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NEUROENDOCRINE SYSTEM AND TOXIC ENVIRONMENTAL FACTORS

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Annotation: This scientific paper provides information and studies on toxic factors of the neuroendocrine system and external environment.

Key words: Hypothalamic structures, exogenous factors, histophysiological characteristics, hypothalamic-pituitary complex, oxytocin.

Relevance. Numerous studies have shown the important role of hypothalamic structures in the regulation of vegetative functions of the body (10; 14). Neurosecretory elements acquire special importance in the implementation of protective and adaptive reactions of the body (2; 4; 7;19). The study of the influence of exogenous factors on the mechanism of hypothalamic regulation of endocrine functions is impossible without knowledge of the morphology and physiology of the hypothalamic-pituitary system. Therefore, the task of this work is to highlight the most important aspects of the functional morphology of the GTNS.

1. Histophysiological characteristics of the hypothalamic-pituitary complex in mature individuals.

A detailed description of the structure, biochemistry and physiology of the neuroendocrine system is given in numerous works (1; 9; 11). Morphologically, the large-cell neurosecretory nuclei of the hypothalamus in mammals are represented by three neuronal centers - the paraventricular, supraoptic and postoptic nuclei. Most researchers consider the last nucleus as a medial group of cells of the supraoptic nucleus.

The neurosecretory cells of the paired supraoptic nucleus begin at the level of the optical chiasm and extend to the average levels of the gray tubercle (3; 13). The nucleus is located above the visual tract, touching it on both sides. Most researchers divide SOY into two parts, calling them the pre- and postchiasmatic divisions of the nucleus (9;17).

The paired paraventricular nucleus is less massive and has a shorter extension than the supraoptic one. The neurons of the PVY are located above and caudal to the SOY and are adjacent to the ependyma of the third ventricle. Currently, the paraventricular nucleus is usually divided into subunits: caudal, rostral and medial, which in turn is divided into medial and lateral zones (5; 17).

Small clusters of neurosecretory cells located between the above-mentioned nuclei are also described in the hypothalamic-pituitary system of mammals. The reaction product was localized in the same way as in cells, SOY and PVYA, in pericaryons and processes. All researchers classify the neurons of additional groups as typically neurosecretory (10).

It is well known that the large-cell nuclei of humans and animals are the most vascularized regions of the hypothalamus (3; 6). The blood supply to the nuclei occurs in more than one branch. This is considered as an adaptive sign, excluding the possibility of violation of focal blood circulation in these nuclei. Arterial vessels surround and accompany clusters of neurosecretory cells, closely adjacent to them. This suggests that NSCs use arterial vessel pulsation as trigger microparticles to stimulate axonal transport. The capillaries of the hypothalamus are characterized by high permeability to large-molecular proteins, and cellular structures are highly sensitive to changes in blood and osmotic pressure (12; 17), to the concentration of various substances in the blood, in particular hormones (11;16).

The main function of neurons in the large-cell nuclei of the hypothalamus remains neurosecretion (3; 5). Not so long ago, it was believed that SOY contains neurons that produce vasopressin, and SOY contains neurons that produce oxytocin. The introduction of modern techniques to determine the localization of neurons containing these hormones that respond positively to both vasopressin and oxytocin, however, they are distributed differently: cells synthesizing vasopressin and their carrier proteins predominate in SOY, whereas oxytocin prevails in PVYA [4;9].

In addition to vasopressin and oxytocinergic neurons in the neurosecretory nuclei, biochemical and immune methods have revealed neurons synthesizing CRF, somatoliberin, prolactin, lutein, atrial natriuretic hormone, substance P, renin, etc. (17).

Thus, at least 10 populations of neurons should currently be distinguished in the composition of large-cell neurosecretory nuclei (9) The main substrate of the neurons of the supraoptic and paraventricular nuclei is a neurosecretory substance containing the neurohormones vasopressin, oxytocin and, possibly, corticoliberin (4; 6; 18). It is well known that the nature of the response of the hypothalamic-pituitary system to changes in the external and internal environment is related to the nature of these factors. Therefore, it would be necessary to at least briefly indicate their physiological effect:

Vasopressin is directly involved in the regulation of water metabolism and electrolyte balance, vascular tone, secretion of adenohypophysis hormones, a number of behavioral and neuroprotective reactions (14).

Oxytocin regulates smooth muscle tone (1; 6), induces maternal instinct and models lactation by activating prolactin synthesis in the anterior pituitary lobe (5; 13).

It is not subject to the involvement of neurohypophysial hormones in stress reactions, in the mechanisms of social behavior, regulation of the functions of the cardiovascular system, immune homeostasis, etc. is doubtful (13).

In the female reproductive system, oxytocin is responsible for uterine contractions and milk release from the mammary glands, changes in the ovaries, whose role in steroidogenesis, follicle recruitment and ovulation It was undeniable. Oxytocin in the male reproductive system affects steroidogenesis, contractile activity and gamete health. In the cardiovascular system, the oxytocinergic system plays an important cardioprotective role. This role is probably related to the emergence of evidence that peripheral oxytocin is an important hormone in the endocrinology of glucose homeostasis due to its action in adipose tissue, pancreas and, to a large extent, the oxytocinergic systems of the adrenal glands and liver (5; 10).

2. Morphofunctional shifts in the HPA under conditions of exposure to toxic substances.

According to the literature, HGNS reacts sensitively to the effects of physical and chemical environmental factors (3;6). To date, quite a lot of factual material has been accumulated regarding the reaction of the neuroendocrine system under the influence of pathogenic factors (7; 15).

As mentioned above, the neurosecretory centers of the hypothalamus are involved in the regulation of protective and adaptive reactions of the body through their activation. The degree of HHNS activation largely depends on the strength and duration of the active agent and the functional state of the neurosecretory cells, as well as the nature of the active stressor. In conditions where an endocrine response to stress factors of different nature is observed, the neuroendocrine response turns out to be different. In rats, the specificity of the nature of the stress response is confirmed by the fact that some endocrine reactions to a certain stressor in adapted animals decrease while maintaining a reaction similar in unadapted animals to another stimulus.

It has been experimentally proven that extreme strength and relative duration of exposure lead to the instantaneous release of a small portion of "free" neurohormones from the posterior pituitary gland, and then a prolonged blockade of their excretion into the bloodstream occurs, which leads, most often, to death [10]. Short-term effects of moderate force lead, respectively, to short-term activation of HHNS, expressed in moderate hypertrophy of neurosecretory cells, a slight decrease in the content of neurosecretory matter and moderate hyperemia in all parts of this system (1;4;16), i.e. moderate release of neurogorms into the bloodstream. This gives reason to assume that in such conditions the HHNS reacts non-specifically and acts as one of the regulatory links of the nonspecific protective reaction of the body.

The third period can go in two ways. If the action of the stressor stops, then the normalization of the functions of the GGN will occur. With the continued action of the pathogenic factor, depletion of the specified system occurs with pronounced signs of destructive processes. In this case, a breakdown of the specific and non-specific resistance of the body occurs. The second and third phases can be repeated many times, alternating.

If, with short-term effects of stressors, changes in the hypothalamic-neurohypophysial system are non-specific, then with chronic pathology, the nature of the changes acquires some originality associated with the nature of the active agent. Not every exposure has a ”specific” effect. We are talking about the predominance of reactions of certain neurosecretory nuclei, or the severity of certain phases of the secretory activity of the neurosecretory system towards activation or suppression.

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