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Mullacheri Kamalon Rohith Krishnan
Fergana Medical Institute of Public Health

MORPHOFUNCTIONAL AND PATHOPHYSIOLOGICAL ASPECTS OF THE ENDOCRINE SYSTEM

Annotation: The endocrine system coordinates the functions of various organs through hormones, which are chemicals that are released into the bloodstream from specialized cells found inside the endocrine glands (endocrine glands). Endocrine glands release hormones into the bloodstream. This lets the hormones travel to cells in other parts of the body[1,2]. Endocrine glands release hormones into your bloodstream. Your endocrine glands influence reproduction, metabolism, growth and many other functions. The endocrine system is made up of glands that make hormones. Hormones are the body's chemical messengers. They carry information and instructions from one set of cells to another.

Key words:endocrine glands, body's chemical messengers, hypothalamus, pituitary, thyroid, parathyroids, ,adrenals, pineal body, endocrine system.

INTRODUCTION

The endocrine system regulates how much of each hormone is released. This can depend on levels of hormones already in the blood, or on levels of other substances in the blood, like calcium. Many things affect hormone levels, such as stress, infection, and changes in the balance of fluid and minerals in blood[3].

While many parts of the body make hormones, the major glands that make up the endocrine system are the: hypothalamus, pituitary, thyroid, parathyroids, ,adrenals, pineal body, the ovaries, the testes.

Hormones made in the hypothalamus include:

- growth hormone releasing hormone (GHRH)
- thyrotrophin releasing hormone (TRH)
- corticotrophin releasing hormone (CRH)
- gonadotrophin releasing hormone (GnRH)
- oxytocin
- vasopressin (also called anti-diuretic hormone)
- dopamine
- somatostatin

The glands of the endocrine system include the:

- **Hypothalamus.** While some people don't consider it a gland, the hypothalamus produces multiple hormones that control the pituitary gland. It's also involved in regulating many functions, including sleep-wake cycles, body temperature, and appetite. It can also regulate the function of other endocrine glands.
- **Pituitary.** The pituitary gland is located below the hypothalamus. The hormones it produces affect growth and reproduction. They can also control the function of other endocrine glands.
- **Pineal.** This gland is found in the middle of your brain. It's important for your sleep-wake cycles.
- **Thyroid.** The thyroid gland is located in the front part of your neck. It's very important for metabolism.
- **Parathyroid.** Also located in the front of your neck, the parathyroid gland is important for maintaining control of calcium levels in your bones and blood.

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- **Thymus.** Located in the upper torso, the thymus is active until puberty and produces hormones that are important for the development of a type of white blood cell called a T cell.
- **Adrenal.** One adrenal gland can be found on top of each kidney. These glands produce hormones that are important for regulating functions such as blood pressure, heart rate, and stress response.
- **Pancreas.** The pancreas is located in your abdomen behind your stomach. Its endocrine function involves controlling blood sugar levels.

Some endocrine glands also have non-endocrine functions. For example, the ovaries and testes produce hormones, but they also have the non-endocrine function of producing eggs and sperm, respectively.

Some hormones act on the cells of the same organ that is their source (paracrine effect), and sometimes even on the cells themselves that produce them (autocrine effect)[5,6]. Endocrine system disorders result from disruption of the endocrine glands and/or their target tissues.

MATERIALS AND METHODS OF RESEARCH

Symptoms of a hormonal imbalance specific to AFAB people include:

- heavy or irregular periods, including missed periods, stopped periods, or frequent periods
- hirsutism, or excessive hair on the face, chin, or other parts of the body
- acne on the face, chest, or upper back
- hair loss
- hyperpigmentation, especially along neck creases, in the groin, and underneath the breasts
- skin tags
- vaginal dryness
- vaginal atrophy
- pain during sex
- night sweats
- headaches

Analysis of statistical indicators of morbidity and mortality from diseases of the endocrine system obtained from WHO reporting statistics from 2021. Too much or too little of any hormone can harm the body. Medicines can treat many of these problems.

A hormonal imbalance has many possible causes. They can differ depending on which hormones or glands are affected.

Common causes of hormonal imbalance include:

- hormone therapy
- medications
- cancer treatments such as chemotherapy
- tumors, whether cancerous or benign
- pituitary tumors
- eating disorders
- stress
- injury or trauma

While hormonal imbalances may initially cause some of the conditions below, having these conditions can also lead to further hormonal imbalances:

- type 1 and type 2 diabetes
- diabetes insipidus
- hypothyroidism, or an underactive thyroid
- hyperthyroidism, or an overactive thyroid
- hyperfunctioning thyroid nodules
- thyroiditis

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- hypogonadism
- Cushing syndrome, or high levels of cortisol
- congenital adrenal hyperplasia, which causes low levels of cortisol and aldosterone
- Addison's disease

In humans, the major endocrine glands are the thyroid, parathyroid, pituitary, pineal, and adrenal glands, and the (male) testicles and (female) ovaries.

The hypothalamus, pancreas, and thymus also function as endocrine glands, among other functions. (The hypothalamus and pituitary glands are organs of the neuroendocrine system. One of the most important functions of the hypothalamus—it is located in the brain adjacent to the pituitary gland—is to link the endocrine system to the nervous system via the pituitary gland.) Other organs, such as the kidneys, also have roles within the endocrine system by secreting certain hormones. The study of the endocrine system and its disorders is known as endocrinology[7]. The endocrine system is a messenger system in an organism comprising feedback loops of hormones that are released by internal glands directly into the circulatory system and that target and regulate distant organs. In vertebrates, the hypothalamus is the neural control center for all endocrine systems[8].

Diabetes mellitus occupies a leading place in the structure of all endocrine diseases, which today is one of the most dangerous challenges to the global community and an important priority for national healthcare systems. The second place in the structure of endocrine pathology belongs to various diseases of the thyroid gland. One of the leading indicators that determine the epidemiological situation of diabetes mellitus in the world is the prevalence due to the growth in the size and age of the population, urbanization of the territory, the increase in the prevalence of obesity and a sedentary lifestyle." There are many endocrine glands in your body that release different hormones. Many of these glands are controlled by the hypothalamus and the pituitary gland (also known as the master gland) in our brain. There are many medical conditions that can affect your glands and cause hormonal problems. The proportion of patients with pathology of the endocrine system is constantly increasing in all economically developed countries of the world[9,10].

There are clear geographic differences in growth trends, but the average annual growth rate is 3%. It has been established that type 1 diabetes in the world affects 81,100 children under the age of 15 every year. Of the 499,100 children living with type 1 diabetes today, 27% are in Europe, where the latest and most reliable data on the incidence of new diabetes cases is available, and 23% are in North America and the Caribbean[13]. Global health care spent about $549 billion in 2017 to prevent complications of diabetes and treat the disease itself. This figure is expected to exceed US$628 billion by 2035. According to experts, in the European region, which includes 59 countries, the number of people with diabetes is 59.3 million, or 9.5% of the adult population. The highest rate is observed in Turkey - 15.8%. The prevalence of diabetes mellitus in Germany is 12.95%, in Spain - 10.53%, Italy - 7.55%, France - 7.20%, in the UK - 6.97%. The minimum national prevalence of diabetes mellitus is observed in Azerbaijan - 2.78%, China has the largest number of people with diabetes mellitus - 109.6 million, and the prevalence rate reaches 11.6%. The majority of the region's population lives in North America and the Caribbean in the USA, Mexico and Canada, and in these same countries the vast majority of people with diabetes are registered. The national prevalence of diabetes mellitus in Mexico is 11.7%, Canada – 11.21%, USA – 10.90%. Another important indicator that determines the epidemiological situation with regard to diabetes mellitus is the incidence[11,12].

Diseases of the endocrine system are common, including conditions such as diabetes mellitus, thyroid disease, and obesity. Endocrine disease is characterized by misregulated hormone release (a productive pituitary adenoma), inappropriate response to signaling (hypothyroidism), lack of a gland (diabetes mellitus type 1, diminished erythropoiesis in chronic kidney failure), or structural enlargement in a critical site such as the thyroid (toxic multinodular goitre). Hypofunction of

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endocrine glands can occur as a result of loss of reserve, hyposecretion, agenesis, atrophy, or active destruction[14,15]. Hyperfunction can occur as a result of hypersecretion, loss of suppression, hyperplastic or neoplastic change, or hyperstimulation.

As the thyroid, and hormones have been implicated in signaling distant tissues to proliferate, for example, the estrogen receptor has been shown to be involved in certain breast cancers. Endocrine, paracrine, and autocrine signaling have all been implicated in proliferation, one of the required steps of oncogenesis[16]. Endocrinopathies are classified as primary, secondary, or tertiary. Primary endocrine disease inhibits the action of downstream glands. Secondary endocrine disease is indicative of a problem with the pituitary gland. Tertiary endocrine disease is associated with dysfunction of the hypothalamus and its releasing hormones.

Cushing's disease is characterized by the hypersecretion of the adrenocorticotropic hormone (ACTH) due to a pituitary adenoma that ultimately causes endogenous hypercortisolism by stimulating the adrenal glands. Some clinical signs of Cushing's disease include obesity, moon face, and hirsutism. Addison's disease is an endocrine disease that results from hypocortisolism caused by adrenal gland insufficiency. Adrenal insufficiency is significant because it is correlated with decreased ability to maintain blood pressure and blood sugar, a defect that can prove to be fatal. Other common diseases that result from endocrine dysfunction include Addison's disease, Cushing's disease and Graves' disease. Cushing's disease and Addison's disease are pathologies involving the dysfunction of the adrenal gland. Dysfunction in the adrenal gland could be due to primary or secondary factors and can result in hypercortisolism or hypocortisolism[17].

Thyroid pathology ranks second in prevalence after diabetes among all endocrinopathies. Since the beginning of the 90- In the 1990s, it is also characterized by an increase in prevalence, depending on many factors, such as gender, age, genetic predisposition, the presence of goitrogens in food (thioglycosides, thiocyanates), and iodine supply of the region. Graves' disease involves the hyperactivity of the thyroid gland which produces the T3 and T4 hormones. Graves' disease effects range from excess sweating, fatigue, heat intolerance and high blood pressure to swelling of the eyes that causes redness, puffiness and in rare cases reduced or double vision. The amount of spending on diabetes treatment varies significantly from region to region and from country to country. Only 1/5 of global spending occurs in middle- and low-income countries, although about 80% of patients with diabetes live in them. An average of 356 US dollars per year is spent per patient in middle- and low-income countries, and 5,621 US dollars in high-income countries.

A common condition is hypothyroidism. Manifest hypothyroidism occurs in 0.2-2% of the population, subclinical - 4-10% (in the elderly - 7-26%). The prevalence of hypothyroidism ranges from 3 to 16% in men and from 4 to 21% in women and increases with age. Such a high prevalence determines the medical and social significance of hypothyroidism. The most common cause of this pathology is autoimmune thyroiditis.

In general, autoimmune thyroid diseases occur in 2-5% of the population. The number of patients who have suffered temporary and permanent disability due to thyroid pathology is increasing. The incidence of thyroid cancer is currently increasing throughout the world. The rate of increase in the detection of this disease is 4% per year. Today, this pathology is the most common malignant neoplasm of the endocrine system, accounting for 2.2% in the structure of cancer incidence.

Thyrotoxicosis remains a serious problem, leading to a worsening life prognosis and accompanied by an increase in mortality from diseases of the cardiovascular system. Thus, mortality from coronary heart disease, heart failure, arrhythmias, valve defects and arterial hypertension in combination with thyrotoxicosis increased 1.2 times compared to the general population. The reason for this is the development of changes in the cardiovascular system. Among the manifestations of "thyrotoxic heart" are pulmonary hypertension, diastolic dysfunction, the development of heart failure,

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dilatation of the heart cavities, atrial fibrillation and left ventricular myocardial hypertrophy. Atrial fibrillation, which occurs in 2-25% of cases with thyrotoxicosis, often persists even after thyrotoxicosis has been eliminated.

One of the most common diseases of the thyroid gland is diffuse toxic goiter, the prevalence of which in the population is 1-3%, the incidence is from 5 to 23 cases per 100 thousand population per year, the ratio of men to women is 1:5 - 1:7. Diffuse toxic goiter is primarily dangerous due to disorders of the cardiovascular system associated with thyrotoxicosis and leading to a worsening prognosis of the disease and loss of ability to work.

CONCLUSIONS

The data presented indicate the high significance of endocrine pathology - diabetes mellitus and thyroid diseases. Thus, the nature of the prevalence and course of the disease, the frequency of identified patients depend on the level and quality of local endocrinological care, timely active identification of patients and complications, provision of sufficient quantities of drugs, proper organization of dispensary observation and therapeutic measures.

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