

# Complications Spectrum in Patients After SARS-CoV-2 Infection

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## ABSTRACT

The aim of this research was to study the course of postcovid syndrome in patients who suffered severe SARS-CoV-2 infection (lung damage from 10 to 40 %). Patients were from 45 to 65 years old. This group of patients was examined by the allergic immunologist. All patients (1000 people) underwent a comprehensive examination: a general and biochemical blood test, feces for dysbacteriosis, an immunogram were taken. Serious irregularities on the part of internal organs and neuropsychiatric deviations were revealed. According to statistical analysis, the following data were revealed: 50 % of those affected patients had asthenic syndrome (weakness, fatigue), 10 % of patients had headaches. 40 % of patients complained of sleep disturbance, a decrease in smell and taste was noted in 10 % of patients, 3 % of patients indicated joint pain, hair loss in 20 % of patients, myocarditis was diagnosed in 5 % of patients, toxic hepatitis in 2 % of patients. The following allergic diseases were diagnosed in patients: allergic urticaria in 15 %, allergic rhinitis 10 %, atopic dermatitis in 10 %. Neurological complications were noted in patients who underwent severe COVID-19 forms: depressive conditions were noted in 10 %, 5 % complained of panic attacks, 15 % indicated mood swings. In 20 % of those affected, anxiety was noted, 25 % of patients indicated memory impairment. Thus, the consequences of COVID-19 infection are diverse and cause disruption to the patient's health.

**Keywords:** *Complications spectrum, SARS-CoV-2, COVID-19, postcovid syndrome*

## 1. INTRODUCTION

In December 2019, the SARS-COV-2 virus (COVID-19) of Wuhan was first discovered with a population of more than 11 million people in central China. This virus is genetically most closely associated with a coronavirus isolated from bats in Yunnan Province, China [1–6].

### 1.1 Variants of the course of SARS-COV-2 infection

Despite the fact that the number of COVID-19 cases worldwide is approaching 50 million, and almost 1 million people have died, little is known about this very complex disease [4]. The clinical spectrum of the disease varies greatly. In 40 % of people infected with SARS-CoV-2, symptoms do not develop at all. In about 80 % of patients who develop symptoms, the disease is

mild and does not require hospitalization; about 15 % of the disease is so severe that it requires hospitalization; but only 5 % of patients need hospitalization in the intensive care unit, as a rule, to perform mechanical ventilation in order to treat respiratory failure [4, 7, 9].

At the beginning of the pandemic, many believed that COVID-19 was a fleeting disease. In February 2020, the World Health Organization, using preliminary data obtained at that time, reported that the time from onset of the disease to clinical recovery in mild cases is approximately 2 weeks, and recovery in patients with severe or critical disease takes from 3 to 6 weeks. It was revealed that in some patients, debilitating symptoms persist for several weeks or even months. In some of these patients, symptoms have not disappeared [3].

Postcovid syndrome is a pathological condition after coronavirus infection, which can be accompanied by various symptoms [1, 2]. According to the researchers,

about 15 % of patients who have undergone COVID-19 indicate further poor health and a feeling of poor recovery for more than 20 days after the disease. Approximately 2 % of those affected have unpleasant symptoms for more than three months [1, 8, 10].

According to observations available today, the following groups of patients are most susceptible to the development of postcovid syndrome: adults over 50 years old; people who have suffered a severe form of infection and prolonged ventilation of the lungs; people with chronic diseases: chronic heart failure, pulmonary pathology, hypertension, obesity, diabetes mellitus, autoimmune diseases [4, 5].

## ***1.2 Clinical Picture of Postcovid Syndrome***

The clinical picture of postcovid syndrome is quite diverse. It may include such symptoms as fever, chest, abdominal and/or joint pain, severe fatigue; difficulty breathing, coughing; feeling of heavy and chest pain, frequent heartbeat; neurocognitive disorders, lightheadedness, weakened concentration of attention, memory impairment, head pain, insomnia or drowsiness, numbness of the limbs, tingling in the fingers and legs, dizziness; abdominal pains, periodic nausea, diarrhea, disorders of appetite (including possible anorexia); muscle and joint pain; anxiety disorders, depression; ear pains, sensation of tinnitus, sore throat, loss of smell, change in taste perception, appearance of additional flavors; skin rashes [2].

In addition, disorders of the blood coagulation system, disorders of metabolic processes were often noted throughout the postcovid syndrome. The most common first signs of the development of postcovid syndrome are as follows: seizure weakness, more often strongly expressed, which does not allow to do ordinary household chores or even get out of bed; a strong decrease in endurance, the inability to perform even moderate physical activity; failure of daily rhythms when nocturnal insomnia replaces daytime sleepiness (sleep inversion); muscle pain caused by a decrease in the protein component of muscles during an acute period of COVID-19. Also patients had psychoemotional disorders: depression, pessimistic mood, suppression, anxiety, in severe cases – suicidal thoughts; emotional lability, sudden changes in mood, loss of behavioral self-control; panic attacks, accompanied by attacks of blood pressure change, nausea, dizziness [4].

The so-called postcovid asthenovegetative syndrome is more characteristic of female patients prone to vegetal vascular disorders. Typical signs of such a disorder are considered: a change in blood pressure (more often an increase, but sometimes hypotension); feeling difficulty breathing; seizure dizziness, loss of balance; seizure nausea (vomiting – rarely); the emergence of various

fears (including the fear of death); a bout-like feeling of cold or heat [4].

The respiratory organs can also fail, even in those patients who did not have obvious respiratory problems during the acute course of the COVID-19. With the development of postcovid syndrome, such signs appear: a feeling of lack of air; severity in the chest, feeling of incomplete inhalation; periodic bronchial cramps, which can be accompanied by abrupt dyspnea, tachycardia, dizziness [2].

Such symptoms can last from one week to six months or even more. Often, postcovid syndrome affects the nervous system, which is manifested by the following pathological symptoms: headache, permanent or spasmodic, disturbing periods; thermoregulatory failures (long-term temperature rise, or vice versa, decrease); frequent chills, muscular tremors (even against the background of normal body temperature); – sensitivity disorders in the form of paresthesias, tingling, burning, itchy sensations on the skin; – altering taste and olfactory sensations (up to six months or more) [4].

The specific involvement of the cardiovascular system in COVID-19 also makes itself felt during post-vascular syndrome. In about 20 % of cases, sick people have a heart rhythm disorder, the development of acute or chronic heart failure. Most often, such signs are observed: blood pressure differences (increase or decrease), in severe cases orthostatic collapse develops, which is characterized by a sharp decrease in pressure up to a fainting state; vasculitis, angiitis, which are accompanied by skin rashes, hemorrhages and hematomas on the skin; arrhythmias, tachycardia, bradycardia.

Postcovid syndrome often manifests itself as digestive disorders associated with both infectious lesions of the gastrointestinal tract, as well as with antibiotic therapy and the use of other medicines. Patients often complaints of deterioration of intestinal peristalsis, periodic occurrence of constipation or diarrhea; change in appetite (more often – loss of craving for food) [1–4].

Rehabilitation measures and examinations for patients with postcovid syndrome are necessary and are a prevention of subsequent complications.

The purpose of this research was to study the course of postcovid syndrome in patients who suffered a severe SARS-CoV-2 infection.

## **2. MATERIALS AND METHODS**

### ***2.1 Research materials:***

4,000 patients who suffered SARS-CoV-2 infection were examined in our clinic. Out of these, 1000 people

who suffered SARS-CoV-2 infection had postcovid syndrome. All patients underwent SARS-CoV-2 infection within the previous 3 months. Patients were from 45 to 65 years old. Informed consent was taken from all patients for examination.

**2.2 Research methods:**

This group of patients was examined by allergologist-immunologist, cardiologist, neurologist, gastroenterologist, therapist. All patients were examined for biochemical blood tests (ferritin, C-reactive protein), general blood tests, immune status (CD3 +, CD4 +, CD8 +, CD16 +, CD22 +, IgA, IgG, IgM, IgE).

Immune status scores were taken from healthy individuals aged from 45 to 65 years old (control group).

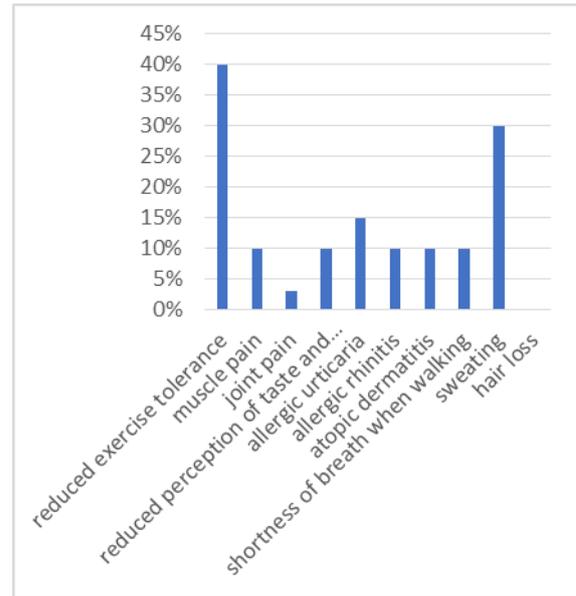
**2.3 Mathematical data processing:**

Comparison of the mean values were made by univariate dispersion analysis with Student's T-test to evaluate the equality of the mean Fisher F-test to evaluate the variance equality. The relationship between parameters was evaluated using linear and rank correlation coefficients.

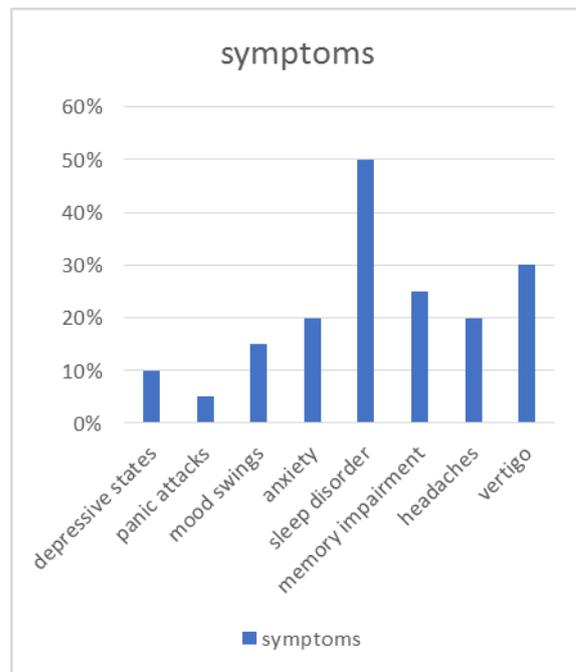
**3. RESEARCH RESULTS**

All patients (1000 people) underwent a comprehensive examination: a general and biochemical blood test, feces for dysbacteriosis, an immunogram were taken. According to the case histories, all 1000 patients suffered a severe COVID-19 infection, all were diagnosed with pneumonia with a lung lesion of 10 % to 40 %. According to statistical analysis, the following data were revealed: 50 % of those affected had asthenic syndrome (weakness, fatigue), 10 % of patients had headaches. 40 % of patients complained of sleep disturbance, a decrease in smell and taste was noted in 10 % of patients, 3 % of patients indicated joint pain, hair loss in 20 % of patients, myocarditis was diagnosed in 5 % of patients, toxic hepatitis in 2 % of patients. The following allergic diseases were diagnosed in patients: allergic urticaria, in 15 %, allergic rhinitis 10 %, atopic dermatitis 10 % (fig. 1).

Patients who suffered from severe COVID-19 forms were noted neurological complications: depressive conditions were observed in 10 % of patients, 5 % complained of panic attacks, 15 % indicated mood swings. In 20 % of those affected, anxiety was noted, 50 % of those affected complained of sleep disorders, 25 % of patients indicated memory disorders. Headaches were noted in 20 % of the sick, dizziness was noted in 30 % of the sick (fig. 2).

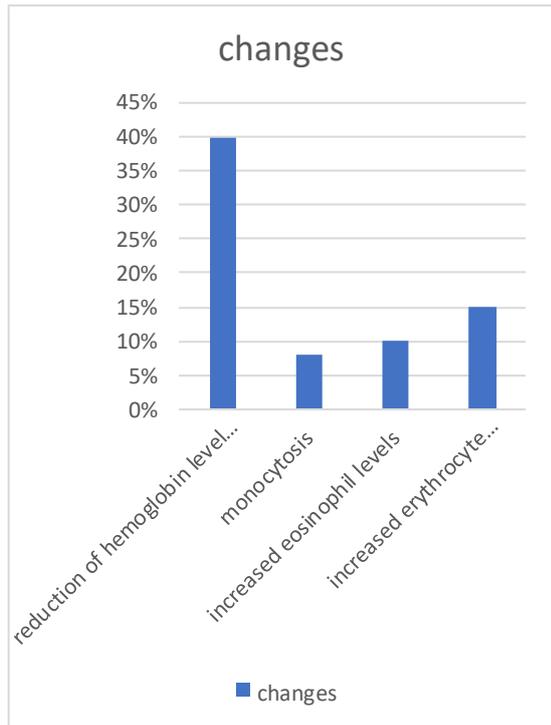


**Figure 1** Structure of complications in patients who have suffered severe COVID-19 forms



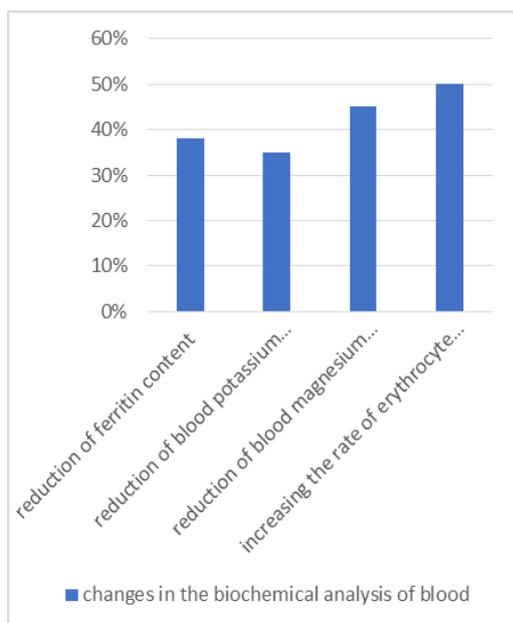
**Figure 2** Structure of neurological complications in patients suffering severe forms of COVID-19

According to the examination results, the following data were obtained: according to the general blood test, a hemoglobin level decrease in blood below 120 mg/l was detected in 40 % of patients. Monocytosis (over 5) was noted in 8 % of the patients examined, eosinophils level increase (over 5) was noted in 10 % of patients, the rate of subsidence of red blood cells above 15 mm/h was noted in 15 % of patients (fig. 3).



**Figure 3** Changes in the general blood test in patients suffered from severe COVID-19 forms

According to the results of the biochemical blood analysis, the following changes were revealed: ferritin decrease below 150 µg/l in 38 % of patients, blood potassium decrease below 3.5 mmol/l in 35 % of the examined and blood magnesium content below 0.7 mmol/l in 45 %, C-reactive protein increased over 10 mm/h in 50 % of the sick (Figure 4).



**Figure 4** Changes in biochemical blood analysis in patients suffered from severe COVID-19 forms

**Table 1.** Indicators of immune status in patients with postcovid syndrome

Indicators	Patients after COVID-19 (n = 1000) M ± m	Healthy (n = 1000) M ± m
CD3+	21.2 ± 1.03	27.2±1.04
CD4+	18.9 ± 0.5*	28.3±0.6
CD8+	16.9 ± 0.8*	24.1±2.5
CD16+	11.1 ± 1.2*	22.0±1.01
ИПИ	0.7 ± 0.6	1.08±0.02
IgA	1.6 ± 0.1*	2.9±0.6
IgG	18.2 ± 0.7	17.1±0.09
IgM	5.2 ± 0.08*	2.2±0.09
IgE	113.9 ± 1.2*	67.6±0.7
ЦИК	186.2 ± 1.5	70±0.07

\*p < 0.05 between the standard and the obtained indicators in each group.

The level of immunoglobulins A, M, G in patients significantly differs from the standard indicators. Thus, the level of immunoglobulins A and G is significantly lower than normal values in the sick patient. The average content of CD3 +, CD4 +, CD8 +, CD16 +, IgA is IgM significantly lower than in healthy people, indicating a decrease in T-cell immunity. There was a reliable increase in IgE, CIC (Table 1).

#### 4. DISCUSSION

As a result of the examination, complications were noted in the group of patients who suffered from severe COVID-19 form: fatigue, weakness, sweating, and a tolerance decrease to exercises. Half of the patients have impaired sleep and dizziness. There was a decrease in ferritin in 38 % of patients, in 40 % of hemoglobin, in 50 % of those who have accelerated ESR. According to the results of biochemical blood test: a ferritin decrease below 150 µg/l were in 38 % of patients, a blood potassium decrease below 3.5 mmol/l were in 35 % of the examined and blood magnesium below 0.7 mmol/l were in 45 % of the examined. Half of the sick patients showed a decrease in immunoglobulin A, M, subpopulations of immunocompetent cells. The significant negative impact of the syndrome on quality of life dictates the need to develop a strategy for postcovid rehabilitation. Currently, clinical recommendations for the treatment of postcovid syndrome have not been developed. Basically, the therapy is symptomatic and generally reinforcing. The action of triggers that can provoke exacerbations of postcovid symptoms should be avoided: significant physical activity, overwork, stressful situations, insolation. Women and men of reproductive age who have suffered a coronavirus infection are not advised to plan conception for six months. Also, all those affected during this period should refrain from any planned immunization [1–4]. Drug therapy may include administration of nerve stimulating drugs that improve microcirculation, neuroprotectors, vitamin-mineral complexes, anti-anxiety drugs and antidepressants.

The positive effect was demonstrated by the prescription of physiotherapeutic procedures, reflexotherapy, massage, therapeutic gymnastics under the control of the instructor.

It should be noted that an interdisciplinary approach in treatment and rehabilitation is important in the treatment of postcovid syndrome.

## 5. CONCLUSIONS

The patients with a severe SARS-CoV-2 course preserve long-term multi-organ disorders, changes of microelements in blood, and immune status decrease.

Severe COVID-19 patients need rehabilitation treatment and supervision. The main measure of SARS-CoV-2 prevention is vaccination.

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