ENDOCRINE SYSTEM PATHOPHYSIOLOGY

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Abstract.

The endocrine system, together with the nervous system, participates in the regulation of the basic physiological processes in the body. Violation of the central mechanisms of regulation of the functional activity of the endocrine glands, pathological processes in the glands themselves or a violation of the peripheral mechanism of action of hormones lead to a violation of the metabolism, growth, development and reproduction of the body.

Key words:

Endocrine system, hormone secretion, hormone in the blood.

Nonspecific resistance of the organism and its disturbances are also associated with the functioning of the endocrine glands: the pituitary gland and the adrenal glands. The participation of hormonal factors in the pathogenesis of not only endocrine, but also non-endocrine diseases necessitates the study of the pathology of the endocrine system.

Disruption of the endocrine system is manifested by symptoms of increased or decreased function of the endocrine glands. A specific stimulus for the secretion of the hormone is a change in the potential of the cell membrane and its permeability under the influence of mediators of nervous excitement, the action of neuropeptides, tropic hormones of the pituitary gland, biologically active substances, changes in the biochemical composition of the blood, and the content of electrolytes.

The appearance of these symptoms may be due to:

1. Changes in the level of hormone secretion.
2. Changes in its content in body fluids.
3. Inadequacy of the action of the hormone on the target tissue, i.e. tissues at the level of which the effect of the hormone is realized.

Inappropriate hormone secretion can be associated with:

1) with a change in the neurohumoral regulation of the Endocrine Glands.

All endocrine organs are subordinate to the central nervous system in their activity. The main coordinating and controlling center is the hypothalamus. The primary lesion of this part of the brain underlies the occurrence of diseases such as diabetes insipidus, centrogenic obesity, a number of growth disorders, puberty, etc. It is in the hypothalamus that the transformation of nerve impulses received from other parts of the nervous system into chemical signals takes place, which in the form of physiologically active substances - neurohormones (of a polypeptide nature), secreted in the nuclei of this part of the brain, reach the corresponding effector organs in various ways. A significant part of these neurohormones is delivered with the portal blood flow to the cells of the anterior pituitary gland. Some of them - liberins activate the secretion of the corresponding adenohypophyseal cells, while others - statins inhibit it. Damage to peptidergic neurons of the hypothalamus or a change in

the ratio of the content of neurotransmitters in it: dopamine, norepinephrine, serotonin is reflected in the level of secretion of neurohormones and, accordingly, affects the secretion of tropic hormones of the pituitary gland, which, in turn, changes the level of secretion of hormones in the corresponding peripheral glands.

For example, a decrease in the activity of dopaminergic receptors in the hypothalamus leads to an increase in the secretion of corticoliberin in the nuclei of the hypothalamus. In response to this, a large amount of corticotropin (ACTH) enters the bloodstream from the pituitary gland, which stimulates the bundle zone of the adrenal cortex and the patient develops symptoms of hyperfunction of the adrenal cortex.

The role of peripheral nerves in the regulation of the activity of the EF is less significant than the humoral one. The normal function of the endocrine gland is preserved even after its complete denervation (for example, transplantation of the gland).

However, the circadian rhythm of hormone secretion is disrupted, the sensitivity to humoral regulators changes, which leads to a deviation of the feedback mechanisms upward or downward.

The feedback mechanism is that the excess of the hormone in the blood inhibits, and its deficiency stimulates the secretion of this hormone. In the feedback mechanism, three areas of application of peripheral hormones can be distinguished: the hypothalamus, the pituitary gland and the corresponding peripheral gland - the producer of these hormones. Pathological changes in the peripheral gland can cause disruption of the activity of the endocrine glands precisely through this mechanism.

For example, in the presence of a tumor in one of the adrenal glands, a glucosteroma, the concentration of glucocorticoids in the blood sharply increases. As a result, there is atrophy of the cells of the adenohypophysis that produce corticotropin (ACTH) and the cells of the bundle zone of the healthy adrenal gland. After surgical removal of the tumor, the patient may experience acute adrenal insufficiency. atrophied cells of the pituitary gland stopped producing corticotropin and the stimulus for the release of glucocorticoids by the remaining adrenal gland disappeared. A similar situation can arise with the therapeutic use of hormonal drugs. Currently, the clinic is very widely used glucocorticoid drugs (hydrocortisone, prednisolone) in the treatment of various diseases (more than 100). But it is necessary to take into account that prolonged use of hormonal drugs can cause atrophy of the gland and when they are canceled, acute endocrine insufficiency occurs.

Functional activity of the so-called pituitary glands (pancreas, parathyroid glands, glomerular zone of the adrenal cortex) are also regulated according to the principle of feedback, under the influence of blood ingredients specifically regulated by the hormones of these glands (for example, hyperglycemia stimulates, and hypoglycemia reduces insulin secretion). Self-regulation disorders at the level of these endocrine organs lead to a change in their secretory activity.

2) in violation of the processes of synthesis and deposition of hormones.

Violation of synthesis can be associated with:

1) with damage to the endocrine glands as a result of trauma, with circulatory disorders (thrombosis, hemorrhage), with infectious diseases, intoxication. For example, the development of diabetes mellitus, especially in children, is caused by rubella, mumps, Coxsackie B4 viruses. In a tuberculous process, adrenal tissue is often damaged. In chronic alcoholics, hypofunction of the adrenal glands and atrophy of the thyroid gland are observed in the offspring.

2) with the development of a tumor in the endocrine gland. More often benign tumors (adenomas) occur, less often malignant (carcinomas). If a tumor is formed from hormone-producing cells, then its development, as a rule, is accompanied by increased synthesis of the hormone and is clinically manifested by symptoms of hyperfunction of this gland. For example, if a tumor develops from basophilic cells of the adenohypophysis, the corticotropin

content in the blood sharply increases and symptoms of adrenal hyperfunction appear. In this case, the feedback mechanism is violated, because the tumor is "deaf" to the regulatory influences of the body. If a tumor develops from hormone-producing cells, then growing it causes atrophy of the normal parts of the gland. For example, chromophobic pituitary adenoma. It usually does not produce hormones, but compresses the pituitary gland. Clinically, the disease will manifest itself as hypofunction of the pituitary gland.

3) auto-allergic processes. The tissue of most endocrine glands belongs to natural autoantigens. Therefore, damage to the histohematic barriers separating the gland from the blood can lead to the development of an autoimmune process. The damage can involve both delayed and immediate allergic processes. However, the greatest importance belongs to cytotoxic antibodies. Fixing on the cell surface, they interact with various components of the complement system. Lysis, caused by the action of complement, leads to cell death.

4) blockade of metabolism, leading to a defect in the biosynthesis of hormones. If, as a result of a genetic defect, there is no enzyme involved in the synthesis of the hormone, then its formation is disrupted. This results in:

a) to hormone deficiency

b) to a violation of the feedback mechanism, manifested, as a rule, by an increase in the content of the corresponding triple hormone in the blood;

c) to the appearance in the blood of intermediate metabolites that have a specific pathophysiological effect.

A striking example of this form of disorder is the development of adrenogenital syndrome (see the material of the 2nd lecture).

5) the lack of synthesis may be associated with functional overstrain of the endocrine apparatus, which leads to its depletion or with an insufficient supply of the necessary ingredients from the external environment. For example, a deficiency of iodine in food will lead to insufficient synthesis of thyroxine (in places of thymus endemic, the daily intake of iodine is 20-80 µg instead of 200-220 µg). The deficiency of thyroid hormones by the feedback mechanism increases the secretion of thyrotropin, which causes hyperplasia of the thyroid gland with the development of goiter. A lack of vitamin A disrupts the synthesis of sex hormones, leucine and arginine, and helps to reduce the synthesis of insulin.

6) violation of the deposition of the hormone. Protein and peptide hormones are stored either in secretory granules or as precursors (thyroglobulin). Steroid hormones are not deposited.

The appearance of symptoms of hypo- or hyperfunction of the endocrine glands can also occur in the absence of a pathological process in the endocrine gland itself due to a change in the content of the active hormone in the blood.

A change in the content of the active hormone in the blood may be associated with:

1) with impaired transport function of carrier proteins. Most of the hormones in the blood are associated with the so-called. protein carriers. This protects the hormone from rapid destruction, thereby creating a kind of depot, which allows, if necessary, to increase the level of free hormone in the blood.

Deficiency of the binding protein (for example, as a result of a genetic defect) leads to an increase in the concentration of the active (free) hormone in the blood. When the qualitative composition of the blood protein changes - paraproteinemia, the strength of the bond with the hormone changes.

2) with the formation of antibodies to the hormone, leading to its inactivation.

3) ectopic production of hormones by paraendocrine tumors, i.e. tumors originating from tissues that usually do not produce these hormones. For example, cells of malignant tumors of the lungs, stomach, ovaries and some other organs (about 20 types of tumors capable of synthesizing up to 15 types of hormones) acquire the ability to produce and release polypeptides into the blood that resemble corticotropin in structure and biological effect, which leads to the appearance of symptoms of hyperfunction of the adrenal cortex. During

surgery or chemotherapy, the determination of the hormone in the blood in such cases helps to assess the effectiveness of treatment and the possibility of relapse.

4) violation of hormone metabolism. All hormones circulating in the blood ultimately undergo metabolic transformations, leading, as a rule, to their inactivation. Basically, the metabolism of hormones occurs in the liver, kidneys and lungs. The rate of hormone decay also affects the rate of their synthesis. For example, with cirrhosis of the liver, the rate of destruction of corticosteroids in it slows down, which leads to an increase in their concentration in the blood and, by the feedback mechanism, their synthesis and secretion in the adrenal cortex is inhibited. The opposite relationship is also possible, when the accelerated destruction of the hormone leads to an increase in its synthesis and secretion by the endocrine gland. For example, with thyrotoxicosis, the metabolism of glucorticoids in the liver increases. According to the feedback mechanism, the release of corticotropin increases and in patients with thyrotoxicosis, hypertrophy of the adrenal cortex may occur. However, as a result of the rapid destruction of glucocorticoids, the depletion of the adrenal cortex ultimately occurs and the synthesis of cortisol decreases.

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