

# THE USE OF OZONE THERAPY IN COMPLEX TREATMENT OF PATIENTS WITH COVID-19

## (Preliminary results)

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### **Abstract**

The new coronavirus (SARS-CoV-2) is spreading rapidly around the world, and all efforts to control the coronavirus are currently focused on anti-epidemic measures and the development of new antiviral medicines and vaccines. In the absence of etiotropic therapy, pathogenetic therapy aimed at the key factors of pathogenesis of severe conditions that occur in patients becomes important. Knowledge about mechanisms of action of medical ozone is very appropriate to include various methods of ozone therapy in the treatment of patients with COVID-19.

Recently, a number of articles have appeared in the literature about the fairly high effectiveness of ozone therapy for COVID infection, which is due to the mechanisms of its biological action:

1. The high oxidative potential of ozone provides a bactericidal, fungicidal, viricide effect against the most important types of gram-positive and gram-negative bacteria, viruses, pathogenic fungi and protozoa.

2. The effect of parenteral ozone administration in pathologies accompanied by hypoxic disorders is based on the activation of oxygen-dependent processes. Ozone increases the return of oxygen to insufficiently blood-supplied tissues, helps to restore hemoglobin, improve tissue respiration and utero-placental blood circulation, as well as normalize the rheological properties of blood, and is one of the methods to increase the adaptive capabilities of the body. In addition to the pronounced anti-hypoxic effect, ozone has a positive effect on the metabolism of red blood cells, by rearranging their intracellular contents and increasing the resistance of membranes.

3. Ozonides formed as a result of the ozonolysis of unsaturated fatty acids modify cell membranes, which provide an intensification of enzyme systems, and thereby enhance the metabolic processes of energy substratum production.

4. The immunomodulatory effect of ozone is based on its ability to activate phagocytosis through the formation of peroxides and stimulation of cytokine production by lymphocytes and monocytes.

5. Modification of the membranes of shaped blood elements and ultrastructural organization of the vascular bed, reduction of blood viscosity lead to improved microcirculation and gas exchange at the tissue level.

Since March 2020, the Ministry of Health of the Russian Federation has launched an infectious disease hospital for patients with COVID-19 infection. All patients are treated in accordance with the Temporary guidelines of the Ministry of Health of the Russian Federation "Prevention, diagnosis and treatment of new coronavirus infection (COVID-19)" (Version 7; 03.06.2020)., Also, in complex therapy, we use systemic ozone therapy to treat patients with COVID infection, regardless of severity (mild, moderate and severe), in particular, intravenous drip of ozonized physiological saline was carried out, which was prepared immediately before administration on domestic medical ozonators "UOTA" 60-01 "produced by" Medozon "(Russia) and "MEDOZONS-SYSTEM "produced by the Arzamas Electromechanical Plant (Russia). The infusion volume was 400 ml, the concentration of ozone in the solution was 4-5 mg / l after saturation, infusion at a rate of 20-25 ml per minute, every other day, only 6 procedures per course. Twice a week, patients received intravenous administration of glutathione (600 mg.) With vitamin C (1 g) in 100 ml of physiological saline. Ozone therapy was performed for 134 patients (patients age - from 18 to 94 years). Clinical data clearly indicate the effectiveness of ozone therapy. All patients underwent therapy without complications.

There was a rapid normalization of body temperature (50% of patients were feverish for 2-3 weeks, after switching on ozone therapy, the temperature returned to normal within 2-3 days). Reduction of shortness of breath at rest and during physical exertion (BDD less than 22/min), improvement of oxygen saturation (SpO<sub>2</sub>) indicators, its increase by 2-3 units after intravenous infusion.

According to laboratory tests: a rapid decrease in serum C-reactive protein (from 200 mg / l to 4 for 4-5 days), a significant decrease in ferritin levels. There was an increase in the relative and absolute number of lymphocytes in the blood, the concentration of hemoglobin, a decrease in the platelet content (before treatment, the platelet level is more than  $500 \times 10^9/l$ , within 3 days - a gradual decrease to normal values).

According to the hemostasiogram: within 5 days after the inclusion of ozone therapy, a decrease in the level of fibrinogen and d-dimer was registered (also, all patients received low-molecular-weight heparin therapy), but in the group that additionally received ozone therapy, the normalization of the hemostatic system occurs faster by 2-4 days.

Consequently, patients (especially those with mild and moderate severity) did not develop a worsening of the course of the disease and spent fewer days in the hospital.