Spontaneous Abortions and Gestational Diabetes Mellitus

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ABSTRACT

Background: Spontaneous abortions lead to adverse outcomes that include preeclampsia, intrauterine growth retardation and gestational diabetes mellitus in later pregnancies.
Objectives: The objective of the study was to explore the relationship of spontaneous abortions with gestational diabetes mellitus in pregnant women from rural and urban Lahore.
Methods: This cross-sectional study was conducted at University of Health Sciences, Lahore in 2019. Among 60 pregnant women sampled, 30 had gestational diabetes mellitus (GDM) and 30 were normal pregnant controls. Pregnant women were sampled from different hospitals of rural and urban areas of Lahore. Independent sample t-test was applied for analyzing the data. Chi- square test was used to analyze the categorical variables. Association of fasting blood glucose (FBG) and abortions was checked. Odd ratio and relative risk were calculated.
Results: Mean fasting blood sugar levels were significantly higher in GDM group (105 mg/dL) as compared to non-GDM group (80.50 mg/dL) at p<0.001. The proportions of the women with increased number of abortions had significantly higher blood glucose levels (OR 5.091, 95% CI, RR 1.27).
Conclusions: Gestational diabetes mellitus is associated with an increased risk of spontaneous abortions.

Key Words: Spontaneous abortion, Gestational Diabetes Mellitus, Maternal hyperglycemia.

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INTRODUCTION

Gestational diabetes mellitus (GDM) is a state of glucose intolerance that sets in pregnancy.[1] GDM is associated with various maternal and fetal complications, including preterm delivery, preterm rupture of membranes (PROM), pregnancy-induced hypertension and type 2 diabetes mellitus (T2DM). Studies reported GDM as a risk factor for spontaneous

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abortions and detrimental pregnancy outcomes.[2,3] Spontaneous abortion is the pregnancy loss that occurs naturally prior to 20 weeks of pregnancy.[4] Spontaneous abortions are common worldwide and 20% of all pregnancies end up in abortions.[5,6]

In pregnancy there is increased insulin resistance that settles in the later part of pregnancy.

If hyperinsulinemia remains, chronic insulin resistance damages blood vessels and reduces blood flow to placenta secondary to elevated insulin levels. This in return causes spontaneous abortion.[7,8]

Various global studies have reported that risk factors for GDM vary in different ethnicities and geographic areas.[9] GDM and spontaneous abortions are two common complications of gestation. So, proper understanding of the relationship between the risk of GDM and spontaneous abortions is particularly important in a developing country like Pakistan where prevalence of GDM is increasing and health resources are limited. GDM is a reversible disorder and effective control of plasma glucose levels can help reduce its complications and economic burden. The objective of the study was to explore the relationship of spontaneous abortions with gestational diabetes mellitus in pregnant women.

MATERIALS AND METHODS

This cross-sectional study was conducted in 2019 after its approval by the Institutional Review Board of the University of Health Sciences, Lahore. Study participants were recruited from the outpatient departments of various hospitals of rural and urban Lahore. Written informed consent was taken from the participants. A detailed history was explored from the participants and recorded on data sheet. Pregnant women were subdivided into two groups. The group with GDM included 30 pregnant women, aged 20-40 years, in third trimester of pregnancy and diagnosed with GDM. The non-GDM group included 30 pregnant women who had no GDM and were age and gestational age-matched to the GDM group. The exclusion criteria were as follows: pregnant women who had hypertension, history of induced abortions, T2DM, and GDM in previous pregnancies. The diagnosis criteria used for GDM was 75-g OGTT recommended by American Diabetes Association (ADA) 2020.[10] In 75g OGTT, blood glucose was determined while the patient was fasting and consecutively at 1 and 2-hour post glucose load, at 24–28 weeks of pregnancy in women not formerly diagnosed with diabetes. The diagnosis of GDM was made when blood glucose levels were as follows: Fasting $\geq$ 92 mg/dL, 1 h$\geq$ 180 mg/dL and 2h$\geq$153 mg/dL. Spontaneous abortion was defined as the pregnancy loss that occurs naturally before 20 weeks of pregnancy. Gestational age was calculated from the last menstrual period of the subjects. Systolic and diastolic blood pressure was recorded with a mercury sphygmomanometer.

Statistical Analysis

The data were analyzed by SPSS version 23. Shapiro Wilk test was used to check the distribution of data. Independent sample T test was used to compare the quantitative variables between two groups. The chi-square test was used to compare categorical variables between two groups. Odd's ratio and relative risk were calculated. P<0.05 is considered statistically significant.

RESULTS

Comparison of study parameters between the two groups was done (Table 1). Mean age shows a non-significant difference between GDM and non-GDM group (p=0.77). Mean

Gestational age also shows a non-significant difference between two groups (p=0.311).

Mean FBG levels were significantly higher in GDM group compared to non-GDM group (p=0.000).

Chi-square test (Table 2) was applied to differentiate the number of individuals with respect to their past abortions in GDM and non-GDM groups. Chi-square test was significant ($\chi2$=4.32, p=0.03), hence it was deduced that these differences were statistically significant among the groups.

The proportions of the women having abortions was higher in GDM group and associated with higher blood glucose levels (Table 3) (OR 5.091, 95% CI, RR 1.27).

Chi-square test (Table 4) was applied to differentiate the number of individuals with respect to their past abortions in GDM and non-GDM groups. Chi-square test was significant ($\chi2$=4.60, p=0.02), hence it was deduced that these differences were statistically significant among the groups. The individuals with their past abortions ranging from 1-3, were more in GDM group. With single abortion in the past, there were 11 observations in the GDM group as compared to 9 in non-GDM. Similarly, pregnant women with GDM having two abortions were 5 while they were 4 in control group. For three abortions, these numbers were 10 in comparison to 2 in GDM and non-GDM group, respectively. Expectedly higher the number of past abortions, higher would-be risk for GDM.

Table 1: Comparison of variables between Gestational Diabetes Mellitus and the Control Group

Variables	GDM mean±SD	Non-GDM mean±SD	p value
Age (Years)	31.4±2.21	30.50±2.98	0.772
Gestational Age (Weeks)	28.64±1.39	28.92±1.46	0.311
Fasting Blood Glucose (mg/dL)	105.1±10.01	80.50±8.50	<0.001*
Systolic blood pressure (mmHg)	107.62±11.01	105.50±15.1	0.322
Diastolic blood pressure (mmHg)	67.97±10.05	68.27±8.25	0.462

Independent sample T test was applied; P<0.05 considered statistically significant

Table 2: Comparison of GDM and Non-GDM Group with respect to Abortions

	Abortions *No*	Abortions *Yes*	Total	P-value	χ^2
GDM	2	28	30	0.037*	4.32
Non-GDM	8	22	30		

Chi square test was applied; P<0.05 considered statistically significant

Table 3: Odd's Ratio & Relative Risk of GDM and Non-GDM Group

	Rate	Relative Risk	Odd's Ratio	95% CI for odd's ratio & relative risk
GDM	0.933			1.27(1.005-1.611)
Non-GDM	0.733	1.27	5.091	5.091(0.98-26.43)

Table 4: Comparison of GDM and Non-GDM Group by number of Abortions

	Number of abortions					Chi-square value
	0	**1**	**2**	**3**	**Total**	
GDM	2	11	5	12	30	χ2=4.600
Non-GDM	8	9	5	8	30	p=0.024*

Chi square test was applied; P<0.05 considered statistically significant

DISCUSSION

In this cross-sectional study, we found that GDM is associated with increased risk of spontaneous abortions. As GDM is becoming a global problem, so it is need of time to explore this disease and its related factors in different ethnicities. Also, there are controversial studies regarding relationship between abortions and GDM. A pilot study based on a small population reported no relationship between threatened miscarriage and GDM.[11] Our study replicated the findings of an Indian study conducted on 140 pregnant women and reported GDM as a risk factor for recurrent abortions.[12] A study conducted by BE Feleke in 2017, also found high risk of abortions in women with history of GDM.[13] This might be the result of increased insulin resistance in pregnant women with GDM.[14] A Chinese study conducted on 586 pregnant women also reported the significant association of GDM and abortions. The risk of spontaneous abortion increased 6 times in pregnant women who had GDM (OR = 6.382, p < 0.05).[15] Our study is also supported by an Ethiopian study conducted on 518 pregnant women and reported past history of GDM as a risk factor for spontaneous abortions (AOR 3.5). This increased risk may be due to overweight/obese BMIs associated with increased number of pregnancies.[16-20] Poor socioeconomic conditions and lack of awareness may even contribute to this.[21]

Increasing parity causes various hormonal changes in the body and increase in BMI that increases the risk of diabetes as reported by a Chinese study conducted on 1294 pregnant women.[22] Pregnancy also affects a woman's daily life through dietary behavior and bodily activity that may increase the risk of abortions and diabetes later on. Our study reported that women who have highest levels of fasting blood sugar levels had higher of GDM. Our findings are supported by a Chinese study conducted on 586 pregnant women and reported that the pregnant women who had ≥3 abortions had highest positive association with GDM (β=1.853, p=0.007).[23] GDM group had 3.01 times higher odds of spontaneous abortions compared to non-GDM group (95% CI: 2.38–3.82).

Present study has few limitations that include small sample size, and it only included the pregnant women who availed the services of government sector hospitals. But present study provided enough power of study and minimized the confounders by selecting age and gestational age matched population. Future studies on larger sample size are recommended to check its causal association.

CONCLUSION

Higher blood sugar levels are associated with increased risk of spontaneous abortions. Women of reproductive age should be educated about gestational diabetes mellitus and strict monitoring of blood glucose levels during pregnancy. There should be early pregnancy screening for GDM in pregnant women.

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University of Health Sciences, Lahore.

Conflicts of interest

All authors declared no conflicts of interest.

Contributors

AK: Conception, data collection, data analysis, results, primary drafting, and final approval.

AS: Data collection, results, discussion, and literature review.

AB: Results, discussion, and literature review.

All authors approved the final version and signed the agreement to be accountable for all aspects of work.

REFERENCES

1. Natamba BK, Namara AA, and Nyirenda MJ. Burden, risk factors and maternal and offspring outcomes of gestational diabetes mellitus (GDM) in sub-Saharan Africa (SSA): a systematic review and meta-analysis. BMC Pregnancy Childbirth. 2019; 19(1): 450.

2. Lee HJ, Norwitz E, Lee B. Relationship between threatened miscarriage and gestational diabetes mellitus. BMC Pregnancy Childbirth. 2018; 18(1): 318.

3. Peters SAE, Yang L, Guo Y, Chen Y, Bian Z, Sun H, et al. 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.

4. Alves C, Rapp A. Spontaneous abortion 12th Ed. StatPearls Publishing LLC; 2021. P218-225.

5. American College of Obstetricians and Gynecologists. The American College of Obstetricians and Gynecologists practice bulletin no. 150. Early pregnancy loss. Obstet. Gynecol. 2015; 125(5): 1258-1267.

6. Lawn JE, Blencowe H, Waiswa P, Amouzou A, Mathers C, Hogan D, et al. Stillbirths: rates, risk factors, and acceleration towards 2030. The Lancet. 2016; 387(10018): 587-603.

7. Kleinberger JW, Maloney KA, Pollin TI. The genetic architecture of diabetes in pregnancy: implications for clinical practice. Am J Perinatol. 2016; 33(13): 1319-1326.

8. Ruchat SM, Mottola MF. The important role of physical activity in the prevention and management of gestational diabetes mellitus. Diabetes Metab Res Rev. 2013; 29(5): 334-346.

9. Mohan MA, Chandrakumar A. Evaluation of prevalence and risk factors of gestational diabetes in a tertiary care hospital in Kerala. Diabetes Metab Syndr. 2016; 10(2): 68-71.

10. Federation ID, Atlas ID. International Diabetes Federation. IDF diabetes atlas, 6th edn Brussels, Belgium: Diabetes Res Clin Pract. 2013.

11. Calleja-Agius J, Calleja N, Brincat M, Spiteri D. Obstetric outcome in cases of threatened spontaneous abortion. Int J Gynaecol Obstet. 2010; 110(1): 75-76.

12. Feleke BE. Determinants of gestational diabetes mellitus: a case-control study. J Matern Fetal Neonatal Med. 2018; 31(19): 2584-2589.

13. Tian L, Shen H, Lu Q, Norman RJ, Wang J. Insulin resistance increases the risk of spontaneous abortion after assisted reproduction technology treatment. The Journal of Clinical Endocrinology & Metabolism. 2007; 92(4): 1430-1433.

14. Yaping X, Chunhong L, Huifen Z, Fengfeng H, Huibin H, Meijing Z. Risk factors associated with gestational diabetes mellitus: a retrospective case-control study. Int. J. Diabetes Dev. Ctries. 2021:1-10.

15. Han Y, Tong M, Jin L, Yu J, Meng W, Ren A. Maternal age at pregnancy and risk for gestational diabetes mellitus among Chinese women with singleton pregnancies. Int. J. Diabetes Dev. Ctries. 2021; 41(1): 114-120.

16. Luo X, Zhu Y, Chen L, Wang Y. Analysis of risk factors for gestational diabetes mellitus and its effect on pregnancy outcome. Chin. J. Pri. Med. Pharm. 2016;23(18):2728-2731.

17. Cefalu WT, Berg EG, Saraco M, Petersen MP, Uelmen S, Robinson S. Classification, and diagnosis of diabetes: standards of medical care in diabetes-2019. Diabetes Care. 2019; 42: S13-S28.

18. Woticha EW, Deressa W, Reja A. Prevalence of gestational diabetes mellitus and associated factors in

Southern Ethiopia. Asian J. Med. Sci. 2019; 10(1): 86-91.

19. Fathy WM, Khalil NA, Mahmoud NS. Risk factors for gestational diabetes mellitus among pregnant women attending Monshaat Sultan Family Health Center, Menoufia Governorate. Menoufia Med. J. 2018; 31(2): 640-645.

20. Wang JF. Risk factors of gestational diabetes mellitus and its effect on pregnancy outcome. Chin J Med. 2017; 14(24): 135–8.

21. Mueller NT, Mueller NJ, Odegaard AO, Gross MD, Koh WP, Yuan JM, et al. Higher parity is associated with an increased risk of type-II diabetes in C hinese women: the S ingapore C hinese Health Study. BJOG: Int. J. Gynecol. Obstet. 2013; 120(12): 1483-1489.

22. Stuebe AM, Mantzoros C, Kleinman K, Gillman MW, Rifas-Shiman S, Seely E, Rich-Edwards J. Gestational glucose tolerance and maternal metabolic profile at 3 years postpartum. Obstet. Gynecol. 2011; 118(5): 1065-1073.

23. Moosazadeh M, Banakar M, Behbahani D, Akbari M, Dabbaghmanesh MH, Mohamadkhani M, Tabrizi R. Association between gestational diabetes mellitus and spontaneous abortion: A systematic review and meta-analysis. J. Maz. Univ. Med. Sci. 2017; 27(155): 187-195.