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COVID-19 БИЛАН КАСАЛЛАНГАН ОНАЛАРДАН ТЎҒИЛГАН ЧАҚАЛОҚЛАР ЎПКА ТЎҚИМАСИНИНГ МОРФОЛОГИЯСИ

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МОРФОЛОГИЯ ЛЁГКИХ У НОВОРОЖДЁННЫХ, РОЖДЁННЫХ ОТ МАТЕРЕЙ С COVID-19

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Резюме. Ушбу мақолада COVID-19 пандемияси даврида COVID-19 билан касалланган оналардан туғилган чақалоқларда ўпка токсиклиги сабабли амалга оширилган ўпка биопсияси ва аутопсия текширувлари натижалари ўрганилади. Шунингдек, соғлом ва касал чақалоқларнинг ўпка тўқималарининг морфологик хусусиятларини таққослаб диагностика қилиш натижалари баён этилади.

Калит сўзлар: COVID-19, пандемия даври, пневмония, пневмопатия, перинатал ўлим, неонатал асфиксия, нафас олиш етишмовчилиги синдроми.

Abstract. This article studies the results of lung biopsy and autopsy examinations of infants born to mothers with COVID-19 during the COVID-19 pandemic due to lung toxicity. It also describes the results of comparative diagnosis of morphological features of lung tissue in healthy and sick infants.

Keywords: COVID-19, pandemic period, pneumonia, pneumopathy, perinatal death, neonatal asphyxia, respiratory distress syndrome.

Relevance of the topic. One of the viruses that has caused a pandemic in recent years is coronavirus, and the disease it causes is COVID-19. Coronaviruses are a large family of viruses that can cause diseases in humans ranging from simple colds to severe acute respiratory syndrome, which can be fatal. Coronavirus infection is an acute respiratory disease characterized by inflammation of the upper respiratory tract and mild symptoms of general intoxication [3, 8, 11].

According to WHO, respiratory diseases are the leading cause of death worldwide and are among the top ten causes of death worldwide. Taking the above into account, this requires in-depth pathomorphological investigations in cases of death caused by upper and lower respiratory tract infections [1, 4, 5, 7, 9].

In general, pregnant women occupy a special place among the risk groups for contracting COVID-19. It is known that pregnancy, despite being a physiological state, is accompanied by changes in a number of organs and systems, including the immune system. Therefore, susceptibility to infections increases significantly during pregnancy [4, 8, 10].

Currently, there is insufficient evidence of pregnant women infected with COVID-19, but some studies conducted in China, the United States, and Russia allow us to draw some conclusions [2, 6, 7].

In newborns, especially premature babies, according to available data on the course of infection, there are respiratory (tachypnea, apnea, cough), cardiovascular (tachycardia), and gastrointestinal (diarrhea, constipation, vomiting) disorders. At the same time, it showed that there were characteristic mani-

festations such as unstable body temperature, weakness, and low birth weight. From the very beginning, it was not denied that the infection could be transmitted vertically from an infected mother to newborns and cause harm [3, 9].

Later, information began to emerge that if a mother is diagnosed with COVID-19, the baby may be born prematurely and with a low birth weight for the gestational age, as well as developing respiratory distress syndrome and pneumonia [10, 11].

In this regard, a systematic review published in April of this year, which included 23 scientific studies conducted in China, the United States, Korea, and Central America, noted the following data based on the results of examinations of 172 pregnant women with confirmed COVID-19, the course of pregnancy, and 162 newborns: premature birth in 23% of pregnancies, respiratory distress syndrome in babies in 14%, pneumonia in 14%, low birth weight in 11% of babies, and a decrease in body weight compared to gestational age in 3% of children [3, 8].

This review presents data on the possibility of vertical transmission of the infection, with antibodies to SARS-CoV-2 detected in 11% of cases in umbilical cord blood samples from infants. In general, given the identified risks to the newborn, scientists are concerned about antenatal or intranatal infection of the fetus or infant. To date, the postnatal period after birth is considered the period of highest risk for infection in the newborn [9, 10].

According to the Centers for Disease Control and Prevention (CDC), at the beginning of the pandemic, cases of the novel coronavirus COVID-19 were not very common in children and were low compared to cases in the general population.

Materials and methods of examination. The Khorezm Regional Bureau of Pathological Anatomy

collected retrospective results of autopsy and biopsy examinations, archival materials, and histological and biochemical laboratory test results of 117 infants brought from the regional perinatal center during the pandemic.

Results. During the COVID-19 pandemic, the course of coronavirus infection in pregnant women and its impact on the health of the newborn have been studied as a pressing issue. When a mother becomes infected with SARS-CoV-2 during pregnancy, the virus can be transmitted to and affect the baby in several ways. Vertical transmission (through the placenta), through pathological changes in the placenta leading to fetal hypoxia, or airborne transmission of infection to the baby after birth. According to available evidence, direct transmission of the virus to infants born to mothers with COVID-19 is relatively rare (in 2–8% of cases), and the mortality rate associated with this infection in the neonatal period is also very low (approximately 0.1–0.3%). In most cases, neonatal infection in pregnant women is mild or asymptomatic, and only in severe symptomatic cases, infants develop respiratory distress syndrome (RDS) and characteristic changes on lung X-rays. However, maternal COVID-19 infection can trigger serious pathological processes in the lungs of the newborn. In particular, placental infection can cause malperfusion changes in the placental vessels, disrupting the oxygen supply to the fetus and worsening the baby's condition during birth. Another risk is that the virus can be transmitted to the baby during or after birth, which can lead to neonatal pneumonia and acute respiratory distress syndrome (ARDS).

In this study, histological preparations of lung tissue from 117 infants (aged 1 to 60 days) born to mothers with COVID-19 infection were analyzed.

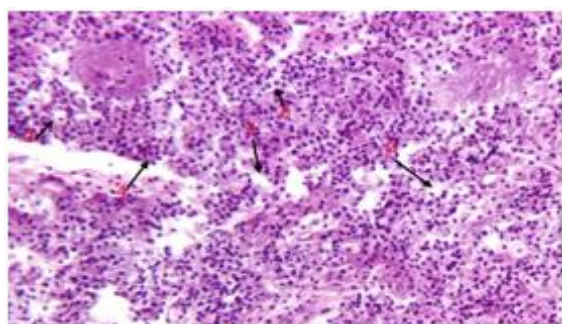


Fig. 1a. Lung of a 1-day-old infant. Born to a mother with COVID-19. Staining: Hematoxylin and eosin, Magnification $\times 100$. 1. Alveolar spaces are filled with air, with sparse and evenly distributed walls. 2.

Interalveolar barriers are thin, interstitial pus is not detected. 3. Inflammatory infiltration is weak, mainly lymphocytes. 4. Epithelial structure is completely preserved, there is little desquamation. 5. Hyaline membranes and fibrinous exudate are not noticeable

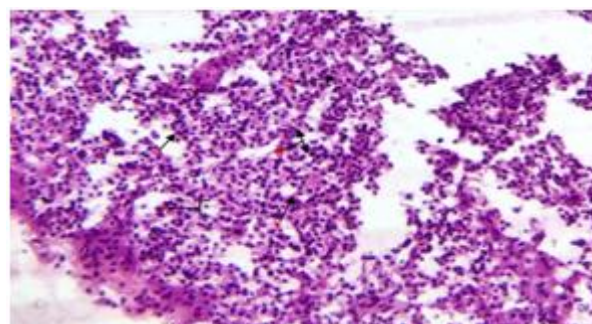


Fig. 1b. Lung of a 15-day-old infant. Born to a mother with COVID-19. Staining: Hematoxylin and eosin, $\times 100$. 1. Alveolar spaces filled with serous and phagocytic exudate. 2. Inter-alveolar walls thickened, interstitial edema and hyperemia. 3. Inflammatory cells include many lymphocytes, macrophages and neutrophils. 4. Desquamation of the epithelium is clearly visible. 5. Fibrinous and hyaline membranes are present in some places

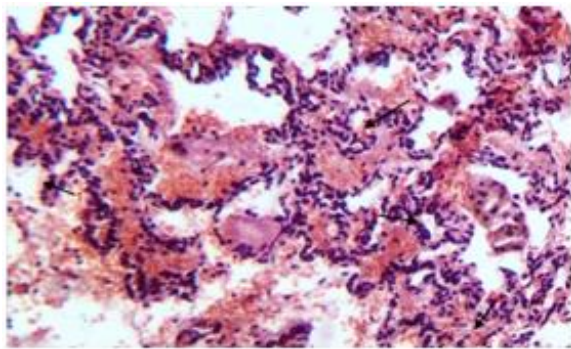


Fig. 1c. Lung of a 30-day-old infant. Born to a mother with COVID-19. Staining: Hematoxylin and eosin, Magnification $\times 100$. 1. Alveolar spaces filled with fibrinous exudate, architecture disrupted. 2. Interalveolar barriers are thickened, lymphocyte macrophage infiltration. 3. Epithelial cells are destroyed, basement membrane is not clearly visible. 4. A hyaline membrane is formed, there is a possibility of vascular scarring

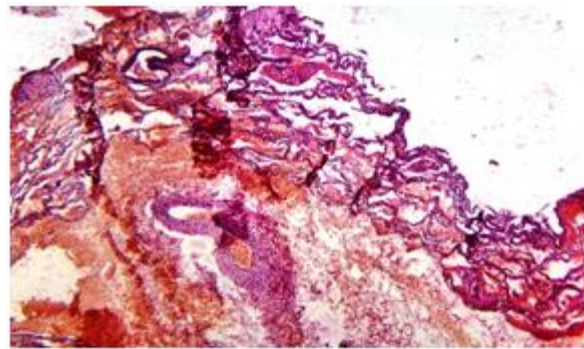


Fig. 2a. Lung of a 10-day-old infant. Born from a mother with COVID-19. Staining: Hematoxylin and eosin. Magnification $\times 100$. 1. The architecture of the lung parenchyma is lost, and the alveolar ducts are not fully preserved. 2. Sparse homogeneous substances (hyperexpressed fibrin) drawn in the tissue in a folded form. 3. Lymphomonocytic infiltration around vascular walls and peribronchial zones. 4. Eosinophilic fibrotic tissue and hyaline membranes around the epithelium. 5. The contours of the nucleus are preserved, but the alveolar air-dry is rarefied

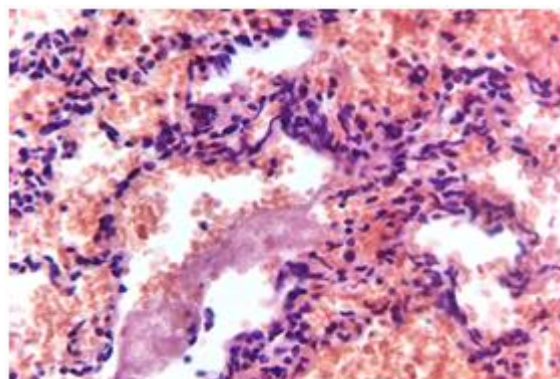


Fig. 2b. Lung of a 25-day-old infant. Born to a mother with COVID-19. Staining: Hematoxylin and eosin. Magnification $\times 200$. 1. Collection of blood cells and macrophages within the alveolar spaces. 2. The interalveolar walls are thickened, the infiltration is composed of macrophages and lymphocytes. 3. Large phagocytes located in the space are in the process of "cleaning" the epithelium. 4. Fibrinous substance and desquamated pneumocytes in part of the alveolar wall. 5. Congestive conditions in blood vessels, hyperemia

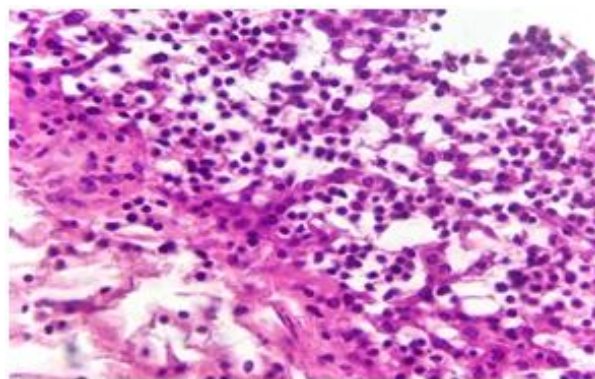


Fig. 2c. Lung of a 45-day-old infant. Born to a mother with COVID-19. Staining: Hematoxylin and eosin. Magnification $\times 200$. 1. Increased inflammatory infiltration in the tissue. 2. Alveolar walls are blurred, walls atrophy macrophages and detritus accumulation. 3. Hemosiderophages are a sign of possible re-injury. 4. Interalveolar walls are thickened due to fibrin and inflammatory cells. 5. Alveolar epithelium is desquamated, reconstruction is expected (delayed regeneration)

The presented conclusion is based on the results of this morphological analysis and summarizes the stages and characteristics of pathological processes in the lungs of infants under the influence of COVID-19. The observed findings are interpreted within the framework of the process of diffuse alveolar damage, that is, the classic stages of the pathogenesis of ORDS (exudative, infiltrative, destructive and fibrosing phases). Microscopic signs, pathogenetic mechanisms and clinical significance of each stage are discussed below.

These changes indicate that the effects of COVID-19 infection on the lungs in the newborn

have not yet fully manifested. This condition may be the initial subclinical phase of ARDS pathogenesis. In a 15-day-old infant, an active infiltrative-exudative phase of acute respiratory distress syndrome in newborns is observed, and damage to the alveolar-capillary barrier has occurred due to infection.

A 1-month-old infant is experiencing the destructive-fibrin phase of severe distress syndrome. This pathology seriously impairs the gas exchange function of the lungs, leading to a condition requiring artificial ventilation.

This image shows the fibrinosclerotic stage of COVID-19 infection in the lung tissue during the 2-

week neonatal period. The hyaline substance in the alveolar walls corresponds to the late phase of the pathogenesis of the distress syndrome.

This microscopy showed active inflammation and early fibrinous exudation resulting from COVID-19 infection. This corresponds to the infiltrative-fibrinous phase of Acute Respiratory Distress Syndrome.

Conclusion. In conclusion, it can be said that 1. A number of changes were observed in the morphological structure of the lungs of infants born to mothers with COVID-19 infection. In particular, uneven development of alveoli, blood filling of interstitial tissues, lymphoid infiltration, and microvascular disorders were noted.

2. Due to the effects of hypoxia and hypoxemia, the ventilation-perfusion balance of the lungs of infants was disturbed, and in some cases, the symptoms of surfactant deficiency and respiratory distress syndrome appeared.

3. Histomorphological studies have shown that mothers who have had COVID-19 have a predisposition to vascular endothelial cell dystrophy, microthrombosis, and fibrosis in the lungs as a result of the effects of inflammatory mediators and the immune response to the virus.

4. As a scientific novelty, it is emphasized that COVID-19 infection affects the morphology of the infant's lungs not directly through transplacental transmission of the virus, but rather through hypoxia, inflammation, and the mother's immune-hormonal status.

5. Practical significance - these data serve as the basis for early diagnosis of respiratory problems in neonatological practice, preventive respiratory support, and the development of individual rehabilitation programs for infants born to mothers with COVID-19 infection.

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МОРФОЛОГИЯ ЛЁГКИХ У НОВОРОЖДЁННЫХ, РОЖДЁННЫХ ОТ МАТЕРЕЙ С COVID-19

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Рузметова Д.Т.

Резюме. В статье изучены результаты биопсии легких и вскрытий новорожденных, рожденных матерями с COVID-19 во время пандемии COVID-19, по поводу токсического поражения легких. Также описаны результаты сравнительной диагностики морфологических особенностей легочной ткани у здоровых и больных новорожденных.

Ключевые слова: COVID-19, период пандемии, пневмония, пневмопатия, перинатальная смертность, неонатальная асфиксия, респираторный дистресс-синдром.