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COVID-19 İNFEKSİYASI KEÇİRMİŞ PSİXİ PATOLOGİYALI XƏSTƏLƏRDƏ BEYNİN ARTERİAL HEMODİNAMİKASI

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Xülasə. *Məqalədə psixika pozulmaları olan və COVID-19 infeksiyası keçirmiş xəstələrdə beynin arterial hemodinamikasını öyrənmək məqsədilə aparılmış tədqiqat işi haqqında məlumat verilmişdir. Tədqiqata müvafiq patologyası olan 43 xəstə (I qrup) daxil edilmişdir. Müqayisə qrupunu (II qrup) COVID-19 keçirmiş və çox zəif psixi pozuntusu olan 35 xəstə təşkil edib. Göstərilmişdir ki, I qrupda 28 (65,1±7,3%), II qrupda 13 (37,1±8,6%) xəstənin sol orta beyin arteriyasında qan dövranı sürəti sağ orta beyin arteriyasındakı qan dövranı sürətindən çox olub (Vs sol > Vs sağ). I qrupda 15 (34,9±7,3%), II qrupda 22 (62,9±8,6%) xəstədə isə əksinə, az olub (Vs sol < Vs sağ). Sol orta beyin arteriyasındakı pulsasion index I qrupda 0,93+0,06, II qrupda 0,76 ± 0,04 (p<0,05) olub.*

Əldə edilmiş məlumatlara görə, psixika pozulmaları olan COVID-19 keçirmiş xəstələrdə orta beyin arteriyalarındakı qan dövrani sürətinin asimmetriyasi psixi pozulmaları olmayan xəstələrdəkindən statistik dəqiqliklə (p<0,05) yüksək olub. Belə nəticə periferik müqavimət (RI, PI) göstəriciləri üçün də alinib.

Açar sözlər*: COVID-19, beyin arterial hemodinamikasi, psixi pozuntular, doppleroqrafiya*

Ключевые слова*: COVID-19, церебральная артериальная гемодинамика, психические расстройства, допплерография*

Key words*: COVID-19, cerebral arterial hemodynamics, mental disorders, doplerography*

CEREBRAL ARTERIAL HEMODYNAMICS IN PATIENTS SURVIVORS OF COVID-19 WITH MENTAL DISORDERS

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Summary. *The article presents data on the assessment of cerebral arterial hemodynamics in 43 patients who had Covid-19 and had mental disorders (group I). The comparison group (group II) consisted of 35 patients who had suffered Covid-19, who were less likely to have mental disorders. It was shown that in 28 (65.1±7.3%) patients of group I and 13 (37.1±8.6%) of group II, the blood flow velocity in the left middle cerebral artery (Vs lmca) was higher than in the right middle cerebral artery (Vs rmca). In 15 (34.9±7.3%) patients of group I and in 22 (62.9±8.6%) patients of group II, on the contrary, it was less (Vs lmca<Vs rmca). The pulsation index on the left middle cerebral artery was 0.93+0.06 in group I and 0.76±0.04 in group II (p<0.05).*

According to the data obtained, the asymmetry of blood flow velocity in the middle cerebral arteries in patients who had suffered Covid-19 and had mental disorders was statistically significantly higher (p<0.05) than in patients without mental disorders. The same result was obtained for peripheral resistance indicators (RI, PI).

The COVID-19 pandemic is considered the largest global crisis with severe consequences not only for the health of the individual patient, but also for the healthcare system and economyc of the whole world [1]. As is known, the severity of the disease caused by the new coronavirus 2019 (COVID-19) is mainly manifested in the occurrence of severe acute hypoxemic respiratory failure, which often requires artificial ventilation. However, damage to the central nervous system (CNS), as well as thromboembolic complications, including the development of ischemic stroke, have been reported [2, 3].

According to the literature, mental and neurological symptoms are observed in almost half of patients with COVID-19. The most common complaints among these individuals are constant fatigue and anxiety [4, 5]. Some researchers note that in the first weeks of the acute phase of Covid-19, the risk of developing mental disorders becomes high [6, 7].

According to Xie Y. et al. (2022) among patients with COVID-19, damage to the central nervous system was observed in 24.8%, skeletal muscles - in 10.7% of cases. Among patients with lesions of the central nervous system, dizziness was observed in 16.8% of cases, headache - in 13.1%, disturbances of taste - in 5.6% and smell - in 5.1% of cases. Among patients with severe COVID-19, mental disorders were recorded in 14.8% of cases, with mild cases in 2.4% ($p<0.001$), respectively [8]. Other studies have shown that in patients who had COVID-19, anxiety was recorded in 61.0% of cases, depression – in 61.7%, bipolar disorder – in 58.8% of cases, respectively. According to the authors, these symptoms were the reason for re-hospitalization [9]. It is important to note that it is still unclear whether disorders of the central nervous system develop as a result of acute respiratory failure, systemic aggression or hypercoagulability syndrome [10].

Research by Batra A. et al (2021) shows that in severe cases of COVID-19, circulating microemboli occur, which can cause stroke or encephalopathy, while there may be no pulmonary complications of the disease [11].

Neuroimaging methods play an important role in assessing cerebral hemodynamics among patients with neurological disorders after COVID-19 [12–15]. Transcranial Dopplerography, being a non-invasive accessible method, allows you to record quantitative parameters of blood flow in the main arteries of the brain, thereby assessing hemodynamic conditions [16, 17].

The purpose of the study is to evaluate of Dopplerographic features of cerebral arterial hemodynamics in patients who have had COVID-19 with and without mental disorders.

Material and methods. The results of transcranial Dopplerography of cerebral arterial hemodynamics were analyzed in 43 patients aged 28–49 years (average 35.6±4.7 years) who had COVID-19 with the presence of psychoemotional disorders (group I). Group II consisted of 35 patients of similar age (on average 36.0±4.9 years) who also had COVID-19, but with episodic symptoms of psycho-emotional disorders. In group I, 32 patients were treated in a hospital due to their serious condition, and in 11 patients - on an outpatient basis, and in group II - in 4 and 31 patients, respectively.

Doppler sonography was carried out 2-4 months after suffering from COVID-19 using a Philips HD-11 ultrasound machine with a sector sensor in a frequency mode of 2-4 MHz. Hemodynamic parameters were determined in the middle cerebral artery on both sides of the brain.

Statistical analysis was carried out using the nonparametric Mann-Whitney method. If the p value <0.05, the difference between the compared groups was considered statistically significant.

Results and discussion. The analysis of psychoneurological clinical symptoms in patients who had COVID-19 was carried out on the basis of previously published scientific works [18, 19]. Table 1 shows the frequency of clinical symptoms of psychoemotional disorders. Initially, group I included patients who recorded at least 5 symptoms out of 13 presented in Table 1.

As can be seen from the table 1, clinical symptoms of psycho-emotional disorders were also rarely found among patients in group II who suffered from mild COVID-19. However, among them there was no combination of more than 5 symptoms of psychoemotional disorder. All symptoms of psychoemotional disorders in the I group were recorded statistically significantly more often ($p<0.001$) than in the II group.

Table 1. Frequency of clinical symptoms of psychoemotional disorders in patients who suffered COVID-19

Clinical symptoms of psychoemotional disorder	I group n= 43	II group n=35
Sense of anxiety	39 (90,7±4,4%) p<0,001	4 (11,4±5,4%)
Internal tension	32 (74,4±6,7%) p<0,001	6 (17,1±6,4%)
Lowered mood background	31 (72,1±6,8%) p<0,001	5 (14,3±5,9%)
Sleep disorders	29 (67,4±7,1%) p<0,01	8 (22,9±7,1%)
Vegetative hyperactivity	28 (65,1±7,3%) p<0,01	7 (20,0±6,8%)
Inability to self-control anxiety	26 (60,5±7,5%) p<0,001	6 (17,1±6,4%)
Anxious fears	25 (58,1±7,5%) p<0,001	5 (14,3±5,9%)
Motority tension	23 (53,5±7,6%) p<0,001	5 (14,3±5,9%)
Intrusive anxious thoughts	21 (48,8±7,6%) p<0,001	4 (11,4±5,4%)
Irritability	19 (44,2±7,6%) p<0,01	5 (14,3±5,9%)
Exaggerated alertness	17 (39,5±7,5%) p<0,001	3 (7,7±4,5%)
Decreased ability to concentrate	16 (37,2±7,4%) p<0,05	6 (17,1±6,4%)
Feeling of losing control over your life	14 (32,6±7,1%) p<0,01	2 (5,7±3,9%)

The average value of systolic blood flow velocity (Vs) in the left middle cerebral artery (MCA) in patients of group I was 116.7±8.1 cm/s, in patients of group II – 96.5±7.2 cm/s, in the right MCA – 104.3±6.4 cm/s and 102.8±6.9 cm/s, respectively. For end-diastolic velocity (Vd), these parameters were 40.8±6.2 cm/s, 41.3±5.8 cm/s, 38.2±4.5 cm/s and 42.3±4.7 cm/s, respectively. The resistance index (RI) in the left MCA in patients of group I was 0.65±0.04, in patients of group II – 0.57±0.03, in the right MCA – 0.63±0.03 and 0.59± 0.02, respectively. For the pulsation index (PI), these parameters were 0.93±0.06, 0.76±0.04, 0.89±0.05 and 0.81±0.05, respectively (Table 2). As can be seen from the table, a significant difference ($p<0.05$) between groups I and II was detected only in the PI index in the left MCA (Table 2).

Table 2. Blood flow parameters in the middle cerebral artery (MCA) in patients who suffered COVID-19 with and without psychoemotional disorders

	Left MCA		Right MCA	
	I group	II group	I group	II group
Vs, cm/s	116.7 ± 8.1	96,5 ± 7,2	104,3 ± 6,4	102,8 ± 6,9
Vd, cm/s	40.8 ± 6.2	41,3 ± 5,8	38,2 ± 4,5	42,3 ± 4,7
RI	0.65+0.04	0,57 ± 0,03	0,63 ± 0,03	0,59 ± 0,02
PI	0.93+0.06 p<0,05	0,76 ± 0,04	0,89 ± 0,05	0,81 ± 0,05

As shown in Table 3, among patients of group I, in 28 (65.1±7.3%) in the left MCA the Vs value was higher than in the right MCA (Vs lmca > Vs rmca), and in 15 (34.9±7 .3%), on the contrary, Vs lmca < Vs rmca. In group II, 13 (37.1 ± 8.6%) patients had Vs lmca > Vs rmca, and 22 (62.9 ± 8.6%) patients had Vs lmca < Vs rmca (Table 3). As can be seen from the table, in group I the number of patients (28 people) with the index of Vs lmca>Vs rmca was statistically significantly (P<0.05) greater than in group II (13 people). In group II, the number of patients (22 people) with the index of Vs lmca<Vs rmca was significantly (P<0.05) greater than in group I (15 people). The same trend was observed within groups I (p^*<0.01) and II (p^*<0.05) of patients.

The degree of Vs asymmetry between SMAs is divided into 3 degrees - less than 10%, within 11-20% and more than 20%, respectively. In group I, in 16 (37.2±7.4%) patients, the degree of Vs asymmetry between the SMAs was less than 10%, in 13 (30.2±7.0%) patients - within 11-20%, and in 14 (32.6±7.1%) of patients was more than 20%, respectively. In group II of patients, these parameters were 19 (54.3±7.6%), 11 (31.4±7.8%) and 5 (14.3±5.9%), respectively (Table 4). As shown in the table, a significant (P<0.05) difference between groups I and II was detected only when the value of Vs asymmetry in the middle cerebral arteries was more than 20% (Fig.1, Fig. 2).

Table 3. Distribution of patients taking into account the ratio Vs in the left and right middle cerebral arteries

Ratio Vs in the left and right MCA	Number of patients, %	
	I group (n=43)	II group (n=35)
Vs лсма> Vs псма Vs lмca < Vs rmca	28 (65,1±7,3) p<0,05 p^*<0,01	13 (37,1±8,6)
Vs лсма < Vs псма Vs lmca < Vs rmca	15 (34,9±7,3)	22 (62,9±8,6) p<0,05 p^*<0,05

Note: Vs – systolic blood flow velocity, lmca – left middle cerebral artery, rmca – right middle cerebral artery.

Table 4. Distribution of patients according to the degree of asymmetry of systolic blood flow velocity in the middle cerebral artery

The degree of asymmetry between left and right MCA, %	Number of patients, %	
	I group (n=43)	II group (n=35)
< 10	16 (37,2 ± 7,4)	19 (54,3 ± 7,6)
11-20	13 (30,2 ± 7,0)	11 (31,4±7,8%)
> 20	14 (32,6 ± 7,1) P<0,05	5 (14,3±5,9%)

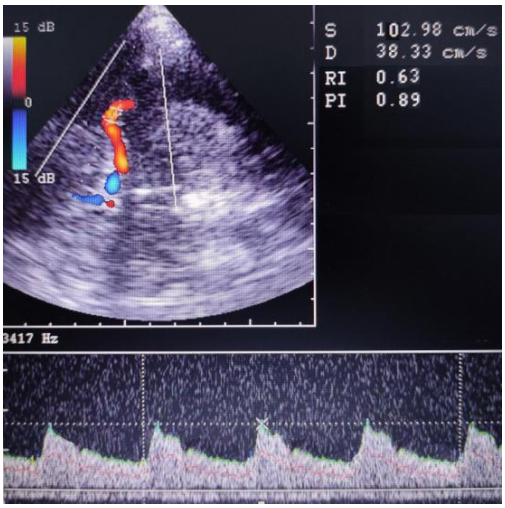

Fig. 1. Registration of blood flow in the right middle cerebral artery in a patient who has had COVID-19 with clinical symptoms of mental and emotional disorders. Vs - cm/c, RI – 0.63, PI – 0.89.

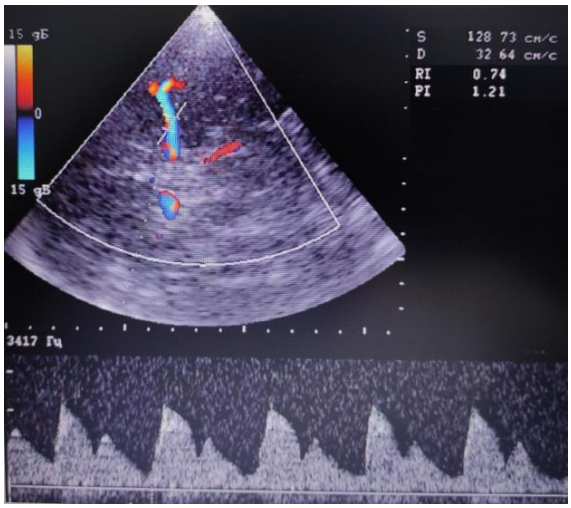

Fig. 2. Same patient. Registration of blood flow in the left middle cerebral artery. Vs - 128 cm/s, RI – 0.74, PI – 1.21, Vs lmca/ Vs rmca.

Discussion. Research by Lang J.P. et al. (2020) show that patients with COVID-19 have not only pulmonary, but also gastrointestinal, cardiac and neurological dysfunctional symptoms [20]. Data from some authors indicate that despite achieving control over the spread of the virus, the frequency of mental disorders among people who have recovered from COVID 19 will increase [21].

Transcranial Doppler (TCD) provides a non-invasive functional assessment of blood flow characteristics and cerebrovascular hemodynamics in the basal arteries of the brain. The ability to study cerebral arterial hemodynamics using TCD in patients with COVID-19 was demonstrated by obtaining key cerebrovascular parameters. TCD-based assessments provide reliable estimates that can be used in further studies of these patients, mainly in the context of prospective studies of COVID-19 complications, which are often associated with delirium, cognitive decline and ischemic impairment [22].

We studied cerebral arterial hemodynamics in previous studies in acute ischemic stroke [23]. We identified an increase in peripheral resistance indices as a response to impaired arterial blood flow. An analysis of the nature of the Doppler spectrum in patients with psychoemotional disorders as a result of COVID-19 revealed an asymmetry in the systolic blood flow velocity between the left and right middle cerebral arteries of both hemispheres of the brain. Among patients who suffered COVID-19 with clinical symptoms of psycho-emotional disorders, the degree of asymmetry was statistically significantly higher than in patients without these symptoms.

Conclusions

1. Among patients who suffered COVID-19 with psycho-emotional disorders, the degree of asymmetry of systolic blood flow velocity between the left and right middle cerebral arteries was significantly ($p<0.05$) higher than in patients who suffered COVID-19 without psycho-emotional disorders.

2. Parameters of peripheral resistance (RI, PI) in patients survivors of COVID-19 with psycho-emotional disorders significantly higher ($p<0.05$, $p<0.001$) than in patients without clinical symptoms of psychoemotional disorders.

Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

1. Talevi D, Socci V, Carai M, Carnaghi G, Faleri S, Trebbi E. Mental health out-comes of the COVID-19 pandemic // Riv Psichiatr. 2020; 55(3):137-44. DOI: 10.1708/3382. 33569. PMID: 32489190;
2. Bridwell, R., Long, B., Gottlieb M. Neurologic complications of COVID-19 // Am. J. Emerg. Med. 2020, 38, 1549.e3–1549.e7.
3. Needham, E.J.; Chou, S.H.; Coles, A.J.; Menon, D.K. Neurological implications of COVID-19 infections // Neurocrit. Care 2020, 32, 667–671.
4. Sher L. The impact of the COVID-19 pandemic on suicide rates. QJM: An International Journal of Medicine. 2020;113(10):707-12. DOI: 10.1093/qjmed/hcaa202. PMID: 32539153.
5. Leshchyna I.V. Phenomenological structure of anxiety disorders in persons who have transferred COVID-19 // Medicine Today and Tomorrow. 2023;92(4):82-6. https://doi.org/10.35339/msz.2023.92.4.les
6. Brulhart M, Klotzbьcher V, Lalive R, Reich SK. Mental health concerns during the COVID-19 pandemic as revealed by helpline calls // *Nature* 2021;600:121-6. doi:10.1038/s41586-021-04099-6.
7. Taquet M, Geddes JR, Husain M, Luciano S, Harrison PJ. 6-month neurological and psychiatric outcomes in 236 379 survivors of COVID-19: a retrospective cohort study using electronic health records // *Lancet Psychiatry* 2021;8:416-27. doi:10.1016/S2215-0366(21)00084-5.
8. Xie Y., Xu E., Al-Aly Z. Risks of mental health outcomes in people with covid-19: cohort study // BMJ 2022;376:e068993 http://dx.doi.org/10.1136/bmj‑2021‑068993.
9. Al-Aly Z, Xie Y, Bowe B. High-dimensional characterization of post-acute sequelae of COVID-19 // *Nature* 2021;594:259-64. doi:10.1038/s41586-021-03553-9
10. Spallazzi, M.; Morelli, N.; Taga, A. COVID-19 and neurologic manifestations: A still missing link and a call for neurologists // Neurol. Sci. 2020, 41, 1997–1998
11. Batra A., Clark J.R., LaHaye K., Nathan A. Shlobin K.A., Hoffman S.C. Transcranial Doppler Ultrasound Evidence of Active Cerebral Embolization in COVID-19 // Journal of Stroke and Cerebrovascular Diseases, Vol. 30, No. 3 (March), 2021: 105542.
12. Longhitano Y, Iannuzzi F, Bonatti G. Cerebral autoregulation in nonbrain injured patients: a systematic review // Front Neurol. 2021;12: 732176.
13. Li Y., Li M., Wang, M., Zhou Y., Chang J. Acute cerebrovascular disease following COVID-19: A single center, retrospective, observational study // Stroke Vasc. Neurol. 2020, 5, 279–284.
14. Sonkaya, A.R.; OztUrk, B.; Karada, S.O. Cerebral hemodynamic alterations in patients with Covid-19 // Turk. J. Med. Sci. 2020, 51, 435–439.
15. Brasil S, Taccone FS, Wahys SY. Cerebral hemodynamics and intracranial compliance impairment in critically Ill COVID-19 patients: a pilot study // Brain Sci 2021;11(7).
16. Abdullayev R.Ya., Dudnik T.A., Tovazhnyanska O.L., Kozarenko T.M., Vasko L.N., Markovska O.V., Zhukova T.A. Dopplerometry of the cerebral main arteries // Azerbaijan Medical Journal, 2021, No. 1, 18-23
17. Baracchini C, Pieroni A, Kneihsl M, et al. Practice recommendations for neurovascular ultrasound investigations of acute stroke patients in the setting of the COVID-19 pandemic: an expert consensus from the European Society of Neurosonology and Cerebral Hemodynamics // Eur J Neurol 2020.
18. Liotta EM, Batra A, Clark JR, et al. Frequent neurologic manifestations and encephalopathy-associated morbidity in Covid-19 patients // Ann Clin Transl Neurol 2020.
19. Leshchyna I.V. Clinical phenomenology of mental disorders in patients with COVID-19 // Experimental and Clinical Medicine. 2021;90(3):76-81. https://doi.org/10.35339/ekm.2021.90.3.les
20. Lang JP, Wang X, Moura FA, Siddiqi HK, Morrow DA, Bohula EA. A current review of COVID-19 for the cardiovascular specialist // Am Heart J 2020;226:29-44.
21. Kozhyna HM, Strelnikova IM, Tieroshyna IF. Adaptation disorders in relatives of patients with COVID-19 // The journal of the European psychiatric association. 2021;64:283.
22. Caldas J., Passos R., Sancho L. Monitoring cerebral hemodynamics in COVID-19 patients in the prone position Journal of Critical Care 70 (2022) 154055. https://doi.org/10.1016/j.jcrc.2022.154055.
23. Abdullaiev R.Y., Sysun L.A., Tovazhnyanska O.L., Posokhov N.F., Markovska O.V. Transcranial dopplerography in acute left-hemispheric ischemic stroke. *J Brain Neurol 2018 Volume 2 Issue 1 P.8-13. http://www.alliedacademies.org/journal-brain-neurolog*

ЦЕРЕБРАЛЬНАЯ АРТЕРИАЛЬНАЯ ГЕМОДИНАМИКА У БОЛЬНЫХ ПЕРЕНЕСШИХ COVID-19 С ПСИХИЧЕСКИМИ НАРУШЕНИЯМИ

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Резюме. В статье представлены результаты исследования, проведенного с целью изучения церебральной гемодинамики у больных с психическими расстройствами, перенесших COVID-19. 43 пациентов перенесших COVID-19 и имеющих психические расстройства (I группа). Группу сравнения (группа II) составили 35 пациентов перенесших COVID-19, у которых реже наблюдались психические расстройства. Показано, что у 28 (65,1±7,3%) больных I группы и 13 (37,1±8,6%) II группы скорость кровотока в левой средней мозговой артерии (СКЛМР) была выше, чем в правой средней мозговой артерии (СКПМА). У 15 (34,9±7,3%) больных I группы и у 22 (62,9±8,6%) больных II группы, наоборот меньше (СКЛМА>СКРМА). Индекс пульсации на левой средней мозговой артерии составил 0,93+0,06 в I группе и 0,76±0,04 во II группе (P<0,05).

Согласно полученным данным, асимметрия скорости кровотока в средних мозговых артериях у пациентов перенесших Covid-19 и имеющих психические расстройства была статистически значимо выше (P<0,05), чем у пациентов без психических расстройств. Такой же результат получен и для показателей периферического сопротивления (РИ, ПИ).

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