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The Relationship between the Reactivity of the Autonomic, Nervous and Hypothalamic-Pituitary-Neurosecretory Systems, The Activity of the Prooxidant and Antioxidant Systems in Intact Rats in the Arid Zone

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Among the most important regulatory systems of the body, the role of the hypothalamic-pituitary neurosecretory system (HGNS) in maintaining tissue and cellular homeostasis, ensuring the processes of adaptation and compensation of impaired body functions is very significant [2; 7; 1; 8;9; 10; 17; 15; 18; 19]. Any etiological factor directly or indirectly reflects its effect primarily on the central nervous system, and on subcortical formations, that is, the centers of hypothalamic structures. Which, in turn, contribute to the activation of the sympathoadrenal system, respectively, and the endocrine system. [14; 16]. Such an organism's reaction also depends on the region where the organism lives. We know that the arid zone has its own dry and hot climate. At the same time, it has distinctive features, acting in a special way on the reactivity of the organism of experimental animals, causing them to connect compensatory reactions to maintain the body's homeostasis. Therefore, the relationship between the reactivity of the autonomic, nervous and hypothalamic-pituitary-neurosecretory systems, the activity of the prooxidant and antioxidant systems in intact rats living in the arid zone remains insufficiently studied and is an urgent problem.

Goals and objectives of the study. To identify the relationship between the reactivity of the autonomic nervous and hypothalamic-pituitary-neurosecretory systems, as well as the prooxidant and antioxidant systems in mature males of intact rats living in the arid zone.

Materials and methods of research. In connection with the task, the study was conducted on 20 mongrel white mature male rats weighing 180-220 g. The reactivity of the autonomic nervous system was studied using the Hildebrant coefficient [3]. The prooxidant activity of the peroxidation product (POL) – malondialdehyde (MDA) was determined by the biochemical method [12]. The state of the antioxidant system was studied by determining catalase [6]. Reactivity in the hypothalamic-pituitary–neurosecretory system (HPNS): Supraoptic nucleus (SON), paraventricular nucleus (PVN), median elevation (ME), and the main posterior part of the neurohypophysis (MPNG) was studied using histochemical, morphometric research methods. Pieces of the brain, including the hypothalamus and pituitary gland, were fixed in Buena's fluid. After wiring with alcohols of ascending concentration, the pieces were poured into paraffin, then sections 5-7 microns thick, oriented frontally and sagittal, were prepared from them. The sections were stained according to the following methods:1) Coloring with paraldehyde-fuchsin (PAF) according to Gomori-Gabu with azan coloring according to Heydenhain. 2) Staining with chromo-quartz hematoxylin and phloxin by Homori. Morphofunctional activity of neurosecretory cells (NSCs) with high, moderate and low activity was determined by the criteria of the content of neurosecretory substances (NS), the volume of nuclei, nucleoli, states of the nucleolus and chromatin in the nucleus, which includes calculating the percentage of individual types of NSCs [11]. In addition, morphological shifts in neurons, processes, glial satellite cells, and the state of blood vessels were studied. The number of NSCs and glial satellite cells was determined on an area of 25,000 mm2 [4]. The diameter of the vessels was determined using an ocular

micrometer MOB-1-15, and the area of the nuclei of glial satellite cells was determined using the point method [13]. Statistical processing was performed using the standard Microsoft Office software package – Excel 2000.

The results obtained and their discussion. When studying the reactivity of the autonomic nervous system (ANS) in intact male rats using the Hildebrant coefficient, the heart rate was 562,0 ± 12,4 times per minute, the respiratory rate was 110,0 ± 15,0 times per minute. The Hildebrant coefficient at the same time was 5,1 ± 0,8. And the indicators of endogenous intoxication – the state of the prooxidant system of the product of half a ml of blood was 34,4 ± 2,2 nmol/ml, the indicators of the activity of the antioxidant system – catalase was 7,4 ± 1,6 mmol. min/l. At the same time, the index of endogenous intoxication was 4,65 ± 1,4. At the same time, the NSCs are densely located in SON, they have a rounded, oval, less often angular shape, are at various stages of the secretory cycle. Among the cell formation of the nucleus, dark-colored type II NSCs predominate, which make up 65,8 ± 1,3%, in which dust-like granules of PAF positive material are detected in the form of insignificant clusters in the near-nuclear space and in places where axons walk. The cytoplasm of these cells is mostly located in the form of a rim around the nucleus and is somewhat basophilic. The nuclei of neurons are more often ellipsoid in shape with a small content of chromatin, which is located in the form of individual lumps of various sizes. In some nuclei, chromatin is diffusely located, the nucleolus is located mainly in the center of the nucleus. The processes of neurons are fuzzy, of various lengths and thicknesses. Between these neurosecretory cells, there are also a small number of light-colored type I NSCs within 13,6 ± 1,3% with a very loose arrangement of PAF-positive material in the cytoplasm and type III NSCs – 17,2 ± 2,2% of low functional activity with a high content of neurosecretory substances, which is detected throughout the cytoplasm of cells. The nuclei and nucleoli in them are small sizes. hyperchromic destructively altered NSCs, hyperchromic destructively altered NSCs of type IV, which amount to 3,4 ± 0,8%.Glial satellite cells are also determined between the NSCs of SON. The nuclei of satellite cells are chromatic, have an oval shape and are chromatic. The vessels in the SON region are well expressed, most of them are in a half-asleep state, moderately filled with shaped blood elements.

The study of the morphofunctional activity of the paraventricular nucleus showed that the nucleus in intact rats is a triangular-shaped formation with the base facing upwards. In the dorsal part of the nucleus, the NSCs are larger, and smaller cells are located in the narrowing ventral part of the nucleus. The large-cell part of the PVN is separated from the surrounding cell groups by a light cell-free zone. The NSCs of this nucleus are different in shape: in most cases they have a round-oval shape, less often there are spindle-shaped cells. NSCs of moderate functional activity of type II NSCs, which amount to 64,6± 1,2%, are mainly predominant in PVN, as well as dust-like granules of PAF-positive material in the form of insignificant accumulations mainly in the perinuclear space and in the places of axon departure are found in SON. Between type II NSCs, NSCs of high functional activity of type I are detected in the range of 12,8 ± 1,2%, which are characterized by an almost complete absence of PAF positive material. in which neurosecretory granules occupy the entire cytoplasm of type III within 18,7 ± 1,2%, in which neurosecretory granules occupy the entire cytoplasm, there are many of them in axons.

The nuclei of NSCs are pronounced, of various sizes and shapes, but more often they have an oval shape with a diffuse arrangement of chromatin, the latter is mostly located in the center of the nucleus. Destructively altered IV-type cells are detected along the periphery of the PVN nucleus, where its number prevails within 3,9 ± 0,5%. Glial satellite cells are also found between the NSCs of PVN, as well as in SOY, their nuclei are chromatic. The vascular network in the area of PVN is well expressed, the diameter of their vessels is 6,8 ± 1,2 microns., the vessels are filled with shaped blood elements.

Consequently, the predominant type II b neurosecretory cells, which are in a state of moderate functional activity, were also in PVN.

When studying the median elevation of the pituitary gland, the course of nerve fibers, unevenly colored with PAF, is clearly visible in the inner and outer zones of the ME. That is, neurosecretory granules fill nerve fibers and areas of large extensions (Goering bodies).

When examining the main posterior part of the neurohypophysis, it contains a large amount of NSV both in the neurosecretory fibers and in their terminals (in Goering bodies), it is diffusely and densely located.

Thus, based on the presented data, it can be concluded that against the background of the biased reactivity of the ANS, the balanced state of the pro and antioxidant system in SON and PVN in intact rats, dark-colored second-type NSCs in the stage of moderate functional activity were predominant in the secretory formula. The nuclei of glial satellite cells, to which the trophic function for nerve cells is attributed, are quite clearly visible. Positive granules are poorly detected in the NE and hypothalamic-pituitary tract of homori, which may indicate the release of NSV into the bloodstream. At the same time, the NSM is located more or less evenly in the MPNG and the PAF is colored intensively. The vascular network in the area of SON and PVN, ME, MPNG are slightly hyperemic. If the obtained data are interpreted with the data of Polenov A.L.(1971) Bein A.M.(1991) Karabaev A.G.(2021) Then the neurosecretory cells of SON and PVN against the background of the displaced reactivity of the ANS, the balanced state of the pro and antioxidant system all this indicates a relatively "calm" functioning of the HGNS and its constituent structures in intact rats are of moderate functional activity.

Based on the received data, the following can be done conclusions:

1. Indicators of endogenous intoxication of intact rats living in the arid zone against the background of mixed reactivity of the ANS are in a balanced state.

2. GGNS and its constituent structures in intact rats, rats living in the arid zone against the background of mixed reactivity of the ANS, a balanced state of the pro and antioxidant system are in moderate functional activity, that is, "calm" functioning.

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