DOI 10.25789/YMJ.2022.77.28
УДК 616 – 053. 2 (571.56)

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CORONAVIRUS INFECTION IN CHILDREN

Resume. A review of the literature of foreign and Russian studies on the course of a new coronavirus infection in children (SARS-CoV-2) is presented. Studies conducted over the past two years have shown a difference in the course of COVID-19 in children. The clinical picture of coronavirus infection in children is very diverse, from symptoms of respiratory infection to multisystem inflammatory syndrome. It was found that the frequency of severe coronavirus infection in children is lower. To fully understand the features of disease course and treatment of a new coronavirus infection, large-scale epidemiological studies are required.

Keywords: SARS-CoV-2, COVID-19, child population.

Introduction. Coronavirus disease 2019 (COVID-19) is a type of atypical pneumonia that broke out in December 2019, the causative agent of which was isolated and named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [2,3,5,9]. Due to the rapid spread of COVID-19, the World Health Organization and countries around the world have published relevant guidelines on the principles of prevention. Hundreds of millions of people have been infected in more than 200 countries, and it seems that the trend of increasing the number of infected will continue for a long time [1,2,4,11,12].

Coronaviruses (Coronaviridae) are a large family of RNA-containing viruses that can infect humans and some animals. In humans, coronaviruses cause a number of diseases: from mild forms of acute respiratory infection to severe acute respiratory syndrome (TOPC/SARS) [1,3,13,14]. According to the results of serological and phylogenetic analyses, coronaviruses are divided into alphacoronavirus, betacoronavirus and gammacoronavirus [17].

SARS-CoV-2 belongs to the betacoronovirus genus of viruses, which also includes viruses of severe acute respiratory syndrome and Middle East respiratory syndrome [7].

The maximum release of the virus from the patient occurs in the first 3 days from the onset of the disease. Virus isolation usually lasts up to 12-14 days in mild and moderate cases and more than 2 weeks in severe cases [19].

At the beginning of the spread of coronavirus infection, children were considered immune to COVID-19, but according to a survey published by the Centers for Disease Control (CDC) in April 2020 in the United States and China, children accounted for 2% of the total number of cases [11,16]. And by the end of 2021, children account for 17% of all COVID-19 cases. In addition, children have atypical symptoms of infection and cannot clearly describe their condition, which creates serious problems for the diagnosis and treatment of this population group. Infantile infections and features of clinical manifestations in COVID-19 in children required a more thorough study of clinical, laboratory and visual features of the course of coronavirus infection in children [6,10,15]. According to the results of a study by some authors, children who do not have chronic diseases, such as respiratory diseases or immunosuppression, have a low risk of developing a severe form of COVID-19. The authors attribute this to the anatomical and physiological features of the child's body and the way of life of children. However, some children face severe course of coronavirus infection. According to the Centers for Disease Control and Prevention, they may need hospitalization, treatment in an intensive care unit or a ventilator. In addition, children with other diseases, such as obesity, diabetes and asthma, may be at higher risk of severe COVID-19. Children with congenital heart defects, genetic diseases, diseases of the nervous system and metabolism can also get a severe form of COVID-19 [5,8,11,19,20].

Children under the age of 1 are also at high risk of severe coronavirus infection. This is likely due to the immaturity of the immune system and short airways, which are the cause of respiratory problems with respiratory viral infections [1,3,23,25,33].

While children and adults experience similar symptoms of COVID-19, symptoms in children tend to be milder and similar to seasonal viral disease. Most children recover within one to two weeks [2,4]. Possible symptoms may include: fever, cough that becomes productive, loss of taste and smell, changes in the skin, such as discoloration of skin areas on the hands and feet, sore throat, gastrointestinal symptoms - nausea, vomiting, abdominal pain, diarrhea, muscle pain, weakness, headache pain, nasal congestion [11,24,25].

Previous studies have shown that COVID-19 can be transmitted from person to person by airborne droplets and physical contact. The main susceptible population are people over the age of 50 [6,27,29]. The main symptoms are fever, cough, myalgia, headache and weakness. Laboratory tests usually show lymphopenia and leukocytosis [14,17,26,32].

According to the results of a study by some authors, lymphocytopenia, which is an important feature of adult COVID-19 and is considered one of the indicators for predicting the severity of the disease, was rare in children with COVID-19. Studies conducted in 2020 showed that SARS-CoV2 will cause a number of immune reactions after introduction into the body, which will cause an inflammatory reaction, leading to an increase in the inflammatory process and a decrease in the number of lymphocytes [31,33]. And in recent studies, leukopenia, high levels of C-reactive protein, increased erythrocyte sedimentation rate and high ALT were rarely indicated, which may indicate that the immune response in children with COVID-19 is weak [22,31]. Computed tomography data in 36% of children with COVID-19 did not reveal serious pathological changes in the lungs [28,30].

According to the results of studies conducted in 2021, we can say that the data on clinical symptoms, together with the results of laboratory tests and instrumental studies of children with COVID-19, show that the course of the disease is relatively easy for them. The authors indicate healthier respiratory tracts of children as possible causes of the mild course, because they are not exposed to cigarette smoke and polluted air for a long time, since these fac-

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tors contribute to the severe course of COVID-19 [13,19,20]. Also, many other types of viruses have been found in children in the upper respiratory tract and lungs, which can limit the growth of SARS-CoV2 through direct interaction and competition between viruses [18]. Some researchers consider the low number of mature angiotensin-converting enzymes-2 (ACE2) in lung receptors to be another factor of the mild course in children [14,21]. SARS-CoV2 uses ACE2 receptors on the cell surface to penetrate the epithelial cells of the human respiratory tract, and a limited number of ACE2 receptors increases the resistance of children to COVID-19 [14,28].

As it is known, the immune system of children is immature. Therefore, SARS-CoV2 infection will not cause a large number of inflammatory factors, severe damage to the autoimmunity of the lungs, heart, liver and other organs, and the possibility of a cytokine storm, which is the main cause of death in patients with severe COVID-19, will also decrease [8,30,32,33]. Therefore, the number of lymphocytes in the blood of children with COVID-19 is rarely reduced, and the indicators of inflammation are usually within the normal range or slightly increased.

Studies also indicate that since children are engaged in relatively limited outdoor activities, they tend to become infected in their families, and the virulence of these second or third generation infections may be lower [9].

The combination of all these factors, according to the researchers, leads to a mild course of COVID-19 in children. However, these children are carriers of the virus, and due to the latent mild or asymptomatic course, children can be a key link in the transmission of COVID-19 in the community. Thus, early detection and treatment of children with coronavirus infection is of great importance to prevent the spread of the disease [15].

The largest number of published foreign studies were conducted in the USA and China. In Russian medical publications, the largest number of publications on COVID-19 was in 2020. Thus, the Russian authors noted that there are fewer studies on the course of COVID-19 in children than in adults. It is noteworthy that all the studies conducted on the course of COVID-19 in children confirm the similarity of symptoms and laboratory data. The clinical picture in children was dominated by manifestations of respiratory viral infection of mild or moderate severity. Also, infants with COVID-19 are characterized by an atypical course of the disease.

To further study the course of coronavirus infection in children and to determine the best prevention and treatment strategy, it is necessary to conduct large-scale epidemiological studies.

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