СОВРЕМЕННЫЕ МЕТОДЫ ОПРЕДЕЛЕНИЯ УРОВНЯ ГЛЮКОЗЫ В КРОВИ У БОЛЬНЫХ САХАРНЫМ ДИАБЕТОМ

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АННОТАЦИЯ

Сахарный диабет является хроническим эндокринным заболеванием, основным патогенетическим признаком которого является гипергликемия. Точное и своевременное определение уровня глюкозы в крови имеет ключевое значение для ранней диагностики сахарного диабета, оценки эффективности лечения и профилактики осложнений. В последние годы в клинической практике широко внедряются современные лабораторные, портативные и системы непрерывного мониторинга глюкозы. В данной статье рассмотрены современные методы определения уровня глюкозы в крови у больных сахарным диабетом, их клиническое значение, преимущества и ограничения.

Ключевые слова: сахарный диабет, гликемия, мониторинг глюкозы, глюкометр, гликированный гемоглобин, CGM.

MODERN METHODS FOR DETERMINING BLOOD GLUCOSE LEVELS IN PATIENTS WITH DIABETES MELLITUS

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ABSTRACT

Diabetes mellitus is a chronic endocrine disease characterized primarily by persistent hyperglycemia. Accurate and reliable assessment of blood glucose levels is essential for early diagnosis, monitoring treatment efficacy, and preventing complications of diabetes mellitus. In recent years, modern laboratory methods, portable devices, and continuous glucose monitoring systems have been widely

implemented in clinical practice. This article analyzes contemporary methods for determining blood glucose levels in patients with diabetes mellitus, highlighting their clinical significance, advantages, and limitations.

Keywords: diabetes mellitus, glycemia, glucose monitoring, glucometer, glycated hemoglobin, CGM.

Introduction

Diabetes mellitus (DM) represents one of the most significant global public health challenges of the 21st century due to its steadily increasing prevalence, chronic course, and high risk of disabling complications. According to data from **World Health Organization** and **International Diabetes Federation**, the number of individuals affected by diabetes continues to rise worldwide, imposing a substantial burden on healthcare systems and national economies.

The fundamental pathophysiological hallmark of diabetes mellitus is chronic hyperglycemia, which results from impaired insulin secretion, insulin resistance, or a combination of both. Sustained elevation of blood glucose levels leads to progressive damage of various organs and systems, including the cardiovascular system, kidneys, eyes, and peripheral nerves. Microvascular and macrovascular complications remain the leading causes of morbidity and mortality among patients with diabetes mellitus.

Accurate measurement of blood glucose is therefore essential not only for establishing the diagnosis of diabetes but also for monitoring disease progression and evaluating the effectiveness of therapeutic interventions. Traditional laboratory-based biochemical methods have long been considered the gold standard for glucose determination. However, these methods provide only a snapshot of glycemic status and are insufficient for capturing daily glucose fluctuations.

In response to these limitations, modern approaches to glucose monitoring have emerged, including portable glucometers, measurement of glycated hemoglobin (HbA1c), and continuous glucose monitoring (CGM) systems. These technologies have revolutionized diabetes management by enabling more precise, dynamic, and individualized glycemic control.

Particularly noteworthy is the growing role of CGM systems, which allow real-time monitoring of glucose levels and provide valuable information on glycemic

variability, nocturnal hypoglycemia, and postprandial hyperglycemia. The integration of such technologies into routine clinical practice aligns with the contemporary paradigm of personalized medicine in diabetes care.

The aim of this article is to comprehensively review modern methods for determining blood glucose levels in patients with diabetes mellitus, analyze their clinical applicability, and discuss their advantages and limitations.

Materials and Methods

This review is based on a comprehensive analysis of international scientific literature, including clinical guidelines, original research articles, and systematic reviews related to blood glucose monitoring in diabetes mellitus. The following methods were evaluated:

- Laboratory biochemical determination of glucose in venous and capillary blood
- Self-monitoring of blood glucose using portable glucometers
- Measurement of glycated hemoglobin (HbA1c)
- Continuous glucose monitoring (CGM) systems
- Emerging minimally invasive and non-invasive glucose sensing technologies

The methods were compared in terms of accuracy, clinical relevance, practicality, and applicability in various patient populations.

Results

The analysis demonstrated that modern glucose monitoring methods offer complementary information and differ in their clinical utility:

1. **Laboratory biochemical methods** provide high analytical accuracy and remain essential for diagnosis and confirmation of diabetes mellitus.
2. **Portable glucometers** enable frequent self-monitoring, facilitating day-to-day glycemic control and treatment adjustments.
3. **HbA1c measurement** reflects average glycemia over the preceding 2–3 months and serves as a key indicator of long-term metabolic control.
4. **Continuous glucose monitoring systems** provide detailed insights into glycemic patterns, variability, and hidden hypo- or hyperglycemic episodes.
5. **Advanced biosensor technologies** aim to reduce invasiveness and improve patient comfort while maintaining measurement accuracy.

Discussion

The findings of this review highlight that no single method of glucose determination can fully capture the complexity of glycemic control in diabetes mellitus. Laboratory-based glucose measurements remain indispensable for diagnostic purposes; however, their inability to reflect daily glycemic variability limits their usefulness for ongoing disease management.

Self-monitoring of blood glucose using glucometers has become a cornerstone of diabetes self-care. It empowers patients to actively participate in their treatment and supports timely therapeutic decisions. Nevertheless, glucometer readings may be influenced by user technique, hematocrit levels, and environmental factors, which should be considered during interpretation.

HbA1c is widely recognized as the gold standard for assessing long-term glycemic control and predicting the risk of chronic complications. Despite its clinical value, HbA1c does not capture short-term glucose excursions and may be affected by conditions such as anemia or hemoglobinopathies.

The introduction of CGM systems represents a major advancement in diabetes management. These systems provide continuous, real-time data, allowing early detection of dangerous glycemic events and facilitating individualized therapy. CGM is particularly beneficial for patients with type 1 diabetes, pregnant women, children, and individuals with unstable glycemic control.

Ongoing research into minimally invasive and non-invasive glucose monitoring technologies holds promise for further improving patient adherence and quality of life. The widespread adoption of these innovations may significantly enhance future diabetes care.

Overall, the selection of glucose monitoring methods should be individualized, taking into account patient characteristics, type of diabetes, disease duration, and risk of complications.

Conclusion

Modern methods for determining blood glucose levels in patients with diabetes mellitus provide high diagnostic and clinical value. Their combined and rational use enables effective glycemic control, reduces the risk of complications, and improves patient outcomes. Continued technological innovation and integration of

advanced monitoring systems are expected to further optimize diabetes management.

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