PROBLEMS IN CHANGING THE HORMONAL SYSTEM IN THE BODY UNDER THE INFLUENCE OF THE ENVIRONMENT

Jabborova Oysha Iskandarovna
Bukhara State Medical Institute named after Abu Ali ibn Sina. Uzbekistan

Abstract. In this paper presented current state about hormonal changes in sympathetic-adrenal, hypophysis-adrenal, hypophysis-gonads and thyroid levels from extreme environment factors. It's shown that hypophysis gonads and thyroid endocrine links along with sympathetic adrenal, hypophysis adrenal axes are very important relevance in response to extreme environment factors and organism adaptation. In this time a hormonal secretion changes corresponds as interrelated reactions cascade in mechanisms of homeostasis maintenance. A studying of this mechanisms and revealing of its role in stress pathogenesis is fundamental biomedical investigation task. A problem solving allow to perfect prophylactic and treatment methods against stress diseases.

Key words: endocrine system, stress, adaptation.

Environmental factors cause a complex range of neurohumoral signals in a multicellular organism. In the formation of the regulation of the compensation mechanism for various extreme factors affecting the body, the endocrine system is assigned one of the leading roles. The adequacy and nature of adaptive changes in the body, which ensure the restoration and maintenance of the constancy of the internal environment of the organism as a whole, depend on changes in hormonal secretion [1, 2]. The activity of any endocrine gland depends on the content of its hormone secreted and circulating in peripheral tissues, which forms the general principle of homeostasis in relation to endocrine glands [3, 4]. Excessive increase in hormone concentration in the peripheral circulatory system inhibits the activity of trophocytes and tropocytes in the hypothalamus and pituitary gland with a corresponding decrease in the secretion of stimulating tropic hormones (the principle of negative feedback in the regulation of the endocrine system) [5].

Various extremal factors affecting the body trigger compensatory-adaptive mechanisms that accordingly change the metabolism and functional state organs and tissues. A single or short-term exposure to these factors, as a rule, does not lead to a stable restructuring of the mechanisms of regulation of homeostasis, while prolonged and repeated stress can become the basis of stress-induced development of pathology [6].

It is known that, in response to external influences and the formation of an organism's adaptation, one of the main endocrine units includes activation of the

sympathoadrenal and hypothalamic-pituitary-adrenocortical systems [7, 8]. However, other links of endocrine regulation (gonadal, thyroid) play an important role in providing the body's adaptive response to stressful effects [9, 10].

Reactions of the sympathoadrenal and hypothalamic-pituitary-adrenal link of endocrine regulation under stress

The sympathoadrenal link (active substances — catecholamines, serotonin-like substances) affects the metabolism and energy and forms the processes of short-term (urgent) adaptation. Catecholamines belong to the stress-relieving part of this link, and serotonin — to the stress-limiting part. An imbalance between the secretion of these substances serves as one of the pathogenetic mechanisms for disrupting the implementation of adaptive processes. The hypothalamic-pituitary-adrenocortical link (active substances — corticotropin-releasing hormones, adrenocorticotropic hormone, glucocorticoids) activates long-term adaptation processes in the body [11, 12]. If excessive long-term exposure to damaging environmental factors, there are violations of functioning in these systems. Among the main manifestations of their excessive activation are the following: hypersecretion of biologically active substances, the emergence of resistance to them of target cells, damage to the feedback mechanism in regulation [13].

From the point of view of physiology, each individual stimulus triggers a complex neuroendocrine response aimed at overcoming extraordinary circumstances. To date, it is known that the SIM-pathoadrenal and pituitary-adrenal axis form a non-specific response to exposure, are common and necessary elements in a wide range of stimuli [14]. However, the very nature of the stressor, individual assessment of the stressful situation, and the strategy of the subject's behavior during stress still determine the presence of a specific component in the body's response [15, 16].

Under the influence of a stressor, there is an active release of hypothalamus corticoliberin, which leads to increased secretion of adrenocorticotropic hormone (ACTH) from the pituitary and, accordingly, glucocorticoids from the adrenal glands. At the same time, under the influence of a psychological component, the activation of the cortico-liberin system of the amygdala complex occurs when a stressor is perceived [17]. Thus, at the primary stage of stress development, corticoliberin plays a key role, triggering a cascade of biochemical reactions and integrating further protective adaptive processes by interacting with all mediators and hormonal mediators that form the stress-activating and stress-limiting systems [18].

ACTH is a peptide which is produced by cells of the anterior pituitary in response to action corticata - pin-releasing hormone. The effect of corticotropin-releasing hormones on the release of ACTH is increased by other hypothalamic hormones (vasopressin), whose activity depends on the stimulating or inhibiting action of such active substances as acetylcholine, catecholamines, dopamine, serotonin, and

cytokines. On the periphery, the effector organ - the target of ACTH are cells of the adrenal cortex. ACTH stimulates the synthesis and secretion of glucocorticoids (ha) and, to a lesser extent, mineral corticoids and adrenal androgens [19].

The final hormones of the hypothalamic-pituitary-adrenal system (GGAS) — GC — in a stressful situation play a key modulating role, leading the body to the most appropriate state for this situation. They regulate many Central and peripheral functions. At the level of the Central nervous system (CNS), GC is inhibited by the feedback mechanism of corticoliberin. The metabolic effect of ha is provided by preparing the body to mobilize energy resources. GC changes the processes of carbohydrate, lipid, protein and electrolyte metabolism.

In addition, GC regulates the development and differentiation of cells, changes in gene activity, and has a modulating effect on the immune system and many specific reactions that develop in response to stimuli [20].

It is shown that the balanced activation of stress-implementing (sympathoadrenal and hypothalamic-Hypo-physical-adrenal) and stress-limiting (dopamine and serotonergic, antioxidant) systems determines the development of an adequate adaptive response to external influences [21].

Reactions of the hypothalamic-pituitary-gonadal system under stress

Endocrine regulation of the reproductive function is performed by the hypothalamic-pituitary - gonadal system (GGGS). The Central link of regulation is represented at the hypothalamic (gonado - Tropin-releasing hormones, dopamine) and pituitary levels (luteinizing and follicle — stimulating hormones, prolactin), and the peripheral link - steroid-producing glands (gonads, adrenal glands), which synthesize and secrete testosterone, estradiol and progesterone. In turn, the secretion of gonadotropin-releasing hormones depends on neuroamines (noradrenaline, serotonin, acetylcholine) or on the content of sex steroid hormones in the blood [22].

In addition to the main purpose of the hypothalamic-pituitary-gonadal system, which is to regulate reproductive function, GGGS plays an important role in ensuring the adaptation of the body in response to extreme environmental factors. Reducing or increasing the biosynthesis, secretion, and, consequently, the content of GGGS hormones in response to extreme exposures has a certain functional significance in supporting an adequate response of the body [23].

GGGS has a close relationship with GGAS. GGAS, which is activated under stress, has a direct effect on GGGS, entering into reciprocal relations with it [24]. On the other hand, sex steroids have been shown to modulate the action of norepinephrine, dopamine, and serotonin. The joint participation of monoamines and sex steroids regulates the activity of the cyclic center of gonadotropin secretion and release, forming the basis for the formation of adaptive (sexual, food, and aggressive-defensive) behavior, including stress reactions [25]. Thus, synergistic and antagonistic

correlations between GGGS and GGAS determine changes in reproductive function and the implementation of adaptation under stress [26].

Gonadotropins LH and FSH. Activation of the secretion of luteinizing (LH) and follicle-stimulating (FSH) hormones in the pituitary gland is performed by the corresponding hypothalamic releasing hormones: LH - (LH-RG) and folliculoliberin (FSH-RG), and it is known that LH-RG can stimulate the production of not only LH, but also FSH [27].

In stressful conditions of various Genesis, the initial concentration of LH and FSH increases, probably due to the stimulating effect of corticotropin-releasing hormone [28]. Among other, no less significant hormones that modulate the initial increase in gonadotropi

now, prolactin and thyrotropin-releasing hormone should be isolated [12]. However, in the future, the secretion of LH and FSH is suppressed by increasing the content of ha in the blood. The mechanism of action is related to the influence of steroids (including sexual ones) on the differentiation of pituitary gonadotrophs indirectly through catecholamines [13].

Prolactin is one of the most ancient pituitary hormones, whose main function is to stimulate lactation. However, prolactin is present in quite large quantities in the male body. Prolactin receptors are present in the cells of most tissues, therefore, its role in the body is extremely multifaceted: prolactin participates in almost all regulatory processes, exerting a synergistic or antagonistic effect on biologically active substances [13].

It is known about the antistress role of prolactin. It prevents the development of stress-induced catabolic reactions mediated by hypersecretion of ha. Under extreme influence of various factors that contribute to the development of stress, the content of prolactin in the blood changes, and its dynamics largely depends on the duration and intensity of this impact [2]. When modeling a stressful state, there is a significant increase in the concentration of prolactin, which levels the catabolic effect of ha. However, with continued exposure to the stressor, ha, intensively produced due to activation of GGAS, suppress the secretion of prolactin until it is completely blocked [3]. Thus, one of the most important compensatory links with the corresponding prerequisites for the development of stress is switched off.

Such dynamics of prolactin content (initially expressed in an increase in the level of the hormone against the background of stress factors and its subsequent decrease under the continued influence of the damaging factor) was registered in the study of pathogenic stress States of various Genesis, such as overheating, Smoking, the effect of ethanol, injuries and diseases of internal organs, immobilization, excessive physical exertion [4, 5].

There is strong evidence that in increasing prolactin secretion at the initial stages

of response to a stressful situation, one of the exceptional links is the action of thyroxine together with serotonin [16].

GC have a dose-dependent effect on the concentration of prolactin in the blood: low doses of cortisol stimulate the release of prolactin, and high — depress. The mechanism of action here is related to the influence of ha via catecholamines, which activate receptors for steroids under stress, on the differentiation of pituitary lactotrophs and, accordingly, the synthesis of prolactin [17].

On the other hand, increasing the level of prolactin increases the release of corticotropin-releasing factor by hypothalamus cells with the corresponding synthesis of ACTH and subsequently ha, necessary for the formation of the body's response to extreme effects [18]. A stimulating role of prolactin in corticosterone production was also found by direct direct action on cells of the reticular zone of the adrenal cortex [19]. Thus, prolactin maintains a certain, balanced level of the main stress hormones (ha) for the formation of adaptation.

Prolactin has a pronounced immunomodulatory effect, which is due to the presence of receptors for this hormone on almost all cells of the immune system [4]. The role of prolactin in increasing the phagocytic activity of macrophages and stimulating humoral and cell-mediated immune response is known within the link of antigen protection of the immune system [4,5]. On the other hand, prolactin affects the proliferation of immunocompetent cells and their production of cytokines (in particular, interleukin 1, 10, and tumor necrosis factor a), which are involved in the response to extreme stress factors and adaptive processes of the body [12]. It is known about the exclusive role of prolactin in some parts of the anti-and nociceptive response in various damaging effects [13]. In traumatic injuries, prolactin is actively involved in reparative and plastic processes [4]. Prolactin is one of the links in the processes of thermoregulation under stress. Increasing its content balances the work of the thermoregulation center, preventing the development of hyperthermia [15].

Sex steroid hormones play one of the most important roles in the system of normal functioning of the body as a whole. In addition to ensuring the functioning of the reproductive system, they determine the growth and development of the body, participate in the processes of differentiation of various tissues, have a protective effect against cells, slow down the aging process. The sphere of action of sex steroids involves such systemic reactions as mood, the manifestation of mental abilities, memory state, physical activity and endurance [16].

Conclusion

Analysis of the literature data has shown that the hormones of the hypothalamic-pituitary-gonadal and thyroid axis of endocrine regulation, along with the sympathoadrenal and hypothalamic-pituitary- adrenal link of EN- endocrine regulation , play a crucial role in the response to extreme environmental influences and adaptation

of the body.

LITERATURE

1. Меерсон Ф.З. О «цене» адаптации. *Патол. физиология и экспериментальная терапия.* 1986; 3: 9—19.
2. Charmandari E., Tsigos C., Chrousos G. Endocrinology of the stress response. *Annu. Rev. Physiol.* 2005; 67: 259-284.
3. Горизонтов П.Д. Гомеостаз. *М.: Медицина.* 1981. 576 с.
4. Daniels D., Fluharty S.J. Neuroendocrinology of Body Fluid Homeostasis. Hormones, Brain and Behavior. Second Edition. D.W. Pfaff, A.P. Arnold, S.E. Fahrbach (eds.). *USA: Academic Press.* 2009. P. 259-289.
5. Старкова Н.Т. Клиническая эндокринология: Руководство. *СПб.: Питер.* 2002. 576 с.
6. Larzelere M.M., Jones G.N. Stress and health. *Primary Care: Clinics in Office Practice.* 2008; 35 (4): 839-856.
7. Гаркави Л.Х., Квакина Е.Б., Уколова М.А. Адаптационные реакции и резистентность организма. Изд. 3-е, доп. *Ростов- на-Дону: Изд-во Ростовского ун-та.* 1990. 223 с.
8. Selye H. Stress without distress. *Philadelphia, USA: Lippincott.* 1974. 171 p.
9. Горобец Л.Н. Нейроэндокринные дисфункции и нейролептическая терапия. *М.: Медпрактика-М.* 2007.312 с.
10. Cameron J.L. Stress and Reproduction. *Encyclopedia of Hormones.* H.L. Henry, A.W. Norman (eds.). *USA: Academic Press.* 2003. P. 433-438.
11. Хныченко Л.К., Сапронов Н.С. Стресс и его роль в развитии патологических процессов. *Обзоры по клинической фармакологии и терапии.* 2003; 3: 2-15.
12. Eiden L.E. Neuropeptide-Catecholamine Interactions in Stress. A New Era of Catecholamines in the Laboratory and Clinic. *USA, Elsevier Inc.* 2013; 68: 399-404.
13. Kino T., Charmandari E., Chrousos G.P. Disorders of the Hypothalamic-Pituitary-Adrenocortical System. Handbook of Neuroendocrinology. G. Fink, D.W. Pfaff, J. Levine (eds.). *USA, NY: Academic Press.* 2012. P. 639-657.
14. McCarty R., Pacak K. Alarm Phase and General Adaptation Syndrome. Encyclopedia of Stress. Second Edition. G. Fink (ed.). *USA: Academic Press*. 2007. P. 119-123.
15. Summers C.H. Mechanisms for quick and variable responses. *Brain Behav. Evol.* 2001; 57 (5): 283-292.
16. Armario A., Marti O., Vallfes A., Dal-Zotto S., Ons S. Long-term effects of a single exposure to immobilization on the hypothalamic- pituitary-adrenal axis: neurobiologic mechanisms. *Ann. N.Y. Acad. Sci.* 2004; 1018: 162-172.
17. Arendt D.H., Smith J.P., Bastida C.C., Prasad M.S., Oliver K.D., Eyster K.M.,

Summers T.R., Delville Y. and Summers C.H. Contrasting hippocampal and amygdalar expression of genes related to neural plasticity during escape from social aggression. *Physiol. Behav.* 2012; 107 (5): 670-679.

18. Boltayevna Z. F. Requirements For A Healthy Lifestyle //Academicia Globe: Inderscience Research. – 2021. – Т. 2. – №. 05. – С. 269-272.
19. Ronan P.J., Summers C.H. Molecular signaling and translational significance of the corticotropin releasing factor system. *Prog. Mol. Biol. Transl. Sci.* 2011; 98: 235-292.
20. Pearson-Murphy B.E. Glucocorticoids, Overview. Encyclopedia of Stress (Second Edition). G. Fink (ed.). *USA: Academic Press.* 2007. P. 198-210.
21. Jiang X., Wang J., Luo T., Li Q. Impaired hypothalamic-pituitary- adrenal axis and its feedback regulation in serotonin transporter knockout mice. *Psychoneuroendocrinology*. 2009; 34 (3): 317-331.
22. Melmed S., Polonsky K.S., Reed Larsen P., Kronenberg H.M. Williams Textbook of Endocrinology. *USA: Elsivier Saunders.* 2011. 1816 p.
23. Амстиславская Т.Г., Попова Н.К. Нейроэндокринные механизмы регуляции полового мотивационного поведения самцов: эффекты неблагоприятных воздействий в разныепериоды онтогенеза. Обзоры по клинической фармакологии и лекарственной терапии. *2009; 2: 3-21.*