

BLOOD CLOTTING DISORDER IN COVID-19 FROM THE POINT OF VIEW OF BIOPHYSICS

Sodikov N.O.

Samarkand State Medical University

Abstract: In this paper, an analysis of modern methods and technologies for the diagnosis and treatment of patients with coronavirus is carried out. And so, when the coronavirus settles in the cells of the endothelium (the inner wall of blood and lymphatic vessels), a thrombus (thrombosis) is created. Thrombosis is the formation of blood clots (blood clots) inside blood vessels that interfere with the free flow of blood through the circulatory system.

Key words: Coronavirus, thrombus, thrombosis, hemocoagulation, viscosity, hemostasis, coagulation, vasospasm, adhesion, fibrinogen.

When a blood vessel is damaged, the body uses platelets and fibrin to form a blood clot, preventing blood loss. Under certain conditions, blood clots can form in the bloodstream even without vascular damage. The cell is supported by membranes. The 10^{-6} sm^2 membrane plane has from 10 to 500 channels. The coronavirus clogs these channels, creates a blood clot and the cells begin to die.

At this moment, the body is doing everything to repair these injuries as quickly as possible. In patients with this disease, the entire Virchow triad can be detected: 1) Damage to the vascular wall (damage to the vascular endothelium by the virus itself, and due to the inflammation that it causes). 2) Slowing of blood flow. 3) Changes in the hemocoagulation system.

Let's take a closer look at the last point. This is due to the process of blood clotting, when a lot of viruses enter the body at the same time and they affect a large number of blood vessels. Blood clotting (hemocoagulation) is the most important stage of the hemostasis system, responsible for stopping blood loss when the vascular system of the body is damaged. Clotting leads to an imbalance and begins to create a lot of blood clots, which is the main cause of death. By determining the viscosity and coagulability of blood in humans, it is possible to determine in which form a person will get over an infection-in mild or severe form. The viscosity of the blood is due to the fact that it is in constant motion in the vascular bed. As a result, individual

layers of it move at different speeds, friction occurs between them, and besides, the extreme layers of blood plasma also rub against the wall of blood vessels. Blood viscosity depends on the concentration of erythrocytes and plasma proteins, on their composition, on the size of blood cells, and the elasticity of erythrocyte membranes. At such moments, so that the disease does not proceed in a severe form, it is necessary to regulate the activity of the blood clotting system, preventing the clotting system from being strongly activated, i.e. suppress it for a while, thereby giving the lungs a few days of respite until the immune system whitens the virus. To prevent negative consequences, it is necessary to fully decipher the mechanism of blood clotting. Blood clotting is preceded by a stage of primary vascular-platelet hemostasis. This primary hemostasis is almost entirely due to vasoconstriction and mechanical blockage by platelet aggregates of the site of damage to the vascular wall. Actually, blood clotting (hemocoagulation, coagulation, plasma hemostasis, secondary hemostasis) is a complex biological process of formation of fibrin protein strands in the blood, which polymerizes and forms blood clots, as a result of which the blood loses its fluidity, acquiring a curd consistency. The process of hemostasis is reduced to the formation of a platelet-fibrin clot. Conditionally, it is divided into three stages: 1. Temporary (primary) vasospasm 2. Formation of a platelet plug due to adhesion and platelet aggregation. 3. Retraction (contraction, sealing of the platelet plug). Vascular damage is accompanied by immediate activation of platelets. The adhesion (adhesion) of platelets to the fibers of connective tissue at the edges of the wound is due to Glycoprotein factor of Willebrand. Platelet aggregation occurs simultaneously with adhesion: activated platelets attach to damaged tissues and to each other, forming aggregates that block the path to blood loss. A platelet plug appears. Various biologically active substances (ADP, adrenaline, norepinephrine, and others) are intensively secreted from platelets that have undergone adhesion and aggregation, which lead to secondary, irreversible aggregation. At the same time, platelet factors are released, thrombin is formed, which acts on fibrinogen to form a fibrin network, in which individual erythrocytes and leukocytes get stuck, a so-called platelet-fibrin clot (platelet plug) is formed. Due to the contractile protein thrombostenin, platelets are pulled together, a platelet plug contracts and condenses, and its retraction occurs. In

in its simplest form, the blood clotting process can be divided into three phases: 1-the activation phase includes a complex of sequential reactions leading to the formation of prothrombinase and the transition of prothrombin to thrombin; 2- the coagulation phase is the formation of fibrin from fibrinogen; 3-the retraction phase is the formation of a dense fibrin clot. The lungs may be the epicenter of Covid-19, but scientists believe it can also enter the circulatory system by penetrating our arteries. Exactly how the virus attacks the heart and blood vessels remains a mystery, but experts believe that infection can cause blood clots, heart attacks, as the virus binds to ACE2 receptors on the cells lining our blood vessels and heart. Patients in the hospital, showing signs of serious heart and vascular problems. We see that a significant proportion of patients develop blood clots in the arteries entering the heart.

One study published in the scientific journal JAMA Cardiology found that 20 percent of the 416 patients hospitalized in Wuhan with coronavirus had heart damage. The increased likelihood of blood clots appears to be one of the features of severe Covid's disease. This may explain why patients with diabetes and cardiovascular diseases are at risk of severe illness with Covid-19, since their vascular system is already under additional stress.

Biologically, the process of thrombosis is the norm. This mechanism is designed to protect a person from heavy bleeding, and natural thrombolysis is sufficient to destroy small blood clots, platelets and proteins. But with coronavirus, the thrombolysis process becomes difficult, the vessels (and the heart) experience a very high load, including toxic viral, cytokinin, and the risk of thrombosis increases 3-6 times. If a patient suffers from severe viral pneumonia, has a history of atherosclerosis, aneurysms, and chronic cardiovascular pathologies, then the coronavirus can turn into a disaster. The vascular walls thin out, and at the same time blood clots form, which dissolve with great difficulty, especially at high temperatures. In some patients with coronavirus, cytokinin occurs. Storm is a redundant pathological immune response to a virus with the release of a huge number of protective molecules-cytokines. However, they not only kill the virus, but also destroy healthy cells of the human body, including the same endothelial cells. Any infection, viral and especially bacterial, affects blood clotting. The severity of

the consequences, including thrombotic ones, depends on the characteristics of the causative agent of the infection and the patient's body. More over, for example, those with the first blood group have a lower risk of thrombosis, while people with the second and third blood groups have a higher risk of almost 30%. There are patients whose vascular endothelium is thinner by nature. There are patients with genetically determined thrombophilia (a mutation that significantly increases the risk of severe thrombosis). And so we come to three conclusions: 1) the cause of death is not always pneumonia or respiratory failure. 2) the cause of death is often thrombosis (heart attack, stroke, PE), as well as toxic damage to the heart and blood vessels (myocarditis, heart failure) the presence of pneumonia is an aggravating factor. 3) the cause of death may be indirect or direct infectious damage to others the internal organs of the brain, kidneys, gastrointestinal tract, and the presence of chronic diseases and pneumonia is an aggravating factor. In some of the deceased, the virus was detected even in the cerebrospinal fluid. Therefore, the primary task of treatment or coronavirus is to destroy the infection, while the high temperature is necessarily brought down and heparin drugs are prescribed for blood anticoagulation and detoxification of the body. Late initiation of anticoagulant therapy is an adverse factor that increases the risk of death. The most commonand severe complication after coronavirus is thrombosis, especially with stenosis - vasoconstriction, and rupturesaneurysm (bulging of the vessel wall with its thinning). It should be borne in mind that the vascular endothelium damaged by the virus recovers slowly, and the processes taking place in the body put an increased load on the entire circulatory system. Blood clots, jelly-like clots of blood, cellular components and proteins, are formed due to vascular damage, and even against the background of blood clotting (coagulation disorders). They grow over time and circulate in the blood, while the patient does not suspect or feel that a blood clot is forming. Such blood clots can block the arteries of the heart and brain. Therefore, a heart attack or stroke may be a complication of the coronavirus. Pulmonary embolism (PE) is no less life-threatening. Moreover, often blood clots blocking the vessels of the lungs are initially formed in the deep veins of the legs, after which they come off and move. Therefore, in the presence of symptoms such as:

- sudden causeless shortness of breath,
- chest pain,
- blood in the discharge when coughing,
- chest wheezing,
- fainting condition
- dizziness,
- a sharp increase in the pulse at rest.

CONCLUSION. The patient is urgently recommended to have a CT scan of the pulmonary artery with contrast. Unfortunately, in most cases, such a diagnosis is post-symptomatic, as is the diagnosis of stroke. CT angiography is performed using contrast. It allows you to see blood clots, neoplasms, aneurysms, pathologically narrowed areas of blood vessels. Sometimes ultrasound copes with this task, while the result of the examination is perfectly complemented by CT data. Ultrasound allows you to assess the dynamics of blood flow, recognize its violation, while CT is the most reliable method of visual assessment of blood vessels. As soon as a large blood clot is detected in the bloodstream, the patient is prescribed special drugs (thrombolytics, statins) to reduce it or an invasive thrombolysis procedure. Therapy for the prevention of diseases of the cardiovascular system after coronavirus should be comprehensive. Only a doctor will be able to individually select the necessary diagnostic and therapeutic measures.

LITERATURE

1. Remizov A.N. Medical and biological physics. Textbook. Moscow 2018. GEOTAR-Media
2. Akhmedzhanov N.Yu., Zotova S.V. Risk factors and incidence of deep vein thrombosis. Krasnodar 2021
3. Features of the flow Long-COVID infections. Therapeutic rehabilitation measures. Part 3.
4. Gorelov A.V., Malyavin A.G. SMSU-Training Center, 2022, Moscow.
5. Sodikov N.O. , Sodikov M.N. Biophysical mechanisms of thrombus formation. SamGMU "Selected issues of diagnostic radiology and nuclear medicine" 2020. Samarkand. pp.73-75

6. Kostenko N.K. Assessment of the level of physical and emotional stress as negative factors for the health of students - at the stage of transition from secondary school to higher education: Mat. 89th Intern. scientific - pract. con. students and young scientists "Theoretical and practical –aspects of modern medicine" / N.K. Kostenko, B.L. Bessonov. - Simferopol, 2017.
7. E.Kh. Bozorov, A. Zh. Ergashev. How to protect yourself from radiation when using γ -radiation accelerators in chemotherapy in neoplasms 2022, Volume 2. Issue No. 2 (Special issue) <http://doi.org/10.55620/uzhcr> . 2.2.2022 Collection of materials of the international scientific-practical conference "New technologies of radiation diagnostics and treatment".
8. Kutepov M.M. Didactic possibilities of interactive electronic educational resources // Baltic Humanitarian Journal. 2020. V. 9. No. 3(32).
9. Andrienko O.A. Modern educational technologies: technology of self-presentation // Balkan Scientific Review. 2019. Vol. 3. No. 1 (3). pp. 5-7.
10. B.S.Yuldashev, S.V.Artemov, E. Kh . Bozorov, D.A. Karshiev, M.A. Kayumov, G.A.Kulabdullaev, I.I.Nuritdinov. I am nuclear technology. Volume V, Nuclear Medicine 2022.
11. V.P.Martsenyuk, V.D.Didukh, R.B.Ladykam, I.A. Baranyuk , I.S. Soroka. Textbook "Medical biophysics and medical equipment". Ternopil: Ukrmedkntgp. 2008.
12. Sodikov N.O., Muminova Z.A., Khasanova D.B. "WHEN THE WHOLE WORLD, STARTING FROM DECEMBER 2019, IS CONCERNED ABOUT THE "CORONAVIRUS" -COVID-2019, HOW CAN BIOPHYSICS HELP?", March 27, 2023. Crossref doi: <https://doi.org/10.37547/ajast/Volume03Issue03-07>.