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THE ASSOCIATION OF HISTORY OF PREVIOUS SPONTANEOUS ABORTION OR STILLBIRTH WITH SUBSEQUENT RISK OF GESTATIONAL DIABETES MELLITUS

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Abstract

Introduction: Gestational diabetes mellitus [GDM] is a disorder of glucose metabolism, with varying degrees of clinical severity, that first appears during pregnancy. The aim of this study is to examine the association of a history of previous spontaneous abortions and stillbirths with the occurrence of GDM in the current pregnancy.

Material and methods: The study included all pregnant women who underwent an OGTT [Oral Glucose Tolerance Test] for the diagnosis of GDM, in the period of 3 years, in the laboratory of the University Clinic for Endocrinology, Diabetes and Metabolic Disorders – Skopje. Patients were divided into two groups: Study group [with a positive OGTT] and Control group [with negative OGTT]. Anamnestic and laboratory parameters were provided by medical documentation.

Results: The analysis indicated that pregnant women with positive OGTT had a significantly higher number of previous miscarriages compared to pregnant women with a negative OGTT [Pearson Chi-square=8.6521, df=3, p=0.0343]. According to the analysis, pregnant women with a positive OGTT had significantly more stillbirths compared to pregnant women with a negative OGTT status [Pearson Chi-square=9.5779, df=2, p=0.0083].

Conclusion: History of previous miscarriages significantly increases the risk of gestational diabetes mellitus. A history of one miscarriage significantly increases the likelihood of gestational diabetes mellitus by 1.599 times. A history of two miscarriages significantly increases the likelihood of gestational diabetes mellitus by 2.339 times. Pregnant women with a positive history of one previous stillbirth are 4.365 times more likely to have a positive OGTT status compared to pregnant women who have not had any stillbirths.

Keywords: gestational diabetes mellitus, spontaneous abortion, stillbirth

Introduction

Gestational diabetes mellitus [GDM] is a disorder of glucose metabolism, with varying degrees of clinical severity, that first appears during pregnancy [1]. GDM is one of the most common complications in pregnancy. It occurs in 7-25% of pregnancies worldwide [2-4].

The high prevalence of GDM is of concern due to its association with poor perinatal outcomes, but also as a risk for cardiovascular and metabolic complications in later life of mother and child [5-9]. Many population-based studies have shown that the incidence of GDM is increasing in parallel with an increase of the incidence of type 2 diabetes.

With an increase in obesity rates, the prevalence of GDM is expected further to increase [10]. It is important to detect pregnant women with a high risk for occurence of GDM so they can be diagnosed and treated promptly.

It is estimated that approximately 30% of all pregnancies terminate in miscarriage [11,12], and over 43 million elective induced abortions are performed worldwide each year [13].

Several studies have shown that a history of previous miscarriage (especially recurrent miscarriages) is associated with an increased risk of future cardiovascular disease and venous thromboembolism [14-17], and women with a previous induced abortion are at increased risk of developing metabolic disorders and type 2 diabetes [18-20]. This association may be due to oxidative stress and inflammation [19,21], which have also been associated with the development of GDM [22-24].

Women with pre-existing diabetes have a 4–5 fold increased risk of stillbirth compared with the general obstetric population [25,26]. There is inconsistent data in the literature about the incidence of stillbirth in women with gestational diabetes. Several studies have shown an increased incidence of stillbirth in patients with GDM, but less than women who had diabetes before pregnancy [27, 28].

Objectives

The aim of this study is to examine the association of a history of previous spontaneous abortions and stillbirths with the occurrence of GDM in the current pregnancy.

Material and methods

This study is a retrospective analytical case-control study. The study included all pregnant women who underwent an OGTT [Oral Glucose Tolerance Test] for the diagnosis of GDM, in the period of 3 years, in the laboratory of the University Clinic for Endocrinology, Diabetes and Metabolic Disorders – Skopje. OGTT is performed according to the recommendations of the International Association of Diabetes and Pregnancy Study Groups [29], at the gestational age of 24-28 weeks. After overnight fasting, in the morning, 75 grams of glucose were given by oral ingestion. The fasting blood glucose levels and glucose levels 1 and 2 hours after glucose ingestion were measured in venous plasma.

The cut-off values of glycemia for a positive OGTT are:

- ≥ 5.1 mmol/l [0']
- ≥ 10.0 mmol/l [60']
- ≥ 8.5 mmol/l [120']

The test is positive (GDM is diagnosed) if one or more glycemia values are equal or higher than the cut-off values.

We divided the patients into two groups:

Group 1 [Study group]: Patients with a positive OGTT [with gestational diabetes]

Group 2 [Control group]: Patients with a negative OGTT [without gestational diabetes] Data were provided from medical documentation and questionnaires with anamnestic data of the patients, at the University Clinic for Endocrinology, Diabetes and Metabolic Disorders.

Results

In the period of three years, a total of 668 pregnant women were examined for presence of GDM. Based on the results of OGTT, 290 patients [3,4%] were diagnosed with gestational diabetes (positive OGTT - studied group), and 378 [56,6%] did not have gestational diabetes [negative OGTT - control group]. In the study group, 210 [72.4%] of the patients reported that they had no previous miscarriages, and 58 [20%] had one miscarriage. In the control group, 307 patients [81.2%] reported that they had no previous miscarriages, and 53 [14%] had one miscarriage. In the study group, there were 16 [5.5%] with 2 previous miscarriages. In the control group, there were 10 [2.6%] with 2 previous miscarriages. The descriptive analysis of the sample according to the number of spontaneous abortions is given in Table 1.

Table 1. Analysis of the sample according to the number of spontaneous abortions and OGTT status

Number of spontaneous abortions		OGTT status		Total
		study group (positive)	control group (negative)	
0	N	210	307	517
	%	72.41%	81.22%	77.40%
1	N	58	53	111
	%	20%	14.02%	16.62%
2	N	16	10	26
	%	5.52%	2.65%	3.89%
3	N	4	8	12
	%	1.38%	2.12%	1.80%
4	N	1	0	1
	%	0.34%	0%	0.15%
5	N	1	0	1
	%	0.34%	0%	0.15%
Total	N	290	378	668
	%	43.41%	56.59%	100%

Table 2. Comparison of the two groups according to the number of spontaneous abortions

Group	Average (Means)	N	Standard deviation (Std.Dev.)	Minimum (Min)	Maximum (Max)	Median (IQR)
study group	0.38	290	0.74	0	5	0 (0-1)
control group	0.26	378	0.61	0	3	0 (0-0)
Total	0.31	668	0.67	0	5	0 (0-0)

Mann-Whitney U Test: Z=-1.9659 p=0.0493** significant for p<0.05

The analysis of two groups according to the number of spontaneous abortions, indicated a statistically significant difference [Mann-Whitney U Test: Z=-1.9659 p=0.0493] [Table 2]. According to the results, the average number of spontaneous abortions in pregnant women of the study group is significantly higher compared with the control group. The number of spontaneous abortions as a risk factor was quantified using the odds ratio [OR]. The analysis indicated that pregnant women with a positive OGTT test had a significantly higher number of previous miscarriages compared to pregnant women with a negative OGTT test [Pearson Chi-square=8.6521, df=3, p=0.0343] [Table 3]. Additional analysis indicated that pregnant women with a history of one miscarriage were 1.599 times more likely to have a positive OGTT status compared to those with no miscarriages [OR=1.559; 95% CI [1.059 – 2.415]; p=0.0246] [Table 3].
According to Table 3, pregnant women with a history of two miscarriages have a 2.339 times significantly higher probability of a positive OGTT status compared to those with no miscarriages [OR=2.339 [1.041 – 5.255] 95% CI]

Table 3. Analysis of the sample according to the number of spontaneous abortions

Number of spontaneous abortions		**OГTT status**		**Total**
		Study group	**Control group**	
0	N	210	307	517
	%	72.41%	81.22%	
1	N	58	53	111
	%	20%	14.02%	
2	N	16	10	26
	%	5.52%	2.65%	
≥3	N	6	8	14
	%	2.07%	2.11%	
Total	N	290	378	668
	%	43.41%	56.59%	100%

Pearson Chi-square=8.6521, df=3, p=0.0343* *significant for p<0.05
Pearson Chi-square=5.0552, df=1, p=0.0246* 1/0
Pearson Chi-square=4.4586, df=1, p=0.0347* 2/0
Pearson Chi-square=0.0283, df=1, p=0.8664 3/0

Pregnant women of the study and control groups were analyzed according to their history of stillbirths in previous pregnancies [table 4].

Table 4. Analysis of the sample according to the number of previous stillbirths and OGTT status

Number of Stillborn children		OГТТ status		Total
		Study group	Control group	
0	N	272	371	643
	%	93.79%	98.15%	96.26%
1	N	16	5	21
	%	5.52%	1.32%	3.14%
≥2	N	2	2	4
	%	0.69%	0.53%	0.60%
Total	N	290	378	668
	%	43.41%	56.59%	100%

Pearson Chi-square=9.5779, df=2, p=0.0083* *significant for p<0.05
Pearson Chi-square=9.5089, df=1, p=0.0021* 1/0
Pearson Chi-square=0.0965, df=1, p=0.7561 ≥2/0
Pearson Chi-square=1.1432, df=1, p=0.2849 1/ ≥2

In the study group [with a positive OGTT test], the most common patients were those without previous stillbirths - 272 [93.8%], followed by those with a history of one stillbirth in 16 [5.5%] and a history of ≥2 stillbirths in 2 [0.7%] patients. In the control group (with a negative OGTT test), the most common patients were those without previous stillbirths - 371 [98.2%], followed by a history of one stillbirth in 5 [1.3%] and a history of ≥2 stillbirths in 2 (0.5%).

Previous stillbirths as a risk factor was quantified using the odds ratio [OR]. According to the analysis, pregnant women with a positive OGTT test had significantly more stillbirths compared to pregnant women with a negative OGTT status [Pearson Chi-square=9.5779, df=2, p=0.0083] [Table 4]. Additional analysis indicated that, pregnant women with a positive history of one previous stillbirth were 4.365 times more likely to have a positive OGTT status compared to pregnant women who did not have any stillbirths [OR=4.365; 95% CI [1.579 – 12.059]; p=0.0021] [Table 4].

Discussion

A study by Vaajala et al., that included 180.673 primiparous women, found that women with a history of previous spontaneous and induced abortions [or both] had higher incidence of GDM compared with controls [without abortions]. The incidence in patients with a previous induced abortion was 24.7%, in those with a previous spontaneous abortion was 24.8% and in those with both induced and spontaneous abortions was 27.7%. The incidence in the reference group was 20.8%. The incidence was elevating with increasing of the number of previous abortions [30].

In a study of Zhao et al. in 2022, the association of a history of previous spontaneous or induced abortions with the occurrence of gestational diabetes mellitus was examined. In a large population of 102.259 patients, they found that pregnant women with a history of spontaneous abortion had a 25% higher

risk of developing GDM, while patients with a history of spontaneous and induced abortion had a 15% higher risk of developing GDM. The authors of this study also linked this to the presence of metabolic syndrome, which is also associated with the occurrence of spontaneous abortion [31].

In the meta-analysis of Wang et al., a 41% higher risk of developing GDM was found in patients with a history of recurrent miscarriage. This risk increased with increasing number of previous miscarriages [32].

According to the same study, it is possible that miscarriages cause increased oxidative stress, inflammation and endothelial dysfunction, leading to insulin resistance and GDM [32]. It has also been hypothesized that early pregnancy loss may initiate an immune responce that may lead to subsequent development of diabetic and hypertensive disorders [33].

Dunne et al., in their 2024 meta-analysis, found a 44% higher risk of developing gestational diabetes mellitus in patients with a history of spontaneous miscarriage [34].

In our study, the sample was analyzed according to the number of previous miscarriages. Within the study group [pregnant women with gestational diabetes], the average number of miscarriages was 0.4±0.7, and in the control group (pregnant women without gestational diabetes) it was 0.3±0.6. For $p<0.05$, the analysis indicated that pregnant women with a positive OGTT test had a significantly higher number of previous miscarriages compared to pregnant women with a negative OGTT test.

Additional analysis indicated that, for $p<0.05$, pregnant women with a history of one miscarriage had a 1.599 times significantly higher probability of a positive OGTT status compared to those who had no miscarriages. For $p<0.05$, the analysis indicated that pregnant women with a history of two miscarriages were 2.339 times significantly more likely to have a positive OGTT status compared to those with no miscarriages.

In our study, we analyzed the sample according to the number of previous stillbirths among the respondents. According to the analysis, pregnant women with a positive OGTT test have significantly more previous stillbirths compared to pregnant women with a negative OGTT status. Additional analysis indicated that pregnant women with a positive history of one previous stillbirth were 4.365 times more likely to have a positive OGTT status compared to pregnant women without any stillbirths [$p<0.05$].

Studies provide inconsistent data about the incidence of stillbirth in women with gestational diabetes. Several studies have shown an increased incidence, but it is lower than that in women who had diabetes before pregnancy [27,28]. A 2022 meta-analysis of 66 cohort studies with 69 million participants found no association between stillbirth and GDM. However, an association was found in studies that included stillbirths beyond 28 weeks of gestation and studies performed before 2013 [35]. Some comorbidities, such as obesity and advanced maternal age, are risk factors for stillbirth by themselves and failure to adjust the study will result in an inaccurate estimation of the risk of fetal death [36]. Also, although increased, the risk of fetal death in women with GDM is reduced with adequate control of blood glucose levels, as well as by timely induction of labor, before possible fetal death occurs [37]. Despite the heterogeneity of studies, there are proffesional association recommendations that all pregnant women with GDM should be offered induction of labor between 38 and 40 weeks of gestation [38-41].

Conclusion

According to the results of our study, a history of previous miscarriages significantly increases the risk of gestational diabetes mellitus. A history of one miscarriage significantly increases the likelihood of gestational diabetes mellitus by 1.599 times. A history of two miscarriages significantly increases the likelihood of gestational diabetes mellitus by 2.339 times.

Pregnant women with a positive history of one previous stillbirth are 4.365 times more likely to have a positive OGTT status compared to pregnant women who have not had any stillbirths.

Further research and studies of a larger number of patients are needed regarding the association of gestational diabetes mellitus with previous miscarriage, as well as the potential mechanisms leading to this association. Also, in our study, the data about previous miscarriage and stillbirth were based on anamnesis. Miscarriage is a sensitive issue, some misscariages occur at home in the first weeks of pregnancy, so it is

possible that the true incidence is misreported and thus underreported, which may result in an underestimation of the strength of the association between miscarriage and GDM.
Regarding the association between GDM and stillbirth, additional risk factors should be considered, such as obesity, excessive weight gain during pregnancy, advanced maternal age, and the presence of undiagnosed diabetes before pregnancy. They increase the risk of stillbirth by themselves. The risk of stillbirth in women with GDM is reduced with adequate control of blood glucose levels, as well as by timely induction of labor.

References

1. American Diabetes Association. Clinical practice recommendations 2001: gestational diabetes mellitus. Diabetes Care 2001;24:S77-S79
2. Guariguata L, Linnenkamp U, Beagley J, et al. Global estimates of the prevalence of hyperglycaemia in pregnancy. Diabetes Res Clin Pract. 2014;103(2):176-185. doi:10.1016/j.diabres.2013.11.003
3. Ferrara A. Increasing prevalence of gestational diabetes mellitus: a public health perspective. Diabetes Care. 2007;30(2)(suppl):S141-S146. doi:10.2337/dc07-s206
4. Zhu Y, Zhang C. Prevalence of gestational diabetes and risk of progression to type 2 diabetes: a global perspective. Curr Diab Rep. 2016;16(1):7. doi:10.1007/s11892-015-0699-x
5. Bellamy L, Casas JP, Hingorani AD, Williams D. Type 2 diabetes mellitus after gestational diabetes: a systematic review and meta-analysis. Lancet. 2009;373(9677):1773-1779. doi:10.1016/S0140-6736(09)60731-5
6. CarpenterMW. Gestational diabetes, pregnancy hypertension, and late vascular disease. Diabetes Care. 2007; 30(2)(suppl):S246-S250. doi:10.2337/dc07-s224
7. Kitzmiller JL, Dang-Kilduff L, Taslimi MM. Gestational diabetes after delivery: short-term management and long-term risks. Diabetes Care. 2007;30(2)(suppl):S225-S235. doi:10.2337/dc07-s221
8. Sullivan SD, Umans JG, Ratner R. Gestational diabetes: implications for cardiovascular health. Curr Diab Rep. 2012;12(1):43-52. doi:10.1007/s11892-011-0238-3
9. West NA, Crume TL, Maligie MA, Dabelea D. Cardiovascular risk factors in children exposed to maternal diabetes in utero. Diabetologia. 2011;54(3):504-507. doi:10.1007/s00125-010-2008-1
10. Gestational diabetes mellitus. American diabetes association. Diabetes Care 27 Suppl 1: S88-S90.
11. Rai R, Regan L. Recurrent miscarriage. Lancet. 2006;368(9535):601-611. doi:10.1016/S0140-6736(06)69204-0
12. Gupta S, Agarwal A, Banerjee J, Alvarez JG. The role of oxidative stress in spontaneous abortion and recurrent pregnancy loss: a systematic review. Obstet Gynecol Surv. 2007;62(5):335-347. doi:10.1097/01.ogx.0000261644.89300.df
13. 1Sedgh G, Singh S, Shah IH, et al. Induced abortion: incidence and trends worldwide from 1995 to 2008. Lancet. 2012;379(9816):625-632. doi:10.1016/S0140-6736(11)61786-8
14. Quenby S, Gallos ID, Dhillon-Smith RK, et al. Miscarriage matters: the epidemiological, physical, psychological, and economic costs of early pregnancy loss. Lancet. 2021;397(10285):1658-1667. doi:10.1016/S0140-6736(21)00682-6
15. Horn J, Tanz LJ, Stuart JJ, et al. Early or late pregnancy loss and development of clinical cardiovascular disease risk factors: a prospective cohort study. BJOG. 2019;126(1):33-42. doi:10.1111/1471-0528.15452
16. Asgharvahedi F, Gholizadeh L, Siabani S. The risk of cardiovascular disease in women with a history of miscarriage and/or stillbirth. Health CareWomen Int. 2019;40(10):1117-1131. doi:10.1080/07399332.2019.1566332
17. Wagner MM, Bhattacharya S, Visser J, et al. Association between miscarriage and cardiovascular disease in a Scottish cohort. Heart. 2015;101(24):1954-1960. doi:10.1136/heartjnl-2015-307563

18. Liu Y, Lu J, Xu M, et al. Association between history of abortion and nonalcoholic fatty liver disease in middleaged and elderly Chinese women. Ann Epidemiol. 2013;23(3):119-123. doi:10.1016/j.annepidem.2012.12.002
19. Peters SAE, Yang L, Guo Y, et al; China Kadoorie Biobank Collaboration Group. Pregnancy, pregnancy loss and the risk of diabetes in Chinese women: findings from the China Kadoorie Biobank. Eur J Epidemiol. 2020;35(3):295-303. doi:10.1007/s10654-019-00582-7
20. Xu B, Zhang J, Xu Y, et al. Association between history of abortion and metabolic syndrome in middle-aged and elderly Chinese women. Front Med. 2013;7(1):132-137. doi:10.1007/s11684-013-0250-x
21. Ahmed SK, Mahmood N, Malalla ZH, et al. C-reactive protein gene variants associated with recurrent pregnancy loss independent of CRP serum levels: a case-control study. Gene. 2015;569(1):136-140. doi:10.1016/j.gene.2015.05.052
22. Khambule L, George JA. The role of inflammation in the development of GDM and the use of markers of inflammation in GDM screening. Adv Exp Med Biol. 2019;1134:217-242. doi:10.1007/978-3-030-12668-1_12
23. Rueangdetnarong H, Sekararithi R, Jaiwongkam T, et al. Comparisons of the oxidative stress biomarkers levels in gestational diabetes mellitus (GDM) and non-GDM among Thai population: cohort study. Endocr Connect. 2018;7(5):681-687. doi:10.1530/EC-18-0093
24. Lappas M, Hiden U, Desoye G, et al. The role of oxidative stress in the pathophysiology of gestational diabetes mellitus. Antioxid Redox Signal. 2011;15(12):3061-3100. doi:10.1089/ars.2010.3765
25. Mathiesen ER, Ringholm L, Damm P. Stillbirth in diabetic pregnancies. Best Pract Res Clin Obstet Gynaecol 2011; 25(1):105–111. https://doi.org/10.1016/j.bpobgyn.2010.11.001
26. Tennant PW, Glinianaia SV, Bilous RW, et al. Pre-existing diabetes, maternal glycated haemoglobin, and the risks of fetal and infant death: a population-based study. Diabetologia 2014; 57(2):285–294. https://doi.org/10.1007/s00125-013-3108-5
27. Hutcheon JA, Kuret V, Joseph KS, et al. Immortal time bias in the study of stillbirth risk factors: the example of gestational diabetes. Epidemiology 2013;24(6):787–790. https://doi.org/10.1097/EDE.0b013e3182a6d9aa
28. Rosenstein MG, Cheng YW, Snowden JM, et al. The risk of stillbirth and infant death stratified by gestational age in women with gestational diabetes. Am J Obstet Gynecol 22012; 206(4):309 e301-307. https://doi.org/10. 1016/j.ajog.2012.01.014
29. Metzger BE, Gabbe SG, Persson B, et al; International Association of Diabetes and Pregnancy Study Groups Consensus Panel. International association of diabetes and pregnancy study groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. Diabetes Care. 2010;33(3):676-682. doi:10.2337/dc09-1848
30. Vaajala M, Liukkonen R, Ponkilainen V et al. Previous induced abortion or miscariage is associated with increased odds for gestational diabetes: a nationwide register-based cohort study in Finland. Acta Diabetologica 2023;60:845-849. https://doi.org/10.1007/s00592-023-02047-6
31. Zhao Y, Zhao Y, Fan K, Jin L. Association of history of spontaneous or induced abortion with subsequent risk of gestational diabetes. JAMA Netw Open 2022; 5(3):e220944
32. Wang H, Guo X, Song Q, et al. Association between the history of abortion and gestational diabetes mellitus: a meta-analysis. Endocrine 2022; 80(1):29-39. https:// doi. org/ 10. 1007/ s12020- 022- 03246-x
33. Egerup P, Mikkelsen AP, Kolte AM, et al. Pregnancy loss is associated with type 2 diabetes: a nationwide case–control study. Diabetologia 2020; 63(8):1521–1529. https://doi.org/10.1007/s00125-020-05154-z.
34. Dunne J, Foo D, Dachew BA, et al. Diabetic and hypertensive disorders following early pregnancy loss: a systematic review and meta-analysis. eClinicalMedicine 2024;71: 102560. https://doi.org/10.1016/j.eclinm.2024.102560
35. Lemieux P, Benham JL, Donovan LE et al. The association between gestational gestational diabetes and stillbirth: a systematic review and metaanalysis. Diabetologia 2022; 65:37-54. https://doi.org/10.1007/s00125-021-05579-0

36. Aune D, Saugstad OD, Henriksen T, Tonstad S. Maternal body mass index and the risk of fetal death, stillbirth, and infant death: a systematic review and meta-analysis. JAMA 2014; 311(15):1536–1546. https://doi.org/10.1001/jama.2014.2269
37. Stacey T, Tennant P, McCowan L, et al. Gestational diabetes and the risk of late stillbirth: a case-control study from England, UK. BJOG 2019;126(8):973–982. https://doi.org/10.1111/1471-0528.15659
38. Diabetes Canada Clinical Practice Guidelines Expert Commitee, Feig DS, Berger H et al. Diabetes and pregnancy. Can J Diabetes 2018; 42 (Suppl 1): S255–S282. https://doi.org/10.1016/j.jcjd.2017.10.038
39. Kapur A, Mahmood T, Hod M. FIGO's response to the global challenge of hyperglycemia in pregnancy - toward a global consensus. Gynecol Endocrinol 2018; 34(1):1–3. https://doi.org/10.1080/09513590.2017.1381682
40. Zhang M, Zhou Y, Zhong J, et al. Current guidelines on the management of gestational diabetes mellitus: a content analysis and appraisal. BMC Pregnancy Childbirth 2019; 19(1):200. https://doi.org/10.1186/s12884-019-2343-2
41. Coates D, Homer C, Wilson A et al. Induction of labour indications and timing: a systematic analysis of clinical guidelines. Women Birth 2020; 33(3):219–230. https://doi.org/10.1016/j.wombi.2019.06.004