

Changes in hemodynamic parameters during complex treatment
patients with chronic cerebral ischemia

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Yesterday's³

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The hemodynamic parameters change in chronic cerebral ischemia patients complex
treatment

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RESUME

This article examines the phototherapy treatment usage for patients with chronic Cerebral ischemia with predominant lesion of vertebrbasilar basin and basin of internal carotid artery. 75 observations with chronic cerebral ischemia analysis were conducted. The age of patients ranged from 24 to 72 years. Before and after treatment pulse pressure and Kerdo index calculation was conducted for both groups of patients. After treatment was observed the normalization of pulse pressure as well as the Kerdo index shift in parasympathetic nervous system and aiton predominance zone.

Keywords: autonomic nervous system, brain chronic ischemia, pulse pressure, the Kerdo index, physiotherapy.

SUMMARY

The paper considers the use of photochromotherapy in the treatment of patients with chronic cerebral ischemia with a predominant lesion of the vertebrobasilar basin and the basin of the internal carotid artery. The analysis of 75 observations with chronic cerebral ischemia was carried out. The patients' age ranged from 24 to 73 years. Before and after treatment, pulse pressure and Kerdo index were calculated for patients of both groups. After the treatment, there was a normalization of pulse pressure, as well as a shift in the Kerdo index to the zone of predominance of the parasympathetic nervous system and eutonia.

Key words: autonomic nervous system, chronic ischemiabrain, pulse pressure, Kerdo index, physiotherapy.

Introduction

One of the urgent problems of restorative medicine is the development of new methods of treating diseases associated with chronic ischemia.

the brain, as well as the introduction of these methods in various branches of medicine [1, 2].

The progressive course of this disease requires the inclusion of non-drug methods in the complex of treatment aimed at restoring the functional reserves of the human body. In this work, the method of photochromotherapy is considered [3].

Light radiation affects the functional state of the central nervous system, metabolism, activity of the endocrine glands, blood composition, etc. It has the following features: it does not have a damaging effect on cells, tissues and organs, promotes the development of adaptive reactions, and ensures good tolerability of procedures [4, 5].

The aim of this work was to study the effect of photochromotherapy on hemodynamic parameters in the complex treatment of patients with chronic cerebral ischemia (CCI). As part of this work, an analysis of 75 observations with HIGM was carried out. The patients' age ranged from 24 to 73 years old on the basis of the N.N. prof. A.L. Polenov in the period from 2003 to 2007.

For the diagnosis of CCI, it is necessary to carefully study the history of the disease, assess the neurological status, and use neuropsychological and instrumental research methods. There is a need for evidence of a causal relationship between the symptoms observed in the clinical picture and ischemic brain damage, which is reflected in the currently accepted diagnostic criteria for CCI [3]:

CCI has a progressive development, and based on the severity of symptoms, it is divided into 3 stages:

I - moderately pronounced (with focal neurological symptoms, but not pronounced enough to diagnose the next neurological syndrome).

II - severe (the presence of a rather pronounced neurological syndrome, neuropsychological changes, including a decrease in criticism of one's condition and emotional and personal disorders).

III - pronounced (a combination of several neurological and neuropsychological syndromes, which indicate multifocal brain damage; the vast majority of patients in this group also have vascular dementia).

The main clinical manifestations of the examined patients were headache, dizziness, tinnitus, decreased memory and performance, pyramidal disorders [6].

In order to verify the diagnosis, all patients underwent a standard neurological examination with an assessment of the somatic and neurological status, EEG, transcranial Doppler sonography, duplex scanning of the main arteries of the carotid and vertebral-basilar basin using a Siemens Sonoline Versa plus ultrasound machine.

Two groups were formed: main (n = 43) and control (n = 32). Treatment of patients of the main group was carried out according to the standard scheme with the addition of a course of photochromotherapy procedures. Control group patients

received only drug treatment according to the standard scheme.

Photochromotherapy is a medical method that uses the therapeutic effect of various parts of the visible spectrum. For each color, a corresponding spectrum range is defined:

Violet - 380-420 nm; Blue -
421-495 nm;
Green - 496-566 nm;
Yellow - 567-589 nm;
Orange - 590-627 nm;
Red - 628-780 nm.

Visible radiation is a range of different colors that have a selective effect on the excitability of the cortical and subcortical nerve centers. Red and orange radiation excite the cortical centers and subcortical structures, blue and violet - oppress them, and green and yellow balance the processes of inhibition and excitation in the cerebral cortex. When visible radiation is absorbed in the skin, heat is released, which changes the impulse activity of sensitive skin fibers, activates reflex and local reactions of the microvasculature and enhances the metabolism of the irradiated tissues.

Photochromotherapy procedures were performed using the Spectr-LC-02 apparatus. The impact was carried out on the reflex-segmental zone C4-Th4 and the zone of carotid sinus ganglia. The emission wavelength was 540 nm (green light). The course of treatment consisted of 10 sessions, 3-5 minutes each. Within the framework of this study, we tried to clarify the features of the effect of photochromotherapy with a wavelength of 540 nm in grade II-III CCI in patients with discirculation in the carotid and vertebro-basilar basins at the stage of rehabilitation.

As you know, blood pressure is due to the pumping function of the heart. Pulse pressure is the difference between systolic and diastolic pressure, normally it is 35 ± 10 mm Hg. With increased pulse pressure, fatigue of the heart muscle occurs. A decrease in pulse pressure leads to cerebral hypoxia.

Registration of hemodynamic parameters before and after treatment in the main and control groups made it possible to evaluate the effectiveness of the treatment. Hemodynamic parameters were recorded using a blood pressure monitoring system (Okorokov A.N., 2003). From the data obtained, pulse pressure was calculated ($PD = SD - DD$).

Table 1 shows the pulse pressure before and after treatment by groups. From the analysis of the presented table, it follows that in the patients of the main group, the pulse pressure decreased by 24.23 mm Hg, while in the control group after treatment it decreased only by 13.91 mm Hg. The results obtained are shown graphically in Fig. 1 and 2.

For a statistical assessment of the reliability of the results obtained, a comparative analysis of the dynamics of pulse pressure was carried out both within the groups and between groups for each of the patients. The test for normality was carried out using the Kolmogorov-Smirnov test. For both groups, the result is in

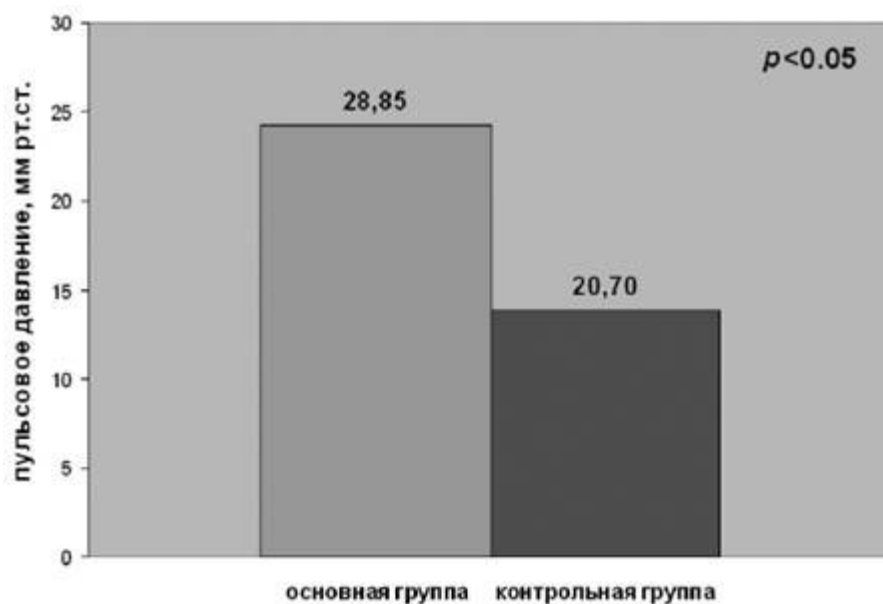
zone of significance.

The decrease in pulse pressure in both groups is significant ($p < 0.05$).

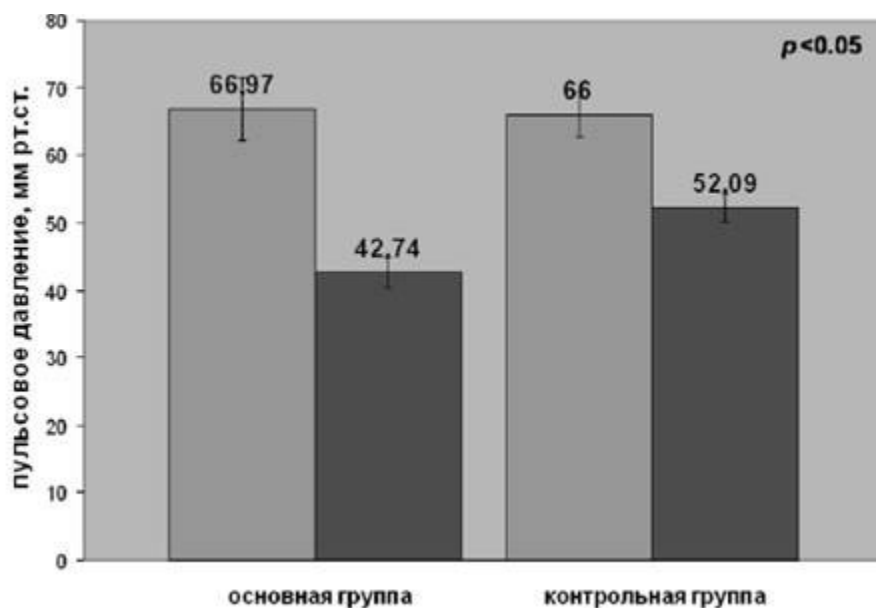
Table 1

Pulse pressure in the study groups

Пульсовое давление	Основная группа $M \pm m$	Контрольная группа $M \pm m$
До лечения	$66,97 \pm 4,52$	$66,00 \pm 3,43$
После лечения	$42,74 \pm 2,19$	$52,09 \pm 2,0$
Динамика	$\pm 24,23$	$\pm 13,91$



Rice. 1. Change in pulse pressure in the main and control groups in the result of treatment.



Rice. 2. Comparison of the dynamics of pulse pressure in the main and control groups as a result of treatment.

Further, a comparison of the dynamics of pulse pressure by groups was carried out using the Student's test. The obtained result $p = 0.047$ is significant ($p < 0.05$). The result is graphically shown in Fig. 2.

In addition to pulse pressure, the Kerdo index was calculated [7, 8]. It reflects the regulatory function of the body's activity for the purpose of life support and balancing external influences. The results of clinical observations and experimental studies obtained earlier [9] show that two antagonistic divisions of the autonomic nervous system take part in the regulation of life processes not according to the "either-or" principle, but are simultaneously involved in proportion to the load on the body.

Sympathicotonia and parasympathicotonia differ in the intensity and direction of metabolic processes, which are based on oxidation and acid-base balance. In turn, the intensity of oxidative processes determines the body's need for oxygen. Oxygen delivery is provided by the circulatory system, which matches the body's oxygen demand. This relationship allows us to make a conclusion about the actual vegetative tone [9]. According to the indicators characterizing the work of the heart, blood circulation and oxygen transport, one can judge the patient's condition and the effectiveness of therapeutic measures [10].

The calculation was made using the following formula:

$VIC = (1 - DBP / HR) - 100$, where DBP is diastolic blood pressure, HR is heart rate.

With a shift in autonomic tone towards sympathicotonia, diastolic pressure drops, heart rate increases. With parasympathicotonia, diastolic pressure increases, heart rate decreases. Thus, the VIC is a positive or negative integer. According to this formula, if $DBP / HR = 1$, i.e. coincides with the average value, then $VIB = 0$. If $DBP / HR < 1$,

then VIC is positive, if $DBP / HR > 1$, then VIC is negative.

Positive values mean a shift in autonomic tone towards sympathetic predominance, negative values towards parasympathetic.

Thus, with the help of repeated determinations of the index, it is possible to establish what shifts in the autonomic tone of patients occurred as a result of treatment. Table 2 shows the mean modulus values of the Kerdo index in each of the groups before and after the treatment.

table 2

Kerdo index module in the study groups before and after treatment

Индекс Кердо	Основная группа, $M \pm m$	Контрольная группа, $M \pm m$
До лечения	$14,369 \pm 5,1$	$8,076 \pm 2,7$
После лечения	$5,995 \pm 3,7$	$3,255 \pm 2,1$
Динамика	$\pm 8,374$	$\pm 4,821$

From the analysis of the presented table, it follows that in the patients of the main group, the Kerdo autonomic index decreased by 8.374, while in the control group after treatment, it decreased only by 4.821. The results obtained are shown graphically in Fig. 3.

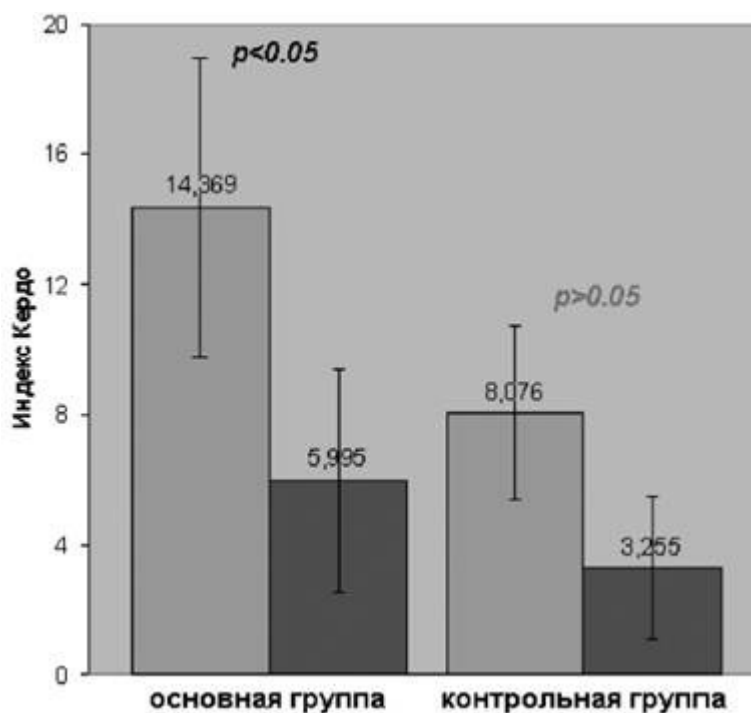
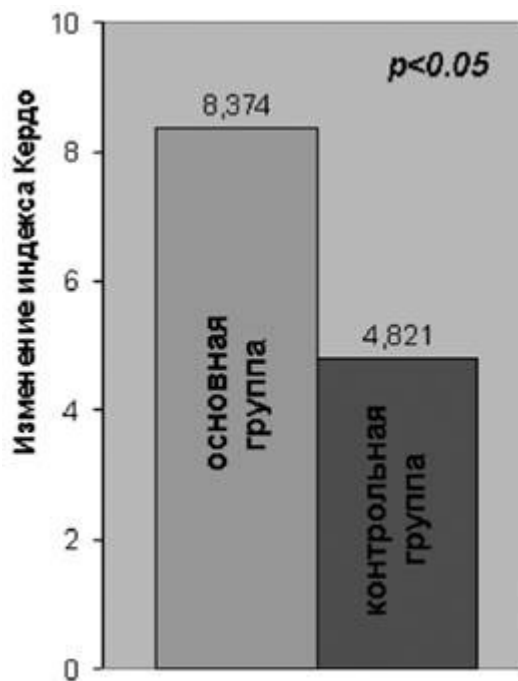


Рис. 3. Values of the Kerdo index in the main and control groups before and after treatment performed.



Rice. 4. Dynamics of the Kerdo index in the main and control groups as a result treatment.

For a statistical assessment of the reliability of the results obtained, a comparative analysis of the dynamics of the Kerdo index was carried out both within the groups and between groups for each of the patients. The test for normality was carried out using the Kolmogorov-Smirnov test. For both groups, the result was in the zone of significance.

The decrease in the Kerdo index in the main group is significant ($p < 0.05$), while in the control group we can only talk about a downward trend ($p > 0.05$).

We also compared the dynamics of the Kerdo index by groups using the Student test. The obtained result $p = 0.049$ is significant ($p < 0.05$). The result is graphically shown in Fig. 4.

The relationship between the dynamics of changes in pulse pressure (PP) and the dynamics of the Kerdo index is analyzed.

There is a direct average relationship between the dynamics of the Kerdo index and pulse pressure.

Table 3

		Изм. ПД	Изм. Кердо
Динамика ПД	Корреляция Пирсона		0,173
	N (число пациентов)		75
Динамика индекса Кердо	Корреляция Пирсона	0,173	
	N (число пациентов)	75	

conclusions

Analysis of the Kerdo index values allowed us to draw the following conclusions:

1. Analysis of pulse pressure revealed the fact that under the influence of phototherapy, pulse pressure is shifted to the zone of normal values, which does not happen without its use.
2. Before treatment, patients with CCI had a predominance of sympathetic or the parasympathetic influence of the ANS.
3. After the treatment, there was a shift in the zone of predominance of the parasympathetic nervous system and eutonia, which was accompanied by a decrease in heart rate and a relative normalization of the heart.
4. There is a connection between the dynamics of the Kerdo index and the pulse pressure.

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