

## Examination of myocardium and adrenal glands structure in patients with COVID-19

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**Motivation and Aim:** The new coronavirus, severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), has caused numerous deaths worldwide [1]. However, little is known about the causes of death [2]. Along with the development of viral pneumonia in COVID-19, extrapulmonary lesions, in particular the heart, are observed. The contractile activity of the heart is coordinated by the hypothalamic-pituitary-adrenal axis. In the terminal period with COVID-19, cardiac function is supported by adrenomimetics. The aim of this study was to analyze the structure of the myocardium and adrenal glands in patients who died from COVID-19.

**Methods and Algorithms:** A histological study was carried out on autopsy material from patients ( $n = 8$ ) died from Covid-19. As a control, autopsy material was used from "blunt trauma of the body" patients ( $n = 3$ ). Tissue samples were fixed in a 4 % paraformaldehyde solution. The formalized samples were subjected to a standard procedure in the histological tissue processor STP 120. Paraffin slices were stained with hematoxylin and eosin and examined under a Leica DME microscope.

**Results:** The study of the heart revealed acute circulatory system disorders, dystrophic and necrobiotic changes in cardiomyocytes. Foci of contractures of I-III degrees, myocytolysis of cardiomyocytes were observed in the myocardium. Intracellular lipid inclusions were detected in cardiomyocytes. In the zona glomerulosa of the adrenal cortex, dilated lumens of blood capillaries, the presence of large lipid droplets in cortical adrenolocyte and necrosis of individual cells were revealed. The medulla was characterized by medullary cells swelling and destructive changes, significantly enlarged of blood capillaries lumens. In the zona reticularis of the adrenal cortex, swelling of cortical adrenolocyte, accumulations of erythrocytes, lymphocytes and plasma cells, and large lipid droplets in the lumen of capillaries were observed. The most pronounced structural changes were noted in the zona fasciculate of the adrenal cortex. The heterogeneity of cortical adrenolocyte of the content of lipid inclusions was revealed. Cells with a small amount of lipid droplets, medium and hypertrophied cells with a large amount of lipids in the cytoplasm were observed. Signs of cell apoptosis were noted.

**Conclusion:** The data obtained indicate significant changes in the structure of the myocardium and adrenal gland in patients with COVID-19. The revealed structural changes can be informative in the development of cardioprotection to reduce mortality.

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### References

1. Menter T. et al. Postmortem examination of COVID-19 patients reveals diffuse alveolar damage with severe capillary congestion and variegated findings in lungs and other organs suggesting vascular dysfunction. *Histopathology*. 2020;77(2):198-209.
2. Wichmann D. et al. Autopsy findings and venous thromboembolism in patients with COVID-19: A prospective cohort study. *Ann Intern Med*. 2020;173(4):268-277.