

Objective: To clarify the state of neurophysiological pathways of the visual analyzer of patients with type I diabetes before and after treatment.

Materials and methods of research

The study 31 patients (12 men and 19 women, mean age 21,3 ± 2,10 years) with type I diabetes were involved and were treated at the endocrinology department of Stavropol City Clinical Hospital № 3. The average duration of the disease was 5,1 ± 2,1 years long. All patients underwent clinical and laboratory examination, including determination of antibodies to myelin basic protein (MBP), which were determined by enzyme immunoassay analysis using a kit of reagents developed by N.E. Yastrebova and N.P. Benaiah (Company "Navi", Moscow).

Most examined were in a state of decompensating diabetes. The clinical status of the visual analyzer in patients was studied together with an ophthalmologist. The criterion for the possible study was the presence of type I diabetes with an initial stage of diabetic retinopathy or without changes in the fundus. From the group of patients studied were excluded those with anisometropia, myopia greater than 1,0 diopters, astigmatism, amblyopia, exophoria, color abnormalities, any other (except for diabetic retinopathy), eye diseases or injuries, none of who had photo laser coagulation before.

In order to evaluate the visual analyzer neurophysiological study was conducted using the unit "Neuro-MEP/4" made by a firm "NeuroSoft" with computer processing, developed by Russian Academy MTN in Ivanovo city. The latency period (LP) and the amplitude of the response caused by the visual evoked potential (VEP) was studied on the reversible black and white checkerboard pattern. The advantage of this study is the possibility to select in the graphical display of the fundamental wave P100 most accurately, which corresponds to the activation of the 17th (primary visual cortex) and 18th (visual associative cortex) pole according to Brodmann [1].

The method allows to trace the nerve impulse within the optic fibers from the cells of the retina (rods), the optic nerve, optic tract and through the mid-brain structures to the occipital lobe of the cerebral cortex [1]. This method also gives a quantitative estimate of the speed of the optic analyzer. The study was conducted according to standard procedures. The active electrode was placed over the occipital area in O2 area, O1 international chart "10–20 %" and the ground electrode on the forehead (at Frz point). Ipsilateral at the point Cz. The impedance under the electrodes was not higher than 5 kW.

Stimulation was carried out on alternate black and white checkerboard pattern alternately on the left and right eye in a darkened room with a prior adaptation in a sitting position. Time of analysis – 500 ms. The number of averaging – 70–100. Components N75 response, P100

and N145ms were evaluated. Advantageously, emphasis was placed on the study of the basic component P100 and wave of amplitude N75-P100.

In order to clarify the status of bioelectric activity (BEA) of cortical brain structures the electroencephalogram (EEG) was studied using the unit "Neuro-MEP/4". A visual and computer analysis of 16 monopolar derivations was conducted: Fp1, Fp2, F3, F4, F7, F8, C3, C4, P3, P4, O1, O2, T3, T4, T5, T6 according to international scheme "10–20 %" with the reference electrode on the ipsilateral ear lobe. The era of the analysis was 4 seconds at a sampling rate of 250 in 1 sec. Spectrum of power density in each lead, which was normalized to its power to total EEG, was analyzed with assigned step of 0,125 Hz between 0,5 to 35 Hz interval. The ground electrode was placed on the frontal pole – FPZ with impedance at 40 ohms not more. The following EEG frequency ranges was defined: δ – 0,5–3,5 Gts, θ – 4–7 Gts, α – 8–13 Gts, β1 – 14–20 Gts, β2 – 21–40 Gts.

The examination of patients was performed before and after basic treatment, the foundation of which was the use of the drug Thiogamma. Last injection was at a dose of 600 mg intravenously per 200 ml. of saline solution for 10 days and then performed neurophysiological study again. During the treatment of patients with diabetes modern treatment principles was used: along with diet and drug therapy, applied training programs. The average daily dose of insulin was 39,1 ± 2,32 units. All patients were treated with human insulin firm Novo-Nordisk and Eli Lilly according to intensified insulin therapy. The control group consisted of 15 healthy adults, matched to age and sex.

For the analysis of the results obtained using the arithmetical value (*M*) and error (*m*), standard deviation (δ). Reliability of differences of values was evaluated using Student's test (*t*).

Results of research and their discussion

During the clinical examination 18 patients (58.1 %) were diagnosed with diabetic encephalopathy, a demonstration of which were complaints asthenic character: general weakness, fatigue, decreased performance, anxiety, emotional lability, impaired concentration, loss of memory. In 67,7 % of cases detected cephalgic syndrome. It should be noted that the headache often had the character of compression, compressing the type "tide hat".

Symmetric distal polyneuropathy was met among 28 (90,3 %) patients At the same time some complained about tingling, numbness, coldness of feet and sometimes hands or a feeling of burning, pain in the limbs, which often amplified at night or at rest. Was identified reduction of pain, temperature or vibration sensitivity according to the type "socks" and "gloves", reduction of reflexes, tone, in some cases moderate movement disorders. Gipostezii gradually was spreading from the distal portions of the legs and arms to the proximal portions.

In all cases, patients reported vegetative dystonia syndrome as dermographism diffuse, diffuse hyperhidrosis and acrocyanosis. In 3 cases, patients reported the development of lightheadedness. Due to the destruction of vegetative fibers in 5 cases (16.1 %), patients developed vegetative-trophic disorders in the form of arthropathy which was shown as progressive deformity of the ankle and foot joints.

11 patients (35.5 %) had various degrees of depression, which in our opinion is a consequence of the disease.

Conducted neurophysiological examination revealed a number of patterns (Table). After analyzing the results of SGP was found that patients with type I diabetes compared with the control group surveyed in terms of P100 wave there was an increase in the LP to the right and left of the treatment, which concluded to 119,3 ± 2,58 ms vs. 103,1 ± 1,72 ms in the control ($p < 0,05$).

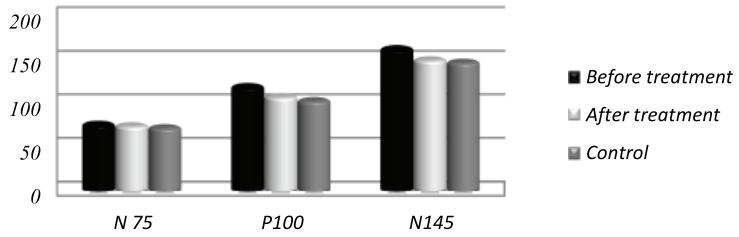
Also a significant change in this period PL indices was diagnosed in the late EP components. So PL N145 waves was 172,3 ± 3,66 ms vs. 151,3 ± 2,22 mkV in the control group ($p < 0,05$). Should be noted that the elongation of LP P100 wave was observed in the overwhelming majority of patients (87,1 % in the cases).

Conducting course of treatment using basic therapy Thiogamma drug revealed a tendency to restore the LP (Figure).

VEP dynamics of quantitative indicators in the examined group of patients with type I diabetes before and after treatment ($M \pm m$)

Period	D I type (*n* = 31) before treatment	D I type (*n* = 25) after treatment	Control group (*n* = 15)
Latent, period (mc)			
N75	76,1 ± 2,81	74,3 ± 3,93	72,1 ± 2,09
P100	119,3 ± 2,58*	110,6 ± 2,74	103,1 ± 1,72
N145	172,7 ± 2,73*	149,9 ± 2,21	151,3 ± 2,22
Amplitude (mV) P100	4,3 ± 1,63	7,2 ± 1,36	8,1 ± 1,21

Note. * – Significant differences ($p < 0,05$) – in the control group.



Indicators of VEP components relative to the control group before and after treatment using Thiogamma ms.

Analysis of wave amplitude N75-P100 showed that the patients had a reduction in the amplitude to the response to presented stimuli. So examinees amplitude of wave N75-P100 was 4,3 ± 1,63 mV, that characterized the depression of visual cortical structures. To verify the results, in particular, changes in the depressive nature of the available research was conducted EGG research parallel with the brain registration of BBA. The results of the study noted that neurophysiological EEG indexes, their frequency and amplitude characteristics are substantially comparable to the control group data. Patients' with diabetes index was the average alpha rhythm amplitude amounted to 75,8 ± 2,3 mV, the average frequency of alpha rhythm – 9,6 ± 1,1 Hz, the average index – 71 %. EEG results characterize that brain BBA in cortical visual areas and remain functionally in the state close to the control group. This suggests that the reduction of the amplitude response according to VEP results is associated with a reduction in the pulse flow along the fibers of the optic analyzer and as a result a decrease in the number of neurons that activate a response in the cortex presented stimuli.

In this regard, we believe that the decline in conductivity along the fibers of the optic analyzer may result from the demyelination processes. To clarify these changes, immunological studies have been performed, which are related to the specification of the concentration of IgG antibodies to myelin basic protein. It was found that the concentration of IgG antibodies to MBP in diabetic patients before the treatment was higher than the control group and amounted to 156,2 ± 4,22 and 50 ± 2,1 g/ml. These immunological changes may further indicate demyelination processes, which result in a decrease of conductivity along the fibers of the optic analyzer.

The existing theory of the transitioning process associated with the assessment of brain response to impulse action is related to the whole brain system: corticosubcortical homeostasis, stem reticular formation, responsible for the maintenance of the processes of sleep – wakefulness, attention, ft [1]. In our opinion, the results of impulse excitation and in particular VEP allow an objective assessment not only of the visual analyzer, but in general have an objective understanding of the functional state of the brain.

Conclusion

Thus, these results indicate that the type 1 diabetic demyelination processes occur in the structures of optic analyzer, which help to reduce the "flow" in pulse conduction visual cortical visual analyzer structure that leads to a reduction in cortical response reaction to presented stimuli. Using Thiogamma drug in the treatment of type 1 diabetes can significantly improve the metabolic processes in the structures of the visual analyzer, and thereby restore their functional state.

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