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Neurological disorders in patients underwent COVID-19

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Abstract

Introduction: COVID-19 is the current global coronavirus pandemic caused by the SARS-CoV-2 coronavirus. The first reports of the disease outbreaks appeared in China on December 31, 2019 and the first clinical manifestations occurred earlier on December 8, 2019. On January 30, 2020, the World Health Organization declared the outbreak as a public health emergency of international concern. On March 11 it was declared a pandemic. Common symptoms include fever, cough, fatigue, shortness of breath, and anosmia (loss of smell).Complications can cause acute respiratory distress syndrome (ARDS) and pneumonia. The incubation period is usually around five days, but can range from two to fourteen days.

Aim of the research isto study of clinical and diagnostic criteria for neurological disorders and changes of laboratory parameters in patients with COVID-19.

Material and methods: We examined 31 patients who had undergone COVID-19 and were hospitalized at the private clinic "Neuromed-Service" named after academician N.M. Madjidov. There were 19 males and 14 females. The age of the patients varied from 18 to 75 years (the mean age made up 41 years).

Results: Patients with inflammatory diseases of the peripheral nervous system (neuropathy, facial nerve, trigeminal neuralgia), considering an increase of C-reactive protein were performed anti-inflammatory therapy with NSAIDs and steroids (Dexamethasone intramuscularly). In patients with convulsive syndrome EEG was monitored using the "Neuron - range 2" (Russia). Diffusechangesinthebioelectricalactivityofthecerebralcortexwererevealedinthestudiedpatients.Epiactivityinthefronto-parietalregionofthebrain (against the background of taking anticonvulsants)was also recorded. The dose of anticonvulsants was increased for these patients and decongestants were prescribed. An increase in fibrinogen was also noted in the blood of these patients.

Conclusion: Thereby, in patients after suffering COVID-19, the blood tests showed an increase of fibrinogen by more than 2 times and an increase of C-reactive protein. All this

ISSN 2515-8260 Volume 08, Issue 02, 2021

testifies the fact that in these patients after treatment, at the alleged improvement of their condition, the blood continued the process of thrombosis strengthening and inflammation persisted in tissues and organs. In patients who prematurely stopped taking antiplatelet agents and anti-inflammatory drugs after illness, neurological and other complications were developed.

Key words: COVID-19, SARS-CoV-2, neurological complications, C-reactive protein.

1. INTRODUCTION

COVID-19 is the current global coronavirus pandemic caused by the SARS-CoV-2 coronavirus [3]. The first reports of the disease outbreaks appeared in China on December 31, 2019[1]and the first clinical manifestations occurred earlier on December 8, 2019 [1-2].On January 30, 2020, the World Health Organization declared the outbreak as a public health emergency of international concern. On March 11, 2020, it was declared a pandemic[2-3]. Basically, the SARS-CoV-2 virus is transmitted by close contact, most often through small droplets formed when coughing, sneezing and talking. Droplets usually fall to the ground or surfaces rather than travel long distances through the air [4-6]. Less commonly, infection is possible after touching a contaminated surface and then to the face. An infected person is most contagious during the first three days after symptom onset, although proliferation of the disease is possible before symptom onset and through asymptomatic individuals [6-7].

Common symptoms include fever, cough, fatigue, shortness of breath, and anosmia (loss of smell)[7, 9-10]. Complications can cause acute respiratory distress syndrome (ARDS) and pneumonia[10]. The incubation period is usually around five days, but can range from two to fourteen days [11,13].

Washing hands, covering your mouth when coughing, maintaining distance from other people, wearing a face shield in public places, disinfecting surfaces, increasing ventilation and air filtration in the room are recommended as preventive measures[15].According to various virologists from the UK and Germany, the pandemic can last from one to two years. Personal hygiene measures must be followed to prevent transmission of infection. American professor-epidemiologist Justin Loessler believes that COVID-19, on the one hand, will not disappear, and on the other hand, it will not become an obstacle to the normalization of life, which will come thanks to vaccines or due to the getting of immunity by the population naturally.

The virus can enter any organs with blood. However, according to the latest data, almost half of all infected people undergo Covid-19 without any symptoms at all. Several thousand pairs of identical twins were studied in Britain in order to understand why in some people the disease proceeds completely unnoticed, while in others it leads to such serious consequences. According to preliminary data, the severity of the infection, many of its symptoms and possibly of infection are quite dependent on genetic factors (heredity)[16-17].

Covid-19 infection is not limited by respiratory infections. As practical studies show, in a significant number of patients, the virus also affects the nervous system[18].

ISSN 2515-8260 Volume 08, Issue 02, 2021

The mechanism of its effect on nerve cells has not been studiedyet, however, scientists have no doubt that there is some connection: a temporary loss of taste or smell was recognized as specific symptoms of Covid-19 in the middle of March[18].In addition, from the nasopharynx, the virus is able to penetrate directly into the brain, and this, in turn, can provoke a number of complications, disrupting the normal functioning of almost any organ.The list of possible comorbidities is huge, from digestive problems and vascular blockages to heart failure and encephalitis [20].

In the case of Covid-19, if the virus nevertheless entered the brain, further infection is almost inevitable: membrane receptor ACE2 is present on the surface of the brain cells through which the virus easily penetrates, causing inflammation. The same receptor is also present in the cells lining the inner surface of blood vessels. Therefore, in severe cases, the virus breaks out from the respiratory organs into the general bloodstream. As a result, thrombotic complications occur in almost every third patient with coronavirus pneumonia [22].

In particular, several cases of encephalitis (inflammation of the brain), as well as Guillain-Barré syndrome are described as side effects of Covid-19: the patient's immune system begins to attack its own nerve cells. Itleads to muscle weakness and in severe cases - to paralysis [23].

According to preliminary data, as a side effect of inflammation, the coronavirus provokes the formation of blood clots in large vessels which ultimately leads to an acute violation of cerebral circulation.Basically, neurological disorders are observed in severe patients.In such cases these symptoms sometimes persist even after patients recover from Covid-19. The virus can disrupt the work of the nervous system both indirectly, through excessive activation of the immune system (so-called cytokine storm) and directly. It was revealed as a result of Covid-19 victims’autopsy [23-24]. Viral particles were found in the victims brain. There is a version that the infection gets there from the respiratory tract through the olfactory receptors in the nose. It is not some unique ability of the new coronavirus.Several other viruses including influenza and measles can cause a similar infection of the brain which also sometimes leads to neurological disease, but quite rarely [23-24].

Testing for COVID-19 and the associated SARS-CoV-2 virus is most often performed by two main methods: molecular recognition of viral fragments and serological testing to find antibodies.Molecular techniques use polymerase chain reaction (PCR) to detect nucleic acid sequences corresponding to regions of the viral genome.A sample for them is the contents of the respiratory tract, obtained, for example, by a swab from the nasopharynx or from sputum.Serological testing is performed on blood samples using kits to detect the presence of antibodies produced by the immune system against several proteins of the virus.A positive antibody test persists for a long time after the infection is cleared, and therefore is used for observation and research purposes [26, 28-29].

Aimof the research was to study the clinical and diagnostic criteria of neurological disorders and changes of laboratory parameters in patients who have undergone COVID-19.

ISSN 2515-8260 Volume 08, Issue 02, 2021

2. MATERIAL AND METHODS

We examined 31 patients who had undergone COVID-19 and were hospitalized at the private clinic "Neuromed-Service" named after academician N.M. Madjidov. There were 19 males and 14 females. The age of the patients varied from 18 to 75 years (the mean age made up 41 years).Neurological complications of these patients are presented in Table 1.

Table 1. Neurological complications

Nosology		**Male**	**Female**	**Total**
1	Acute cerebrovascular accident by ischemic type	3	2	5
2	Acute cerebrovascular accident by hemorrhagic type	2		2
3	Dyscirculatory encephalopathy with asthenic-depressive syndrome	3	1	4
4	Polyneuropathy	2	-	2
5	Vegetative-vascular dystonia with asthenoneurotic syndrome	2	3	5
6	Convulsive syndrome	1	1	2
7	Trigeminal neuralgia	2		2
8	Cavernous sinus thrombosis	2	1	2
9	Myasthenia gravis	1		1
10	Facial nerve neuropathy	1	2	3
11	Herpetic ganglionitis		2	2
	Total	18	12	30

3. RESULTS

All patient sunderwent the following examinations: General bloodtest, biochemicalbloodtest, coagulogram, EEG. In 22 patients leukocytosis and increased ESR were noted in the general blood analysis. All patients had an increase in C-reactive protein by more than 2 times in the biochemical blood test.An increase in the fibrinogen index and prothrombin index (PTI) in 2 or more times was revealedaccording to the results of the coagulogram. Patients with inflammatory diseases of the peripheral nervous system (neuropathy, facial nerve, trigeminal neuralgia), considering an increase of C-reactive protein were performed anti-inflammatory therapy with NSAIDs and steroids (Dexamethasone intramuscularly).Considering the persisting leukocytosis, the patients continued to receive antibiotic therapy under the protection of antifungal drugs.We also used a solution of MultiVit, a drug that is a mixture of water-soluble and fat-soluble vitamins (A, D3, E, B1, B6, B12, C, biotin and folic acid) intravenously with a metabolic, antioxidant purpose and to improve impulse conduction along nerve endings.

In patients with convulsive syndrome EEG was monitored using the "Neuron - range 2" (Russia).EEG registration was performed using the standard "8-20" electrode disposition. Diffuse changes in the bioelectrical activity of the cerebral cortex were revealed in the studied patients.The dose of anticonvulsants was increased and decongestants were

ISSN 2515-8260 Volume 08, Issue 02, 2021

prescribed for these patients. In these patients an increase of fibrinogen in the blood was also noted. These patients were also prescribed anticoagulants under the control of a coagulogram.

4. CONCLUSION

Thereby, in patients after suffering COVID-19, the blood tests showed an increase of fibrinogen by more than 2 times and an increase of C-reactive protein. All this testifies the fact that in these patients after treatment, at the alleged improvement of their condition, the blood continued the process of thrombosis strengthening and inflammation persisted in tissues and organs. In patients who prematurely stopped taking antiplatelet agents and anti-inflammatory drugs after illness, neurological and other complications were developed.

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