NEUROLOGICAL DISORDERS AND CONDITIONS OF CEREBRAL HEMODYNAMICS IN PATIENTS WITH DISCIRCULATORY ENCEPHALOPATHY ON THE BACKGROUND OF ARTERIAL HYPOTENSION

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Abstract: The aim of the work was to determine the nature of cerebral hemodynamics of discipatory encephalopathy in the background of arterial hypotension. To do this, all the patients carried out ultrasound, the nature of clinical and neurological disorders was revealed, as well as minor focal symptoms with prevailing factors of complaints: the presence of reduced blood flow rate, confirmation of the absence of compensatory vasodilation in arterial hypotension.

Keywords: Arterial hypotension (AH), Ultrasound Dopplerography (UD), disciculatory encephalopathy (DE).

Introduction. Apart from arterial hypertension, atherosclerosis, cardiac disorders and blood clotting pathology, arterial hypotension (AH) has a special place among the risk factors for vascular brain pathology.[6, 11].The disease is found in about 5-15% of the adult population and has a multifactorial effect on the body's functional systems, health and quality of life [3, 8]. Patients with AH may have asthenic complaints, reduced adaptive responses of the cardiovascular system, mild cognitive impairment, and other clinical manifestations of chronic cerebrovascular disease (CCD) [2, 4].In MRI of the brain in young and middle-aged patients with AH it is possible to visualize small-focal vascular lesion, expansion of licorative spaces and leukoaraosis [10]. In ultrasound investigation in hypotensive patients there are often signs of abnormal arterial structure of the villisium circle (4).

However, the mechanisms of chronic CCD formation under AH remain poorly understood.

Objective of the study: to evaluate cerebral hemodynamics in patients with discirculatory encephalopathy.

Materials and methods of study: the study was based on the data from a survey of 65 patients with AH (20 men and 45 women) aged 30 to 60 years, the average age - 42.3±8.1 years.

Criteria for inclusion were patients with prolonged stable AP below 105-100/65-60 mm Hg) and with absence of cranial brain injuries, neurological pathology, acute cerebral circulation disorders, including transient attacks, stroke.

On admission, patients complained of headaches, dizziness, reduced ability to work, decreased memory, irritability, sleep disturbance. These complaints were the main reason to contact a neurologist.

The diagnosis was established on the basis of MKD-10. As a result of neurological examination, the patients were divided into 2 groups:

Group 1 - 19 (29%) patients with somatoform disorders (SD; code M 45.0.) Average age indexes of patients of the 1st group were 31,9±2,4 years. The analysis of anthropometric data revealed that the body mass index (BMI) in this group averaged 19.6±2.1 kg/m2.

Group 2 - this group includes 46 (71%) patients with stage I discirculatory encephalopathy (DE) against the background of early manifestations of insufficient blood supply to the brain (EMIBSB) [22]. Based on similarities in diagnostic criteria of stage 1 DE and EMIBSB, we combined these patients into one group - the initial forms of chronic cerebral vascular insufficiency [9]. The average age of patients of this group was 1.4 times higher in comparison with the 1st group and made 45.8±5.7 years. It was also found that the majority of patients in this group had excessive body weight, BMI was 25.3±2.4 kg/m2 ($p < 0.05$).

In an attempt to compare and establish normative values, we have set up a control group consisting of 35 virtually healthy individuals, of whom 68.6% (24/35) were women and 31.4% (11/35) were men. This group was formed based on the absence of neurological disorders and deviations of AP from the norm. The average age of the control group was 39.7±8.2 years and BMI was 23.8±4.2 kg/m2. The control group was comparable with the 1st and 2nd groups by sex and age, with the 2nd group - by BMI.

The blood flow in internal carotid arteries (ICA) and vertebral arteries (VA) was studied using ultrasound scanners SSD-5500 SVQ (Aloka, Japan), Sonoline G-60 (Siemens, Germany) and SSH-140A (Toshiba, Japan) with 7.0-13.0 MHz sensors. Time Averaged Linear Blood Flow Rate (LBFR), Resistance Indexes (IR), and Pulsation Index (Pi) were automatically calculated. Blood flow in the middle cerebral arteries (MCA) was studied by transcranial duplex scanning using Sonoline G-60 (Siemens, Germany) and SSH-140A (Toshiba, Japan) ultrasound scanner with a 2.0 MHz sector sensor. We analyzed the average LBFR, IR, PI.

Statistical data processing was carried out on a personal computer using the MS Excel program.

Research results. The objective examination revealed that such complaints as sleep disturbance, irritability, frequent mood swings were recorded in almost the same number of patients in both groups. Distinctive feature of subjective manifestations of initial forms of chronic vascular brain failure in patients in Group 2 was a reliable presence of headaches and dizziness, reduced performance, memory impairment (Table 1).

Table 1: Semiological characteristics of cerebral complaints in the patients surveyed

Complaint	1st group (n=19)		2nd group (n=46)		P
	abs.	%	abs.	%	
Headache	9	47,4	37	80,4	<0,01
Dizziness	7	36,8	35	76,1	<0,01
Memoryreduction	10	52,6	42	91,3	<0,05
Decreaseinproductivity.	6	31,6	39	84,8	<0,05
Frequentmoodswings	18	94,7	37	80,4	>0,05
Irritability	17	89,5	39	84,8	>0,05
Sleepdisorder	15	78,9	38	82,6	>0,05

The age (31.9±2.4 vs. 45.8±5.7 years; P<0.05) and manifesto of the disease (2.3±0.2 vs. 4.9±0.3 years) are also one of the main factors of DE development in AH.
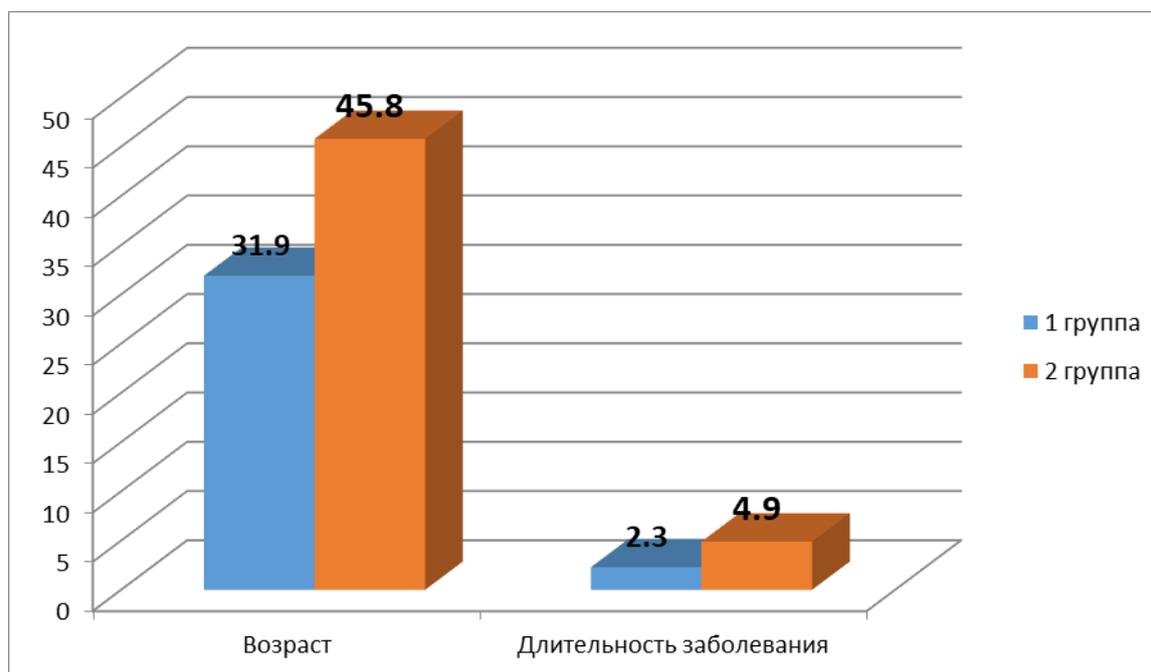
Fig. 1. Indicators of age and duration of the disease among the surveyed patients

In the analysis of the literary scientific sources on this problem, we found out that the study of neurological disorders and cerebral blood circulation in AH has received mixed results. Thus, A.A. Shutov and L.V. Pustokhanova. (2010) it was shown that "...vegetative dystonia syndrome with the phenomena of long-term and persistent decrease in AH does not significantly affect the frequency and time of appearance of initial signs of cerebral blood circulation insufficiency" [10]. In studies by Belova V.V. (2011), on the contrary, showed that "...in AH the cerebral blood supply is impaired, which leads to chronic cerebral ischemia" [2].

Most likely, these disagreements indicate that a patient with a stable AH is active at a young age and that the change in well-being is not constant, so that they seek medical attention only when the disease begins to be long-term [1]. In this connection, the clinical picture and symptomatology of AH is changing and excessive tension of adaptation systems mechanisms is observed [5]. Decrease in vascular elasticity and neuroendocrine system rearrangement leads to manifestation of subjective and objective SFR symptomatology. Further somatoform pathology is formed which is characterized by neurological disorders against the background of progressive imbalance of central and cerebral hemodynamics.

On the basis of duplex scanning it was found out that LBFV values in ICAwere lower (p<0,05) in comparison with control in patients of the 2nd group (Table 2).

Table 2: Hemodynamic indexes of arteries in AH patients and control subjects

Parameters	1st group (n=19)	2nd group (n=46)	Control (p=35)
Internalcarotidarteries			
LBFVcp., cm/s	45,2±5,6	37,1±3,2*	43,9±3,6
IR	0,57±0,07	0,41±0,1*	0,60±0,08
Pi	0,91±0,3	0,88±0,11*	1,11±0,18
Middlecerebralarteries			

LBFVspeed, cm/s	77,1±5,4*	78,6±6,8*	92,0±8,3
IR	0,42±0,04#	0,55±0,07	0,57±0,04
Pi	0,81±0,14*	0,78±0,13*	0,87±0,11
Vertebral arteries			
LBFVspeed, cm/s	34,2±8,3	31,2±6,8	32,3±6,2
IR	0,67±0,07	0,65±0,08	0,68±0,04
Pi	1,19±0,4	1,22±0,3	1,27±0,2

Note: * - differences between patients with Ischemic Arterial Pressure and control ($p<0,05$); # - differences between patients of the 1st and 2nd groups ($p<0,05$).

As can be seen from the obtained data, there is a decrease in the tone of the arterial component, which is characterized by lower values of peripheral resistance indices in comparison with the control: IR in Group 1 ($p<0.05$) and IR in both groups ($p<0.05$ for Group 2). The same type of changes are observed on the intra-cranial level. Thus, LBFVand IR indicates to the SMAin the patients of the 1st and 2nd groups were characterized by the decrease of values in comparison with the control values.

The data obtained agree with the hypothesis that in AH patients the arterial vessels tone reduction due to the arteriolar component can be compensatory and adaptive in nature, aimed at improving blood supply to vital organs [9].

Thus, the established changes in blood flow in different vascular systems of the brain depending on the presence of DE indicate an imbalance of adaptive-disregulatory reactions in AH. Decrease of IR in the 1st group in carotid system is aimed at compensation of appearing insufficiency of blood supply, whereas in the 2nd group this compensatory mechanism is exhausted, though it doesn't affect the degree of insufficiency of blood flow in carotid system yet.

At the same time, the study of blood flow from PA showed that normal values ofLBFVin the absence of compensatory vasodilation do not approach the control indicators of volume blood flow. In patients of the 2nd group the values of blood flow parameters corresponded to the lower limit of the normal indices range [9].

Hemodynamic disturbances noted in patients of the 2nd group are connected not only with existing chronic cerebral ischemia, but also with risk of hypotensive crises in future. Therefore, measures aimed at increasing the adaptive capacity of the body, preventing neurological disorders and improving the quality of life are of practical importance in the management of patients with AH.

Thus, most AH patients with neurological and asthenic complaints have initial forms of chronic vascular brain failure. In AH, brain blood flow in the carotid system, regardless of the presence of DE, is characterized by a moderate decrease in blood flow rate and a compensatory decrease in vascular resistance. For cerebral blood supply in arterial hypotension conditions there is a lack of compensatory vasodilation and a decrease in blood flow in PA, most pronounced in DE.

Conclusion: Thus, DE in AH patients is associated with age, duration of arterial hypotension, predominant deterioration of blood supply in the vertebral and basilar system.

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