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METABOLIC SYNDROME AND THE DEVELOPMENT OF ATHEROSCLEROSIS

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Introduction: According to the World Health Organization, about 60% of the world's population does not have enough physical activity to lead a healthy lifestyle (1,8). As a result of a lifestyle caused by inactivity, 1.9 million deaths are observed in the literature. Today, many sources provide information about the morphofunctional changes that occur in the body under the influence of the negative consequences of hypokinesia. As a result of inactivity, negative consequences develop in all organs and systems (6,9). In the case of inactivity, changes such as negative changes in the respiratory system, impaired liver function, and decreased reproductive organs have been observed. In the conditions of hypokinesia, a violation of carbohydrate metabolism, a change in the water-salt balance has been determined (2,3,5). These metabolic changes involve many unsolved problems involving the same complex mechanisms in pathogenesis (4,7).

The purpose of the research work: to study the morphological and morphometric changes of the thoracic aorta in experimental hypodynamia and metabolic syndrome.

Research material and methods. Mature white laboratory rats weighing 180-200 grams were used as study material. The white rats taken for the experiment were divided into 2 groups. For morphological studies, the elastic type of thoracic aorta was taken, and the histological sections prepared on a rotor microtome with a thickness of 8-10 microns were stained with hematoxylin and eosin, Van Gison, and Weigert methods. The first group was the control group, 10 rats without clinical signs of somatic and infectious diseases were taken. Rats in the control group were continuously fed a conventional diet with free food and water ad libitum. In our second group, a total of 45 rats were used to induce the experimental metabolic syndrome model. After denying the signs of infectious and somatic diseases, healthy rats were placed in a special cage, fed with a diet rich in fat and carbohydrates. The diet of rats is 60% laboratory feed, 20% sheep fat, 20% fructose. A 20% solution of fructose was given instead of drinking water. Rats with metabolic syndrome formed the experimental group and were euthanized 30, 60, and 90 days after the experiment. For morphological studies, the thoracic aorta was taken, and the histological sections prepared on a rotor microtome with a thickness of 8-10 microns were stained with hematoxylin and eosin, Van Gion, and Weigert methods. In histological preparations, the structure of the cytoplasm of the blood vessel wall, the state of the collagen elastic fibers were determined. The thickness of the wall of blood vessels, the thickness of the intima, and the separate media were calculated by the morphometric method.

Results. The analysis of the obtained data showed that the thoracic aorta belongs to the type of arteries of elastic type. The basis of the thoracic aorta is an elastic skeleton. In the cross-section of the thoracic aorta, 3 parts of its wall can be seen: inner, middle and outer walls. The inner layer of the thoracic aorta is composed of inner endothelial cells, and a subendothelial layer consisting of connective tissue fibers touching it. It can be seen that the nuclei of endotheliocytes are oval in shape and are located at different distances from each other. It can be seen that the endotheliocytes are oriented perpendicular to the axis of the blood vessel wall. The thickness of the internal elastic membrane was found to be 4.3±0.2 μm on average. The thickness of the middle layer is thicker compared to other layers, its thickness is 91.9±1.3 μm on average. In the middle layer, it can be seen that it consists of several rows of elastic membrane and smooth muscle fibers between them. The average number of smooth muscle cells in the thoracic aorta is 7.23±0.08. Among the muscle fibers, thin collagen fibers are identified. Smooth muscles are arranged in circular rows between elastic membranes. The nuclei of myocytes are usually oval in shape. The outer adventitia layer is located on the outside, where capillaries can be seen.

On the 30th day of the experiment, it was found that the thickness of the internal elastic membrane layer of the thoracic aorta of the dead rats was smaller than that of the control group and was on average 4.0±0.08 µm. An increase in the distance between the folds of the elastic membrane was noted in some parts of the thoracic aorta. The nucleus of endotheliocytes was found to be round or oval in shape. In the middle layer, the elastic membrane is thinned. The thickness of the middle layer and the number of smooth muscle cells did not differ between the control and experimental groups. No reliable changes were detected in the external floor compared to the control group. On the 60th day of the experiment, the thickening of the inner elastic membrane layer was observed in the euthanized group, and it was found that the thickness reached 4.18±0.02 µm, which was not reliably different from the control group. In some places, the inner membrane is smooth in places, located at different distances from each other.

There was a reliable increase in the number of smooth muscle cells of the middle layer up to 7.52±1.2 µm, and a decrease in the thickness of the middle layer compared to the control group. And the thickness of the middle layer was equal to 90.5±0.05 µm. It was found that the elastic membrane located in the middle layer is torn and unevenly straightened in some places. The folds of the outer elastic membrane were observed to be smoother than those of the control group. Capillaries located in the outer layer were found to be full of blood. On the 90th day of the experiment, a reliable thickening of the elastic membrane of the inner layer of the thoracic aorta was observed in the euthanized group compared to the control group, and the average thickness was 4.25±0.06 µm.

The smoothness of the internal elastic membrane in places and irregularly smoothed areas of the folds were found. Different shapes of endotheliocytes can be seen at the bottom of these folds: round, oval and flat. In this group of the experiment, a reliable decrease in the thickness of the middle layer of the thoracic aorta was found, and the thickness was found to be 89.5±0.08 μm. By this period of the experiment, a decrease in the number of smooth muscle cells was observed in the middle layer compared to other periods of the experiment and in the control group, and their number was on average 6.8±0.08 μm. Some myocytes in the inner part of the middle layer touching the internal elastic membrane are located between the folds of the internal elastic membrane, and their nuclei are located very close to each other. Deformation of smooth muscle cells and elastic fibers between the elastic membrane was determined. A thickening of the bundle of collagen fibers was observed in the outer fibers of the middle layer. The folds of the outer elastic membrane were observed to be smoother than those of the control group. Capillaries located in the outer layer were found to be full of blood.

Conclusion. In experimental hypokinesia and metabolic syndrome, there is a thickening of the internal elastic membrane of the wall of the thoracic aorta, a decrease in the thickness of the middle layer, and a decrease in the number of smooth muscle cells in the vascular wall.

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