

# Pathophysiology of endocrine system

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## 5.1 Types of endocrine disorders

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Endocrine disorders can be classified according to the intensity of hormonal activity and according to the place of endocrine disorder origin. From the point of view of **intensity** of hormonal activity of endocrine gland we can distinguish:

1. **Hyperfunction** of endocrine gland, which is characterized by increased secretion of its hormone (hormones) as well as by increased concentration of this hormone (these hormones) in circulating blood.
2. **Hypofunction** of endocrine gland, which is characterized by decreased secretion of its hormone (hormones) as well as by decreased concentration of this hormone (these hormones) in circulating blood.

If endocrine gland produces several kinds of hormones (e.g.,adenohypophysis) the symptoms resulting from hyperproduction or hypoproduction of more kinds of hormones may develop, respectively, at the same time the symptoms of hyperfunction resulting from overproduction of one kind of hormones and the symptoms of hypofunction due to a deficiency of other kind of hormones can develop.

3. **Eufunction** of endocrine gland, which is in the time of medical examination characterized by normal secretion of its hormone (hormones) as

well as by normal concentration of this hormone (these hormones) in circulating blood. Sometimes, however, other symptoms referring to existence of eufunctional endocrine syndrome can be present.

According to **the place** of endocrine disorder origin, the following types of endocrine disorders can be distinguished:

1. In endocrine glands regulated by the hypothalamic-pituitary system the following disorders can develop:

- A. **Primary** (peripheral) hypofunction or hyperfunction. The cause of the disorder of hormonal secretion is in peripheral (target) endocrine gland.
- B. **Secondary** (central adenohypophyseal) hypofunction or hyperfunction. The cause of the disorder of hormonal secretion of peripheral endocrine gland is in the adenohypophysis (the anterior pituitary).
- C. **Tertiary** (central hypothalamic) hypofunction or hyperfunction. The cause of the hormonal secretion disorder of peripheral endocrine gland is in the hypothalamus.

2. The cause of the origin of primary hyperfunction or hypofunction of those endocrine glands, which are not regulated by the hypothalamic-pituitary system, is also in the endocrine glands themselves, but their secondary hyperfunction is caused by extra-glandular (non-hormonal) stimulus, e.g., secondary hyperaldosteronism or secondary hyperparathyroidism.

3. Some hormones can be produced also in the cells of organs which do not belong to the glands of internal secretion. It is **an ectopic production of hormones**, which is autonomous and causes the origin of ectopically conditioned endocrine hyperfunction (ectopic endocrine syndrome). As a rule it is the consequence of production of hormones from non-endocrine neoplastic tissue, and, therefore, this clinical syndrome is also called paraneoplastic endocrine syndrome (**paraneoplastic endocrinopathy**).

4. In unique cases, an endocrine disorder can arise in the consequence of **a defect of hormonal transport** from the place of its origin to the place of its action. This disorder is caused by deficiency or by abundance of a plasma transport protein for the hormone or it is due to the defect of hormone binding to the specific carrier protein.

5. The endocrine disorder can also originate as the consequence of **a defect in target tissue** for the hormone or in the place of hormone degradation. This endocrine disorder can be due to:

- A. A change of number or function (structure) of receptors for individual hormones.
- B. A presence of antibodies against receptors for individual hormones.
- C. A defect on the level of postreceptor effector mechanisms for individual hormones.
- D. An accelerated or slowed conversion of prohormone to active hormone.
- E. A defect of inactivation (degradation) of hormone in peripheral tissues.

The above mentioned defects on the level of target (peripheral) tissues are called pseudohypofunctional or pseudohyperfunctional endocrine disorders (**pseudoendocrinopathies**).

6. Adenomas or carcinomas originated from the cells of dispersed endocrine system, known as Amine Precursor Uptake and Decarboxylation (APUD) system, are called **multiple endocrine neoplasia (MEN)**. Adenomas or carcinomas can be found in several endocrine glands or other endocrine structures. They are typical familial diseases with autosomal dominant type of heredity.

The common characteristic of the APUD cells is ability of secretion of polypeptide hormones with local or general effects, in less extent also ability of secretion of biogenic amines, and in special cases also ability to produce prostaglandins and kinins. A neoplasm of the APUD system (apudoma) can produce not only larger amount of hormone, but usually also more kinds of hormones which cause a variety of the clinical picture of this disease.

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## 5.2 Etiology of endocrine disorders

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The causes of endocrine disorders can be acquired or genetic.

### 1. Acquired causes

- A. **Tumors** of endocrine glands. *Adenomas* (benign neoplasms) are one of the main causes of hyperfunctional endocrine syndrome. They occur more frequently than malignant neoplasms. Adenomas may also cause combined endocrine disorder characterized by the excess of one hormone and by the deficiency of other hormones (e.g., adenoma arising from one type of cells of adenohypophysis causes destruction of other types of its cells). *Malignant neoplasms* of endocrine glands are less frequent. The production of hormones by malignant tumors depends on the degree of differentiation of their cells. If the cells are insufficiently differentiated they usually lose their hormonal activity.
- B. **Inflammatory lesions** of endocrine glands. There are a very frequent cause of hypofunctional endocrine syndromes. Etiological factor of these lesions may be autoimmune process or viral and bacterial infection.
- C. **Disorders of nutrition**. The most frequent cause is the deficiency of iodine needed for the synthesis of thyroid hormones. The increased strumigen intake