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CLINICAL AND LABORATORY DIAGNOSTICS OF CORONAVIRUS INFECTION

Tursunov Feruz Uktamovich,
Turakulov Javlon Sodik ugli,
Ibragimova Nadiya Sabirovna,
Assistants at the Department of Clinical and Laboratory Diagnostics with a Course of Clinical and Laboratory Diagnostics at the Faculty of Postgraduate Education

Ergashev Sirojiddin Komiljon ugli
Cadet of the Department of Clinical and Laboratory Diagnostics with a Course of Clinical and Laboratory Diagnostics of FOPE,
Samarkand State Medical University, Uzbekistan, Samarkand

Abstract
The relevance of coronavirus infection today remains extremely high and multifaceted. The global pandemic continues to have a significant impact on public health, economic development and social structures. Uneven distribution of vaccines, the emergence of new virus strains and changing public behavior pose additional challenges to health systems.

Keywords: Coronavirus infection, PCR diagnostics, computed tomography, pulse oximetry, complications.

Introduction

Coronavirus infection caused by SARS-CoV-2 has become a global problem that has affected every corner of our planet. In the summer of 2019, this virus began its rapid journey, conquering countries, cities and regions, changing the usual way of life of millions of people. The symptoms of the disease, ranging from mild respiratory manifestations to severe disease, required the rapid intervention of medical institutions and the development of new treatment methods.

The outbreak of infection prompted the scientific community to unite and rapidly develop vaccines and drugs to combat the virus. The principles of quarantine and social distancing have become part of everyday life, emphasizing the importance of public health.

The etiology of coronavirus infection includes the study of the causes and mechanisms of infectious diseases caused by coronaviruses. The main pathogens are SARS-CoV, MERS-CoV and SARS-CoV-2, each of which exhibits unique characteristics and pathogenesis. SARS-CoV-2, identified at the end of 2019, became the cause of the global COVID-19 pandemic, which attracted the attention of scientists to its zoonotic origin [1, 15, 16]. By participating in complex interactions with cellular receptors, the virus enters the body, causing a wide range of symptoms from mild to severe respiratory distress.

The virus exhibits high variability, making it difficult to develop effective vaccines and treatments. Epidemiological studies highlight the importance of understanding transmission routes and factors

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for spreading infection, such as close contact, airborne transmission, and surface transmission. A comprehensive approach to studying the etiology of coronavirus infection is key to developing preventive measures and effective medical solutions that contribute to disease control on a global scale.

The pathogenesis of coronavirus infection begins with the introduction of the virus into the host's body through the mucous membrane of the upper respiratory tract. The virus, which has the ability to bind to ACE2 receptors on cells, enters cells using its spike proteins. This leads to viral replication and the release of new particles, which causes cell death and inflammation [1, 5, 6].

Immune hyperexcitability caused by SARS-CoV-2 can lead to a cytokine storm—an excessive release of proinflammatory cytokines. This body response leads to damage to lung tissue and blood vessels, which causes respiratory failure and other systemic complications. Uncontrolled inflammation can also affect organs such as the heart and kidneys, exacerbating the clinical manifestations of the infection.

Clinical symptoms of coronavirus infection range from mild to severe forms of the disease and include a wide range of symptoms. The most common symptoms are fever, cough and shortness of breath, which may result from pneumonia. In addition, patients experience non-systemic manifestations such as loss of taste and smell, fatigue and muscle pain.

Important aspects of diagnosing coronavirus infection are also gastrointestinal symptoms, which may include nausea, vomiting and diarrhea. Some patients may be asymptomatic, which creates a risk of unknowingly spreading the virus.

The pathophysiology of COVID-19 requires careful attention to identifying and treating comorbidities, such as cardiovascular disorders and diabetes, that may exacerbate the infection. Research continues to advance our understanding of the virus, emphasizing the need for active monitoring and preventive measures to reduce incidence and prevent complications [2, 4, 19].

Laboratory diagnosis of coronavirus infection plays a key role in controlling and preventing the spread of COVID-19. Since the emergence of the SARS-CoV-2 virus, the development of reliable and rapidly accessible testing methods has become a major concern for healthcare organizations around the world. Current approaches include polymerase chain reaction (PCR)-based molecular tests that detect viral RNA in samples collected from the nasopharynx or saliva [1, 8, 14].

PCR diagnostics of coronavirus infection is currently the gold standard in determining the presence of the SARS-CoV-2 virus in the body. This method is a molecular biology technique that allows the detection of virus ribonucleic acid (RNA) with high accuracy. The procedure involves several intricate steps: first, samples are collected, most often using a nasopharyngeal or oropharyngeal swab. The resulting material is then processed to isolate RNA, after which amplification is carried out using reverse transcriptase polymerase chain reaction [3, 7, 18].

PCR tests are highly sensitive and specific, which makes it possible to obtain reliable results with minimal risk. However, it is important to consider that the time to obtain results can vary from several hours to several days, depending on the workload of the laboratory and the technology used for the analysis.

ELISA diagnostics of coronavirus infection is a modern and highly effective laboratory research method that allows one to detect the presence of specific antibodies to the SARS-CoV-2 virus in the blood serum of patients. This method is based on the principle of enzyme-linked

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immunosorbent assay (ELISA), which provides a high degree of specificity and sensitivity, making it an indispensable tool in the fight against the pandemic.

The main advantage of ELISA diagnostics is the ability to simultaneously analyze several samples, which significantly speeds up the testing process. In addition, this method allows not only to determine the presence of antibodies, but also to assess their level, which can provide important information about the post-infectious immune response.

Instrumental research methods for coronavirus infection play a key role in the diagnosis, monitoring and assessment of the severity of the disease. First of all, the main method is computed tomography (CT) of the chest, which allows identifying changes in the lung tissue, such as infiltration, vitreous opacity and other pathologies characteristic of COVID-19.

Computed tomography (CT) of the chest for coronavirus infection is a key tool in the diagnostic process, allowing detailed visualization of the lungs and adjacent structures. When infected with SARS-CoV-2, the virus that causes COVID-19, clinical manifestations are often accompanied by various pulmonary lesions that can range from minor to severe [1, 9, 17].

CT studies reveal characteristic patterns such as ground-glass opacities, consolidation, and coronary opacity of lung tissue. These changes, as a rule, are diffuse in nature and may indicate an inflammatory process caused by a viral infection.

Additionally, chest radiography can serve as a quick and accessible way to initially assess a patient's condition.

An important instrumental method is pulse oximetry, which allows you to quickly determine the level of oxygen saturation and assess the need for oxygen therapy.

Pulse oximetry of coronavirus infection is one of the key methods for diagnosing and monitoring the condition of patients suffering from COVID-19. This non-invasive method of measuring oxygen levels in the blood allows you to quickly assess the degree of hypoxia, which is especially important in conditions of rapid deterioration in the condition of patients. A pulse oximeter uses light waves to determine hemoglobin saturation, providing clinicians with important information for making decisions about further therapy.

Research has shown that many coronavirus patients may remain asymptomatic despite low oxygen levels. Thus, regular use of pulse oximetry becomes imperative. It allows not only to identify cases requiring immediate intervention, but also to monitor the dynamics of the disease [3, 11, 13].

Ultrasound examinations are also used to assess pulmonary complications and monitor the condition of patients. These methods together contribute to more accurate diagnosis and help doctors develop effective treatment strategies, minimizing the risk of severe complications of coronavirus infection.

The forecast of coronavirus infection continues to be a hot topic for discussion in scientific and medical circles. Given the dynamic development of the virus and its mutations, experts emphasize the need for constant monitoring and adaptation of existing infection control strategies [2, 10, 12]. According to the latest data, depending on effective vaccination measures and compliance with sanitary standards, a steady decline in the number of cases can be expected. However, the emergence of new virus variants may add uncertainty to forecasts.

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Thus, successfully overcoming a crisis depends on a combination of preventive measures, educational programs and rapid response to emerging threats. Constantly informing citizens also plays a key role in shaping responsible behavior and the strength of public immunity.

Conclusions

It is important to note that effective management of the pandemic requires cooperation at the international level. The development of new vaccines and treatments to combat emerging strains should be a priority for the global scientific community.

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