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CLINICAL AND LABORATORY DIAGNOSTICS OF TYPE 1 DIABETES MELLITUS

Isakulova Muhabbat Mardanovna
Assistant of the Department of Clinical and Laboratory Diagnostics with a Course of Clinical and Laboratory Diagnostics at the Faculty of Postgraduate Education,

Goibova Nilufar
Cadet of the Department of Clinical and Laboratory Diagnostics with a Course of Clinical and Laboratory Diagnostics of FOPE,
Samarkand State Medical University, Uzbekistan, Samarkand

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 is an autoimmune disease in which the pancreas stops producing insulin, which is needed to regulate blood sugar levels. The condition most often appears in childhood and adolescence, but can occur at any age. The main causes of this type of diabetes are genetic predisposition and autoimmune processes. People with certain genes have an increased risk of developing the disease, as their immune system may 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 trigger the activation of the autoimmune process. These infections can damage the β-cells of the pancreas, which actively synthesize insulin.

Psychosocial factors can also be a catalyst: stress, poor nutrition, and lack of physical activity can all impact the overall health of the body and contribute to the development of the disease. It is important to understand that a combination of these factors can play a key role in the development 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 disease, interacting with external factors such as viral infections and exogenous antigens. As a

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result of incorrect recognition of the immune system's own cells, destruction of beta cells begins, which leads to a lack of insulin and an increase in blood glucose levels [1, 8, 17].

In the early stages of pathogenesis, a preceding immune response is observed, which can 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 associated metabolic disorders. These changes invariably contribute to the development of complications, which should be kept in mind during treatment and management of the disease [3, 12, 13].

The clinical symptoms of type 1 diabetes mellitus are varied and sometimes frightening, which can significantly affect the patient's quality of life. The main symptom groups include polydipsia, polyuria, and polyphagia, which are the result of metabolic disorders and insulin deficiency.

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

Symptoms may also include fatigue, sudden weight loss without apparent cause, and frequent infections. It is important to note that these symptoms can progress rapidly and require immediate medical attention.

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

Important tests are:

Fasting plasma glucose test: a glucose level above 7.0 mmol/L indicates possible diabetes.

The glucose tolerance test (GTT) is an important clinical method for diagnosing diabetes 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 effectively the body processes carbohydrates and maintains sugar levels within normal limits.

The GTT is especially useful for patients with risk factors such as being overweight, having a family history of diabetes, and for pregnant women to detect gestational diabetes. When the results are obtained, glucose levels are examined and compared with established norms. Indicators above the norm may indicate the development of type 2 diabetes or impaired glycemic tolerance.

Correct interpretation of GTT results is necessary for prescribing appropriate therapy and developing 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 among individuals, but a target of 6.5% or lower is generally considered. 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

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lifestyle changes, including proper diet and physical activity, can help reduce HbA1c levels [3, 9, 16].

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

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

It is also important to remember that diet, regular physical activity, and careful monitoring of blood sugar levels are key to maintaining optimal health and preventing elevated ketones.

Detection of glucose in urine in type 1 diabetes is a critical aspect of disease management and patient assessment. This disease, characterized by insulin deficiency, is characterized by elevated blood glucose levels, which in turn leads to its appearance in the urine. Glucosuria, that is, the presence of glucose in the urine, often demonstrates a discrepancy between carbohydrate intake and the body's ability 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 may serve as an indicator of the need to adjust therapy, as well as signal the occurrence of complications such as ketoacidosis.

Conclusions

Early detection and continuous monitoring of these indicators help prevent complications and improve the quality of life of patients with type 1 diabetes. The importance of a competent assessment of test results cannot be overestimated: they serve as the basis for choosing treatment tactics and lifestyle correction. In addition, the social and economic burden on health systems is increasing, which is becoming an additional incentive for the development of new treatments and self-monitoring technologies. Research in the fields of genetics, immunology and innovative medical technologies allows us to hope for breakthroughs that will change the approach to 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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