

Morphological Changes in the Heart on the Background of Chronic Pulmonary Pneumosclerosis

Shomurodova Mukhayyo Rakhmonovna

Bukhara State Medical Institute

Abstract: As a result of pneumosclerosis, severe heart failure occurs in the body. The development of this heart failure is a long-term fatigue of the myocardium due to overwork, which is explained by the outflow of blood from the heart into the large vessels (overwork fatigue) or as a result of an excessive increase in blood flow to the heart. Pulmonary fibrosis is a chronic pathology that develops continuously. The purpose of the work was to determine the results and collect data on the morphological and morphometric changes in the hearts of white rats with pulmonary fibrosis under experimental conditions.

Key words: pneumosclerosis, morphology, cardiomyocyte, cardiovascular disease.

The urgency of the problem. The negative course of various cardiovascular diseases ends with the development of heart failure. Blood circulation disorders are observed against the background of many clinical syndromes that are pathogenetically closely related to various effects (Kazanseva G.P., 2018). Heart failure is primarily a pathological condition in which tissues and organs cannot provide normal blood circulation. As a result of pneumosclerosis, severe heart failure occurs in the body. The development of this heart failure is a long-term fatigue of the myocardium due to overwork, which is explained by the outflow of blood from the heart into the large vessels (overwork fatigue) or as a result of an excessive increase in blood flow to the heart.

Material and methods. Morphological studies related to the creation of this methodological recommendation were carried out in the vivarium and research laboratory of Bukhara State Medical Institute during 2020-2022. Nuraliev N.A. in the preparation of standard vivarium food ration for laboratory animals. and all. (2016) based on the recommendations in the methodological manual. All biological safety rules and ethical principles of working with laboratory animals were strictly followed in keeping, killing and dissecting laboratory animals.

In order to study the morphological changes occurring in the heart in experimental groups of white rats in the experimental group, the histolaboratory located in the Simulation Center of the Bukhara State Medical Institute was used and preparations were prepared there. In this experiment, 4; 5; 6; 7; 8; one-month-old white rats were used.

Results and conclusions. In our work, the following data were obtained in the modeling of chronic pneumosclerosis in non-white rats with pulmonary pneumosclerosis for 3 months:

According to our data, the signs of interstitial pneumonia caused by NO₂ for 30 days in the biomaterial obtained from the lungs of purebred white rats include the increase of fibrous tissue, thickening of alveolar walls, increase of myofibroblastic cells, enlargement of alveoli, and rupture of their walls, moderate infiltration of the bronchial wall were detected, but no pathomorphological changes were observed in the biomaterial taken from the heart. In our study, as a result of exposure

to NO₂ gas for 60 days, interstitial pneumonia with signs of fibrotic tissue growth was detected in the biomaterial obtained from the lungs of purebred rats.

Alveolar spaces were thickened due to proliferation, increased infiltration of myofibroblasts, and lymphohistiocytic infiltration of lung tissues. In the biomaterial taken from the heart, it was observed that very small pathological changes began, but these changes did not cause clinical symptoms in the cardiovascular system of white rats. 4 from 90 days; 5; 6; 7; 8; An experimental model of pneumosclerosis was created in 180 white purebred rats, and then the changes developed as a result of pathological processes in the heart were analyzed. According to our results, the following data were obtained based on the results of the study of changes in the hearts of 4, 5, 6, 7, 8-month-old white rats against the background of chronic pneumosclerosis:

Macroscopically, the heart of 4-month-old rats of experimental group 3 was asymmetrically located in the anterior thoracic cavity, and most of it was located on the left side of the midline. A large part of the front surface of the heart together with the pericardial layer is covered by the lung, and its front edges together with the respective parts of both pleuras pass through the front side of the heart and separate it from the front chest wall. Macroscopically, other visible pathological changes were not detected, except for a slight increase in heart organometric parameters 1 - control group.

During the follow-up, in the study of the organometric parameters of the rat heart of this research group, the total body mass was from 136 g to 150 g, the average was 141.67 ± 1.2 g, the absolute heart mass was from 600 mg to 665 mg, the average Up to 643.2 ± 4.16 mg, the relative mass of the heart per 1 g of body mass is from 2.8 mg to 4.4 mg, the average is 3.38 ± 0.13 mg, the heart length is from 0.81 cm to 1 It was noted that it was 1.11 ± 0.05 cm on average.

The diameter of right ventricular cardiomyocytes is from 7.98 μm to 8.78 μm , with an average of 8.48 ± 0.1 μm , and the diameter of left ventricular cardiomyocytes is from 8.92 μm to 10.66 μm , on average 9.7 ± 0.14 μm , the diameter of right ventricular cardiomyocytes is from 7.6 μm to 11.71 μm , on average 9.26 ± 0.31 μm , the diameter of left ventricular cardiomyocytes is 11.41 μm to 14 μm , the average was 12.86 ± 0.17 μm .

As a result of macroscopic, histological, histomorphometric studies, it was found that there are various morphological changes in the hearts of 4-month-old purebred rats against the background of chronic pneumosclerosis in experimental group 2 of the study.

In the visual assessment, macroscopically, the organometric parameters of the 4-month-old rat heart against the background of chronic pneumosclerosis did not show a significant change from the values of the control group.

The results of the histological examination showed that a number of obvious changes were detected in the structure of the 4-month-old rat heart against the background of chronic pneumosclerosis. In particular, in the interstitial tissue of the heart myocardium, which consists of cellular elements, there are focal and diffuse infiltrates consisting mainly of neutrophils and eosinophilic granulocytes, the fullness of the venous blood vessels and the dimming of their cavity due to the erythrocyte mass, in the muscle fibers dystrophic changes were found. In addition, histologically, pathomorphological signs such as focal and diffuse hemorrhage zones were not detected.

In this case, it was found that the dynamics of the histomorphometric parameters of the heart tissue cells of the right lobe and right ventricle of 4-month-old white rats slightly exceeded the parameters of the control group, and the dynamics of the above histological changes were reflected in the morphometric parameters.

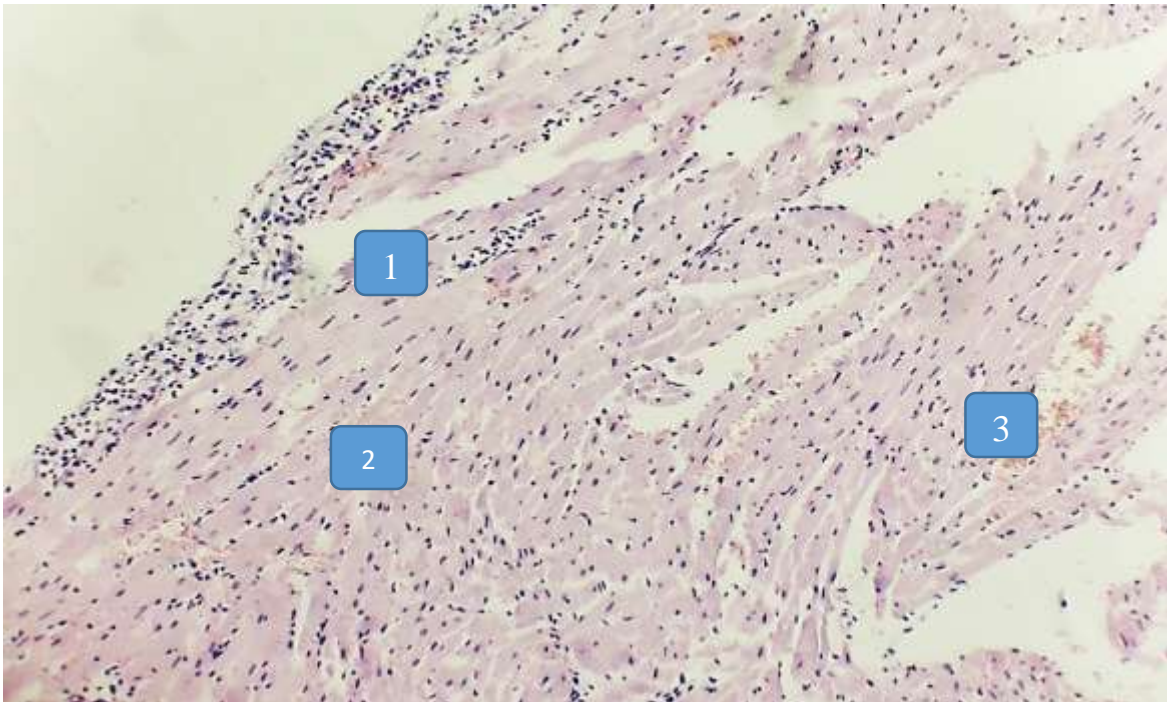


Fig 1. Pathomorphological changes in the right ventricular wall of 4-month-old rats of the research group. Stained with hematoxylin-eosin.

OK 4 x 20 OB. 1 - focal and diffuse infiltrates consisting of neutrophils and eosinophilic granulocytes in the interstitial tissue of the myocardium, 2 - dystrophic changes in muscle fibers.

Thus, it was observed that the effect of pneumosclerosis on the morphology of the heart of rats did not cause macroscopic changes in the heart, but caused changes from the histological side, compared to the animals of the control group of the study. In particular, it was noted that the diameter of cardiomyocytes in the heart myocardium increased to an imperceptible level. Histologically, in 4-month-old white rats of the research group, obvious changes in heart elements against the background of pneumosclerosis were confirmed by histomorphometric indicators.

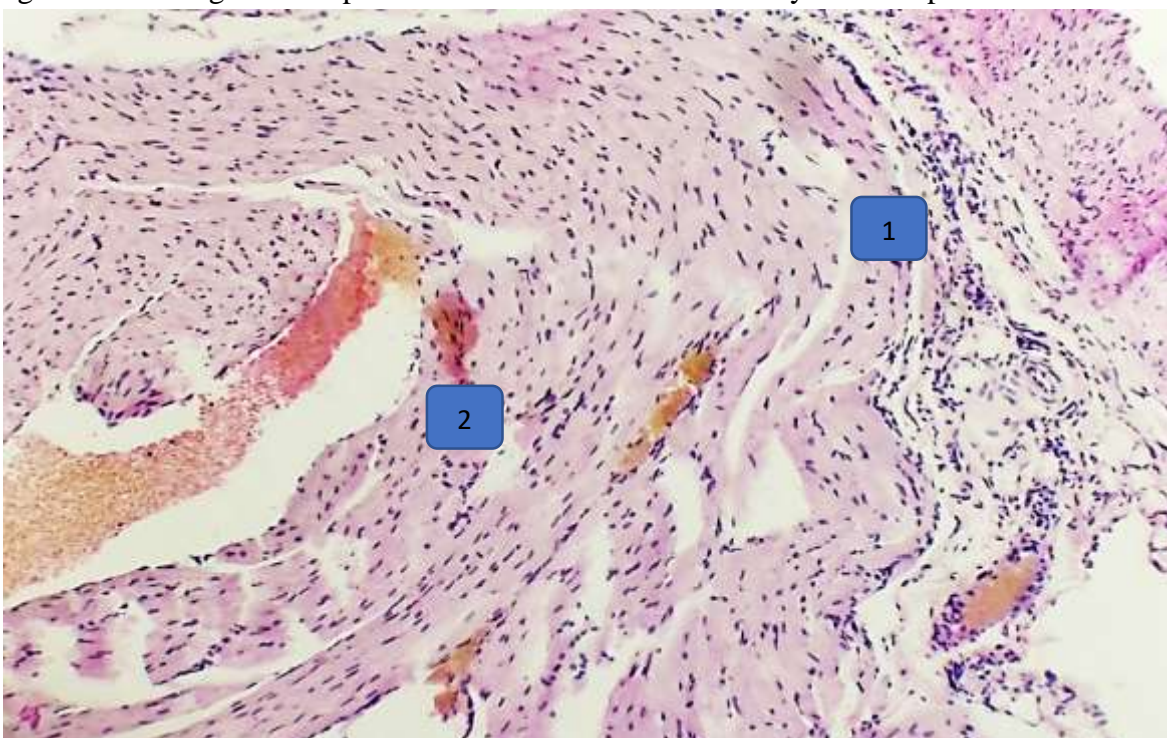


Fig 2. Pathomorphological changes in the right ventricular wall of 4-month-old rats of the research group. Stained with hematoxylin-eosin. OK 4 x 20 OB.

1 - focal and diffuse infiltrates consisting of neutrophils and eosinophilic granulocytes in the interstitial tissue of the myocardium, 2 - dystrophic changes in muscle fibers.

Macroscopically, experimental group 2, 5-month-old purebred rats on the background of chronic pneumosclerosis showed changes in the structure of the heart, especially the enlargement of the right ventricle due to a slight swelling. However, when the histological examination of the heart of the animals of the 2nd research group against the background of chronic pneumosclerosis, it was found that all changes in the structure of the heart increased compared to the 1st control group.

Histologically, although the cardiomyocytes in the myocardial layer of the heart of 5-month-old white rats of research group 2 preserved their structure, but with dystrophic changes in the muscle fibers, the interstitial tissue of the myocardium had foci composed mainly of neutrophils and eosinophilic granulocytes. and diffuse infiltrates, filling of venous blood vessels due to erythrocyte mass, as well as swelling due to the accumulation of aqueous solutions with low-molecular proteins in the interstitial space due to increased permeability of blood vessels and damage to the endothelium of vessels 1 - it was found that it increased compared to the control group.

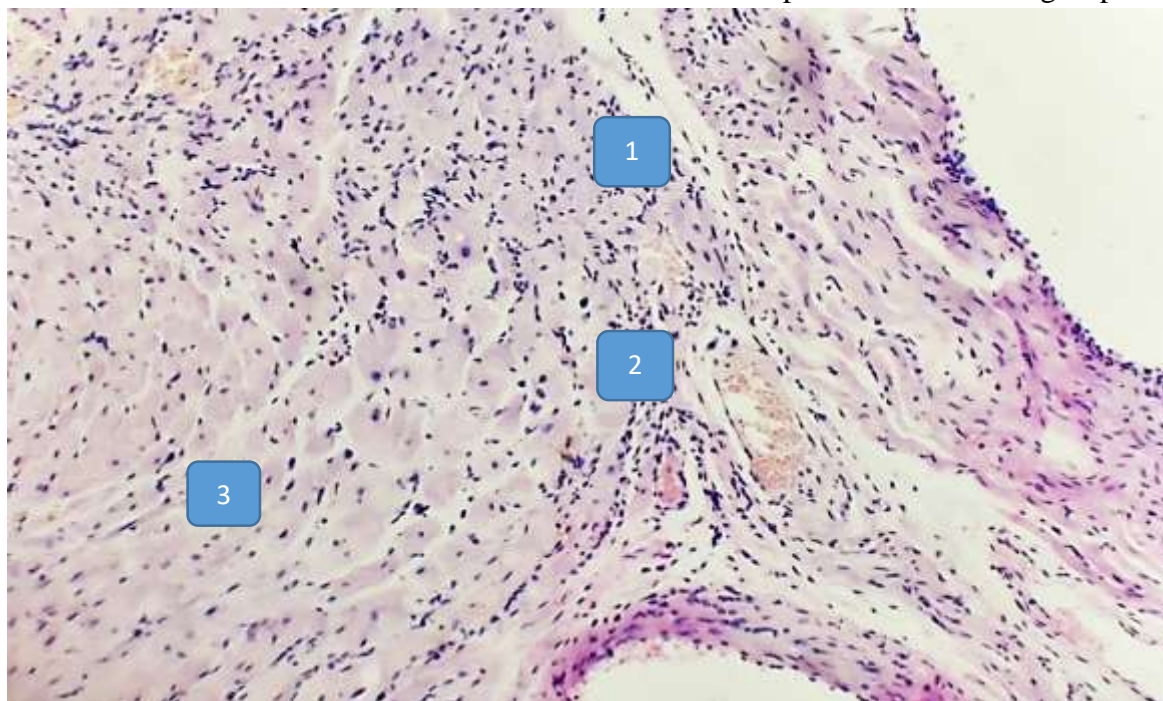


Fig 3. Pathomorphological changes in the right ventricular wall of the 5-month-old rats of the research group. Stained with hematoxylin-eosin. OK 10 x OB. 1 - focal and diffuse infiltrates consisting of neutrophils and eosinophilic granulocytes in the interstitial tissue of the myocardium, 2 - fullness of venous vessels, 3 - dystrophic changes in muscle fibers.

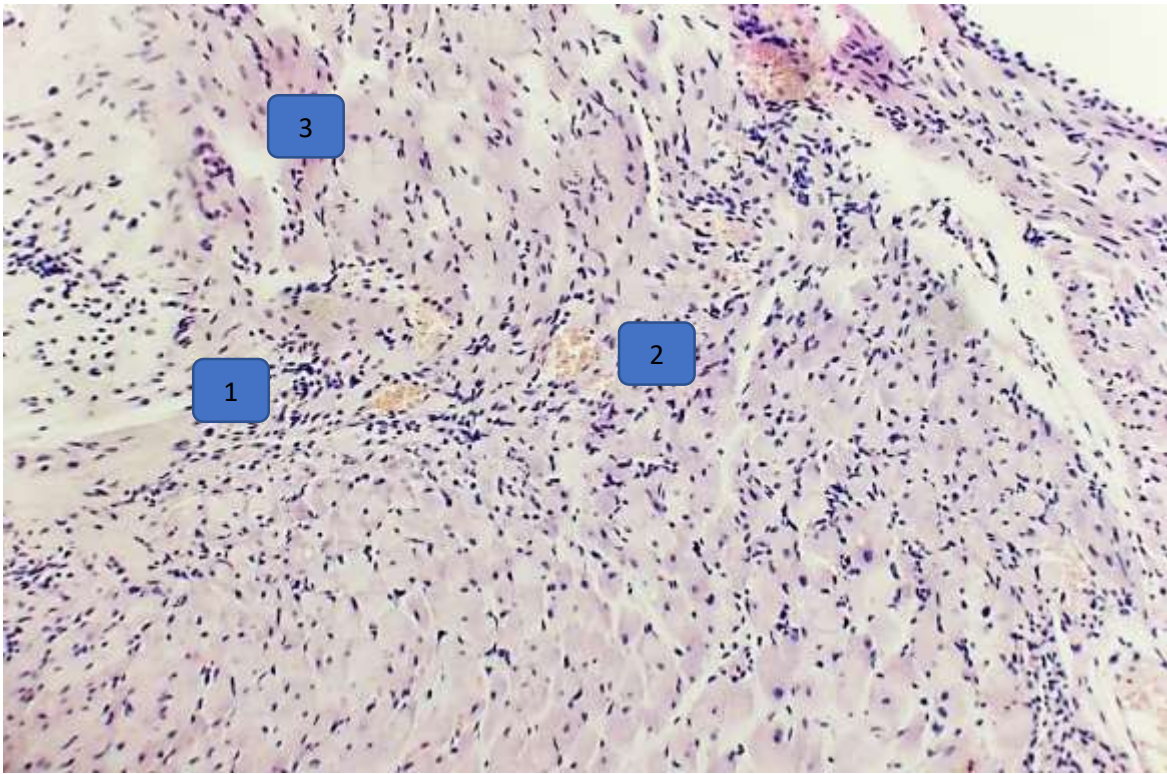


Fig 4. Pathomorphological changes in the right ventricular wall of the 5-month-old rats of the research group. Stained with hematoxylin-eosin. OK 10 x 20 OB.

1 - focal and diffuse infiltrates consisting of neutrophils and eosinophilic granulocytes in the interstitial tissue of the myocardium, 2 - fullness of venous vessels, 3 - dystrophic changes in muscle fibers.

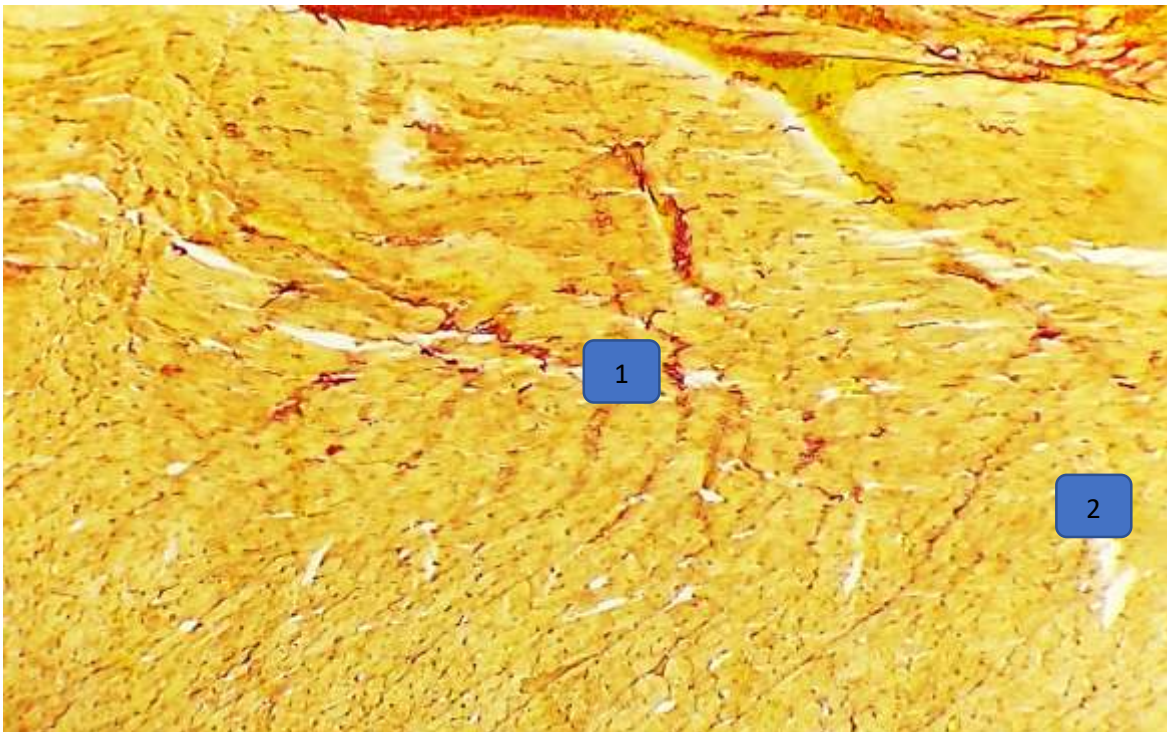


Fig 5. Pathomorphological changes in the right ventricular wall of 6-month-old rats of the research group. Stained with Van Gieson. OK 10 x 20 OB. 1 - sparse growth of connective tissue in the interstitial tissue of the myocardium, 2 - dystrophic changes in muscle fibers.

During observation, macroscopically, the hearts of 8-month-old white rats of research group 2 were located in the chest cavity, surrounded by lungs, and the epicardium, which consisted of dense connective tissue on the outside, except for the front lower surface. was covered with, especially due to the enlargement of the right lobe and the right ventricle, it was observed that the organs of the thoracic cavity were slightly shifted to the left.

The total body mass of 8-month-old rats of the 2nd research group was on average 215.92 g to 240.54 g, on average 226.52 ± 13.77 g, absolute heart weight was 784.44 mg to 828.25 mg, on average 811.17 ± 3.83 mg, the relative mass of the heart per 1 g of body mass is from 7.88 mg to 11.6 mg, on average 9.93 ± 0.3 mg, the length of the heart is 1, From 36 cm to 2.48 cm, the average was 1.94 ± 0.1 cm.

The diameter of right ventricular cardiomyocytes is from 12.8 μm to 15.8 μm , on average 14.8 ± 0.32 μm , and the diameter of left ventricular cardiomyocytes is from 18.71 μm to 23.7 μm , on average 20.24 ± 0.35 μm , right ventricular cardiomyocyte diameter from 15.45 μm to 19.84 μm , on average 17.32 ± 0.3 μm , left ventricular cardiomyocyte diameter 17.68 μm to 24.87 μm , the average was equal to 21.15 ± 0.45 μm .

From the histological point of view, although the cardiomyocytes in the myocardial layer of the heart of the 8-month-old white rats of the 2nd research group preserved their structure, but along with dystrophic changes in the muscle fibers, among the interstitial tissue of the myocardial layer, there were mainly neutrophils and eosinophilic granulocytes. focal and diffuse infiltrates, swelling and swelling of venous blood vessels due to erythrocyte mass, thickening of the vessel wall, as well as increased permeability of blood vessels and damage to the endothelium of vessels due to the accumulation of aqueous solutions with low molecular proteins in the interstitial space, it was noted that there are various pathomorphological changes in the form of cardiomyocyte karyolysis and cytolysis focal necrosis. The obvious organometric and histological changes manifested in heart elements against the background of pneumosclerosis in 8-month-old white rats of the study group were confirmed by histomorphometric indicators.

During the study, statistically significant differences were found in all studied organometric and morphometric indicators, compared to the indicators of 2 - research and 1 - control group animals. Thus, it was observed that the minimum changes in the histological structure of the heart of white rats against the background of chronic pneumosclerosis of the 2nd study group were at 4 months of age, and the maximum changes were at a critical level at 8 months, and the control group in all studied indicators statistically significant differences were found compared to the performance of animals.

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