

THE IMPORTANCE OF GLYCATED HEMOGLOBIN IN THE DIAGNOSIS OF DIABETES

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Abstract: Glycated hemoglobin (HbA1c) plays a key role in the diagnosis of diabetes, as it allows you to assess the average blood glucose level over the past three months. This makes it a more reliable indicator than a regular blood glucose test, which can fluctuate depending on a number of factors such as stress, physical activity, and time of day. The determination of HbA1c concentration is a simple and convenient method that allows doctors to quickly establish a diagnosis and begin appropriate treatment. The HbA1c level not only indicates the presence of diabetes, but also allows us to evaluate the effectiveness of the current therapeutic strategy, which significantly affects long-term treatment planning.

Key words: Glycated hemoglobin, enzyme immunoassay, endocrinology, diagnosis, diabetes mellitus

ВАЖНОСТЬ ГЛИКИРОВАННОГО ГЕМОГЛАБИНА В ДИАГНОСТИКЕ ДИАБЕТА

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Аннотация: Гликированный гемоглобин (HbA1c) играет ключевую роль в диагностике диабета, поскольку позволяет оценить средний уровень глюкозы в крови за последние три месяца. Это делает его более надежным показателем, чем обычный тест на уровень глюкозы в крови, который может колебаться в зависимости от ряда факторов, таких как стресс, физическая активность и время суток. Определение концентрации HbA1c является простым и удобным методом, позволяющим врачам быстро установить диагноз и начать соответствующее лечение. Уровень HbA1c не только указывает на наличие диабета, но и позволяет оценить эффективность текущей терапевтической стратегии, что существенно влияет на долгосрочное планирование лечения.

Ключевые слова: Гликированный гемоглобин, иммуноферментный анализ, эндокринология, диагностика, сахарный диабет

The etiology of diabetes is a complex and multifaceted process that involves the interaction of genetic, exogenous and endogenous factors. In recent decades, the prevalence of this disease has increased significantly, which has caused increased interest in its causes. There are two main types of diabetes: type I diabetes, which usually occurs in childhood or adolescence, and type II diabetes, which is most often diagnosed in adults and is associated with obesity. In the first case, the main point is the autoimmune process, in which the immune system destroys the beta cells of the pancreas responsible for the production of insulin. In the second case, the focus is on insulin resistance, when the body's cells become less sensitive to insulin, which leads to an increase in blood glucose levels. Among the factors contributing to the development of type 2 diabetes, one can single out a genetic predisposition, poor nutrition, sedentary lifestyle and stress. Thus, the etiology of diabetes is the result of the interaction of various factors, and understanding these mechanisms is crucial for the prevention and treatment of the disease. [1,14,16].

The pathogenesis of diabetes is a complex and multifaceted process involving genetic, environmental, and metabolic factors. The main types of diabetes are type 1 diabetes, caused by autoimmune destruction of beta cells of the pancreas, and type 2 diabetes, characterized by insulin resistance and insufficient insulin secretion. In the initial stage of type 2 diabetes, fat cells accumulate, which leads to impaired glucose metabolism. Over time, the pancreas cannot cope with the increased need for insulin, which causes hyperglycemia. At the cellular level, there are changes in the signaling pathways responsible for glucose metabolism, which leads to impaired functions of various organs. In addition, chronic inflammation and oxidative stress play a key role in the progression of diabetes. These processes activate various molecules, such as

cytokines, which exacerbate insulin resistance. Thus, the pathogenesis of diabetes includes both systemic and cellular mechanisms, which makes it complex and requires an individualized approach to treatment and prevention. [2, 5, 9,14,16].\

The Diabetes Clinic is a place where knowledge, technology and human warmth are gathered to combat one of the most common diseases of our time. In this noble institution, every patient is treated not just as a diagnosis, but as a goal worthy of attention and care. This is where the medical profession takes on a new meaning.: This is not only treatment, but also training, support, and building long-term relationships with patients. Specialized programs include comprehensive diagnostics, modern selection of medications and psychotherapy sessions, which allows creating favorable conditions for the patient's adaptation to a new lifestyle. Innovative technologies, such as continuous monitoring of sugar levels and the use of mobile apps, help actively manage your condition. However, the main wealth of the clinic is a team of highly qualified specialists who are ready to share their knowledge and experience. Each patient's story is a unique journey that requires sensitivity and a realistic perspective. In the diabetes clinic, everyone can find support, understanding and hope for a better future. The clinical symptoms of type 1 diabetes mellitus are diverse and may manifest themselves differently in each patient. One of the most characteristic signs is polyuria – increased urinary excretion due to high blood glucose levels, which leads to an increase in osmotic pressure and, consequently, to fluid excretion. This is accompanied by polydipsia, a constant thirst caused by dehydration. In addition, patients often report increased appetite (polyphagia), despite weight loss, which is associated with impaired glucose uptake by cells. Due to a lack of insulin in the body, a condition called ketoacidosis occurs, which can be manifested by symptoms such as fatigue, stomach pain, and the characteristic smell of acetone from the mouth. Digestive system disorders, including nausea and vomiting, are also possible. An exacerbation of the condition can lead to confusion and even loss of consciousness. Early signs of the disease require careful monitoring and timely referral to a specialist for diagnosis and initiation of treatment. [2, 4, 6,17,19].

Functional diagnosis of diabetes is a comprehensive approach aimed at identifying and evaluating the underlying mechanisms of the disease. It includes an assessment of both metabolic and hormonal parameters, which allows you to get a complete picture of the patient's condition. Ongoing tests, such as the glucose tolerance test and determination of the level of glycated hemoglobin (HbA1c), help to partially reveal the dynamics of carbohydrate metabolism and the degree of diabetes compensation. Modern methods of functional diagnostics also include tests for the level of insulin, C-peptide and other metabolites, which makes it possible to assess both insulin secretion and tissue sensitivity to its action. This is important for further selection of a therapeutic strategy that is adequate to the patient's needs. It is also worth

noting that functional diagnostics can identify concomitant diseases and metabolic disorders such as dyslipidemia and hypertension, which contributes to the comprehensive management of patients with diabetes. As a result, proper diagnosis and understanding of functional changes in the body make it possible to prescribe an individualized approach to treatment, which has a positive effect on the quality of life of patients. Ultrasound diagnosis of diabetes is a modern imaging technique that allows you to assess the condition of organs and tissues that have undergone changes as a result of the diabetic process. Ultrasound can identify complications such as diabetic nephropathy, where kidney damage occurs, or diabetic retinopathy affecting the retina of the eyes. The ultrasound procedure is safe and painless, which makes it an ideal tool for regular monitoring of patients with diabetes. Special sensors used in the process allow you to get clear and detailed images that facilitate fast and accurate diagnosis. Ultrasound capabilities also include an assessment of the condition of soft tissues, which makes it possible to determine the presence of fatty liver infiltration, which turns into liver failure in the absence of treatment. Due to the high sensitivity of the method, ultrasound diagnostics becomes an important addition to traditional tests, allowing timely detection of possible complications and control over the course of the disease. Accordingly, regular ultrasound can significantly improve the prognosis for patients with diabetes. [2,14,16].

Laboratory diagnosis of diabetes plays a key role in the timely detection and control of the disease. It includes many studies aimed at assessing blood glucose levels, as well as determining other important metabolic parameters. The main diagnostic methods include measuring fasting blood plasma glucose, a glucose tolerance test, and determining the level of glycated hemoglobin (HbA1c). The first test reveals the presence of hyperglycemia, while the second gives an idea of the body's response to carbohydrates, and HbA1c reflects the average glucose level over the past three months. Additionally, other studies can be used, such as an analysis for the presence of antibodies to pancreatic islet cells, which helps to differentiate the types of diabetes. It is important that laboratory tests are conducted in accordance with international standards, which ensures high accuracy and reliability of the results obtained. Timely diagnosis allows not only to prevent the development of complications, but also to significantly improve the patient's quality of life, as well as optimize therapeutic approaches in the early stages of the disease. Glycohemoglobin, or HbA1c, is an important indicator that is used to assess blood glucose control in patients with diabetes mellitus. This analysis is based on measuring the percentage of hemoglobin that interacts with glucose, a formula-related complex. With elevated blood sugar levels, glucose binds more actively to hemoglobin, which leads to an increase in HbA1c concentration. The standard values of this indicator are in the range of 4.0-5.6%, while for diabetics, targets below 7.0% are recommended, which corresponds to more stable

glucose control. HbA1c allows the doctor to evaluate the effectiveness of therapy, identify possible complications and adjust treatment. This test has certain advantages, as it does not require fasting and gives an idea of the glucose level over the past 2-3 months. Thus, glycohemoglobin plays a key role in the management of diabetes mellitus, allowing not only to monitor the patient's condition, but also to develop individualized therapy plans.[2, 9, 11,14,20].

Insulin plays a key role in regulating blood sugar levels in diabetes mellitus. Under normal conditions, this hormone, produced by the pancreas, promotes the absorption of glucose by the body's cells, thereby reducing its concentration in the blood. However, in diabetes mellitus, the function of insulin is disrupted: in the case of type I diabetes, the pancreas does not produce enough insulin, and in type II diabetes, the cells become resistant to its actions.

When blood sugar levels rise, the body begins to try to compensate by producing more insulin, which in turn can lead to its depletion. As a result, a vicious circle arises, where lack of insulin and high blood glucose concentration become an integral part of the patient's condition, increasing the risk of complications. It is important to properly control the level of insulin in order to maintain the balance of glucose in the blood. This can be achieved through regular monitoring, diet, and, if necessary, insulin therapy, which allows patients to manage their condition and improve their quality of life. [2, 5, 9,14,16].

The glucose tolerance test is an important diagnostic tool used to assess the body's ability to absorb glucose. It is often used to detect prediabetic conditions, type 2 diabetes, and various metabolic disorders. The procedure begins with taking blood in the morning for fasting glucose levels, which allows you to set the baseline blood sugar level. The patient is then asked to drink a solution containing a certain amount of glucose. After that, repeated blood samples are taken at regular intervals, usually after 30, 60, 90 and 120 minutes. These measurements allow you to track how quickly and efficiently the body absorbs glucose and whether sugar levels are restored to normal values. The test results can show various deviations: normal, prediabetes or diabetes, which allows doctors to make informed decisions about further treatment tactics and lifestyle adjustments for the patient. It is important to remember that proper preparation for the test, including following a diet and physical activity regime, plays a key role in obtaining accurate results.

Medical treatment of diabetes mellitus is an integrated approach aimed at controlling blood glucose levels and preventing complications associated with this disease. The most important components of treatment are insulin and oral hypoglycemic drugs. Insulin, as the main hormone regulating sugar metabolism, is used in type I diabetes, as well as in the case of severe type II diabetes. Oral medications such as metformin, sulfonylurea, and SGLT2 inhibitors can achieve stable results

without the need for injections, making the treatment process more convenient and acceptable for patients. An important place in medical treatment is occupied by individualization of treatment – the choice of a specific drug and dosage is carried out taking into account the characteristics of the clinical picture, concomitant diseases and the patient's lifestyle. In addition to the pharmacological effects, the need to monitor glucose levels, diet and physical activity does not lose its importance. Thus, medical treatment of diabetes mellitus is a key aspect of a holistic approach to the treatment and maintenance of patients' quality of life. [2, 5, 9,14,16].

Insulin therapy for diabetes mellitus is a key component in the management of this chronic disease. The main task of insulin therapy is to maintain normal blood glucose levels, which allows patients to avoid serious complications associated with diabetes. Insulin, a hormone produced by the pancreas, is responsible for transporting glucose into the body's cells for its use as an energy source. There are several types of insulins that vary in duration of action and onset of effect. This allows the medicine to adapt to the individual needs of the patient. Insulin therapy can be used both in type I diabetes, where insulin production is completely absent, and in type II diabetes, when the body cannot effectively use the produced insulin. In addition to selecting the right type of insulin, patient education is also an important aspect. Proper use of insulin, knowledge of how to control sugar levels and what factors influence them, play a crucial role in successful therapy. Insulin therapy allows patients not only to control their symptoms, but also to lead a full life, minimizing the risk of long-term complications. [2, 8, 9,15,22].

In addition, understanding the importance of glycated hemoglobin contributes to the early diagnosis of prediabetes, which in turn provides patients with the opportunity to make lifestyle changes and prevent the development of complete diabetes. Thus, HbA1c is becoming not just a diagnostic tool, but also an important element in disease prevention and management strategies, which determines its importance in modern medicine.

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