

# LABORATORY METHODS FOR DETERMINING NEW COVID-19 INFECTION

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The massive and rapid spread of the disease has led to the spread of the new coronavirus becoming a pandemic. The main tasks of specialists in the field of diagnostics and treatment were the creation and use of tests with maximum sensitivity and specificity for reliable interpretation of the results in conditions of limited information about epidemiology, clinical features, prevention and treatment of the disease. Today, these are two areas: the detection of the SARS-CoV-2 antigen, capable of establishing the presence of the components of the virus itself, the determination of antibodies produced by the body's immune system in response to the invasion of the coronavirus.

The main specific test for COVID-19 is the detection of SARS-CoV-2 RNA by polymerase chain reaction (PCR). The material is a swab from the nose and oropharynx. Sputum (if available) and bronchial lavage can be used as an additional material for research. test systems of two types are used. The first and main method of research for SARS-CoV-2 is the PCR method, which determines the genetic material of the virus. To date, several kits have been developed to determine the Covid-19 virus, each of which is aimed at finding its own unique portion of its genetic code. The single-stranded RNA molecule is converted into complementary DNA during the reverse transcription reaction and the single-stranded DNA molecule is amplified.

Another type of PCR is isothermal PCR, a technology for loop isothermal nucleic acid amplification (LAMP). Due to the simplified sample preparation procedure and the reduction in the number of analysis steps, the pathogen detection time is less than an hour. This will increase the throughput of laboratory equipment and increase the number of studies performed by more than 3 times, compared with the current RT-PCR methods. In the current epidemic situation, the productivity of existing laboratories is crucial for a complete and objective diagnosis of coronavirus infection. Therefore, the method of loop isothermal amplification is now successfully used in many countries of the world.

Currently, the Russian Federation is validating the Xpert SARS-CoV-2 express test in nasal and oropharyngeal swabs using the GeneXpert system (manufactured by Cepheid, USA). It is a closed platform that uses disposable, closed Xpert cartridges. Each Xpert cartridge contains all the necessary reagents for the detection of target nucleic acids using polymerase chain reaction (PCR). The time for obtaining results is 2 hours, which is 3-4 times faster than using traditional PCR.

One of the interesting directions in laboratory diagnostics of Covid-19 for clinicians can be a set of reagents for clinical laboratory diagnostics in vitro "Rapid test for detecting SARS-CoV-2 virus antigen in nasopharyngeal swabs by immunochromatographic analysis (COVID-19 Ag Respi-Strip)". Its main functional purpose is to use it as an aid in diagnostics. The definition is based on the principle of immunochromatographic analysis. The nitrocellulose membrane is sensitized with monoclonal antibodies directed against the highly conserved nucleoprotein antigen SARS-CoV and SARS-CoV-2. Positive test result: A visible reddish-purple streak appears at the test line (I). The intensity of the test line can vary depending on the amount of antigens found in the sample. The reaction time is 15 minutes.

Serological testing for COVID-19 shows the body's response to the invasion of the virus to assess the strength of immunity to the SARS-CoV-2 virus or the risk of reinfection. Tests for the presence of IgM antibodies can be used from 7-10 days of illness, and tests for the presence of IgG antibodies - from 10-14 days of illness.



With the help of the determination of antibodies, such problems are solved as: screening the population for the presence of herd immunity; assessment of the individual immune response; screening to assess the need for vaccination; screening for an immune response to return to work.

ICA and ELISA methods are based on the reaction between the corresponding antibody (AB) and antigen (AG) in biological materials. Methods differ in the way the results are evaluated in the laboratory. Along with the complex and time-consuming testing procedures for coronavirus-19, there are also rapid tests that give high-quality preliminary results in 10-15 minutes. Their advantages are convenience, simplicity and the ability to obtain the result (initial presentation and analysis of the cause of the disease) without special skills and equipment. The reliability of the tests reaches 99.8%. Each test has an internal built-in control. In this case, there is an accumulation of antibodies with a dye around the antibodies rigidly immobilized in the test zone of the ICA strip, which manifests itself in the form of a bright colored strip, as an express test for pregnancy. Such tests do not need norms. Their task is to give information in the form of "is" or "not". Such tests can be used in emergency rooms, in an ambulance, to make quick decisions about patient routing, hospitalization in a covid hospital.

### **Conclusion**

The choice of test systems and diagnostic methods in medical organizations depends on the tasks set, the available laboratory equipment and financial resources.

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