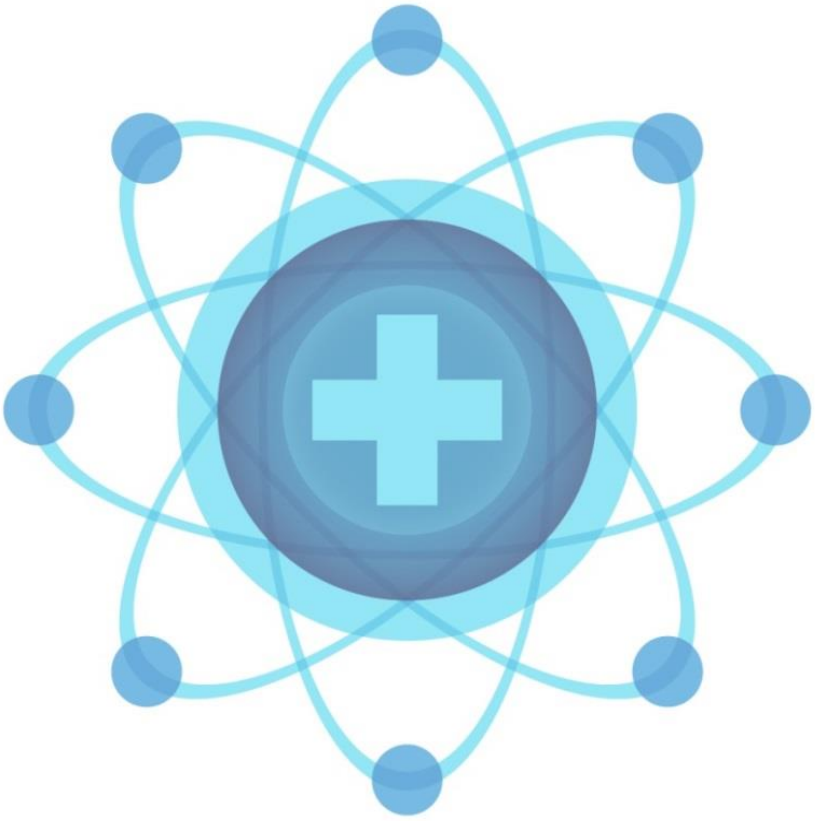

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MORPHOLOGICAL CHANGES IN LUNG TISSUE AND SMALL CALIBER ARTERIAL BLOOD VESSELS DURING COVID-19 INFECTION

Tursunov Kh.Z. Omonov Sh.R. Allaberganov D.Sh.
Tashkent Medical Academy

Abstract: In the period after the Covid-19 pandemic, SARS-CoV-2 caused a nonspecific response of most organs and tissues of the pathogen. In particular, blocking of the APF-2 receptor in the blood vessels of the lung tissue caused the development of acute dystrophic and necrotic changes in the form of respiratory distress syndrome, derailing the principle of nutrition of the vessels in the organs. Specific principles of morphological changes in blood vessels of lung tissue were studied in autopsies of those who died with the diagnosis of Kovid-19. Changes in the endothelial area of the components that make up the vessel wall were studied. During the studies, it was found that thrombi develop as a result of acute swelling and desquamation of endotheliocytes.

Keywords: covid-19, pathomorphology, pulmonary tissue vessel, thrombosis, endothelium.

Relevance of the topic: During the pandemic, death from thromboembolic complications after coronovirus infection is observed a lot (data from SSV RPAM 2021). Pulmonary edema develops as a result of the development of interstitial edema in the alveolar wall of the lung and thrombosis in the capillaries. This, in turn, leads to many complications due to the increase in hydrostatic and oncotic osmotic pressure in the vessels of lung tissue. It is manifested in the lung tissue in the form of respiratory distroess syndrome. Clinical morphologically, it is manifested in the form of shortness of breath, wheezing, and continues for 6-8 hours with the formation of interstitial swellings in the alveolar walls and hyaline protein structures in the alveolar spaces. These same changes have also been found to develop in other organs. However, lung tissue is one of the most dangerous organs among the vital organs, which manifests itself in the form of acute respiratory failure. The mortality rate in patients depends on age, gender and constitutional structure and develops differently. In case of covid-19 infection, blocking of the APF-2 receptor located in the vascular endothelium is manifested by dilatation of the vessel and the development of interstitial tumors in the sub-endothelial layer and desquamation of the endothelial cells.

Purpose: to study the morphological changes that occur in the pulmonary tissue thrombosis and alveolar walls and cavities in the case of coronavirus infection, and to produce guidelines for clinical morphological diagnosis.

Materials and methods: Research materials were collected from patients who died of coronavirus infection at the Republican Pathological Anatomy Center of the Ministry of Health of the Republic of Uzbekistan. In 2020-2021 , 32 lung tissue blood vessels were examined on the basis of autopsy results. General morphological examination by hematoxylin and eosin staining, the obtained materials are fixed in glutaraldehyde, contrasted with osmium 4 oxide, and frozen in epon blocks. Then, they are cut on an ultramicrotome and the obtained micropreparations are stained with methylene blue and picrofuscin. The obtained data are morphologically

examined and clinical anamnestic analysis is carried out from the history of the disease. Then the obtained data will be statistically analyzed.

Research results and their discussion: in our study, different degrees of damage to lung tissue and small-caliber blood vessels are directly related to hemodynamics and rheological indicators of blood . damage to endothelial cells is observed due to slowing of blood circulation and infection. If the damage is observed in the arterial vessels entering the organs, it ends with the development of acute ischemia and necrosis of these organs. If the injury develops in the intima of the venous blood vessels, especially in the postcapillary venules, the occurrence of hydropic dystrophy and desquamation of endothelial cells leads to the development of primary thrombi in this area (see Fig. 1).

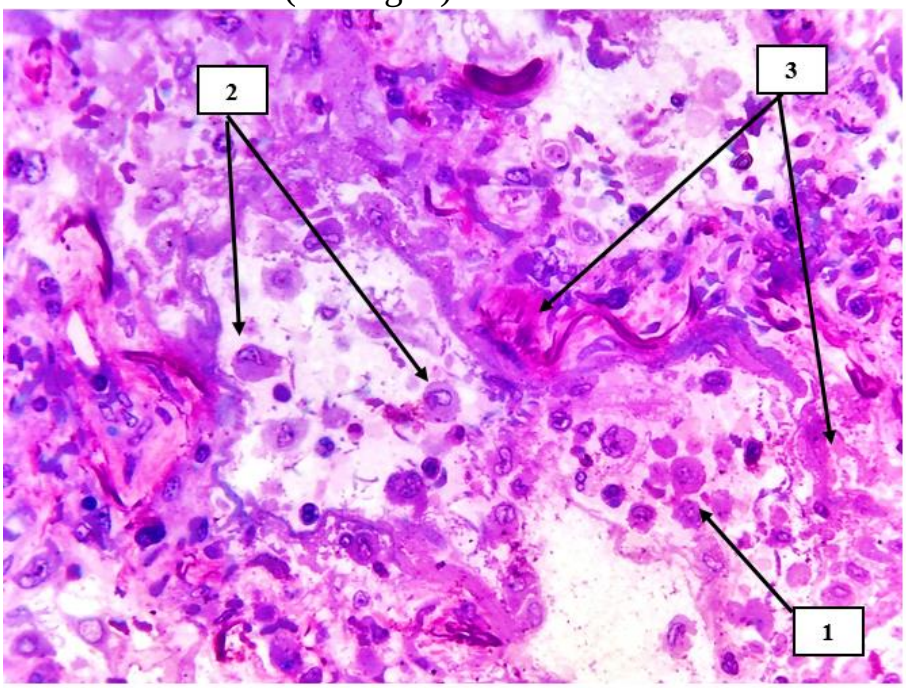

Figure 1. Lung tissue. Macrophages with metaplastic giant cells are detected in the alveolar spaces (1), primary alveolar cells are also desquamated (2), sclerotic changes around small-caliber arteries and coarse fibrous connective tissue structures are detected (3). Semi-thin section. Stain methylene blue and picrofuscin. The size is 40x10.

From a clinical morphological point of view, the formation of red thrombus is characterized by the fact that when it creates a sharp dynamic movement trajectory, it migrates to a large blood circulation circle and causes thromboembolic syndrome. In this research work , the morphological changes that occur on the surface of the small caliber arteries of the lung tissue damaged by SARS-CoV-2 in the pulmonary vessels in Kovid-19 were studied. The endothelium of muscular type arteries is distinguished by its histologically and productively specific aspects in the production and structure of active secretory substances compared to large and medium-sized vessels (a large number of inclusions in the cytoplasm, a relatively large nucleus, high sensitivity to vasopressors and toxic substances). stands (see Figure 2).

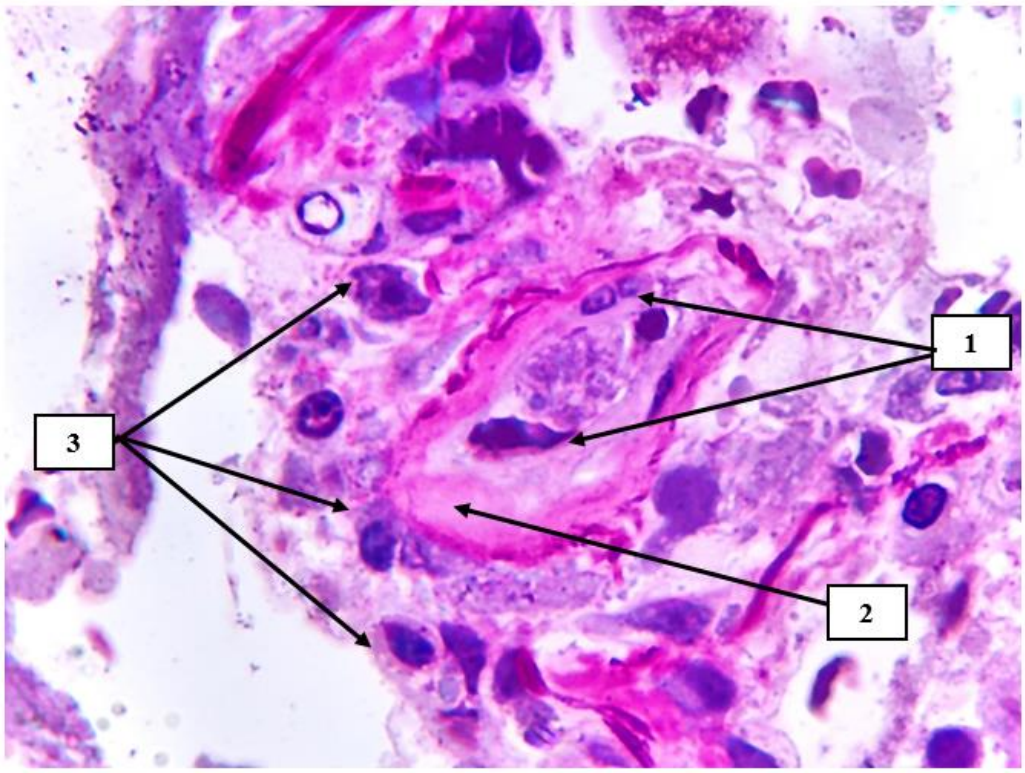

Figure 2. Hyperchromic staining of endotheliocytes with a granular appearance on the surface of the endothelium of the pulmonary vessel (1), hyalinosis and percytic sox fibromatosis are determined on the vessel wall (2), chaotic arrangement of most macrophages (3). Semi-thin section. Stain methylene blue and picrofuscin. The size is 40x10.

Under the influence of any exogenous and endogenous toxic substances, water-salt metabolism in endothelial cells is disrupted, hydropic dystrophy occurs, and the formation of microthrombi in these areas due to migration from the basal layer or secondary pathomorphosis after treatment (chain migration of endothelial cells rich in giant cell inclusions and the occurrence of tissue embolism) arrival), characterized by the focal accumulation of macrophages and histiocytes and the development of a nodule-like feature in this area (see Fig. 3).

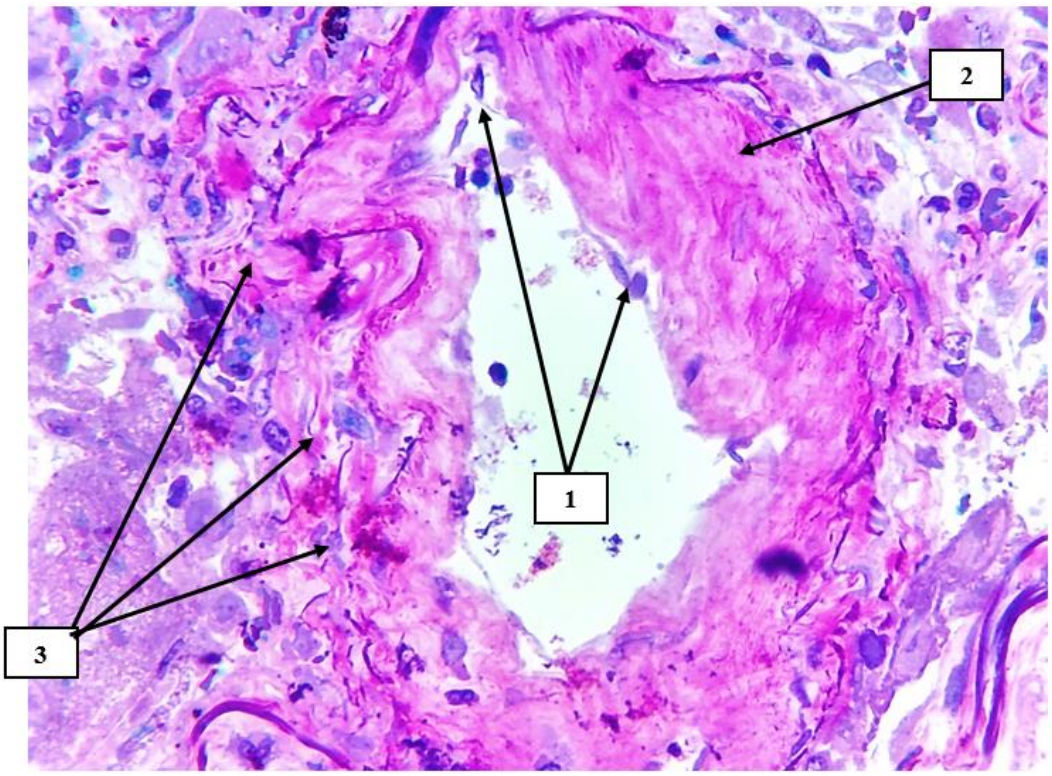

Figure 3. Pulmonary tissue small-caliber artery. Desquamation of endotheliocytes on the surface of the arterial intima (1), hyaline uneven protein structures are detected in the wall (2), irregularly migrated foci of lymphocytes and macrophages are detected on the sharply deformed surfaces of the perivascular sokha relief (3). Semi-thin section. Stain methylene blue and picrofuscin. The size is 40x10.

Focal desquamation of endotheliocytes on the surface of the vessel intima is considered as a factor that determines the course and duration of the process , and serves as a morphofunctional initial factor that determines partial or complete obliteration of the vessel.

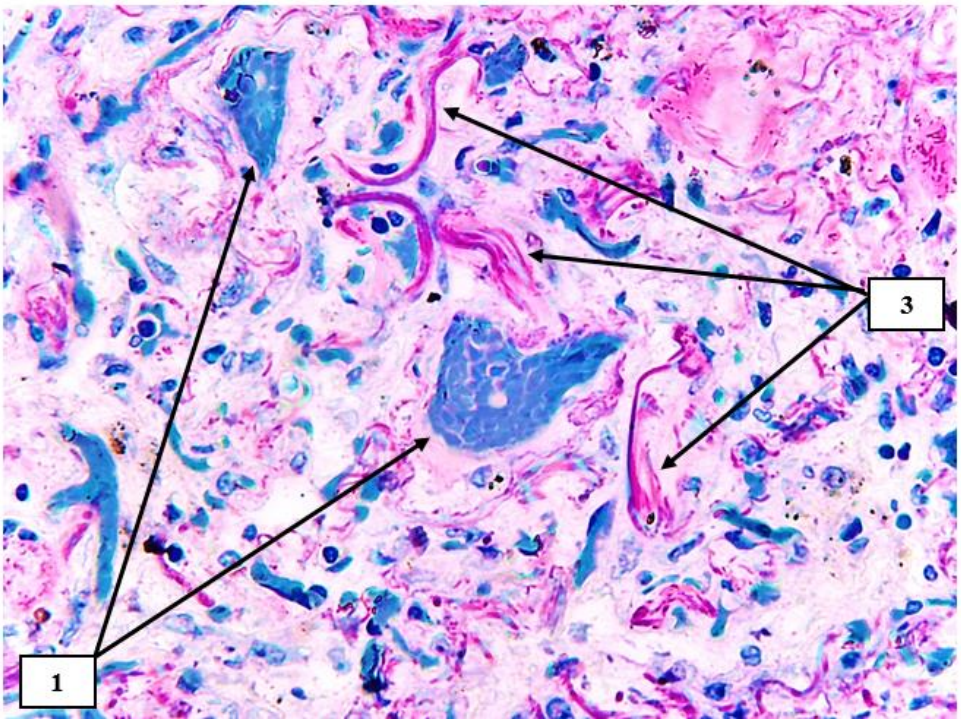

Figure 4. Lung tissue. The histiotopography of the alveolar walls has changed, a small-caliber vessel with thrombosis consisting of erythrocytes is identified in the center and on the left (2). Various irregular fibrous structures with sparse fibers are identified (3). Semi-thin section. Stain methylene blue and picrofuscin.

From a clinical morphological point of view, there is a sharp formation of sparse fibrous structures around the preserved endotheliocytes under the influence of angioprotectors (traditional membrane stabilizing drugs ascorbic acid) that prevent damage to the vascular intima of the processes aimed at treating patients at this point, due to the adhesion of platelets in these areas, due to the contractility of the vessel, a shelf-like intima with a smooth surface deformed foci cause an increase in ischemic processes in organs (see Fig. 4). If patients infected with covid-19 infection without treatment encounter massive desquamation in the area of the endothelium of pulmonary blood vessels , it develops with blockage of the vessel and the formation of blood clots of various degrees (see Fig. 5).

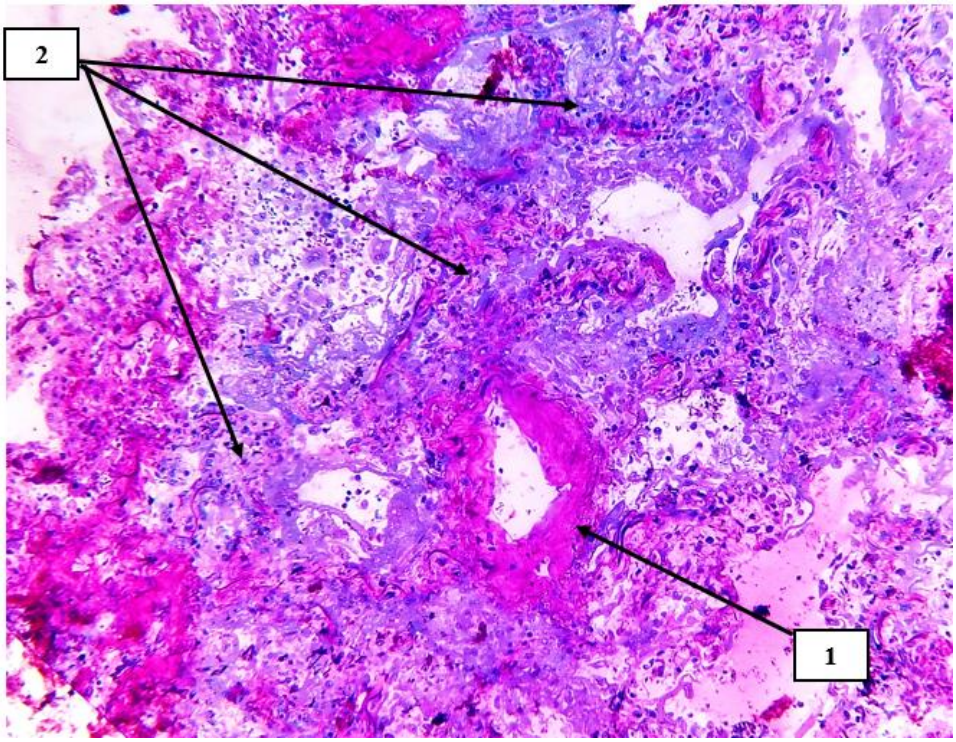

Figure 5. Pulmonary tissue is a small-caliber blood vessel. The vessel wall is thickened, the vessel wall has undergone sclerotic changes (1), alveolar histiarchitectonics has changed, foci of carnification following productive inflammation are identified (2). Semi-thin section. Stain methylene blue and picrofuscin.

NO synthesis and re-expansion of vessels) are stimulated in the devascularized organs, and foci spread to the surface of the vessels in other branches, damage to precapillary, capillary and postcapillary venules, with the development of numerous hemorrhagic (hemorrhage per rexin type) foci . is enough.

Between the vessel wall, weakly formed interstitial swellings, defragmentation in the fibrous structures and foci of hypertrophy of the muscle layer are determined. Swelling and diapedesis, traumatic hemorrhage foci are detected in perivascular areas. As a result, the development of these changes in the form of a large focus is confirmed by the clinical diagnosis that there is 5-15% damage in clinical-morphological X-ray examinations.

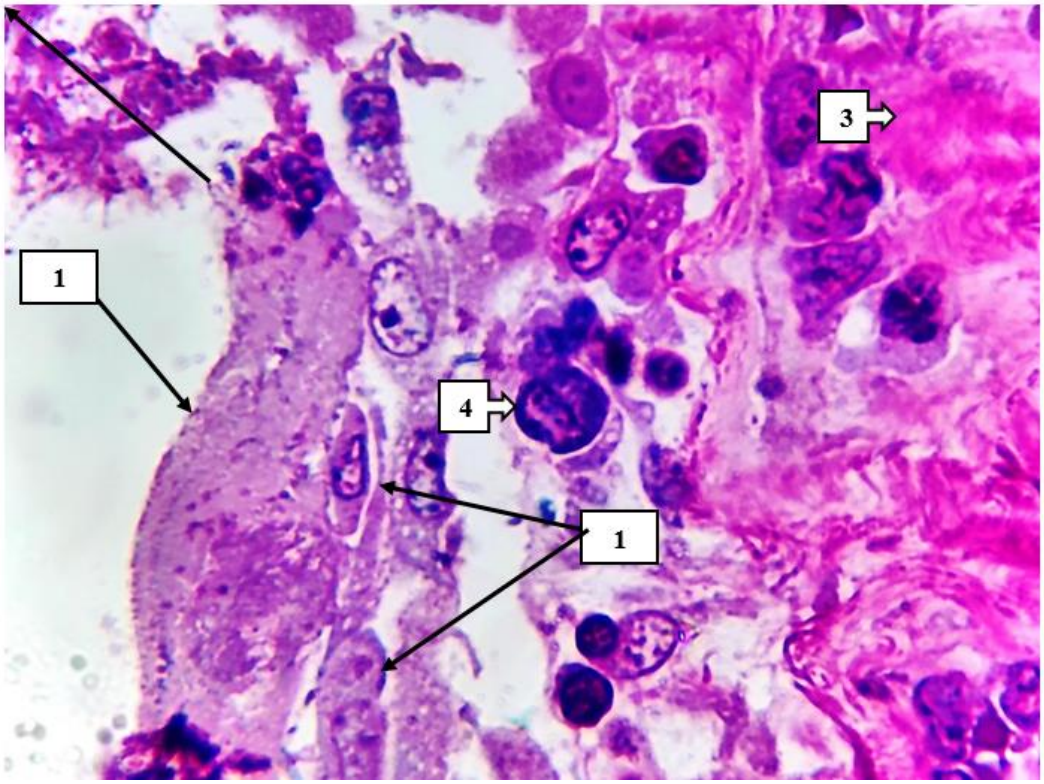

Figure 6. On the inner surface of the adveolar wall, hyaline protein (1), dystrophic and necrobiotic changes of alveolocytes are detected (2). On the right are pink carnified foci (3). Macrophages with giant metaplasia are identified in the interval (4). Semi-thin section. Stain methylene blue and picrofuscin.

It is noteworthy that the clinical morphodynamic development of lung tissue in patients with covid-19 infection develops within 1-5 days after the occurrence of these vascular injuries, and the patients do not show organ failure (in the form of dyspnea, shortness of breath, tachypnea). prospective evaluation will not be possible. In clinical examinations, most of the large red wet lungs are detected only after they are formed. Microscopically, these changes culminate in the appearance of hyaline protein structures in the alveolar walls, the appearance of atelectasis and carnified foci in the functionally damaged areas of the alveolar walls, and lead to pneumosclerosis. It is the massive angisclerosis and obturation of the blood vessels that causes pulmonary hypertension within the small blood circulation and causes the death of the patient.

Therefore, the degree of vascular endothelium damage in covid-19 infection depends on the duration of the disease, the gender of the organism, and the constitutional aspects, and has different manifestations. The main principle of its clinical morphological aspects is the development of thrombus and macrophage reactions in place of the migrated endotheliocytes on the surface of the intima, and the occurrence of deformationally expanded segments due to the narrowing of the vascular space and the stimulation of NO secretion in these areas is characterized by the occurrence of hemodynamic disturbances in the organs.

Conclusions

1. Vacuolar dystrophy and desquamation of vascular wall endothelial cells occur in Kovid-19.
2. It is determined that the migration of endothelial cells in the walls of blood vessels, which are rich in muscle fibers, is more frequent than in vessels of elastic type.
3. Muscular type is characterized by the development of interstitial edema in the subendothelial layer of blood vessels, and the sharp narrowing of the vessel space in the state of muscle contraction and the occurrence of acute ischemic necrosis in the organs fed by this vessel.
4. From a clinical morphological point of view, the deformation of small-caliber vessels, the surrounding of the narrowed vessel spaces with dense tissue and cell components with thromboplastins is manifested in the transient ischemic form or infarct form as a result of acute vessel occlusion.
5. In post-Covid-19 interstitial pneumonia, lung tissue carnification and metaplasia of interstitial macrophages due to productive proliferation in lung tissue were found. These changes increase the probability of causing tumor diseases in the future.

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