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Predicting the Course of Pregnancy in Women with Diabetes Mellitus After COVID-19 Using Continuous Glucose Monitoring (CGM) Systems and Digital Remote Monitoring Devices

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Abstract
Diabetes mellitus is a significant risk factor for complicated pregnancy. COVID-19 infection can exacerbate metabolic and vascular disorders, increasing the likelihood of adverse perinatal outcomes. In recent years, continuous glucose monitoring (CGM) systems and digital remote monitoring devices have been actively implemented to continuously monitor the physiological parameters of pregnant women.

Keywords: pregnancy, diabetes mellitus, COVID-19, CGM, remote monitoring, digital medicine, prognosis, telemedicine

Introduction

Currently, there is an increasing prevalence of diabetes mellitus among women of reproductive age. At the same time, the consequences of previous coronavirus infection remain the subject of active investigation, especially in pregnant women. The combination of diabetes mellitus and previous COVID-19 infection is associated with an increased risk of:

- placental insufficiency,
- preeclampsia,
- preterm birth,
- fetal hypoxia.

Traditional monitoring methods do not always allow for the timely detection of early signs of complications, since measurements are performed only periodically. The use of digital medical technologies creates opportunities for continuous monitoring of pregnant women and prediction of pregnancy outcomes based on objective data. The aim of this study was to evaluate the effectiveness of continuous glucose

monitoring (CGM) systems and digital remote monitoring devices for predicting pregnancy outcomes in women with diabetes mellitus after COVID-19 infection.

Research objectives

1. To study the dynamics of glycemic indicators in pregnant women using CGM.
2. To evaluate changes in cardiovascular and respiratory system parameters.
3. To identify risk factors for complicated pregnancy outcomes.
4. To assess the potential of remote monitoring for early prediction of complications.

Scientific novelty

The scientific novelty of this study lies in the comprehensive evaluation of:

- continuous glucose monitoring indicators,
- pulse oximetry data,
- blood pressure parameters,
- laboratory markers of inflammation and coagulation

for predicting pregnancy outcomes in women with diabetes mellitus after COVID-19 infection.

According to international studies, the use of CGM in pregnant women with diabetes mellitus reduces the frequency of hyperglycemia and improves perinatal outcomes. Recent studies have demonstrated that pregnant women after COVID-19 more frequently exhibit signs of endothelial dysfunction and microcirculatory disturbances. Telemedicine technologies enable remote patient monitoring, increasing the effectiveness of medical supervision and reducing the burden on healthcare institutions. However, comprehensive studies integrating glycemic monitoring, cardiovascular indicators, and laboratory data remain limited.

Materials and methods

The study was conducted over a 12-month period at a perinatal center.

Characteristics of the participants

The study included 64 pregnant women who had recovered from COVID-19 and had diabetes mellitus:

- gestational diabetes mellitus — 40 patients (62.5%)
- type 2 diabetes mellitus — 16 patients (25%)
- type 1 diabetes mellitus — 8 patients (12.5%)

The mean age was 30.1 ± 3.8 years.

The following tools were used in the study:

- continuous glucose monitoring (CGM) systems;
- electronic blood pressure monitors;
- pulse oximeters;

- wearable devices for heart rate and physical activity monitoring;
- mobile applications for remote data transmission.

CGM systems recorded glucose levels every 5 minutes (up to 288 measurements per day).

Research methods

The following parameters were evaluated:

- mean glucose level;
- glycemic variability;
- HbA1c;
- blood pressure;
- oxygen saturation;
- C-reactive protein level;
- D-dimer level;
- pregnancy outcomes.

Statistical and correlation analysis methods were applied.

Indicator	Value
Mean glucose level (CGM)	6.3 ± 0.9 mmol/L
Hyperglycemia episodes > 8.5 mmol/L	19 patients (29.7%)
Mean HbA1c level	6,5 ± 0,6%
Oxygen saturation decrease to 93–94%	10 patients (15.6%)
Blood pressure > 140/90 mmHg	12 patients (18.7%)
Elevated D-dimer level	15 patients (23.4%)
Placental insufficiency	14 cases (21.8%)
Vaginal delivery	41 cases (64%)
Preterm birth	11 cases (17%)
Cesarean section	12 cases (19%)

It was established that complications occurred more frequently in patients with:

- glycemic variability greater than 30%;
- HbA1c above 7%;
- episodes of hypoxia;
- elevated blood pressure.

The obtained data indicate the high informativeness of continuous glucose monitoring and remote observation. CGM enables the detection of hidden glycemic fluctuations that may remain unnoticed during traditional measurements.

Comprehensive monitoring of physiological parameters allows the identification of high-risk groups and early prediction of pregnancy complications.

Conclusion

1. Pregnant women with diabetes mellitus after COVID-19 infection belong to a high-risk group for pregnancy complications.
2. The use of CGM significantly improves the quality of glycemic control.
3. Remote monitoring enables early detection of complication signs.
4. The most significant prognostic factors are glycemic variability, HbA1c, oxygen saturation, and blood pressure.

Practical recommendations

1. Include CGM systems in the standard monitoring protocol for pregnant women with diabetes mellitus.
2. Use remote monitoring technologies in outpatient clinical practice.
3. Develop digital platforms for integration of monitoring data.
4. Conduct further studies using artificial intelligence methods.

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