New Day in Medicine
Новый День в Медицине
NDM

TIBBIYOTDA YANGI KUN

Ilmiy referativ, marifiy-ma'naviy jurnal

AVICENNA-MED.UZ

ISSN 2181-712X.
EiSSN 2181-2187

12 (62) 2023

ТИББИЁТДА ЯНГИ КУН

НОВЫЙ ДЕНЬ В МЕДИЦИНЕ

NEW DAY IN MEDICINE

Илмий-рефератив, маънавий-маърифий журнал
Научно-реферативный,
духовно-просветительский журнал

УЧРЕДИТЕЛИ:

БУХАРСКИЙ ГОСУДАРСТВЕННЫЙ МЕДИЦИНСКИЙ ИНСТИТУТ
ООО «ТИББИЁТДА ЯНГИ КУН»

Национальный медицинский исследовательский центр хирургии имени А.В. Вишневского является генеральным научно-практическим консультантом редакции

Журнал был включен в список журнальных изданий, рецензируемых Высшей Аттестационной Комиссией Республики Узбекистан (Протокол № 201/03 от 30.12.2013 г.)

12 (62)

2023

ноябрь

www.bsmi.uz
https://newdaymedicine.com E: ndmuz@mail.ru
Тел: +99890 8061882

Received: 20.11.2023, Accepted: 27.11.2023, Published: 10.12.2023.

УДК 616.24-001

MODERN PRINCIPLES OF THE PATHOMORPHOLOGY OF LUNG INJURY IN COVID-19

[1]*Bohodir Asadullaevich Magrupov https://orcid.org/0000-0002-8795-0724*
[1]*Murotov Khabibulla Abulkasimovich https://orcid.org/0009-0001-0612-4704*
[2]*Israilov Rajabboy Israilovich https://orcid.org/0000-0002-4474-2722*

[1]Center for the Development of Professional Qualifications of Medical Workers under the Ministry of Health of the Republic of Uzbekistan, Tashkent city, Mirzo Ulugbek district, Parkentskaya street, 51 Phone: +998 (71) 268-17-44 E-mail: info@tipme.ru
[2]Republican Pathological Anatomical Center, Uzbekistan, Tashkent, st. Shifokorlar, 11 Tel/fax: (998) 71-214-50-11

✓ ***Resume***

During a pandemic, SARS-CoV-2 has been found to primarily affect the upper respiratory tract and lungs. Due to increased replication of the virus with the epithelium of the respiratory tract, acute respiratory distress syndrome develops; due to viremia, impaired immune system, hypoxia of tissue structures, clinical worsening of the patient's condition is noted within 2 weeks. In this work, 8 cases of autopsy material were taken to study pathomorphological changes in the lungs. It was found that under the influence of the virus, damage was observed to the integumentary epithelium of the bronchi and alveoli, tissue structures of the vascular wall and interstitial tissue, due to which the development of destruction in the form of atelectasis, distelectasis and the development of distress syndrome was noted. The peculiarity of damage to the lung tissue, vascular walls and interstitium manifested itself in the form of proliferation of connective tissue cells with the development of fibroplastic alveolitis.

Key words: virus, coronavirus, respiratory system, lung, alveolocyte, pneumonia, pneumonitis, distress syndrome.

COVID-19-ДА ЎПКА ШИКАСТЛАНИШИ ПАТОМОРФОЛОГИЯСИНИНГ ЗАМОНАВИЙ АСОСЛАРИ

[1]*Магрупов Боходир Асадуллаевич https://orcid.org/0000-0002-8795-0724*
[1]*Муротов Хабибулла Абулкасимович https://orcid.org/0009-0001-0612-4704*
[2]*Исраилов Ражаббой Исраилович https://orcid.org/0000-0002-4474-2722*

[1]Ўзбекистон Республикаси Соғлиқни сақлаш вазирлиги ҳузуридаги тиббиёт ходимларининг касбий малакасини ошириш маркази Ўзбекистон Тошкент ш., Мирзо Улғбек тумани, Паркентская кўчаси 51-уй Тел: +998 (71) 268-17-44 E-mail: info@tipme.uz
[2]Республика патологик анатомия маркази, Ўзбекистон, Тошкент, кўч. Шифокорлар, 11 Тел/факс: (998) 71-214-50-11

✓ ***Резюме***

Коронавирус инфекцияи пандемиясидан бутун дунё аҳли азият чекмоқда ва SARS-CoV-2 вируси аксарият ҳолларда нафас йўллари ва ўпкани касаллантириши маълум бўлди. Вирус нафас йўллари эпителийсига фаол репликацияланишидан ўткир респиратор синдром (ОЎРС) ва SARS, виремия, иммун бузилишлар, гипоксия ривожланиб, касал юқгандан кейин 2-хафтасида клиник огирланишга олиб келади. Ўпкада ривожланадиган патоморфологик ўзгаришларни ўрганиш учун 8та коронавирусдан ўлганларни аутопсия қилиб текширилди. Вирус таъсирида бронхлар ва альвеолалар қопловчи эпителийси, қон томир ва оралиқ бириктирувчи тўқимаси шикастланиб ва деструкцияга учраб, альвеолалар патологик ателектаз, дистелектаз ва дистресс-синдромга учраганлиги кузатилади. Коронавирус таъсирида ўпка тўқимаси шикастланишиинг яна бир ўзига хослиги, бронхлар, томирлар атрофидаги ва альвеолалар оралиғидаги бириктирувчи тўқима таркибига кирувчи фибробластларнинг пролиферацияланиши ривожланиб, унинг оқибатида интерстициал фибропластик альвеолит кузатилди.

Калит сўзлар: вирус, коронавирус, нафас тизими, ўпка, альвеолоцит, пневмония, пневмонит, дистресс-синдром

СОВРЕМЕННЫЕ ОСНОВЫ ПАТОМОРФОЛОГИИ ПОВРЕЖДЕНИЯ ЛЕГКИХ ПРИ COVID-19

[1]*Магрупов Боходир Асадуллаевич* https://orcid.org/0000-0002-8795-0724
[1]*Муротов Хабибулла Абулкасимович* https://orcid.org/0009-0001-0612-4704
[2]*Исраилов Ражаббой Исраилович* https://orcid.org/0000-0002-4474-2722

[1]Центр развития профессиональной квалификации медицинских работников при Министерстве здравоохранения Республики Узбекистан, город Ташкент, Мирзо Улугбекский район, улица Паркентская, 51 Телефон: +998 (71) 268-17-44 E-mail: info@tipme.ru
[2]Республиканский патологоанатомический центр, Узбекистан, г. Ташкент ул. Шифокорлар, 11 Тел/факс: (998) 71-214-50-11

✓ ***Резюме***

При пандемии от SARS-CoV-2 было установлено, ято преиммущественно поражается верхние дыхательные пути и легкое. За счет усиленной репликасии вируса с эпителием дыхательных путей развиается острый респираторный дисстресс синдром, за счет виремии, нарушении иммунной системы, гипоксии тканевых структур в течение 2-х недель отмечается клиническое утяжеление состояние больного. В данной работе для изучения патоморфологических изменений в легких взято 8 случаев аутопсийного материала. Было установлено, что под действием вируса отмечено поражение покровного эпителия бронхов и альвеол, тканевых структур стенки сосудов и интерстициальной ткани, за счет которых отмечено развитие деструкции в виде ателектазов, дистелектазов и развитие дистресс-синдрома. Особеноость поражения легочной ткани, стенки сосудов и интерстиции проявилость в виде пролиферации соединительнотканевых клеток с развитием фибропластичекого альвеолита.

Ключевые слова: вирус, коронавирус, система дыхания, легкое, альвеолоцит, пневмония, пневмонит, дистресс*-синдром.

Relevance

On March 11, 2020, the World Health Organization (WHO) declared a pandemic due to coronavirus infection, and it was considered the 11th pandemic of the XX-XXI centuries by SARS-CoV-2. SARS-CoV-2 is a single-stranded RNA virus belonging to the Coronaviridae family. The S-protein of SARS-CoV-2 is similar to angiotensin-converting enzyme 2 (APF2) and its affinity is 10 times stronger than that of the previous virus SARS-CoV, which ensures a high level of infectivity [3, 5].

APF2 receptor expression is detected in respiratory epithelium, alveolocytes, alveolar monocytes, vascular endothelium, gastrointestinal epithelium, urinary tract epithelium, macrophages and even other cells. SARS-CoV-2 is characterized by active replication in the epithelium of the upper respiratory tract. Therefore, the course and outbreak of COVID-19 causes severe acute respiratory syndrome (SARS) and SARS, whose strong replication causes viremia, immune disorders, hypoxia, and damages a number of organs, namely the heart, kidney, gastrointestinal tract and other organs, the receptor for APF2-enzyme is expressed in the cells of these organs and causes clinical severity in the 2nd week after infection [1, 2].

At the same time, the main and fundamental essence of this disease is the development of microangiopathy in the form of destructive-productive thrombovasculitis and hypercoagulable syndrome and damage to the immune system. In severe and critical development of COVID-19, vascular inflammation affects the body's coagulation, including IL-6 as an important trigger, activates the blood coagulation system and slows down the fibrinolytic system. The direct effect of the virus on the vascular endothelium provokes hypercoagulation and causes an aggressive immune response, as a result of which the appearance of antiphospholipid antibodies increases the coagulopathy. The severe and rapid course of COVID-19 is due to a sharp decrease in the number of lymphocytes and an increase in neutrophils in the patient's body [3, 4, 5]. But the reasons for the development of lymphopenia in COVID-19 remain unknown. Based on some data, lymphopenia can be attributed to the death of lymphocytes by apoptosis or pyroptosis, as well as pathological mitosis of macrophages.

In response to SARS-CoV-2, a hyperergic immune reaction in the patient's body causes a strong systemic inflammatory syndrome, a severe alteration of the lung alveolar tissue and other organs leads to the development of septic shock. In addition to the above, many aspects of the pathogenesis and morphogenesis of COVID-19 are still unclear and undefined, including the temporary loss of smell in the respiratory tract (anosmia).

APF2 enzyme is present in respiratory epithelium, alveolocytes, alveolar monocytes, vascular endothelium, gastrointestinal epithelium, urinary tract epithelium, macrophages and even other cells. The outer shell of the virus and the membrane of the human cell adhere to each other. SARS-CoV-2 virus enters the cell cytoplasm through S-protein and cellular APF2-enzyme. Inside the cell, the coronavirus loses its outer shell, that is, it "undresses". This is how coronaviruses activate their parasitism. It has a cytopathogenic effect on cells, disrupts protein metabolism in the cytoplasm, creates viral particles from cellular RNA. One virus particle reproduces 1000 times in one cycle, and 10,000,000 times after 3 cycles.

It should be said that the "removed" shell of coronaviruses is now filled by the proteins of the host cells. As a result, the damaged cells do not recognize it and completely lose their ability to resist. Viruses then leave the dead cells and enter other healthy cells and repeat the same process in them. That is why the disease has its own characteristics in the population of each country, and the degree of damage is also different.

The purpose of the study is to study the pathogenesis, morphogenesis and pathomorphology of lung damage in COVID-19.

Material and methods

As a research material, 28 people who died of pneumonia caused by the coronavirus during the pandemic period in August-September 2020 were dissected and examined by the autopsy method at the Uz SSV Republican Pathological Anatomy Center. During the autopsy, samples were taken from all internal organs, including the lungs, for histological examination. The sections were processed in the usual way and paraffin blocks were prepared. Histological sections were taken from it and stained with hematoxylin-eosin. It was studied under a light microscope and the necessary areas were photographed. For the preparation of this article, histological sections from the lungs were studied in 10, 20, 40 objects of a light microscope, and microphotographs were taken that show the most significant pathomorphological changes that develop in lung tissue under the influence of coronavirus. From respiratory tracts, terminal bronchioles and alveolar tissue were studied.

It is known that the covering epithelium of lung alveoli, i.e. alveolocytes, consists of 3 types of cells: type 1 flat or respiratory epithelium; Type 2 large or granular epithelium; 3-ciliated epithelium. I-type flat or respiratory epithelium covers 95-97% of the surface of the alveoli, carries out aerogematic, that is, gas exchange. It is an epithelium with a thin cytoplasm of 0.2 μm, few organelles, many pinocytosis vesicles. Type II - large granular cells cover 2-5% of the area. It is round or cube-shaped, protrudes from the surface of the alveolus, and is rich in microvilli. Cytoplasm contains many mitochondria and endoplasmic reticulum and osmiophilic bodies, and they consist of phospholipids. A surfactant film 0.05 μm thick forms on the surface of the alveoli. Type III- peripheral cells perform chemoreception and neurosecretory functions.

Result and discussions

The results of the investigation showed that the SARS-CoV-2 virus primarily damages type II and III alveolocytes. At the same time, the lower part of the respiratory tract, i.e. the bronchioles and respiratory bronchioles, develops a number of pathological changes, damaging the mucosa covering epithelium. Microscopically, the covering epithelium swells due to dystrophic changes in both its cytoplasm and nucleus, its shape changes, its nucleus is irregularly located, escapes from its basement membrane, some desquamates and migrates from its place. Others adhere to each other and form hyperchromic pads, others take on a multiline form, and still others become flattened, turning into a thin eosinophilic membrane, in which the nuclei also become smaller and flattened. In this case, the bronchiole cavity is filled with a large number of desquamated epithelium, erythrocytes, lymphoid cells, macrophages and other tissue fragments. It is observed that the basal membrane of the wall of the bronchiole is severely swollen, myxmatous, and it is determined that there are disorganized fibrous

structures in its composition. It is determined that activated macrophages, lymphoid cells, erythrocytes and necrobiotic detritus are present in it (Fig. 1).

Therefore, due to the damage and destruction of the covering epithelium and basal membrane of the bronchiole wall, the virus and its toxins spread to the lung tissue around the bronchioles and cause inflammation.

Microscopic examinations showed that SARS-CoV-2 mainly damages type II alveolocytes. Micrographs show that type II alveolocytes in all alveoli are severely enlarged, both cytoplasm and nucleus. In particular, it is observed that the cytoplasm has increased in size and entered into an unclear shape, it is stained with eosin in a chaotic manner, it is desquamated, and it falls into the alveolar cavity (Fig. 2). In some places, it is determined that they are connected to each other, forming large multinucleated cells. It can be specially noted that the alveolar tissue damaged by the virus has lost its normal histotopography, the tissue structures are chaotically located. Due to migration of covering epithelium, alveoli walls are broken and destroyed by blood vessels and connective tissue. Strong swelling, myxomatosis and infiltration of lymphoid cells are detected in them. In other areas of lung alveolar tissue, it is observed that discirculatory changes, i.e., diffuse hemorrhages predominate. In these areas, the space of the alveoli, the interstitial tissue is diffusely filled with erythrocytes (Fig. 3). In these areas as well, it is determined that alveolocytes have undergone dystrophy and destruction, large multinucleated giant cells have appeared.

Therefore, it is observed that the alveoli are affected by pathological atelectasis, dystelectasis and distress syndrome due to the severe damage and destruction of the epithelium covering the alveolar wall, blood vessel and interstitial connective tissue under the influence of the virus.

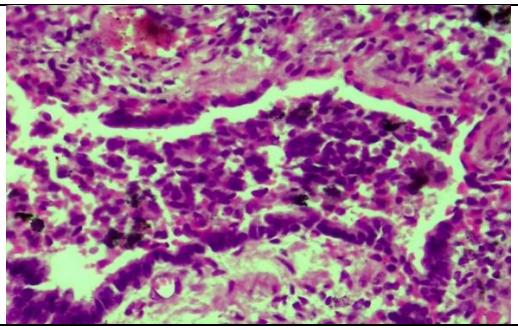

Figure 1. Due to the effect of coronavirus, the bronchiole cavity is filled with cellular mass, the covering epithelium undergoes various changes, the basement membrane is swollen, infiltrated with myxomatosis and inflammatory cells, and blood is shed. Paint: G and E. X: 10x40.

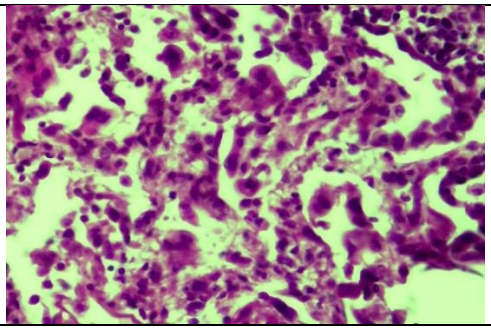

Figure 2. Under the influence of the coronavirus, alveolocytes of type II increased in size and shape due to dystrophy and destruction, interstitial tissue was destroyed and infiltrated with lymphoid cells. Paint: G and E. X: 10x40.

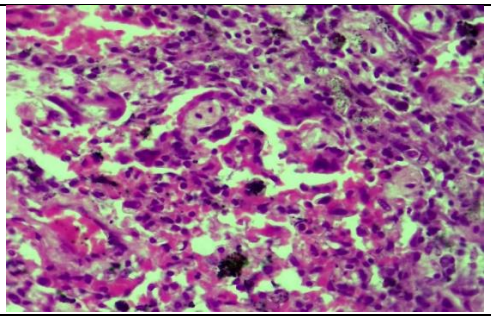

Figure 3. Due to the effect of coronavirus, the alveolar cavity and interstitial tissue are diffusely filled with erythrocytes, the alveolocytes are dystrophied and destroyed, large multinucleated giant cells appear. Paint: G and E. X: 10x40.

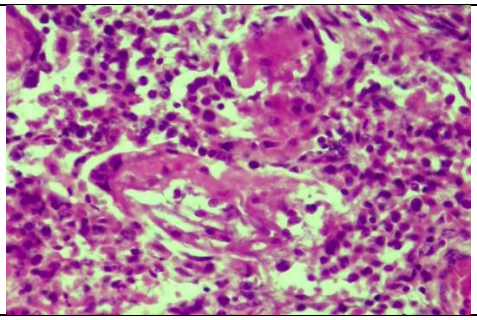

Figure 4. Type II alveolocytes bound with eosinophilic fiber protein and filled the alveolar cavity. Paint: G and E. X: 10x40.

As a result of severe dystrophy and destruction of type II alveolocytes, pathological protein substances are synthesized from them instead of the standard surfactant. As a result, fibrous structures, which were initially randomly located in the alveolar cavity, form a unique network and fill the alveolar cavity. In this case, alveolar wall structures were completely destroyed and diffusely infiltrated with lymphoid cells (Fig. 4). As a result of the movement of the lung tissue and air entering the alveoli, coarse protein substances formed in the alveolar cavity accumulate at the edge of the alveolar cavity, that is, on the inner surface of the alveolar wall, forming hyaline membranes (Fig. 5). As a result, oxygen exchange on the surface of the alveolar wall becomes difficult and hypoxia develops. Therefore, in most cases, damage to type II alveolocytes, production of coarse fibrillar protein instead of surfactant, and formation of hyaline membranes are confirmed under the influence of coronavirus.

It is known that the enzyme ASE2 of cells is an integral part of the renin-angiotensin system (RAS) and its function controls the homeostasis of the cardiovascular system, controls systolic blood pressure, osmotic and electrolyte balance. Under the influence of coronavirus, the activity of this enzyme increases, and this mechanism is strengthened, the bronchial wall shrinks smooth muscle tissue, lung fibroblasts proliferate, alveolar epithelium undergoes apoptosis, vascular wall permeability increases, and leads to acute respiratory distress syndrome. If ASE2 acts through the Mas receptor, it causes vasodilation and lowers blood pressure. Based on these mechanisms, if we shed light on the microscopic changes of blood vessels in lung tissue damaged by SARS-CoV-2, the following can be said. All the vessels of the lung tissue are vasodilated, widened and full. In particular, the venous vessels are sharply dilated, filled with blood, the permeability of their walls increases, and blood is poured around them by the diapedesis method (Fig. 6). Arteries are also relatively widened, plump, but all layers of their walls are thickened due to edema, myxomatosis and inflammatory infiltrate. Innumerable capillaries in the interalveolar tissue are also diffusely dilated and full, blood is poured diapedesically into the surrounding tissue and alveolar space (Fig. 7).

It is known from the above-mentioned mechanisms that under the influence of SARS-CoV-2, the endothelium of blood vessels is also damaged. As a result, strong dystrophy and destruction processes develop in endothelial cells, their cytoplasm swells, desquamates, and moves out of place. Damage to the endothelium of blood vessels is the main local cause of the thrombosis process, which leads to the coagulation of blood cells and fibrinogen in the vessel cavity. As shown in the microphotograph below, it is confirmed that fibrin protein and white blood cells have accumulated in the space of postcapillary venules, in other words, microthrombi have appeared (Fig. 8). In this disease, it is observed that fibrin thrombi appear not only in small blood vessels, but also in the cavity of large veins (Fig. 9).

It is known that the cellular immune network of the immune system responds to viral diseases. In SARS-CoV-2 viral infection, inflammation in the form of diffuse lymphocytic infiltration is observed in the lung tissue. In this case, it is determined that the blood vessels of the lungs, the walls and surroundings of the bronchi, and the interalveolar tissue are diffusely filled with activated lymphoid cells of different degrees (Fig. 10). Therefore, it was observed that under the influence of the SARS-CoV-2 virus, the endothelium of blood vessels is also damaged, often leading to fibrin thrombosis.

Under the influence of the C protein of SARS-CoV-2 virus, the activity of ASE2 enzyme in not only the respiratory epithelium, but also the endothelium and smooth muscle cells of the blood vessel wall increases, as a result, the smooth muscle tissue of the bronchial wall shrinks, the fibroblasts of the interstitial tissue of the lung proliferate and increase, the permeability of the vascular wall increases, and the vessels the wall and surrounding tissue structures undergo swelling, protein absorption, and destruction. In response to it, an inflammatory reaction and cell proliferation are triggered. If ASE2 acts through the Mas receptor, it causes vasodilation and lowers blood pressure.

If we study the pathomorphological changes that develop as a result of these mechanisms microscopically, the following results are obtained. After the endothelium on the inner surface of the blood vessel wall is damaged by the virus, it undergoes dystrophy and destruction, it moves out of place and undergoes necrobiosis.

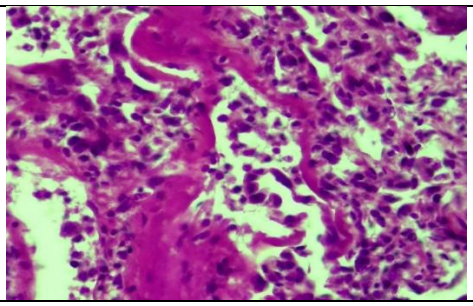

Figure 5. The resulting eosinophilic hyaline membranes covered the inner surface of the alveoli. Paint: G and E. X: 10x40.

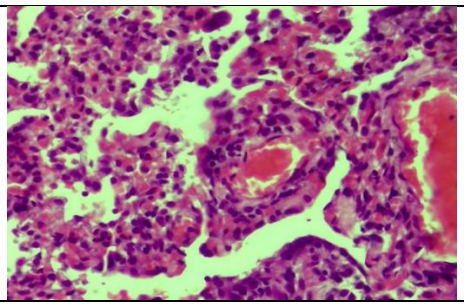

Figure 6. Under the influence of the coronavirus, the large veins and arteries have thickened due to disorganization and inflammation. Paint: G and E. X: 10x40.

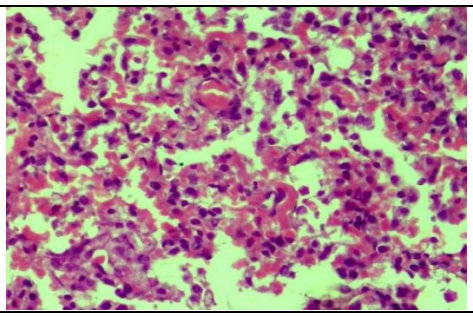

Figure 7. In the tissue between the alveoli, the capillaries are filled diffusely, and blood is poured around and into the alveolar cavity by diapedesis. Paint: G and E. X: 10x40.

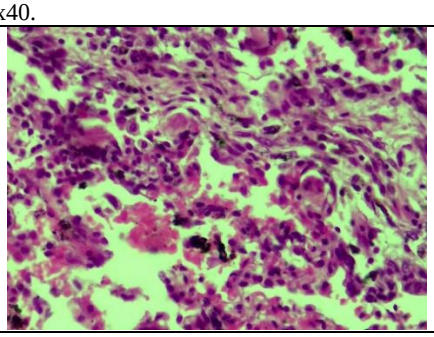

Figure 8. Fibrin thrombi appeared in the space of postcapillary venules of lung tissue. Paint: G and E. X: 10x40.

As a result, the basement membrane becomes swollen, swollen, loses its histotopography, disintegrates and fragments. These changes cause thrombosis, which adheres to the vessel wall. Among the morphological changes that develop under the influence of the virus, the following are noteworthy, i.e., fibroblasts around the basal membrane, which are in fact very few in number, proliferate and infiltrate the basal membrane and muscle layers (Fig. 11). At the same time, connective tissue cells in the adventitia tissue outside the vessel wall, including fibroblasts, rapidly multiply and proliferate, causing the vessel wall to thicken and form a sheath-like wrap around it.

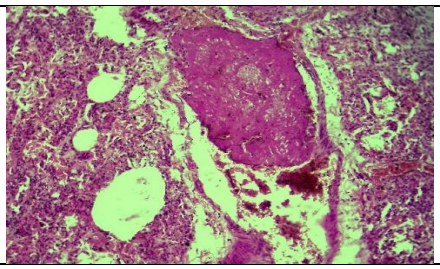

Figure 9. A fibrin thrombus appeared in the cavity of the large pulmonary vein. Paint: G and E. X: 10x10.

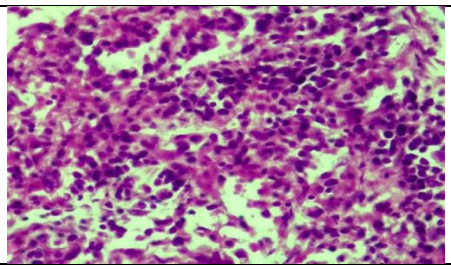

Figure 10. Appearance of lymphoid infiltration in lung tissue in response to exposure to coronavirus. Paint: G and E. X: 10x40

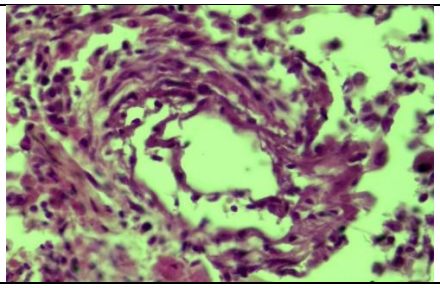

Figure 11. Due to the effect of coronavirus, the endothelium of the damaged artery wall has migrated, the basement membrane has broken down, fibroblasts have proliferated and infiltrated the surrounding area. Paint: G and E. X: 10x40.

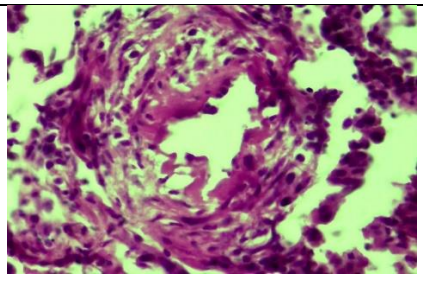

Figure 12. There is no endothelium on the inner surface of the arteriole wall, the basal membrane has undergone fibrinoid necrosis, and a fibrin thrombus is forming in its cavity. Paint: G and E. X: 10x40.

If we study the changes in the wall of another arteriole microscopically, there are almost no endothelial cells on the inner surface of the vessel wall, only fragments of cells and nuclei of various sizes are preserved adhering to the basement membrane. It is determined that the basal membrane is sharply thickened due to strong fibrinoid swelling and fibrinoid necrosis (Fig. 12). The appearance of fibrin threads and rough protein material adjacent to the basement membrane at one end of the vascular space indicates that a fibrin thrombus is forming in the damaged vessel. In the adventitial layer around the arteriole, it is observed that lymphoid cells and fibroblasts proliferate and infiltrate the surrounding tissue.

Conclusion

- It was observed that type II and III alveolocytes were initially damaged under the influence of coronavirus, their nucleus and cytoplasm were deformed and took different forms, polymorphous and giant cells appeared, desquamated and filled the alveolar cavity.

- Pathomorphological changes specific to COVID-19 occurred in the pulmonary blood vessels, the endothelium suffered dystrophy, destruction and desquamation, the basement membrane was severely swollen and disorganized, as a result of which plasma fluid and proteins poured into the wall and cavity of the alveoli, hemorrhagic exudate and foci of hemorrhage appeared. is determined.

- Due to the effect of coronavirus, it is determined that fibroblasts proliferated in the tissue of the bronchi, around blood vessels, and between the alveoli, a specific productive infiltrate appeared, and finally, interstitial fibromatous alveolitis developed in the lungs.

LIST OF REFERENCENS:

1. Винокуров А.С. и др., Дифференциальная диагностика изменений легких на опыте стационара приему внебольничных пневмоний – не только COVID-19. // Медицинская визуализация, 2020;24(2):78-94.
2. Вороббева О.В., Ласточкин А.В. Патоморфологические изменения в органах при COVID-19. // Инфекция и иммунитет, 2020;10(3):587-590.
3. Коган Е.А. ва бошк., Патологическая анатомия инфекции, вызванной SARS-CoV-2. // Судебная медицина, 2020;6(2):8-30.
4. Рыбакова М.Г. и др., Патологическая анатомия новой коронавирусной инфекции COVID-19. Первые впечатления. // Архив патологии, 2020;82(5):5-15.
5. Driggin E., Madhavan M.V., Bikdeli B., Chuich T., Laracy J., Bondi-Zoccai G., Brown T.S., Nigoghossian C., Zidar D.A., Haythe J., Brodie D., Beckman J.A., Kirtane A.J., Stone G.W., Krumholz H.M., Parikh S.A. Cardiovascular considerations for patients, health care workers, and health systems during the coronavirus disease 2019 (COVID-19) pandemic. // J. Am. Coll. Cardiol., 2020; doi: 10.1016/j.jacc.2020.03.031.
6. Zokirovna O.A. Modern Concepts of Idiopathic Pulmonary Fibrosis // American Journal of Pediatric Medicine and Health Sciences. 2023;1(3):97-101.
7. Olimova Aziza Zokirovna. (2022). Technique for cutting biopsy and surgical material in the practice of pathological anatomy and forensic medicine. // Web of Scientist: International Scientific Research Journal, 2022;3(7):116-120. https://doi.org/10.17605/OSF.IO/PSQ59

Entered 20.11.2023