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**FEATURES OF CEREBRAL HEMODYNAMICS,
MICROHEMOCIRCULATION IN PATIENTS WITH RENAL SYNDROME**

R.M.Urinov, S.S.Pulatov

Abstract: Postcovid syndrome is a long-lasting (for 3 months or more) pathological manifestations after an acute period of the disease. The main signs include pronounced weakness, heaviness in the chest, a feeling of incomplete inhalation, headache, joint and muscle pain, sleep disturbance, depression, cognitive decline, thermoregulation disorder, etc. The mechanism of the postcovid syndrome may be associated with the emerging chronic inflammation of the vessels, which negatively affects the work of the nervous system in the first place, and also disrupts the work of internal organs. SARS-CoV-2 destroys the inner surface of blood vessels, which increases the risk of developing microthrombs in the microcirculatory bed. COVID-19 can also have a direct destructive effect on the cells of the body, as well as cause an excessive immune response and provoke autoimmune diseases.

Keywords. Cerebral hemodynamics, microcirculation, disorder, renal syndrome

Materials and methods of research. The study included 100 young and middle-aged people from 30 to 55 years old, with a verified diagnosis of the consequences of COVID-19 coronavirus infection, confirmed by laboratory methods of investigation and after negative results (PCR, ELISA) on SARS-CoV-2, 15 to 35 weeks after the onset of the disease, who made up the main group. The patients of the main group were divided into subgroup I - 70 people who suffered from COVID-19 in mild form and subgroup II - 30 patients who suffered from moderate and severe form of the disease complicated by pneumonia. The control group consisted of 20 healthy subjects of the appropriate gender and age composition who had not had a coronavirus infection or other viral infection over the past 6 months and did not have acute and decompensated chronic pathology at the time of observation.

The results of the study and their discussion.

The study of cerebral blood flow in patients with postcovid syndrome at rest revealed statistically significant differences in the V_{max} (maximum systolic velocity) of blood flow through the main extracranial vessels of the carotid artery system and intracranial vessels of the carotid and vertebral-basilar systems.

In a background study of cerebral hemodynamics in patients of subgroups 1 and 2, a multidirectional change in linear blood flow velocity (LSC) at the extracranial level was observed.

The rate of blood flow at rest along the common carotid artery (CCA) was significantly lower in patients of the first subgroup and was combined with venous dyschemia, relative to the control group ($p < 0.001$). Thus, the blood flow along the right OSA in patients of subgroup 1 was 86.95 ± 1.95 cm/s and 91.1 ± 3.16 in the control group ($p < 0.001$); along the left OSA, the blood flow rate in subgroup 1 was 86.8 ± 1.96 cm/s and 92.53 ± 3.35 cm/s in the control group ($p < 0.001$);

In patients of the second subgroup, there was an increase in the speed indicators for the OSA- 95.4 ± 1.54 cm/s significantly relative to the indicator of the control group ($p < 0.001$); for the left OSA, the blood flow rate in the second subgroup was 95.1 ± 1.81 cm/s ($p < 0.01$)., with the control group.

Indicators of the linear velocity of blood flow in the internal carotid artery (ICA) had similar trends to the LSC in the OCA. The blood flow rate was significantly lower in patients of subgroup 1, relative to the control group ($p < 0.001$). Thus, the blood flow along the right ICA in patients of subgroup 1 was 52.58 ± 2.07 cm/s and 62.6 ± 4.57 in the control group ($p < 0.001$); along the left ICA, the blood flow rate in subgroup 1 was 52.75 ± 2.2 cm/s, and 63.6 ± 4.1 cm/s in the control group ($p < 0.001$); In patients of the second subgroup, there was an increase in speed indicators for ICA - 65.2 ± 1.73 cm/s ($p < 0.01$) relative to the indicator of the control group; for the left LSA, the blood flow rate in subgroup 2 was 65.77 ± 1.28 cm/s, without significant differences with the control group.

When assessing the blood flow rate in the vertebral artery (PA) was also significantly lower in patients from subgroup 1, relative to the control group. Thus, the blood flow along the right PA in patients of subgroup 1 was 12.72 ± 0.84 cm/s ($p < 0.001$) with a control group of 13.93 ± 1.53 .; on the left PA, the blood flow rate in subgroup 1 was 12.74 ± 0.84 cm/s and 14.40 ± 1.28 in the control group ($p < 0.001$).

In patients with postcovid syndrome who had pneumonia in the acute period of the second subgroup, there was an increase in speed indicators on the right PA - 13.17 ± 1.06 cm/s without significant differences with the control group; on the left PA, the blood flow rate in the 2nd subgroup was 13.39 ± 1.18 cm/s without significant differences with the control group.

The resistance indices (RI) were significantly reduced in the subgroup of patients of the first subgroup in OSA and PA and amounted to 0.69 ± 0.01 and 0.63 ± 0.01 , respectively ($p < 0.01$). In patients from the second subgroup, an increase in RI in PA was observed to 0.67 ± 0.01 in the 2A subgroup, which was significantly higher than the control group ($p < 0.01$).

In the study, a violation of vascular anatomy was noted in patients of the 2nd subgroup, with early formation of vascular disorders (C, S vessels), and the formation of initial signs of atherosclerotic lesion vessel – violation of differentiation into layers of the intima-media complex.

The linear velocity of blood flow in the medial cerebral artery (SMA) was evaluated at the intracranial level. A decrease in blood flow rates was revealed both in the group of patients of the first and second observation subgroups relative to the control group ($p < 0.001$),

When assessing venous outflow in the observation groups, all patients had signs of an increase in the velocity along the rectus sinus to 50 ± 0.8 and 57 ± 0.6 cm/s, respectively, reliable relative to the control group ($p < 0.001$). По венам Розенталя ускорение сброса до $27 \pm 0,98$ и $32 \pm 0,55$ см/с соответственно ($p < 0,001$). Вены позвоночных сплетений были расширены до 5-6 мм, сброс доходил до $30 \pm 0,58$ см/сек в обеих подгруппах. В подгруппе II сброс по The medial cerebral vein was accelerated to 20 ± 0.78 cm/sec, and in subgroup I to 17.3 ± 0.4 cm/sec ($p < 0.001$).

In the control group, the discharge rates through venous vessels remained within the age norms.

Thus, the study of cerebral hemodynamics in patients of the studied groups showed a significant effect of the venous component on the autoregulation of cerebral blood flow. Thus, in patients who had a mild coronavirus infection, the velocity indices of the venous link had significantly high values with reduced velocity indices of arterial vessels. Thus, a decrease in the rates of linear blood flow through the main cerebral arteries, a decrease in the tone of arterial vessels, which is a compensatory reaction in case of difficulty in venous outflow, was revealed, however, in these conditions, perfusion cerebral insufficiency is possible, which leads to transient hypoxia of the brain and, as a consequence, violation of autoregulation of blood flow.

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