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ORIGINAL ARTICLE

ANALYSIS OF ADHERENCE TO POSTPARTUM SCREENING FOR EARLY DYSGLYCEMIA IN WOMEN WITH PREVIOUS GESTATIONAL DIABETES

ANALIZA ADHERENCIJE ZA POSTPARTALNI SKRINING NA RANI POREMEĆAJ GLIKOREGULACIJE U ŽENA SA PRETHODNIM GESTACIJSKIM DIJABETESOM

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Abstract

Introduction: Previous studies have shown that women with gestational diabetes (GD) are at higher risk for residual postpartum dysglycemia. Nevertheless, adherence to early postpartum screening among women with previous GD is extremely unsatisfactory.

Aim: Analysis of clinical, anthropometric and sociodemographic characteristics of women with previous GD who were screened during the early postpartum period for residual dysglycemia.

Material and methods: Number of 102 pregnant women with GD were divided into groups based on the early postpartum screening for dysglycemia: group A, screened (n = 19), and group B, not screened (n = 83). We analysed age, body mass index (BMI), parity, smoking habits, having GD in previous and gestational hypertension in the current pregnancy, family history of type 2 diabetes (T2D), glycemic parameters (fasting glucose (FG) and HbA1c in the 2nd and 3rd trimester), therapeutic regimen, number of endocrinology outpatient visits and hospitalizations, pregnancy outcomes and results of screening oral glucose tolerance test using appropriate statistics.

Results: Postpartum screening was conducted in 18.6% (group A), among whom prediabetes was diagnosed in 26.3% of women with previous GD. Women in group A were older (36.21 ± 5.05) than in group B (33.48 ± 5.57 years, p = 0.047). Groups did not differ regarding preconception BMI (A: 28.03 ± 5.69 kg/m^2 vs B: 28.17 ± 6.84 kg/m^2, p = 0.971), second and third trimester FG* (A: 4.64 ± 0.92 mmol/L vs B: 4.62 ± 0.77 mmol/L, p = 0.953; A: 4.61 ± 0.73 mmol/L vs B: 4.91 ± 1.02 mmol/L, p = 0.507, respectively) and HbA1c (A: 5.06 ± 0.40% vs B: 5.18 ± 0.64%, p = 0.621; A: 5.30 ± 0.34% vs B: 5.25 ± 0.54%, p = 0.690, respectively). On the other hand, women in group A (3.57 ± 1.51) more frequently attended outpatient endocrinology examinations than women in group B (2.68 ± 1.16, p = 0.028).

Conclusion: Our results implied very low adherence to early postpartum screening, while women with previous GD who underwent early postpartum screening for residual dysglycemia were older and had more frequent ambulatory endocrinology visits during pregnancy.

Keywords:
screening adherence, gestational diabetes, early postpartum dysglycemia

The authors declare no conflicts of interest.

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Sažetak

Uvod: Prethodna istraživanja ukazuju na povišen rizik za zaostali poremećaj glikoregulacije postpartalno u žena sa gestacijskim dijabetesom (GD). Ipak, adherencija za rani postpartalni skrining među ženama sa prethodnim GD je izrazito nezadovoljavajuća.
Cilj: Cilj rada je analiza kliničkih, antropometrijskih i sociodemografskih karakteristika žena sa prethodnim GD u kojih je sproveden rani postpartalni skrining na zaostali poremećaj glikoregulacije.
Materijal i metode: Trudnice sa GD (102) podeljene su u dve grupe na osnovu sprovođenja ranog postpartalnog skrininga na: grupu A - skrining sproveden (n = 19) i grupu B - skrining nije sproveden (n = 83). Analizirani su: starost, indeks telesne mase (ITM), paritet, pušačke navike, postojanje GD u prethodnoj trudnoći i gestacijska hipertenzija (GH) u aktuelnoj trudnoći, pozitivna porodična anamneza (PA) za tip 2 dijabetesa (T2D), parametri glikoregulacije (glikemija i HbA1c u 2. i 3. trimestru), terapijski režim, broj ambulantnih pregleda endokrinologa i hospitalizacija, ishodi trudnoće, kao i rezultati skrininga oralnog testa opterećenja glukozom (OGTT) korišćenjem odgovarajuće statistike.
Rezultati: Postpartalni skrining je sproveden u 18,6% žena (grupa A), čime je u 26,3% žena postavljena dijagnoza predijabetesa. U grupi A ispitanice su bile starije životne dobi (36,21 ± 5,05 godina) nego u grupi B (33,48 ± 5,57 godina, p = 0,047). Grupe se nisu razlikovale po ITM (A: 28,03 ± 5,69 kg/m² vs B: 28,17 ± 6,84 kg/m², p = 0,971) i glikemiji našte u drugom i trećem trimestru (A: 4,64 ± 0,92 mmol/L vs B: 4,62 ± 0,77 mmol/L, p = 0,953; A: 4,61 ± 0,73 mmol/L vs B: 4,91 ± 1,02 mmol/L, p = 0,507) i HbA1c (A: 5,06 ± 0,40% vs B: 5,18 ± 0,64%, p = 0,621; A: 5,30 ± 0,34% vs B: 5,25 ± 0,54%, p = 0,690). S druge strane, žene u grupi A (3,57 ± 1,51) češće su odlazile na ambulantne kontrole endokrinologa nego žene u grupi B (2,68 ± 1,16, p = 0,028).
Zaključak: Naši rezultati ukazuju na izrazito nezadovoljavajuću adherenciju za rani postpartalni skrining, dok su žene sa prethodnim gestacijskim dijabetesom, u kojih je sproveden rani postpartalni skrining, bile starije životne dobi i imale veći broj ambulantnih poseta endokrinologu tokom trudnoće.

Ključne reči:
adherencija za skrining, gestacijski dijabetes, rani poremećaj glikoregulacije

Introduction

It is well established that gestational diabetes (GD) is associated with an increased risk of developing type 2 diabetes (T2D) over the lifetime (1). Women with previous GD have a 10-fold increased risk of developing T2D compared to women without GD (2). Furthermore, numerous studies suggest that women with a history of GD are at higher risk of early postpartum dysglycemia, including prediabetes (PD) and T2D (3, 4). In this context, current recommendations from the American Diabetes Association (ADA) call for screening of all women with a history of GD between 4 and 12 weeks postpartum for persistent postpartum dysglycemia using a 2-hour oral glucose tolerance test (OGTT) with 75 grams of glucose (5, 6).

However, even in the countries with developed healthcare systems adherence to this screening is notably unsatisfactory (7), with adherence rates reaching only approximately 20% (8). This has led to the belief that the prevalence of postpartum dysglycemia is underestimated (7).

Prior studies indicate older age (7, 9), better glycemic control during pregnancy (10, 11), multiparity and GD in previous pregnancies (10), as well as a higher number of outpatient endocrinology visits in pregnancy (12) could be predictors of successful screening.

In that context, this study aimed to analyse clinical, anthropometric and socio-demographic characteristics of women with previous GD who underwent the early postpartum screening for residual dysglycemia.

Material and methods

The study included 102 pregnant women with GD who were treated either outpatient or inpatient at the Center for Diabetes and Lipid Disorders, Clinic for Endocrinology, Diabetes and Metabolic Disease, University Clinical Center of Serbia, between January 1, 2020, and June 1, 2023. The research was conducted as a retrospective analysis of medical records.

The inclusion criterion was a diagnosis of GD confirmed by a standard 2-hour OGTT using 75 grams of glucose, conducted between the 24th and 28th weeks of gestation, according to the ADA's recommendation. The exclusion criteria were other forms of pregestational diabetes (type 1 or T2D, monogenic diabetes), as well as pregnancies complicated by early onset GD (diagnosed before the 24th week of gestation).

For all participants, we analyzed age, parity, preconception body mass index (BMI), the presence of chronic diseases in personal medical history, gestational hypertension (GH) in the current or GD in previous pregnancy, family history of T2D, therapeutic regimen, number of outpatient visits, and hospitalizations in our department during pregnancy. Additionally, glycemic parameters for all participants during pregnancy were monitored, including

fasting blood glucose and glycated hemoglobin (HbA1c) levels in the second and third trimesters. Simultaneously, data were also collected on maternal (preterm birth, cesarean section) and neonatal outcomes (anthropometric characteristics of the newborn: birth weight, length, head circumference and Apgar score). Furthermore, adherence to postpartum screening for residual dysglycemia, such as PD or T2D, was analyzed, more specifically the frequency of 2-hour OGTT with 75 grams of glucose performed 4 - 12 weeks postpartum.

Based on the adherence to early postpartum screening, participants were divided into two groups: group A (n = 19), consisting of women who completed the test, and group B (n = 83), consisting of women who did not undergo the screening.

Fasting glucose and glucose values during OGTT were measured using the glucose oxidase method (Beckman glucose analyzer), and HbA1c levels were determined using a commercial reagent (SEBIA).

Gestational hypertension was defined as a recorded systolic blood pressure exceeding 140 mm Hg and/or diastolic blood pressure exceeding 90 mm Hg after the 20th week of gestation (13). Preterm birth was defined as delivery before the 37th week of gestation but after the point of viability, which is 20 weeks of gestation (13). A newborn was considered small for gestational age (SGA) if the birth weight was below the 10th percentile for gestational age, or large for gestational age (LGA) if the birth weight was above the 90th percentile for gestational age (14).

All pregnant women were monitored by an endocrinologist monthly during pregnancy after GD was diagnosed. During the last outpatient visit during pregnancy, they were educated about the importance of postpartum screening 4 - 12 weeks after delivery.

Worsening of glycemic control requiring insulin therapy was an indication for hospitalization of women with GD.

The study was planned and conducted in accordance with the ethical standards of the Helsinki Declaration and was approved by the Ethics Committee for Student Scientific Research of the Faculty of Medicine University of Belgrade

Statistical Analysis

Descriptive and analytical statistical methods were used in the study. Descriptive statistics for numerical data were presented using measures of central tendency (mean) and variability (standard deviation). Categorical data were presented as absolute and relative frequencies.

Analytical statistical methods included significance tests: Fisher's exact test for categorical data or the independent samples T-test for numerical data with normal distribution, and the Mann-Whitney U test for numerical data without normal distribution.

Statistical analysis was performed using the SPSS statistical software (SPSS for Windows, release 26.0, SPSS, Chicago, IL).

Results

The average age of pregnant women with GD included in the study was 34.01 ± 5.56 years, with a preconception BMI of 28.13 ± 6.39 kg/m² (**table 1**). Concurrently, 61.5% of the pregnant women were multiparous, and 33.3% previously had GD (**table 1**). Additionally, 45.8% of the participants had a family history of T2D (**table 1**). On the other hand, 11.5% had also been diagnosed with GH during the current pregnancy (**table 1**).

Following the diagnosis of GD, the majority of

Table 1. Anthropometric and socio-demographic characteristics of pregnant women with GD

	All participants	Group A	Group B	p
N (%)	102	19 (18.6%)	83 (81.4%)	
Age (mean ± sd)	34.01 ± 5.56	36.21 ± 5.05	33.48 ± 5.57	**0.047**
Preconception BMI (kg/m²) (mean ± sd)	28.13 ± 6.39	28.03 ± 5.69	28.17 ± 6.84	0.971
Multiparity (%)	61.5	44.4	65.4	0.114
Smoking habits (%)	33.3	0.0	40.7	0.077
Previous GD (%)	33.3	22.2	35.3	0.704
GH (%)	11.5	5.3	13.0	0.687
Family history for T2D (%)	45.8	41.2	47.0	0.787

BMI - body mass index; GD - gestational diabetes; GH - gestational hypertension; T2D - type 2 diabetes

Table 2. Therapeutic regimen during pregnancy complicated by GD

Therapeutic regimen	All participants	Group A	Group B	p
Dietary intervention (%)	84.0	78.9	85.2	NA
Metformin (%)	7.0	15.8	4.9	NA
Insulin therapy (%)	9.0	5.3	9.9	NA

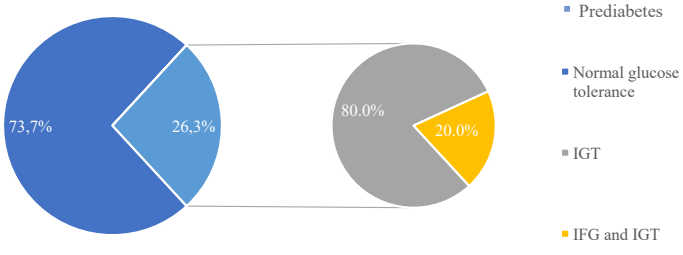

Figure 1. Dysglycemia in early postpartum (IGT-impaired glucose tolerance; IFG-impaired fasting glucose)

Table 3. Glycemic parameters and 2h-OGTT (oral glucose tolerance test) in pregnancy

	All participants	Group A	Group B	p
Glycaemia in 0' OGTT (mmol/L) (mean ± sd)	5.18 ± 0.85	4.87 ± 0.70	5.25 ± 0.87	0.064
Glycaemia in 60' OGTT (mmol/L) (mean ± sd)	10.64 ± 2.16	10.39 ± 1.80	10.69 ± 2.23	0.743
Glycaemia in 120' OGTT (mmol/L) (mean ± sd)	8.82 ± 2.09	9.00 ± 1.84	8.78 ± 2.15	0.466
Glycaemia 2nd trimester (mmol/L) (mean ± sd)	4.63 ± 0.80	4.64 ± 0.92	4.62 ± 0.77	0.953
Glycaemia 3rd trimester (mmol/L) (mean ± sd)	4.85 ± 0.97	4.61 ± 0.73	4.91 ± 1.02	0.507
HbA1c 2nd trimestar (%)	5.15 ± 0.59	5.06 ± 0.40	5.18 ± 0.64	0.621
HbA1c 3rd trimestar (%)	5.26 ± 0.51	5.30 ± 0.34	5.25 ± 0.54	0.690

pregnant women (84%) underwent only dietary intervention, 7% received metformin monotherapy, and 9% required insulin therapy (**table 2**).

Postpartum screening for residual dysglycemia was conducted in 18.6% (Group A, n = 19) of all participants, while 81.4% of the women (Group B, n = 83) did not undergo the screening (**table 1**). According to OGTT, 26.3% of women with previous GD were diagnosed with PD. In this regard, the majority of patients with PD had glucose intolerance (80%), whereas 20% had both impaired fasting glucose and glucose intolerance (**figure 1**).

When analyzing age during pregnancy, women in Group A were older (A: 36.21 ± 5.05 vs B: 33.48 ± 5.57, p = 0.047) (**table 1**). However, no significant differences were observed in preconception BMI, the prevalence of multiparity, smoking habits, GD in a previous pregnancy, or GH during the current pregnancy, nor in the presence of family history for (**table 1**).

Furthermore, glycemic parameters, including fasting glucose in the second and third trimester, HbA1c in the second and third trimester, as well as glucose levels at 0', 60', and 120' during OGTT, did not differ significantly between the groups (**table 3**).

On the other hand, a significant difference was observed in the number of outpatient endocrinology visits between the groups (A: 3.57 ± 1.51 vs B: 2.68 ± 1.16, p = 0.028), while no significant difference was noted in the occurrence of (**table 4**).

Regarding pregnancy outcomes, there were no significant differences in the anthropometric characteristics of the neonates: birth weight neonatal length, and head circumference, Apgar score, presence of SGA, and LGA (**table 5**). Additionally, analysed groups had comparable rates of preterm birth and cesarean delivery (**table 5**).

Discussion

This retrospective study has demonstrated that screening was conducted in only every fifth patient with a history of GD. Simultaneously, PD was identified in nearly one-third of patients who underwent postpartum screening for residual dysglycemia. Conversely, patients who successfully underwent postpartum screening were older and had a higher number of outpatient endocrinology visits during their previous pregnancy.

In routine clinical settings, postpartum screening of women with previous GD is of particular importance, given that these women are at an increased risk of PD or diabetes, not only during their lifespan, but also in the early postpartum period. Despite this, postpartum screening for residual dysglycemia in women with previous GD is frequently not performed. In this regard, previous studies have indicated that the 2-hour OGTT in the early postpartum period was conducted in only a quarter of patients with a history of GD, which is partially consistent with our findings. Concurrently, earlier studies have shown that

Table 4. Contacts with endocrinologist during pregnancy among women with gestational diabetes

	All participants	Group A	Group B	p
Number of outpatient visits (mean ± sd)	2.81 ± 1.25	3.57 ± 1.51	2.68 ± 1.16	**0.028**
Hospitalizations (mean ± sd)	0.11 ± 0.31	0.07 ± 0.258	0.12 ± 0.32	0.570

Table 5. Pregnancy (neonatal and maternal) outcomes among women with gestational diabetes

	All participants	Group A	Group B	p
Birth weight of newborn (g) (mean ± sd)	3243.12 ± 491.92	3354.44 ± 555.05	3210.81 ± 472.03	0.328
Length of newborn (cm) (mean ± sd)	49.89 ± 2.39	50.40 ± 2.56	49.77 ± 2.35	0.396
Head circumference of newborn (cm) (mean ± sd)	34.53 ± 1.42	34.36 ± 1.75	34.56 ± 1.37	0.974
Apgar score (mean ± sd)	8.94 ± 0.37	9.00 ± 0.37	8.92 ± 0.38	0.469
Small for gestational age (%)	10.5	6.7	11.5	0.503
Large for gestational age (%)	11.8	6.7	13.1	0.678
Preterm labor (%)	15.2	15.8	15.0	0.594
Cesarian section (%)	31.6	26.3	33.3	0.778

the prevalence of all glycemic disorders (PD and diabetes) in the early postpartum period varies (from 12.8% to 56%) based on the characteristics of the studied population, the study design, and the diagnostic criteria used for PD. Additionally, one study reported an incidence of PD among women with previous GD three months postpartum at 28.9% (15), which is consistent with our results.

Given the inadequate adherence to postpartum screening and the frequency of glycemic disorders in the postpartum period, there is a significant risk of underrecognition and delay in the diagnosis of PD or diabetes. Therefore, it is of clinical, and public health importance as well, to timely identify the characteristics of women with previous GD and those who have undergone successful postpartum screening to diagnose potential glycemic disorders and implement preventive strategies.

While this study did not reveal a significant impact, various studies had conflicting results regarding the influence of glycemic parameters and glucose values measured during OGTT in pregnancy, as well as gestational age at the time of GD diagnosis, on the likelihood of early postpartum screening. However, these studies have highlighted worse glycemic control in women who did not undergo early postpartum screening (10, 11), suggesting higher incidences of glycemic disorders immediately following pregnancy than those recorded.

Analysing maternal age and adherence to postpartum screening, some studies did not indicate significant differences (12, 16), while other studies found that women who underwent screening were older (7, 9), which is also reflected in the results. Additionally, the contribution of socioeconomic status to non-compliance with medical recommendations has been confirmed in numerous studies (17), though it was not analysed in this research due to missing data.

Current diabetological guidelines suggest more frequent outpatient monitoring of pregnant women with GD to assess glycemic control, which was applied to patients. Furthermore, several studies have highlighted the importance of the number of visits to an endocrinologist during pregnancy for the success of screening (12), which is confirmed by the study. Specifically, patients who successfully underwent postpartum screening had more frequent contact with an endocrinologist during pregnancy.

It is noteworthy that conventional cardiometabolic risk factors (BMI, family history of diabetes, tobacco use) recorded in patients with previous GD were not associated with significantly improved success in postpartum screening, which is consistent with data in the literature (6, 11, 12, 15, 16). Although some studies have suggested that GD in a previous pregnancy may affect adherence to postpartum screening in subsequent pregnancies (12, 16), this was not confirmed in the study.

Regarding parity, a study by Ferrara A. and colleagues demonstrated that postpartum screening is more successful in multiparous women with previous GD (10), which was not confirmed in the study. On the other hand, results align with previous studies that excluded a connection between adverse perinatal outcomes and increased adherence to postpartum screening (11, 12).

The necessity of insulin therapy during pregnancy complicated by GD may lead patients to perceive an increased risk of postpartum hyperglycemia, yet the impact of insulin therapy on screening adherence varies across studies. In this research, no increased adherence to screening was observed in patients who required insulin therapy during pregnancy, which may potentially be explained by sample size.

The limitations of the study are the sample size, as well as the retrospective study design.

Conclusion

Overall, women with previous GD who underwent early postpartum screening for residual dysglycemia were older and had more frequent ambulatory endocrinology visits during pregnancy. In that context, it is essential to define the characteristics of women with successfully conducted screening to adjust education and counseling for pregnant women with GD regarding the importance of early postpartum screening, with the aim of improving adherence and timely diagnosis of PD or T2D.

Literature

1. Li Z, Cheng Y, Wang D, Chen H, Chen H, Ming WK, et al. Incidence rate of type 2 diabetes mellitus after gestational diabetes mellitus: a systematic review and meta-analysis of 170,139 women. J Diabetes Res. 2020; 2020:3076463.
2. Vounzoulaki E, Khunti K, Abner SC, Tan BK, Davies MJ, Gillies CL. Progression to type 2 diabetes in women with a known history of gestational diabetes: systematic review and meta-analysis. BMJ. 2020; 369:m1361.
3. Ikoh Rph CL, Tang Tinong R. The incidence and management of type 2 diabetes mellitus after gestational diabetes mellitus. Cureus. 2023; 15(8):e44468.
4. Kim C, Newton KM, Knopp RH. Gestational diabetes and the incidence of type 2 diabetes: a systematic review. Diabetes Care. 2002; 25(10):1862-8.
5. Nuha E, Grazia A, Vanita A, Raveendhara B, Florence B, Dennis B, et al. Management of diabetes in pregnancy: standards of care in diabetes—2023. Diabetes Care. 2023; 46(Suppl 1):S254-66.
6. Nuha E, Grazia A, Vanita A, Raveendhara B, Florence B, Dennis B, et al. Classification and diagnosis of diabetes: standards of care in diabetes—2023. Diabetes Care. 2023; 46(Suppl 1):S19-40.
7. Blatt AJ, Nakamoto JM, Kaufman HW. Gaps in diabetes screening during pregnancy and postpartum. Obstet Gynecol. 2011; 117(1):61-8.
8. Goueslard K, Cottenet J, Mariet AS, Sagot P, Petit JM, Quantin C. Early screening for type 2 diabetes following gestational diabetes mellitus in France: hardly any impact of the 2010 guidelines. Acta Diabetol. 2017; 54(7):645-51.
9. Beischer NA, Wein P, Sheedy MT. A follow-up program for women with previous gestational diabetes mellitus. Med J Aust. 1997; 166(7):353-7.
10. Ferrara A, Peng T, Kim C. Trends in postpartum diabetes screening and subsequent diabetes and impaired fasting glucose among women with histories of gestational diabetes mellitus: a report from the Translating Research Into Action for Diabetes (TRIAD) Study. Diabetes Care. 2009; 32(2):269-74.
11. Hunt KJ, Conway DL. Who returns for postpartum glucose screening following gestational diabetes mellitus? Am J Obstet Gynecol. 2008; 198(4):404.e1-6.

12. Kim C, Tabaei BP, Burke R, McEwen LN, Lash RW, Johnson SL, et al. Missed opportunities for type 2 diabetes mellitus screening among women with a history of gestational diabetes mellitus. Am J Public Health. 2006; 96(9):1643-8.
13. American College of Obstetricians and Gynecologists' Committee on Practice Bulletins—Obstetrics. Gestational hypertension and preeclampsia: ACOG Practice Bulletin, Number 222. Obstet Gynecol. 2020; 135(6):e237-60.
14. American College of Obstetricians and Gynecologists' Committee on Practice Bulletins—Obstetrics. ACOG Practice Bulletin No. 201: pregestational diabetes mellitus. Obstet Gynecol. 2018; 132(6):e228-48.
15. Retnakaran R, Qi Y, Sermer M, Connelly PW, Hanley AJ, Zinman B. Beta-cell function declines within the first year postpartum in women with recent glucose intolerance in pregnancy. Diabetes Care. 2010; 33(8):1798-804.
16. Kwong S, Mitchell RS, Senior PA, Chik CL. Postpartum diabetes screening: adherence rate and the performance of fasting plasma glucose versus oral glucose tolerance test. Diabetes Care. 2009; 32(12):2242-4.
17. Chaudhry HJ, McDermott B. Recognizing and improving patient nonadherence to statin therapy. Curr Atheroscler Rep. 2008; 10(1):19-24.