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MORPHOFUNCTIONAL CHARACTERESTICIES OF HYPOTHALAMO-HYPOPHYSEAL NEUROSECRETORY SYSTEM (HHNS) AND MYOCARDIAL MUSCLE CELLS (MMC) AFTER ACUTE EMOTIONAL PAINFUL STRESS

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Questions of the study of the physiological reparative regeneration of the tissues in the aspect of its neuroendocrine regulation continue to remain extremely urgent. Despite the fact of the structural reorganization myocardium of animals and man, observed under different experimental and clinical conditions, is dedicated the extensive literature (Rumyansev, 1967; Katzberg et al, 1977; McCallister et al, 1979; Stadnikov, 1999, 2001; Pavlovich, 2003), many aspects of the reactive, adaptive and reparative transformations of cardiac muscle cells and no muscular components of the heart are debatable, or they need refinement. First concerns of the mechanisms reparative reconstruction the cellular elements of myocardium under the influences on the organism different extreme factors. The basic processes of histogenesis, laws governing the reorganization of the tissue elements of myocardium undergo scientific of post-natal development from the positions of the hierarchical principle of the construction of living systems is cellular –deferens.

Material and methods of studied.

Materials and the experimental methods in accordance with purpose and tasks of this work they served as the subjects of a study: the myocardium of left ventricle, hypothalamus and neurohypophysis of 16 white laboratory male rats without pedigree and its mass about of 200g. Emotional- painful stress (EPS) caused in 12 rats. In this case, animals divided into 2 groups. In the first group (3 rats), it is once during 5 hour they simulated the state of emotional- painful stress (Desiderata et al, 1974). In the special camera of animals they subjected to the action of current by the force of 4 mA, avoid which animals could only by withdrawal to the platform, located in the center of camera. This led to the production of the conditioned reflex of avoidance, which will manifest in a constant presence of rats on the platform. Subsequent inflicting of short strong blows of current (6 mA during 2s.) through the floor of platform it was accompanied by the formation of stress-factor reaction in animals, caused by both the presence of conflict between the manufactured

conditioned reflex of avoidance and by unconditioned painful stimulus and by constant stressed expectation of electrically painful irritation. Animal second groups (9- rats) were subject to the influence of the same stress-factor, but during 3, 6 and 10 days on 5 hour daily. The four (4) intact rats of analogous mass served as control. Material for a study (myocardium of left ventricle, the macrocellular nuclei of front hypothalamus and neurohypophis) taken on the completion of the experiment. Material is fixated in 12% solution of neutral formalin and osmium the painting: hematoxylin and eosin (H&E) and uronil acetate and liquid Renald's studied by light & electron microscopy.

RESULT OF THE EXPERIMENT

The regulation of the adaptive and compensatory reactions of visceral organs is one of the most important functions of the HHNS, which realizes its effects by three subsystems: hypothalamo-adenohypophys, hypothalamo-medhypophys and hypothalamo - neurohypophys (Polenov, 1994). The subsystems indicated ensure with tissue and cellular homeostasis, and also participate in the development of stress-factor reaction, mobilize the protecting functions of organism, including under the influences of extreme factors. Our studies on animals with EPS and experimentally stimulation heart insufficiency showed the unidirectional structural and functional reorganization of the nonapeptidergic neurosecretory system of hypothalamus (supraoptic and paraventricular nuclei). Under the conditions EPS by Desiderata et al. (1974) the analysis of photo-optical, ultrastructural and morphometrical data, that characterize the neurosecretory cells of the investigated nuclei, testifies about increases in the volume of nuclei and chromatophelic granule (secretory granule) of "bright" (functionally active cells), with simultaneous reduction in the volume of their cytoplasm. Paraventricular nucleus of the hypothalamus of rats in 6 days EPS an increase the same one should separately emphasize that the nuclear sizes and chromatophelic granule of neurosecretary cells grow considerably more rapid, than the volume of their cytoplasm, about which they testify an increase in the nuclear- cytoplasmic area 2.2 times against the appropriate parameters in intact animals. The increased volumes of nuclei and especially chromatophelic granule in neurosecretary cells testify about the intensification of the flow of the transcription substrata into the cytoplasm synthesized in nucleolus. In this case were observed the "grainy disintegration" of granules and simultaneous appearance in the corpuscles of Gerring of the intracellular accumulations of the fine-grained material, similar to the contents of neurosecretary granules (especially to 6 days of experiment). Is noted the presence of the ergesto granular pool of neurohormones in the neuroplasm of the axons of supraoptic (SO) and paraventricular (PV) nuclei. An increase in the

functional activity of the macro-cellular nuclei of hypothalamus was always manifested in the decrease fragment of the supraoptic nucleus of the hypothalamus and secretory granules in the axons NSC, a total quantity of secretory granules in the axons and elementary granules, and also accumulation in the terminals of "empty" phials. The content of similar degenerately changed elements in the studied neurosecretory centers of hypothalamus reliably grows. In this case, the majority NSC of supraoptic and especially paraventricular nuclei, which are been in a state of functional hyper-activity (hypersecretion), were characterized by the hypertrophy not only nuclei and chromatophelic granule, but also organelles of synthesis. Chromatin in the nuclei was strongly decondensation, chromatosphera loosened, and sometimes they were vacuolated. Golgi apparatus occupies the significant volume of cytoplasm. Increases the number lysosome (dense corpuscles), and secretary granules is very small, since they rapidly are derived into the axons. From other side, we established the phenomenon of the "exhaustion" of the prolonged hypersecretion NSC of the supraoptic and paraventricular nuclei of hypothalamus in experimental animals. Data of NSC had the strongly hypertrophied, bright, swollen precarion and the rounded nuclei, poor in chromatin. In this case, the ducts of granular endoplasmic reticulum, losing ribosome, transformed into the vacuolebody structures with a diameter of 600-980 nm. In such NSC it is small the free ribosomes (polysome), in them is disrupted the structure there is no lamellar complex and mitochondria, but elementary secretary granules almost. Most characteristic for similar cells is large number lysosome, autophagic vacuoles, large liposome and their accumulations, and multi-lamellar corpuscles. We assume on the base that under the conditions for prolonged stress-factor of heart insufficiency, this part of functionally active NSC exhausts its "material resources" it wasted and undergoes ultrastructural degeneration. Probably, part from them converts to the phenotypic state of picnomorphic elements, those cells, which have angular, different degree of compactness the form of the precarion and pycnotic nuclei. Ultrastructural study of neurohypophysis of the prolonged stressed rats (stage of 10 days) showed that against the background of the hypertrophy of the terminals axons NSC, in part of them (30,5%±2,8%), in such cases and contacting with hemocapillary, is noted the accumulation of elementary nonapeptides secretary granules in the form of the electron-dense conglomerations, which resemble hypertrophic of Gerring body. The terminals of similar axons NSC, which are been in a state of the "deposition of neurosecretion", testified about the continuous formation of the elementary granules, which will overfill not only branches, but also precarion. Here is observed the picture of the disintegration of granules without those expressed it is indicative exocytose of their contents. Furthermore, we sufficiently clearly recorded the terminals of axons NSC, which degenerate according to the "dark" type.

Such terminals, probably, can belong not only to typical picnomorphic NSC, but also to degenerately changing "bright" NSC. As a rule, they characterized by the mass degradation of organelles (especially microtubule and microfilament) and by the loss of secretary granules. Destructive elements in this case phagocytes' by pituitary cells. The described phenomenon can be treated from the positions of the special features of the secretary cycle NSC, which as it is known (Polenov, 1993), it is possible in two versions (calm functioning and intensive hypersecretion). We only make accent on what the making more active of peptidergic NSC of hypothalamus with the prolonged stress occurs against the background of the partial blocking of the liberation of neurosecretory material in the general of bedspreads. The described changes in the hypothalamic structures correlated with the changes in the myocardium. With the single simulation, EPS in animals noted the disturbance of the ultrastructural organization of the muscular fiber-like components of cardiac muscle cells (CMC) and blood vessels of myocardium. This observed by expansion of the cisterns of endoplasmic network in the CMC and the formation of the presarcolemmal sections of myofibrils. Although the described changes are observed in the myocardium in the majority of the investigated animals however the degree of their manifestation and the latitude of propagation are unequal in the rats, that relate to different stages of experiment. Section CMC of the myocardium of the rats after single EPS most strongly the disturbance of the ultramicroscopic organization of the muscular fibers of myocardium expressed in rats through 1 and 6 days of experiment. In the (CMC) of these animals occurs not only the formation of the zones of pre-sarcolemmal sections of myofibrils, but also the appearance of the focus contractures, in which the separate parts of sarcomeres are already not distinguished. The destruction of separate (CMC) and the output of their organelles into the intercellular space frequently are observed. Some (CMC) destroy and their fragments accumulate in the intercellular space between preserved CMC. In this case were observed gross changes not only in CMC, but also in the stromal components of myocardium at the cellular and subcellular levels (destruction of mitochondria, the breaks of myofibrils, expressed intra- and intercellular edema, hemorrhage, phenomenon of cariopicnosis, cariorehxes, homogenization of cytoplasm and its vacuolization). The transverse striation of myofibrils disappears in these periods of experiment. Sometimes in the circum-nuclear zone CMC appear vacuoles, which coincide with the cariorhexes. Similar cells encounters among the groups of oxyphilic cells. Are determined changes also in the vessels of the microcirculatory riverbed, where the signs of their expansion and platelets changes by focus patchily hemorrhage, plasmorrhexis, swelling, wrinkling and desquamation of endothelial cells. In the endothelium of the capillaries, which preserve usual structure at the photo-optical level, with the electron-microscopic examinations are

revealed the sharp strengthening of the phenomena of micro-pinocytosis, the formation of endothelial outgrowths, whishes indicate an increase in the processes of the permeability of capillaries. The capillaries, which contain the sludge erythrocytes, frequently filled with osmiophilic granules. Electron-microscopically in the myocardium, reveal the sharp swelling of mitochondria, the enlightenment of matrix, and the failure of crest. In the places of the " failure " of crest sometimes remains the increased optic-electronic density of matrix. The expansion ducts of the endoplasmic reticulum, cisterns of Golgi apparatus is sharply pronounced. At the stage of once day in the cases of the single stress-factor, we observed only the moderate expansion of the vesicles of the apparatus of Gorge, elements endoplasmic reticulum in CMC. In the cells of the endothelium of capillaries, the moderate micro-pinocytosis phials identified. The mitochondria, which have the expressed signs of swelling, encountered rarely. The animals with chronic stress we also revealed the more expressed ultra-structural changes CMC, especially in 10 days of experiment. The mitochondria damaged in the hypertrophied CMC earlier than other structures. This observed their swelling, which accompanied by an increase in the sizes, by the decrease fragment CMC of rats with prolonged stress (stage of 10 days) the mitochondrion electron density of matrix and the position of fracture external and internal membranes of mitochondria, formation of vacuoles. In some CMC revealed the mitochondria of different sizes and configuration (dumbbell-like), with the rough tightly packed cristae. This organelle frequently formed longitudinal belts, or conglomerations, their associations with a large quantity of inter-mitochondrial contacts. In a number of cases revealed the phenomenon of "budding" of mitochondria. Data of change can examined as one of the compensator-adaptive reactions of the energy ultrastructures of heart muscular tissue. Degree and nature of the discovered ultrastructural changes of the mitochondria in different cells, and in the limits of one cell were also unequal. Following disturbances of subcellular organization of mitochondria in CMC described above observed destructive changes in the structure of the myofibrils, which were heterogeneous. In some heart CMC the myofibrils was in the state of uneven reduction, in them observed the presarcolemmal sections. In a number of cases in the presarcolemmal myofibrils notes the formation of focus contractures, probably, connected with the conformational changes actins and myosin protofibrils and by the disturbances of actomyosin complex. In a number, CMC in the paranuclear zones occur the complete destruction of myofibrinogens apparatus. In mosaic located CMC were encountered the myofibrils, in which the motion of the myofilaments changed from the longitudinal to the slanting. The appearance of a phenomenon of many concentric diaphragm outlines, which surround the sections of cytoplasm with the elements endoplasmic reticulum, mitochondria or other organelles, they testify

about the focus degradation of cytoplasm of heart CMC. We also established significant changes in the vessels of microcirculatory riverbed. The heteromorphy of the endothelial cells of capillaries noted, some of them had dense cytoplasmic matrix, others - clear cytoplasm, the third - were vacuolated. In all cases in the endothelial were recorded the pinocytosis phials, the free ribosome's, extended of the duct of endoplasmic reticulum, which can testify about strengthening of trans-capillary exchange. Thus, morphofunction phenomena described above characterize the extremely important role of hypothalamic factors. Both the capillary and erythrocyte are realizations its histo- and organotypics properties.

CONCLUSION

In those situations, when hypothalamo-hypophyseal neurosecretory system actively functions (both in the regime of secretion and extrusion), the CMC in the complete peace realize entire range of their compensating and adaptive possibilities. However, into the conditions of the unbalance of the hypothalamic neurosecretion, which is accompanied by the blocking of the liberation of nonapeptides secretory granules at the level of neurohypophysis, is noted the essential limitation of adaptive and intracellular regenerative potentials CMC and nonmuscular elements of the myocardium.

1. Under the stress-factor conditions volume histo- and the organotypic potentials of the definitive left-ventricular myocardium of rats testifies about the steadfast tissue-specific determinants of heart muscular tissue as the special transverse striated type of contracting tissue.

2. Neuro-hormones of the macrocellular nuclei of hypothalamus are the stress- limiting factors relative to the des-adaptive morpho-functional reorganization of CMC and nonmuscular cells of left-ventricular myocardium that takes place against the background of the blocking of the liberation of hypothalamic nonapeptidergic secretory granules at the level of the axo-vesicular complexes of neurohypophysis.

3. Hypothalamic nonapeptides have a positive effect on the safety of the contracting and energy ultrastructures of cardyomyocytes, including those cellular forms, which destabilized under the conditions of prolonged emotional- painful stress.

4. Morphological changes in the tissue elements of myocardium with the single action of emotional- painful stress have the reversible nature, and with prolonged stress have the structural and functional signs, which correspond to the histological picture of heart insufficiency.

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