

The Effects of Impulse Currents on Changes in Heart Tissue Under Chronic Purulent Inflammation of the Lungs

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Received: February 10, 2021; **Published:** March 31, 2021

Abstract

We caused a model of experimental chronic purulent inflammation of the lungs by prolonged mechanical irritation of the bronchi in outbred white rats. We find that morphological changes in the heart tissue can be detected by uneven hypertrophy of cardiomyocytes, thickening of the walls of blood vessels, an increase in their quantitative ratio, moderate proliferation of connective tissue layers in the perivascular zones and intermuscular edema with impaired blood circulation in the muscle wall. We also find that the effect of certain doses of impulse currents on the respiratory muscles in the cardiac tissue causes changes in the form of dystrophic swelling and focal fibrillation of cardiomyocytes, uneven intermediate edema, hypertrophy of the walls of arterioles, plethora, circulatory disorders in the form of focal hemorrhages in the myocardium and epicardium.

Keywords: Chronic Purulent Inflammation; Cardiac Tissue; Morphology; Experiment; Laboratory Animals; Pulse Currents; Electromyostimulation

Introduction

The chronic obstructive pulmonary disease (COPD) nowadays became one of the leading among world's most widespread diseases. It causes vast socio-economic damage due to its swift progression that often leads to early disability of patients [1,9].

As a result of pneumonia, muscle weakness of the respiratory muscles develops and the cardiovascular system begins to malfunction, worsening the prognosis of recovery [10].

The main cause of death in COPD is the development of dysfunction of the respiratory muscles with severe respiratory and pulmonary heart failure [3,4,6].

Purpose of the Study

Morphological analysis of heart tissue under the influence of a pulsed current on the respiratory muscles in experimental chronic purulent inflammation of the lungs (e-CPL).

Material and Research Methods

12 outbred white male rats weighing 180 - 200g were examined and divided into two groups. We examine healthy rats (4) in the control group. In the experimental group (8), rats with e-CVL model were examined. We apply the method purported by Z.B. Batyrova and N. Kh. Shamirzaev [2], which is based on long-term mechanical intra-tracheo-bronchial irritation of the airways. We made a longitudinal midline incision on the anterior surface of the rat's neck, approximately 1.5 - 2.0 cm long, under local anesthesia and sterile conditions. Then, on a thin piercing needle, we introduce a nylon thread with a diameter of 0.4 mm, up to 8-10 cm long into the gap between the rings of the anterior wall of the trachea. In this case, the distal end of the thread was in the lumen of the trachea, and its proximal end was fixed on the skin. We leave the distal end of the thread in the lumen of the trachea, and fasten its proximal end on the skin, suturing the wound

tightly in layers. After 30 - 45 days from the beginning of the experiment, we cut the fixing nylon thread and remove it with tweezers. The animals were slaughtered by instant decapitation on days 30 - 45 from the moment of reproduction.

We fix pieces of the diaphragm and lung tissue taken after slaughter in a 10% solution of neutral formalin. We stain paraffin histological sections with a thickness of 5 - 6 microns with hematoxylin eosin. We carry out microscopy of the preparation under an XS-213 light-optical microscope and a Leica microscope.

In the experimental group, on the 45th day from the beginning of the experiment with e-CVL, we conduct electrical myostimulation of the respiratory muscles with impulse currents using the Stimul-1 apparatus, attaching electrodes 1.5 x 1.3 cm in size to the pre-treated skin surface of e-CVL along the mid-axillary line bilaterally at the level of 7 - 8 ribs. Four rats in this group were given a current in a constant mode, and other four rats were sent was sent 5 minutes, every day, nine times in total an alternating mode with a current strength of 0.1 mA/cm², a frequency of 2.5 - 5.0 ms.

Research Results

As a result of the study, we find a macroscopic picture of e-CVL characterized by non-collapsed lungs, sometimes pale gray-red or dark red, dough-like consistency, frequent minor hemorrhages under the pleura and in the parenchyma. On the cut from the lumens of the bronchi flows down a frothy, turbid liquid, sometimes colored pink.

Heart morphology in rats in the control group of rats is characterized by unexpressed tissue hyperemia (Figure 1).

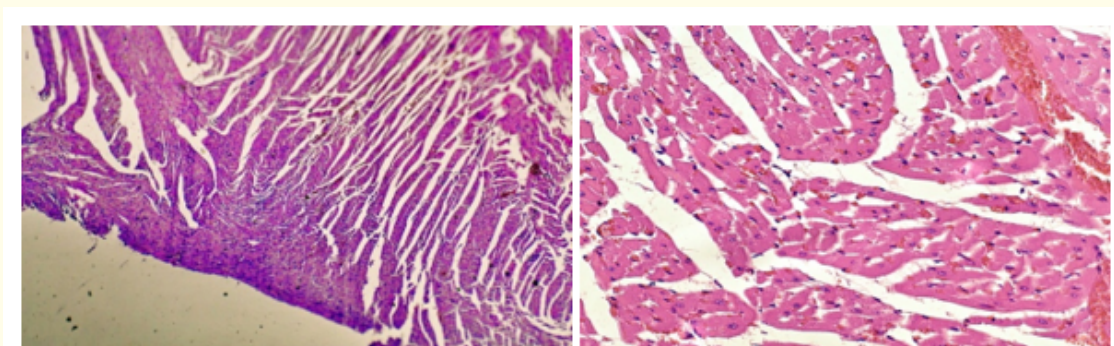


Figure 1: The heart of a rat from the control group. Hyperemia of the tissue. Magnified 10x10, 10x20, 10x40. Hematoxylin-eosin staining.

In rats with e-CVL, the following morphological picture of changes prevailed in the heart (Figure 2). We find that, in comparison with the control group, the cardiomyocyte hypertrophy in the heart of animals is uneven, the walls of the vessels are thickened, and their quantitative ratio is increased.

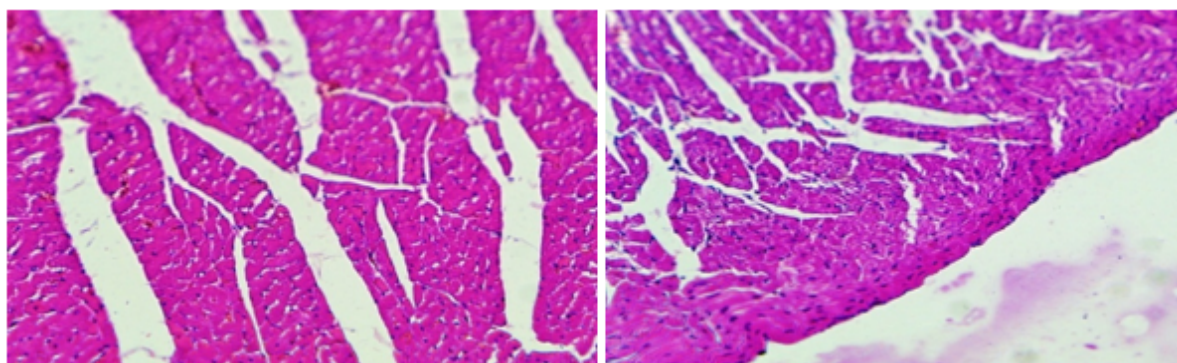


Figure 2: Heart, experimental animal 1. Interlayers of delicate connective tissue in the perivascular and intermuscular regions, intermuscular edema. Magnified. 10x10, 10x20. Hematooclinis-eosin staining.

Also, we noticed a moderate proliferation of connective tissue layers in the perivascular zones along with intermuscular edema (Figure 3 and 4).

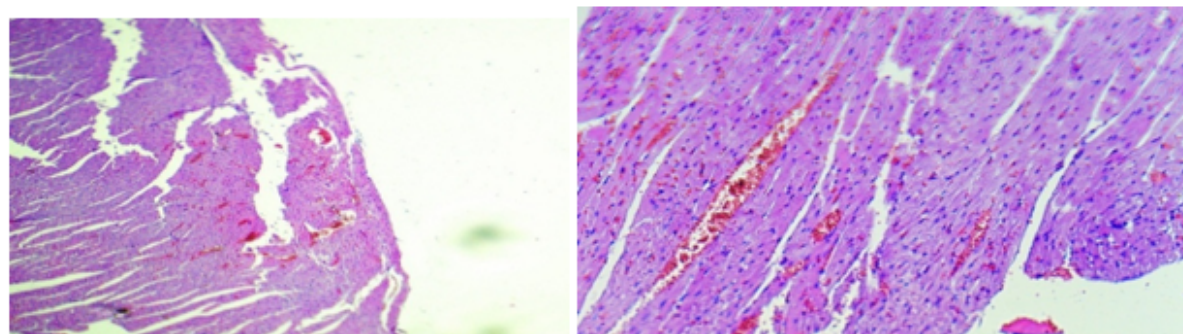


Figure 3: Heart, experimental animal 2. Tissue hyperemia, focal perivascular erythrodiapedesis. Magnified. 10x4, 10x10. Hematoxylin-eosin staining.

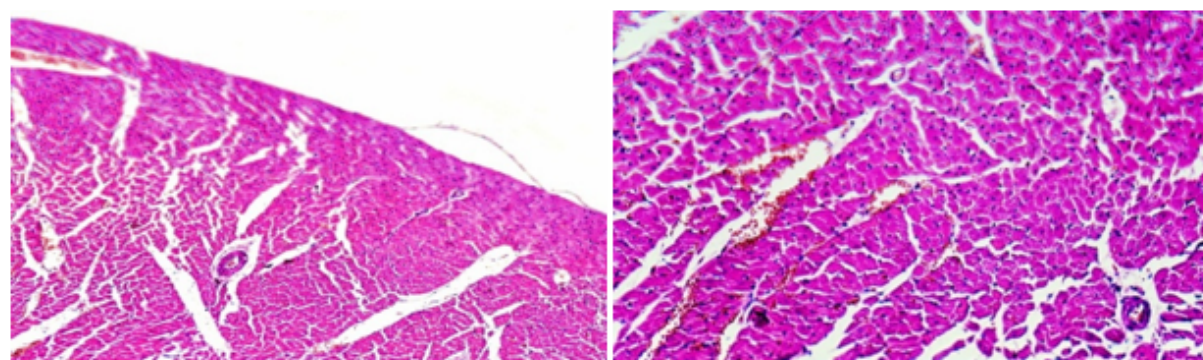


Figure 4: Heart, experimental animal 4. Hypertrophy of arteriolar walls. 10x4, 10x10. Hematoxylin-eosin staining.

In e-HVL after exposure to pulsed currents from the Stimul-1 apparatus in constant and alternating modes in both experimental sub-groups with a current strength of 0.1 mA/cm², a frequency of 2.5 - 5.0 ms. which were sent 5 min every day for nine times in total, we observe the severity of the manifestation of circulatory disorders in the form of focal hemorrhages in the myocardium and epicardium, as well as dystrophic swelling and focal dislocation of cardiomyocytes, uneven intermediate edema, hypertrophy of the arteriole walls, plethora, sometimes parietal expansion of capillaries with stasis of erythrocytes in the lumens.

Purulent inflammation of the lung tissue is a lengthy process, while the inflammatory infiltration dissolves slowly. The development of focal pneumosclerosis and the formation of chronic pneumonia with the development of respiratory failure against the background of developed fatigue of the respiratory muscles often accompanies such inflammation [3,5,8,9].

Discussion

Pathomorphological changes in the heart in chronic obstructive pulmonary disease and pulmonary hypertension are characterized mainly by 2 types of changes. The first (hypertrophic-hyperplastic) type is characterized not so much by dilatation as by hypertrophy of the right ventricle of the heart. In the second type of restructuring, there is a combination of myogenic dilatation of the pancreas with myocardial hypertrophy and, less often, with expansion of the LV cavity. In the muscle fibers of the pancreas, atrophic-sclerotic processes prevail. In the right atrium and right ventricle, endocardial fibroelastosis is expressed. We do not observe a change in muscle fibers in the LV. Their hypertrophy prevails there, while cardiosclerosis has a large-focal character and is noted only in the presence of concomitant diseases (arterial hypertension, atherosclerosis) [1,3].

Conclusion

Thus, prolonged mechanical irritation of the bronchi causes morphological changes in the heart, along with chronic purulent inflammation of the lungs. This indicates the inclusion of cellular shifts in the heart tissue in the inflammatory process during e-CVL.

Pulse currents in constant and alternating modes when exposed to the respiratory muscles in the prescribed dosage did not improve the morphological changes in the heart tissue in e-CVL caused by prolonged mechanical irritation of the bronchi.

Bibliography

1. AS Belevsky. "Global strategy for the diagnosis, treatment and prevention of chronic obstructive pulmonary disease (revision 2014) / Trans. from English ed. - M.: Russian Respiratory Society (2014): 92.
2. Batyrova ZB and Shamirzaev NKh. "Method for modeling chronic nonspecific pneumonia (Certificate v 20420502 a 2.
3. Landysheva IV., *et al.* "The morphofunctional state of the diaphragm in respiratory failure. (Clinical and experimental study). *Blagoveshchensk* (2001): 140.
4. Ovcharenko SI., *et al.* "Personalized approach to pulmonary rehabilitation of patients with chronic obstructive pulmonary disease. *Moscow. / f. Therapeutic archive* 89.3 (2017): 18-235.
5. Sadykova GA., *et al.* "Morphological changes in the diaphragm in chronic purulent inflammation of the lungs (experimental study)". *J. Therapeutic Bulletin of Uzbekistan. Tashkent* 4 (2018): 53-57.
6. Sadykova GA., *et al.* "Electrical myostimulation of the respiratory muscles in the practice of a pulmonologist". *f. Therapeutic Bulletin of Uzbekistan* 2 (2018): 29-33.
7. Sadykova GA., *et al.* "Morphological changes in lung tissue in experimental chronic purulent inflammation of the lungs under the action of impulse currents. *Sat scientific works. International Scientific Conference Kursk* 1 (2020): 646-650.
8. Shmelev EI. "Chronic obstructive pulmonary disease and chronic pneumonia. Terminological and clinical aspects EI Shmelev *Rus. honey. Zhurn* 12 (2000): 487-491.
9. Debigaru R. "Ubiquitination and proteolysis in limb and respiratory muscles of patients with chronic obstructive pulmonary disease". *Proc Am. Thorac. Soc* 7.1 (2010): 84-90.
10. Sadykova GA., *et al.* "Morphological changes of the diaphragm in chronic purulent pneumonia (experimental study)". *Acta Scientifical Medical Sciences Jurnal* 3.3 (2019): 60-63.

Volume 12 Issue 4 April 2021

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