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LABORATORY DIAGNOSIS OF TYPE 1 DIABETES MELLITUS

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Abstract
Type 1 diabetes is one of the most pressing health problems in the world, affecting both young people and adults. This autoimmune disease, characterized by complete or partial insulin deficiency, requires constant monitoring of glucose levels and appropriate treatment. The urgency of the problem lies in the increasing number of cases of the disease, as well as its impact on the quality of life of patients. The dangers of type 1 diabetes are not limited to just high blood sugar; it can lead to a number of serious complications, including cardiovascular disease, nephropathy and nervous system damage.

Keywords: Type 1 diabetes mellitus, polydipsia, blood glucose, glycated hemoglobin, glucose tolerance test.

Introduction

Type 1 diabetes mellitus is an autoimmune disease in which the pancreas stops producing insulin, which is necessary to regulate blood sugar levels. This condition most often manifests itself in childhood and adolescence, but can occur at any age. The main causes of this type of diabetes are genetic predisposition and autoimmune processes. as their immune system can incorrectly identify pancreatic cells as foreign and begin to destroy them [1, 11, 14].

In addition, viral infections, such as rubella or mumps viruses, can serve as a trigger for activating the autoimmune process. These infections can damage pancreatic β cells that actively synthesize insulin.

Psychosocial factors can also be a catalyst: stress, poor diet and lack of physical activity can affect the overall condition of the body and contribute to the development of the disease. It is important to understand that the combination of these factors may play a key role in the onset of type 1 diabetes, requiring a comprehensive approach to prevention and treatment.

The pathogenesis of type 1 diabetes mellitus (T1DM) is a complex process based on autoimmune damage to pancreatic beta cells. Genetic predisposition plays a key role in the development of this

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disease, interacting with external factors such as viral infections and exogenous antigens. increased blood glucose levels [1, 8, 17].

In the early stages of pathogenesis, a prior immune response is observed, which may manifest itself in the form of high titers of antibodies to pancreatic cells. Over time, against the background of the ongoing inflammatory process, the pancreas itself loses its function, which leads to pronounced hyperglycemia and concomitant metabolic disorders [3, 12, 13].

The clinical symptoms of type 1 diabetes mellitus are manifested by a variety of and sometimes frightening signs that can significantly affect the patient's quality of life. The main symptomatic groups include polydipsia, polyuria and polyphagia, which is a consequence of metabolic disorders and lack of insulin.

Polydipsia, i.e. increased thirst, occurs as a result of fluid loss due to frequent urination. Polyuria, in turn, is associated with osmotic diuresis, when excess blood glucose levels are excreted in the urine. Polyphagia is an irresistible desire to eat despite normal or increased caloric levels of food consumed [2, 6, 18].

Symptoms can also include fatigue, sudden weight loss for no apparent reason, and frequent infections. It is important to note that these symptoms can progress rapidly and require immediate medical attention.

Laboratory diagnosis of type 1 diabetes mellitus plays a key role in the timely detection and control of the disease. The main method of diagnosis is the determination of the level of glucose in the blood plasma.

Important tests are:

Fasting plasma glucose test: Glucose levels above 7.0 mmol/L indicate possible diabetes.

The glucose tolerance test (GTT) is an important clinical method for diagnosing diabetes mellitus and prediabetes. The test procedure involves measuring blood glucose levels after fasting and then two hours after drinking a special sweet solution containing glucose. This allows you to assess how efficiently the body processes carbohydrates and maintains sugar levels within normal limits. GTT is especially relevant for patients with risk factors such as being overweight, a family history of diabetes, and pregnant women to detect gestational diabetes. When the results are obtained, glucose levels are examined and compared with the established norms. Higher than normal values may indicate the development of type 2 diabetes or impaired glycemic tolerance.

Correct interpretation of the results of GTT is necessary for the appointment of appropriate therapy and the development of an individual program for monitoring the patient's condition.

Glycated hemoglobin (HbA1c) is an important biomarker that serves as an indicator of blood glucose control over the past two to four months. HbA1c is formed as a result of the reaction of hemoglobin with glucose, and the higher the glucose level, the more glycated hemoglobin is formed. Measuring HbA1c allows doctors to assess the effectiveness of diabetes treatment and the risk of complications such as cardiovascular disease, neuropathy and nephropathy.

Optimal HbA1c levels vary from case to case, but usually 6.5% or lower is considered the target value. The use of this test in clinical practice significantly improves the ability to not only diagnose, but also monitor the condition of patients with diabetes. It is important to note that lifestyle changes, including proper diet and physical activity, can contribute to a decrease in HbA1c levels [3, 9, 16].

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The level of ketones in the blood or urine in type 1 diabetes mellitus is an important indicator that can signal the patient's condition and the need for medical intervention. In this type of diabetes, the body is unable to effectively use glucose for energy, which leads to increased formation of ketones, which are by-products of the breakdown of fats. A high concentration of these substances can cause adverse effects, including ketoacidosis, which requires surgery.

Monitoring ketone levels becomes necessary, especially under conditions of stress, illness, or lack of insulin. It is recommended to check ketone levels regularly using special blood or urine tests [2, 10, 15].

It's also important to remember that diet, regular physical activity, and close monitoring of blood sugar levels play a key role in maintaining optimal health and preventing ketones from rising.

Detection of glucose in the urine in type 1 diabetes mellitus is a critical aspect of disease control and patient assessment. In this disease, which is characterized by a lack of insulin, there is an increased level of glucose in the blood, which in turn leads to its appearance in the urine. Glycosuria, that is, the presence of glucose in the urine, often shows a discrepancy between the intake of carbohydrates and the ability of the body to absorb them [1, 5, 19].

When blood glucose levels exceed the renal threshold, which is approximately 10 mmol/L, the kidneys begin to excrete excess glucose in the urine. This phenomenon can serve as an indicator of the need to adjust therapy, as well as signal the occurrence of complications, such as ketoacidosis.

Findings

Early detection and continuous monitoring of these indicators can prevent complications and improve the quality of life of patients with type 1 diabetes mellitus. The importance of competent assessment of test results cannot be overestimated: they serve as the basis for choosing treatment tactics and lifestyle adjustments. In addition, the social and economic burden on health care systems is increasing, which becomes an additional incentive for the development of new methods of treatment and self-management technologies. Research in the field of genetics, immunology and innovative medical technologies allows us to hope for breakthroughs that will change the approach to the treatment and prevention of the disease. Efforts are needed to increase awareness and access to care for people with type 1 diabetes.

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