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L. Kot, PhD,
L.-A. Karpets, PhD Student,
K. Sviridova, PhD Student,
M. Chernih, PhD Student,
R. Prishlyak, PhD Student
Taras Shevchenko National University of Kyiv, Kyiv, Ukraine

CERTAIN BIOCHEMICAL ASPECTS OF CORONAVIRUS INFECTION COVID-19

An outbreak of coronavirus disease CoViD-19, caused by the new severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), in a short period of time led to a global public health emergency worldwide. The difficult epidemiological situation associated with the rapid increase in the number of patients and the high mortality rate, as well as the need to overcome the consequences of the pandemic as soon as possible, have become an important challenge for science. The special attention of scientists is focused on in-depth study of the pathogenetic mechanisms of coronavirus infection, which is important for the development of antiviral drugs and vaccines to combat CoViD-19. To penetrate the target cells the virus uses receptors, expressed in various tissues of the organism, the main of which is angiotensin-converting enzyme 2 (ACE2). Virus replication is regulated by a lot of factors and causes abrupt morphological and physiological changes in cells. SARS-CoV-2 disrupts the regulation of inflammatory signaling pathways that generate a cytokine "storm", causes multisystem disorders and a life-threatening condition – acute respiratory distress syndrome. An important component of pathogenesis and clinical manifestations of CoViD-19 are hemostasis disorders, activation of thrombosis and thromboembolic complications. This review provides certain data regarding the structure of SARS-CoV-2, routes of infection, defense mechanisms against pathogen invasion, features of the hemostasis system in coronavirus infection, intracellular signal transduction, and current strategies for the prevention and treatment of CoViD-19, which are aimed primarily at suppressing the replication of the virus, limiting its dissemination and reducing the immune response of organism in conditions of infection.

Keywords: SARS-CoV-2, coronavirus infection, CoViD-19, signal regulation, therapeutic strategies.

Introduction. The new severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes CoViD-19, has led to an unprecedented global health crisis around the world. As of June 2021, more than 180 million people (2,2 million in Ukraine) have been infected with coronavirus, and confirmed about 3,9 million CoViD-19-related deaths (more than 52,000 in Ukraine) [1]. The most vulnerable to CoViD-19 infection are the elderly people and those suffering from concomitant pathologies: obesity, diabetes, hypertension, cardiovascular diseases, neurological disorders, and have weakened immunity.

The difficult epidemiological situation caused by the rapid increase in the number of patients and the high mortality rate, as well as the need to overcome the consequences of the pandemic as soon as possible, have become an important challenge for science. Today, the attention of scientists around the world is focused on the study of pathogenetic mechanisms of acute coronavirus infection, the development of methods for diagnosing the disease and finding effective strategies for its prevention and treatment. Currently, the first vaccines have been created in record time, which undergoing different stages of testing, some of them have already been approved by the WHO for use against CoViD-19, which are crucial to ending the pandemic.

Features of the structure of SARS-CoV-2. It is known that SARS-CoV-2 is a single-chain RNA-containing strain of coronavirus of the species SARS-CoV of the genus Betacoronavirus (Coronaviridae), which is characterized by a high frequency of mutations. Sequencing of the SARS-CoV-2 genome showed its similarity to previously detected SARS-CoV (2002) and Middle East Respiratory Syndrome coronavirus (MERS-CoV, 2013), which allowed quickly identify the pathogen and develop diagnostic tests and other tools to counteract the outbreak of the disease [2, 3].

Coronavirus virions, including SARS-CoV-2, have a complex unsegmented spherical or uneven shape with a diameter of 50–200 nm. The nucleocapsid is surrounded by a protein-lipid shell, including characteristic protrusions – peplomers, which form a recognizable "solar corona". The main structural glycoproteins of the acute coronavirus infection virion are protein S (glycoprotein "spike"), envelope protein E, membrane glycoprotein M and nucleocapsid protein N (Fig. 1).

Spike S proteins, which form peplomers, play a key role in the virus infection of the human organism: interaction with the receptor on the surface of host cells, its attachment and penetration into target cells, where the pathogen is actively replicating. The spike glycoprotein is the largest surface protein of coronaviruses, which consists of three identical subunits, each containing two domains, – S1 and S2. S1 domains have a receptor-binding domain (RBD) for the binding of SARS-CoV-2 to the receptor protein of the target cell – angiotensin-converting enzyme 2 (ACE2); while the S2 domain provides the fusion of the virus supercapsid with the plasma membrane of the target cell [4].

It should be noted that S and N proteins are the most immunogenic proteins of coronaviruses. Neutralizing antibodies can block the binding of the RBD domain of the adhesion protein to cellular receptors and prevent the penetration of the virus into the cell. This property is the basis for the development of test systems for serological diagnosis of CoViD-19 and vaccines that are currently approved for use. An important protective role is played by the hydrocarbon components of viral glycoprotein S. On the surface of the spike trimmer there are 66 sites for N-linked glycosylation (22 for each protomer). Glycans form a kind of protective shell that prevents antibodies from binding to the virus and neutralize it, help stabilize the protein configuration, participate in the immune response [5].

Shell proteins E are relatively small viral proteins, viporins, which have a hydrophobic domain and a charged cytoplasmic "tail", capable of oligomerizing and forming ion channels (pores), ensuring the release of virions from an infected cell [6]. The main function of M proteins is to stabilize the structure of the viral envelope. Nucleocapsid proteins N play an important role in the packaging of viral RNA into ribonucleocapsids, are also involved in the processes of inhibition of protein translation, changes in host cell metabolism and apoptosis [2].

Although the exact amount of SARS-CoV-2 functional proteins still needs to be established, in addition to the 4 structural proteins, the viral genome encodes at least 16 nonstructural proteins (NSP 1 ~ 16) that form a replication-transcription complex (RTC) in membrane vesicles, and 8-9 additional, each of which plays a role in the life cycle and pathogenicity of the virus [7].

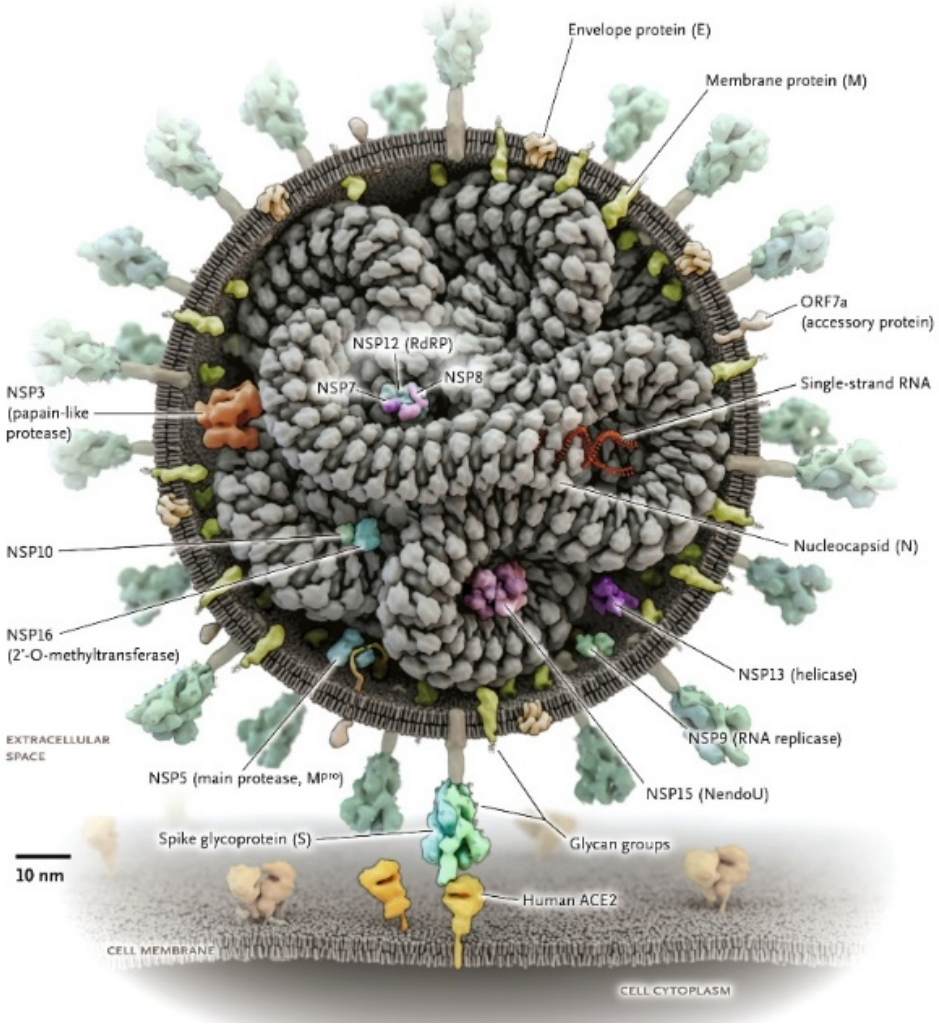

Fig. 1. The structure of the SARS-CoV-2 virion (by J.M. Parks and J.C. Smith, 2020 [3])

Mechanisms of SARS-CoV-2 penetration into the cells of the organism. The pathogen CoViD-19 enters to the organism mainly through the mucous membranes of the eyes [8] and the upper respiratory tract [9]. However, in recent solitary studies have data on the possible transmission of acute respiratory infection through the fecal-oral route [10]. The mechanisms of SARS-CoV-2 penetration into the cell are still being actively studied. It is known that ligand-receptor interaction is important for infection. In scientific studies published during several months of the CoViD-19 pandemic, it has been established that the main receptor for SARS-CoV-2 is a component of the renin-angiotensin-aldosterone hormonal system (RAAS) – zinc-dependent transmebran monocarboxypeptidase ACE2, which is involved in the support of cardiovascular system homeostasis and the functioning of various organs, regulation of blood pressure and water-salt metabolism [11]. The enzyme catalyzes the cleavage of angiotensin II (Ang II), which is responsible for the systemic vasoconstriction and release of aldosterone, with the formation of angiotensin 1-7 (Ang 1-7), which has vasodilating, antiproliferative and antifibrotic effects [12]. There is a circulating (soluble) form of ACE2, which is formed as a result of proteolytic cleavage of the membrane-bound form of the receptor protein by metalloproteinase ADAM17 [13]. Zhao et al. [14] in their studies showed that 83% of cells expressing ACE2 constitute alveolar epithelial cells of type II (pneumocytes). Receptor expression is also found in many extrapulmonary tissues, including the heart, kidneys, brain, blood vessel endothelium, and gastrointestinal tract [15], which may explain the polyorganic dysfunction observed in patients with CoViD-19 [16, 17, 18]. Increased ACE2 expression is observed in the tissues of patients with diabetes and obesity, which can increase the risk of SARS-CoV-2 penetration into cells and damage to the organism by infection [19]. Almost a fifth of hospitalized patients with CoViD-19 experience cardiovascular disorders such as acute heart failure, myocarditis, arrhythmias, and others [20, 21], which can be directly caused by a viral infection. 30–50 % of patients have symptoms of gastrointestinal disorders [22, 23], observed damage to the proximal renal canals [24], were found of neurological disorders, that corresponded to the high expression of the SARS-CoV-2 ACE2 receptor in the relevant tissues of the organism [25]. Whereas the thymus, lymph nodes, bone marrow and immune cells are ACE2-negative [26]. However, direct evidence of an association between ACE2 expression, susceptibility and severity of acute respiratory infection has not been reported in the scientific literature. Angiotensin-converting enzyme is a target of many drugs (ACE2 inhibitors and angiotensin 2 receptor blockers – sartans), which are widely used to treat cardiovascular disease, hypertension and diabetes.

For penetrate into the cell, the SARS-CoV-2 virus can use alternative receptors, including those not yet identified. Studies on cell lines show that in addition to ACE2, the SARS-CoV-2 spike protein can interact with the

glycoprotein CD147, known as basigin, which belongs to the superfamily of immunoglobulins and is expressed in the cell membrane of epithelial and endothelial cells, activated red blood cells and T lymphocytes [27]. However, research on the role of basiginin in viral infection is contradictory [28]. There is evidence of the interaction of spike protein S with glycoprotein CD26 (dipeptidylpeptidase-4) – the main cellular receptor MERS-CoV, which is involved in the activation and proliferation of T-cell receptors and splits the peptides of various chemokines, growth factors, hormones [29]. Among other potential SARS-CoV-2 receptors is the signaling protein neutropilin-1 (NRP1), which interacts with semaphorins, endothelial growth factor (VEGF), transforming growth factor beta (TGF-β), and integrins, and plays an important role in virus penetration, angiogenesis, vascularization, tumor progression, etc. [30]. Its expression is found in many tissues of the body, in significant quantities it is present in the superficial epithelial layer of the respiratory tract and gastrointestinal tract, neurons, immune and endothelial vascular cells [31]. There is an assumption that SARS-CoV-2 can use integrin heterodimers as cellular receptors by binding to them via the RGD tripeptide (403–405: Arg-Gly-Asp) in its receptor-binding domain. Integrins play an important role in cell adhesion, migration and intracellular signaling processes [32, 33].

For the cleavage of protein S (S priming) and the ACE2 molecule and, accordingly, the penetration of SARS-CoV-2 into the cell is important activation of proteolytic enzymes: membrane-bound serine protease TMPRSS2, furin [34, 35] and endosomal pH-dependent cysteine protease, or cathepsin L (CTS-L), which promotes further fusion of the S2 domain of the virus supercapsid with the plasma membrane of the target cell [36]. At the same time a pore is formed in the endosomal wall, through which viral RNA is released into the cell cytoplasm [34], where it is translated/replicated and released by exocytosis of new virions [36], after which the cell dies. An important role in the processes of replication and transcription of the viral genome is played by proteolytic enzymes: chymotrypsin-like protease (3CLpro), papain-like protease (PLpro) and RNA-dependent RNA polymerase (or RNA replicase, RdRp) [37], which are now seen as potential therapeutic targets because they are critical to the survival and spread of SARS-CoV-2 [38].

Immune response and inflammatory pathways of defense in CoViD-19. To counteract the invasion of the pathogen cells have protective mechanisms: a restriction system, pathways of regulated cell death, interferon synthesis, inflammatory response and innate and adaptive immunity, which are used to recognize and prevent viral infection. The first line of defense is a well-coordinated innate immune response, which involves pattern-recognizing receptors: Toll-like (TLR), NOD-like (NLR), RIG-I-like receptors (RLR), lectin-like receptors C-type (CLR) recognizes the molecular structures of microorganisms (pathogens), the so-called pathogen-associated molecular patterns (PAMP), or endogenous ligands associated with damage (DAMP), and triggers complex, multicomponent intracellular signaling cascades, the result of which is the activation of a number a number of transcription factors, in particular the nuclear factor NF-κB, the regulatory factor interferon-3 (IRF-3), the activator protein 1 (AP-1), and the induction of the pro-inflammatory response. The targets of NF-κB are genes encoding proinflammatory cytokines: IL-1, IL-2, IL-6, IL-8, IL-12, tumor necrosis factor α (TNF-α), granulocyte-macrophage colony-stimulating factor (GM-CSF), interferon γ (INF-γ), molecules of intercellular adhesion, proteins of acute phase inflammation, NO-synthase, cyclooxygenase-2, etc. Thus, the activation of NF-κB leads to increased expression of genes involved in the immune response, inflammation and apoptosis [39, 40].

Today Toll-like receptors are the subject of active study both in normal and in various pathologies, however, their participation in the development of CoViD-19 requires research [41]. Membrane-bound TLR-2 and TLR-4 receptors are known to be involved in the recognition of PAMP SARS-CoV-2, which detect surface pathogenic components; and endosomal receptors – TLR-3 and TLR-7, which can recognize the RNA genome of the coronavirus [42]. It has been shown that TLR-2 and TLR-4, by identifying the spike protein of the virus, through the MyD88-dependent signaling pathway cause the activation of immune-inflammatory factors that determine the intensity of inflammation in the tissues of organism during the development of the disease [43].

Impaired regulation of the innate immune response and excessive release of pro-inflammatory cytokines such as IFN-α, IFN-γ, IL-1β, IL-2, IL-6, IL-12, IL-17, IL-18, IL-33, TNF -α, TGFβ and chemokines (CCL2, CCL3, CCL5, CXCL8, CXCL9, CXCL10) and others from immune effector cells causes hyperinflammation and cytokine "storm", which causes polyorganic insufficiency in patients with CoViD-19 and the sudden occurrence of acute respiratory distress syndrome – a life-threatening condition [44]. One of the mechanisms of cytokine regulation is the recognition of danger signals by Nod-like receptors, that leads to the activation of caspase 1, which can cause hyperinflammatory cell death. Timely monitiring of the cytokine "storm" in the early stages of the disease, as well as reducing the infiltration of inflammatory cells in the lungs plays a key role in improving the treatment results of patients with CoViD-19 and reducing their mortality [45]. One of the difficult question is remain the susceptibility and resistance of the organism to the cytokine "storm" and the detection of its main pathogenetic mechanisms.

In the immune response to the SARS-CoV-2 virus is extremely important T-cell immunity. After activating T cell $CD4^+$ T-lymphocytes are mainly differentiated into effector cells that synthesize cytokines and chemokines, whereas $CD8^+$ T lymphocytes differentiated into cytotoxic T-cells that are able to recognize and directly remove virus-infected cells. At the same time, constant and excessive antigenic stimulation of T cells, as well as B cells that produce pathogen-specific antibodies, can cause a state of "depletion", which is observed in many chronic viral infections and tumors, and is often associated with lymphopenia, the detection of which is an important diagnostic sign of the severity of the disease [46].

Hemostasis system. In the last few months, there has been a large number of studies in the scientific literature devoted to various aspects of disorders in the blood coagulation system, arterial and venous thrombotic complications associated with coronavirus infection, especially venous thromboembolism (VTE) [47, 48]. Activation of hemostasis is observed in 30% of patients with CoViD-19 with severe complications and the need for intensive care. The most common picture of coagulopathy is characterized by elevated levels of D-dimer and fibrinogen, a slight increase in prothrombin time and activated partial thromboplastin time, mild thrombocytopenia and low levels of lymphocytes [49, 50]. The pathophysiological mechanisms underlying the link between CoViD-19 and thromboembolic complications have not yet been definitively studied, but are known to include inflammation, hypercoagulation, hypoxia, and disseminated intravascular coagulation. It is assumed that the stimulation of coagulation in case of SARS-CoV-2

infection is associated with immune responses due to the release of proinflammatory mediators that interact with platelets, stimulate tissue factor expression, induce increased the inhibitor of the plasminogen-1 activator, inhibit the fibrinolytic system and lead to endothelium dysfunction, causing thrombogenesis. Accordingly, the hyperinflammatory reaction (cytokine "storm") activates the blood coagulation cascade and is a key factor in the pathophysiology of VTE, while thrombosis is the final stage of inflammation. In general, SARS-CoV-2 infection can provoke VTE by the classical mechanism of the Virchow's triad, which includes hypercoagulation, endothelial dysfunction and venous stasis [51].

Mechanisms of intracellular signal regulation. The main purpose of the virus when entering the host cell is RNA/DNA replication, maintenance or excessive activation of the mechanism of protein synthesis in the cell and avoidance of immune responses of the host. Activation of intracellular signaling cascades during SARS-CoV-2 infection modulates the antiviral immune response and is a key link in the pathogenesis of CoViD-19.

TLR receptors recognize SARS-CoV-2 RNA and initiate an inflammatory cascade through gene expression of the IFN type I and II and the NF-κB nuclear translocation [52]. The virus is also recognized by the cytoplasmic protein NLRP3, which together with ASC and caspase-1 forms an inflammatory complex that splits and releases mature forms of the cytokines IL-1β and IL-18 [51]. IL-1β, IL-18 and TNF bind to specific receptors and promote further nuclear translocation of NF-κB and phosphorylation of p38 mitogen-activated protein kinase (MAPK), resulting in the expression of significant amounts of proinflammatory cytokines and chemokines [53].

Most signaling pathways, including those that involve the epidermal growth factor receptor (EGFR), phosphatidylinositol 3-kinase (PI3K)/protein kinase B (AKT), JNK kinase, can be reactivated by viral proteins. Viral proteins can also affect the transmission of p38 MAPK signals and disrupt the expression of BAX and BCL2 apoptosis regulators. The main signaling pathway, which is mainly inactivated by viral proteins, is the IFN signaling, which leads to the exclusion of the immune response of the host [54]. Excessive activation of EGFR plays an important role in the penetration of the virus into the host cell, which is clinically reflected in the production of significant amounts of mucus and increased inflammatory response [54]. It is known that EGFR belongs to the receptor tyrosine kinases that regulate most intracellular processes, activating by phosphorylation PI3K/AKT, Ras/Raf/MAPK, JAK/STAT signaling pathways [55]. It has been shown [56] that the EGFR signaling cascade plays a crucial role in the progression of pulmonary fibrosis during CoViD-19.

There is evidence that the activation of the JAK/STAT pathway, mainly by cytokines, among which a special role belongs to IL-6, which enhances the production of inflammatory mediators, correlates with further exacerbation of COVID-19 [57, 58]. Recently Bouwman W. and his colleagues reported that the JAK/STAT signaling can be an important indicator of an enhanced immune response to SARS-CoV-2 infection [59], and its inhibition can reduce the hyperinflammatory state but does not affect the virus clearance [60]. However, the exact mechanism of inhibition of JAK/STAT signaling at the molecular level is controversial and needs further study.

Strategies for the prevention and treatment of coronavirus infection. Despite active research by leading research laboratories around the world and progress in the development of vaccines against the new respiratory pathogen, there are still no special therapeutic agents to promote eradication of the virus in patients with COVID-19, and the main methods of treatment are supportive. Today, applying software modeling, the possibility of using existing FDA-approved drugs (Food and Drug Administration) at CoViD-19, which include numerous antiviral and anti-inflammatory drugs, glucocorticosteroids, antibiotics, etc. Research on therapeutic approaches to coronavirus infection focus mainly on finding possible inhibitors that can block the penetration of the pathogen into the cell and enzymes that are important in the life cycle of the virus. As potential targets for drugs and vaccines against SARS-CoV-2 can be considered structural proteins of viral capsid S, E, M, N, replicase isoforms (RdRp1a and RdRp1ab) and proteases (3CLpro and PLpro). In particular, the use of ACE2 inhibitors can help to slow down the response of the RAAS system and reduce tissue damage in patients with CoViD-19 [61]. TMPRSS2 serine protease inhibitors can prevent the cleavage of the S1 and S2 domains of viral adhesion protein reducing the ability of SARS-CoV-2 to infect cells [62]. Specific replication of viral RNA mediated by RdRp can be inhibited by selective compounds [63], as a result of which the virus cannot spread and the infection stops. The use of monoclonal antibodies against the IL-6 receptor, which is crucial in the development of cytokine storms, IL-1 receptor antagonists, and blockade of signaling pathways, including JAK/STAT, can stop inflammation and mitigate the harmful effects associated with IL-6 [64].

Mesenchymal stem cell therapy (MSC) and passive immunization using purified antibodies (plasma therapy) are considered as promising areas of CoViD-19 treatment [65, 66]. Today, studies of a significant number of substances, including those of plant origin, that may be effective in treating CoViD-19 infection with minimal side effects. Important in CoViD-19 therapy is the use of anticoagulants, which is associated with the established risks of coagulopathies [67].

Vaccination is critical to prevent the SARS-CoV-2 infection or reduce the severity of CoViD-19 disease. Several manufacturers have successfully developed vaccines against CoViD-19 in less than 12 months – this is an extraordinary achievement, as it usually takes more than 10 years to develop new vaccines [68]. As of June 2021, 322 candidates for CoViD-19 vaccines have been registered, 98 of which are at different stages of clinical trials, including eight in phase IV [69]. Different approaches are used to create vaccines: vaccines based on DNA and RNA, based on viral protein subunits, vector vaccines, vaccines based on inactivated or attenuated SARS-CoV-2 viruses, and based on virus-like particles. Several vaccines against CoViD-19 based on genetically modified plants that are currently being developed have shown positive results in the preclinical and clinical phases, indicating their potential for use [70]. However, it should be noted that scientists have a rather restrained attitude to the developed vaccines, which is associated with the accelerated timing of clinical trials, because the main characteristics of vaccines that require long-term preclinical and clinical trials are efficacy and safety.

Conclusions. The CoViD-19 pandemic has made significant adjustments to the lives of a significant part of the world's population and has become a serious challenge for physicians and scientists, as the complex pathophysiological mechanisms underlying the disease still need to be studied. However, significant efforts have been made to find successful strategies that can control the spread of the pandemic.

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Л. Кот, канд. біол. наук,
Л.-А. Карпець, асп.,
К. Свиридова, асп.,
М. Черних, асп.,
Р. Пришляк, асп.
Київський національний університет імені Тараса Шевченка, Київ, Україна

ПЕВНІ БІОХІМІЧНІ АСПЕКТИ КОРОНАВІРУСНОЇ ІНФЕКЦІЇ COVID-19

Спалах коронавірусної хвороби CoViD-19, викликаної новим важким гострим респіраторним синдромом коронавірусу 2 (SARS-CoV-2), протягом короткого періоду часу зумовив надзвичайний стан у галузі охорони здоров'я в усьому світі. Складна епідеміологічна ситуація, пов'язана зі стрімким зростанням кількості хворих і високою частотою смертності, а також необхідність якнайшвидшого подолання наслідків пандемії стали важливим викликом для науки. Особливу увагу вчених прикуто до поглибленого вивчення патогенетичних механізмів коронавірусної інфекції, що є важливим для розробки противірусних препаратів і вакцин для боротьби з CoViD-19. Для проникнення у клітини-мішені вірус використовує рецептори, експресовані в різних тканинах організму, основним з яких є ангіотензинперетворювальний фермент 2 (АПФ2). Реплікація вірусу регулюється багатьма факторами та викликає різкі морфологічні й фізіологічні зміни у клітинах. SARS-CoV-2 порушує регуляцію запальних сигнальних шляхів, що генерують цитокіновий "шторм", викликає мультисистемні розлади та загрозливий для життя стан – гострий респіраторний дистрес-синдром. Важливою складовою патогенезу та клінічних виявів CoViD-19 є порушення гемостазу, активація тромбоутворення та тромбоемболічні ускладнення. У пропонованому огляді наведено дані, що стосуються будови вірусу SARS-CoV-2, шляхів інфікування, захисних механізмів організму, які протидіють вторгненню патогену, особливостей функціонування системи гемостазу за коронавірусної інфекції, внутрішньоклітинної сигнальної трансдукції та сучасних стратегій профілактики і лікування CoViD-19, що спрямовані переважно на пригнічення реплікації вірусу, обмеження його розповсюдження та зниження імунної реакції організму в умовах інфекції.

Ключові слова: SARS-CoV-2, коронавірусна інфекція, CoViD-19, сигнальна регуляція, терапевтичні стратегії.

Л. Кот, канд. биол. наук,
Л.-А. Карпец, асп.,
К. Свиридова, асп.,
М. Черных, асп.,
Р. Пришляк, асп.
Киевский национальный университет имени Тараса Шевченко, Киев, Украина

НЕКОТОРЫЕ БИОХИМИЧЕСКИЕ АСПЕКТЫ КОРОНАВИРУСНОЙ ИНФЕКЦИИ COVID-19

Вспышка коронавирусной болезни CoViD-19, вызванной новым тяжелым острым респираторным синдромом коронавируса 2 (SARS-CoV-2), в течение короткого периода времени обусловила чрезвычайное положение в области здравоохранения во всем мире. Сложная эпидемиологическая ситуация, связанная со стремительным ростом количества больных и высокой частотой смертности, а также необходимость скорейшего преодоления последствий пандемии, стали важным вызовом для науки. Особое внимание ученых сосредоточено на углубленном изучении патогенетических механизмов коронавирусной инфекции, что важно для разработки противовирусных препаратов и вакцин для борьбы с CoViD-19. Для проникновения в клетки хозяина вирус использует рецепторы, экспрессированные в различных тканях организма, основным из которых является ангиотензинпревращающий фермент 2 (АПФ2). Репликация вируса регулируется многими факторами и вызывает резкие морфологические и физиологические изменения в клетках. SARS-CoV-2 нарушает регуляцию воспалительных сигнальных путей, генерирующих цитокиновую "бурю", вызывает мультисистемные нарушения и угрожающее жизни состояние – острый респираторный дистресс-синдром. Важной составляющей патогенеза и клинических проявлений CoViD-19 является нарушение гемостаза, активация тромбообразования и тромбоэмболические осложнения. В данном обзоре приведены определенные данные относительно структуры вируса SARS-CoV-2, путей заражения, защитных механизмов организма, противодействующих вторжению патогена, особенностей функционирования системы гемостаза при коронавирусной инфекции, внутриклеточной сигнальной трансдукции, а также современных стратегий профилактики и лечения CoViD-19, направленных в основном на угнетение репликации вируса, ограничение его распространения и снижение иммунного ответа организма в условиях инфекции.

Ключевые слова: SARS-CoV-2, коронавирусная инфекция, CoViD-19, сигнальная регуляция, терапевтические стратегии.