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PANCREATIC MORPHOLOGY IN EXPERIMENTAL STRESS

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Abstract. For the study, we used white laboratory rats born to mothers in a state of control and experimental stress. Morphological studies of the pancreas at different periods of postnatal ontogenesis showed that, compared with the control group, there is a developmental delay and changes in the formation of individual components of the vascular wall. We recorded changes in the arterial wall in all experimental animals from the first days after the experiment. The results showed that in offspring born to mothers in a state of experimental stress, changes in pancreatic cells and their blood vessels occur.

Keywords: stress, pancreas, pancreatic lobes.

Introduction. Gastrointestinal problems are commonly reported in studies of occupational stress. Unfortunately, it is difficult to assess the physiological systems underlying gastrointestinal symptoms in the workplace. Acute psychological stress has a variable effect on pancreatic secretion, stimulating large increases in some individuals and reducing production in others. Gastrointestinal problems are particularly high in many workers, manifested by disruptions in the circadian rhythms of the central nervous system in controlling pancreatic secretion.

Relevance of the work. Stress is a universal nonspecific neurohormonal response of the body in the form of a surge of nonspecific adaptive mechanisms in response to a signal that threatens the life or well-being of the organism, manifested by an increase in the body's resistance. Today, stress disorders are one of the main problems of concern to public health. In addition, the COVID-19 pandemic and the consequences of social isolation have had a profound impact on the mental health of society. These factors are a heterogeneous cluster of mental disorders that can manifest as common physical symptoms (e.g., tachycardia, shortness of breath, or gastrointestinal upset) that accompany anxiety. Other clinical symptoms associated with stress include excessive or disproportionate worry and fear that is persistent and associated with impairment in social, occupational, or other important areas of functioning. The prevalence of stress in the United States has been found to have increased by approximately 6.7% among 18-25 year olds from 2008 to 2018. The increasing prevalence of anxiety and stress in society is considered to be the beginning of several mental health problems, cardiovascular diseases, digestive diseases, and metabolic syndrome.

A growing body of research suggests that prenatal stress can have significant effects on pregnancy, maternal health, and human development throughout life. These effects may occur directly through the impact of prenatal stress-related physiological changes on the developing fetus or indirectly through the effects of prenatal stress on maternal health and pregnancy outcomes, which in turn affect infant health and development (The University of Colorado, Colorado Springs and The Colorado School of Public Health, 1420 Austin Bluffs Parkway, Colorado Springs, CO 80918, USA).

With the changes in the environment and lifestyle, the incidence of pancreatic diseases has been increasing year by year in recent years, and pancreatic diseases have become a common disease of the digestive system. The etiology of pancreatic diseases is diverse, the condition is complex, the treatment is relatively difficult, and the mortality rate is high. The harm of pancreatic diseases to human health has attracted great attention from researchers. How reduce the mortality rate and

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improve the prognosis of patients with pancreatic diseases is becoming a major problem in medicine today.

Purpose: To determine the nature of morphological and morphometric changes in the pancreas in experimental stress.

Materials and methods of research. To achieve the goal, 60 white laboratory rats are subjected to experimental stress. White laboratory rats are divided into 2 groups. Group 1 is a control group of healthy rats. Mother rats in the control group are given 1.0 ml of saline solution every morning in the stomach. A subclavian catheter is used as a probe. Rat pups are anesthetized under ether anesthesia on days 3, 7, 14, 21, and 30 after birth. Group 2 is an experimental group, in which 50 female white laboratory rats are kept in specially prepared maze cages to induce experimental stress. This stress model is continued after the rats become pregnant and give birth. After opening the abdominal cavity of the animals, the pancreas was removed, and fixed in a 12% formalin solution, paraffin blocks were prepared, and histological preparations were made from them. Experiments and slaughter of animals were carried out by the "European Convention for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes" (Strasbourg, 1985). At a thickness of 8–10 µm, histological sections prepared on a rotary microtome were stained with hematoxylin-eosin according to the standard method. Micropreparations were photographed using an MBI-6 microscope. The obtained material was processed by the methods of variation statistics (Boyarsky A.Ya. 1965; Kaminsky L.S. 1953; Sepetliev.D. 1968; Venchikov A.I.; Venchikov V.A.1974, G.G. Avtandilov, 1990) using the tables of R.B. Strelkova (1986).

Results and Discussion. By our research, three parts can be distinguished in the rat pancreas: 1. duodenal - located in the mesentery of the duodenum; 2. biliary - located along the common bile duct; gastrosplenic - located to the right of the spleen. A light-optical study of stained sections reveals a connective tissue capsule surrounding the pancreas from all sides. Partitions follow from the capsule deep into the organ, as a result of which the gland acquires a lobed structure. In the interlobular connective tissue, blood vessels, nerve fibers, and interlobular ducts are determined. The external secretory part of the organ is represented by pancreatic lobules, which occupy 79% of the area of the pancreas. On sections, they have a predominantly polygonal shape. The structural unit of the lobule is the acinus, which includes exocrine cells (adipocytes), centroacinous cells, intercalary ducts, and capillaries. Acinocytes are pyramidal or oval, although their configuration is often polygonal. Within the acinus, the secretory cells are closely adjacent to each other. 7 More often at one of the poles of their bodies, sometimes in the center there is one, less often, two nuclei, spherical or oval. Inside the nucleus, one or two nucleoli are well-contoured, as well as clumps of chromatin

The pancreas of control white rats is covered with a capsule on the outside. The capsule consists of dense connective tissue fibers, and connective tissue strands depart from the capsule inward to the parenchyma of the organ, with the help of which the parenchyma of the organ is divided into lobules of different sizes. The connective tissue strands dividing the pancreas into lobes had a weakly expressed fibrous component. They were thinned and edematous in places, as a result of which the lobulation in such areas was poorly expressed. In these layers of connective tissue, blood vessels, nerve fibers, and excretory ducts can be seen. The blood vessels were characterized by plasma impregnation of the walls, and the lumen of the venous vessels was filled with blood cells, in some vessels, the plethora was pronounced (Fig. 1).

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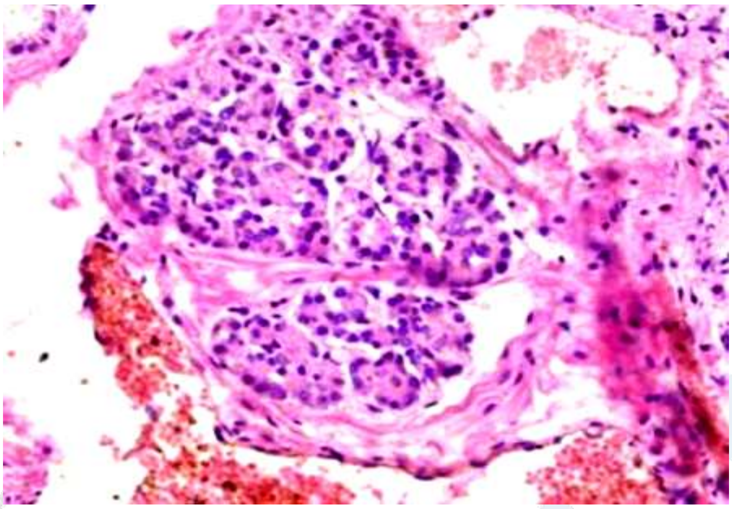

Figure. 1. Rat pancreas on the 14th day of the experiment. Stasis of blood cells in the vessels and accumulation of leukocytes in the parenchyma of the gland. Color: hematoxylin eosin.

In some rats, on sections of the gland in arteries and veins passing in the interlobular connective tissue, blood cells were not detected, or were observed in small quantities. The interlobular excretory duct was formed by a single layer of prismatic epithelium and its plate of connective tissue. In the lumen of the excretory duct, the secreted substance was contained in a small amount.

The control rats were characterized by the presence of mainly medium-sized lobules, in which the exocrine part in the form of acini and ducts of different diameters predominated. The acini had different sizes from 56.2±1.9 μm, the smallest size of the acini was 37.3±1.4 μm. Pancreatocytes in the apical part have narrowings, and the base is much wider. The apical part and the final part of the secretory tubules can be seen as granules of the secret. In these cells, you can see a round or oval nucleus. These macrocytes nuclei are located closer to the base of the cell. The main part of the chromatin of the nucleus of pancreatocytes is located over the entire area, and a small part of the chromatin is adjacent to the sarcolemma. Pancreatocytes, which are located in the walls of the acini, had an average size of 9.17 ± 0.52. In the center of not many acini, flat cells can be seen, they were mostly located closer to the center of the cell, but in rare cases, they were detected in the secretory section.

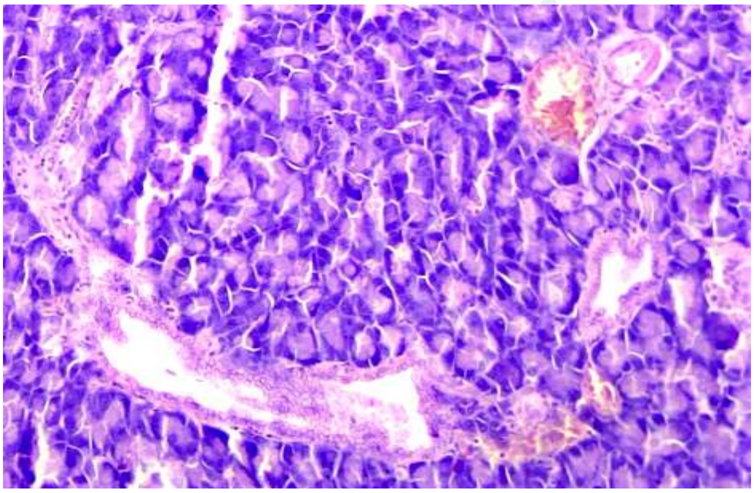

Figure 2. Rat pancreas on the 21st day of the experiment. Expansion of the pancreatic ducts. Colour: hematoxylin-eosin.

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It was difficult to determine the boundaries between some cells of the pancreas and acini, in some areas it was possible to detect a violation of the structure in the final part of the secretory sections (Fig. 2). These pancreatic cells had an average height of 12.9±1.1 µm. Small punctate hemorrhages were found inside the pancreatic parenchyma and pancreatic islet cells. Between the terminal secretory sections of the exocrine part of the lobules, along with smaller intercalary excretory ducts, the wall of which was lined with squamous epithelium, there were also larger intravenous and intralobular excretory ducts, the wall of which was formed by cuboidal epithelium. The study of pancreatic tissue samples from experimental rat groups showed that the interlobular connective tissue had a clearer fibrous pattern, the lobules were slightly enlarged and there was no accumulation of fat cells, which indicates the normalization of the structure of the gland.

Conclusion. It was reflected from the 14th day and decreased to a reliable level by the last days of the experiment The results of the study showed that the introduction of Mercazolil into the pancreatic lobules of experimental rats led to changes associated with the normalization of the structural organization of the pancreatic cranium, interlobular connective tissue with the formation of fibrous tissue components, as well as the disappearance of choroidal edema observed in the interlobular connective tissue. In addition, the intensity of symptoms of the destruction of the terminal secretory section of the lobules decreased and at the same time, the number and height of the pancreas in the lobules increased. This may be due to the intensification of the process of division of the pancreas and the activation of the secretory process. In the endocrine part of the gland lobules, a thickening of the location of insulocytes in the islets and a decrease in areas filled with a loose connective tissue layer were observed, in addition, the size of the islets increased and became larger than in the control animals. This may indicate a general increase in the number of endocrine cells in the gland, and hence an increase in hormone production. Thus, the structural basis of compensatory-adaptive processes takes place after a violation of thyroid hormones. Changes in these biochemical parameters may be due to excessive reactivity of the insular apparatus of the pancreas. The development of destructive processes in pancreatic insulocytes, due to the systematic impact of thyroid hormone disorders, leads to cumulative depletion of the secretory process in these cells.

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