RESEARCH ARTICLE

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AB0 Blood Group Phenotypes and Rhesus Factor in The Pathogenesis of Gestational Diabetes Mellitus

ABSTRACT

Objective: Some AB0 blood group phenotypes can be considered as risk factors in the pathogenesis of both type II diabetes mellitus (DM) and type I DM. The aim of this study was to investigate whether some AB0 blood group phenotypes and Rhesus (Rh) factor are risk factors for the occurrence of the disease in pregnant women diagnosed with gestational diabetes mellitus (GDM).

Method: This study is a case-control study, and the data were analyzed retrospectively. Pregnant women who applied to a training and research hospital for one year and had a 75-gram oral glucose tolerance test (OGTT) were included in the study. According to the OGTT results, pregnant women diagnosed with GDM (case group) and healthy pregnant women (control group) were divided into two groups.

Results: In a one-year data scan, the prevalence of GDM was found to be 15.94%. The average age of pregnant women with GDM was found to be higher than healthy pregnant women ($p<0.001$). There was no significant difference between the percentage frequency distributions of AB0 blood group in pregnant women with GDM and healthy pregnant women ($p>0.05$). Rh factor positivity of both groups was not different ($p>0.05$).

Conclusion: In conclusion, no relationship was found between GDM pathogenesis, AB0 blood group phenotypes and Rh factor.

Keywords: AB0 Blood Group, Gestational Diabetes, Rh Factor.

Gestasyonel Diyabetes Mellitus Patogenezinde AB0 Kan Grubu Fenotipleri ve Rhesus Faktörü

ÖZET

Amaç: Bazı AB0 kan grubu fenotipleri hem tip II diabetes mellitus (DM) hem de tip I DM'nin patogenezinde risk faktörü olarak kabul edilebilir. Bu çalışmanın amacı, bazı AB0 kan grubu fenotiplerinin ve Rhesus (Rh) faktörünün, gestasyonel diabetes mellitus (GDM) tanısı almış gebe kadınlarda hastalığın ortaya çıkması için risk faktörü olup olmadığını araştırmaktır.

Yöntem: Bu çalışma bir vaka-kontrol çalışması olup veriler retrospektif olarak analiz edildi. Bir eğitim ve araştırma hastanesine bir yıl süreyle başvuran ve 75 gram oral glukoz tolerans testi (OGTT) yaptıran gebe kadınlar çalışmaya dahil edildi. OGTT sonuçlarına göre GDM tanısı almış gebe kadınlar (vaka grubu) ve sağlıklı gebe kadınlar (kontrol grubu) iki gruba ayrıldı.

Bulgular: Bir yıllık veri taramasında GDM prevalansı %15,94 olarak bulundu. GDM'li gebelerin yaş ortalaması sağlıklı gebelere göre daha yüksek bulundu ($p<0,001$). GDM'li gebeler ile sağlıklı gebelerde AB0 kan grubunun yüzdelik frekans dağılımları arasında anlamlı bir fark yoktu ($p>0,05$). Her iki grubun Rh faktörü pozitifliği farklı değildi ($p>0,05$).

Sonuç: Sonuç olarak GDM patogenezi ve AB0 kan grubu fenotipleri ile Rh faktörü arasında bir ilişki bulunamadı.

Anahtar Kelimeler: AB0 Kan Grubu, Gestasyonel Diyabet, Rh Faktörü.

INTRODUCTION

Gestational diabetes mellitus (GDM), defined as a transient form of diabetes caused by pancreatic beta cell dysfunction and insulin resistance during pregnancy, is recognized as one of the main challenges to improving child and maternal health. Approximately 9.0-25.0% of pregnancies worldwide are affected by acute, long-term and intergenerational health complications of this disease (1). The etiology of GDM, the most common metabolic disorder in pregnancy, is complex; environmental and genetic factors are involved in epidemiologic and mechanistic studies. Although short-term benefits of treatment with lifestyle and pharmacologic interventions have been proven, the long-term effect of intrauterine exposure to antidiabetic drugs on offspring remains unclear (2). The prevalence of GDM has continued to increase in recent years. It is expected to continue to increase in the coming years. The public health impact of GDM is increasing and may lead to the development of non-communicable chronic diseases in both mothers and their children in the long term. Early detection of high-risk women can help implement interventional and preventive measures to reduce adverse perinatal outcomes and the risk of GDM (3).

Antigenic determinants of the AB0 blood group, whose antigens were discovered more than a century ago, are known to be present not only on the erythrocyte membrane but also in other cells and tissues (gastrointestinal epithelial platelets, respiratory system cells and salivary glands). In the last decade, a large number of studies and systematic literature have been published on the association between a particular disease and blood group type. This shows the clinical importance of defining blood group typing not only for the selection of blood and its components for transplantation and transfusion, but also for the diagnosis of patients with different nosologies, determination of the risk group and treatment tactics (4). The best known and definitive blood group system is the AB0 group system. It is also the only system in which antibodies are continuously present in the blood serum. In studies on pregnant women, scientists have discovered the impact of blood type on the development of pre-eclampsia, the risk of preterm birth and even coronavirus disease-19 inflammation. Due to the heterospecificity of AB0, the influence of the mother's blood group also affects the birth weight of the newborn and the development of hemolytic disease in the newborn. Blood group has also been shown to influence the likelihood of developing certain diseases and complications in infancy (5).

In case of significant carbohydrate metabolism disorder, immunologic reaction (total IgE) indices have been reported to be lower in patients with blood group 0 and A compared to patients with other blood groups. On the other hand, it has been reported that immunologic reaction indices in patients with blood group B and type II diabetes increased two-fold compared to the upper limit of the standard (6). In a meta-analysis including 15 studies examining the relationship between blood group AB0 and type II diabetes, it was reported that individuals with blood group B were at higher risk for type II DM, whereas individuals with blood group 0 were at lower risk for the development of type II DM. In addition, due to the high risk of type II DM, it is recommended that people with B blood group should be closely monitored by their physicians (7). In a study involving 892 childhood cases in seven European research centers, blood group incompatibility (Rh factor and AB0) was found to be an important risk factor for type I DM. In addition, AB0 incompatibility was reported to be a more common and stronger risk factor than Rh incompatibility. It was also reported that the effect of AB0 blood group incompatibility on treatment was not related to this (8).

Although there are studies in the literature showing a relationship between type I and type II DM pathogenesis and AB0 blood group phenotypes, the results of studies examining the relationship between GDM pathogenesis, and AB0 blood group phenotypes are contradictory (9-12). The reason for the contradictory results may be that the studies were conducted in different populations. There is no study examining the relationship between GDM pathogenesis and AB0 blood group phenotypes in the region where this study was conducted. In this study, we aimed to investigate whether there is a relationship between the occurrence of the disease in pregnant women with GDM and AB0 blood group.

MATERIALS AND METHODS

Study Design: The study is a single-center case-control study and is a retrospective study. The study included 24–28-week pregnant women who underwent 75-gram oral glucose tolerance test (OGTT) between 01/01/2023 and 31/12/2023 in the Gynecology Outpatient Clinic of Samsun Training and Research Hospital. Pregnant women without blood group analysis were excluded from the group comparison. Pregnant women who underwent 50- or 100-gram oral glucose tolerance test were also excluded. Pregnant women with type I or type II diabetes were also excluded. The diagnosis of GDM was made according to the criteria including glucose concentration thresholds determined by the International Diabetes and Pregnancy Study Group (IADPSG) (13).

Data Collection and Analysis: Age and blood group information, fasting blood glucose, OGTT 1st hour and OGTT 2nd hour values of both healthy pregnant women and pregnant women diagnosed with GDM were retrospectively scanned from the hospital information management system.

Pregnant women diagnosed with GDM were included in the case group. Healthy pregnant women were included in the control group.

Statistical Analysis: Statistical Package for the Social Sciences (SPSS) version 22.0 for Windows was used for statistical analysis of variables. Continuous variables were defined as X±SD (mean±standard deviation). Categorical data were defined as percentage frequency. Continuous data of the groups were compared by Independent Sample T test. Categorical variables of the groups were compared with the chi-square test. A P value below 0.05 was considered significant.

RESULTS

OGTT was performed in 1468 pregnant women and 234 (15.94%) of these women were diagnosed with gestational diabetes. Blood group analysis was performed in 835 (56.88%) of the pregnant women who underwent OGTT. Descriptive data of these pregnant women aged between 18 and 45 years are presented in Table 1.

Table 1. Descriptive information of pregnant women

Parameter		**Pregnant n=835**
Age X±SD		28.62±5.51
Fasting blood glucose X±SD (mg/dL)		81.76±10.91
Oral glucose tolerance test 1-hour X±SD (mg/dL)		133.71±34.64
Oral glucose tolerance test 2-hour X±SD (mg/dL)		108.12±28.81
Pregnant women diagnosed with gestational diabetes n (%)		167 (20.00)
AB0 blood groups n (%)	A Rh (positive)	343 (41.08)
	A Rh (negative)	53 (06.35)
	B Rh (positive)	106 (12.69)
	B Rh (negative)	13 (01.56)
	AB Rh (positive)	46 (05.51)
	AB Rh (negative)	9 (01.08)
	0 Rh (positive)	231 (27.66)
	0 Rh (negative)	34 (04.07)

It was determined that 167 (20.00%) of the pregnant women who underwent blood group analysis with OGTT were diagnosed with gestational diabetes. The mean age of pregnant women with GDM was 30.46±5.82, while the mean age of healthy pregnant women was 28.16±5.34. The mean age of pregnant women with GDM was higher than that of healthy pregnant women ($p<0.001$). Table 2 shows the percentage frequency distribution of AB0 blood group in pregnant women with GDM and healthy pregnant women.

Table 2. AB0 blood group percentage frequency distribution of pregnant women with gestational diabetes and healthy pregnant women

AB0 blood group	**Healthy pregnant n=668**	**Pregnant women with gestational diabetes n=167**
A Rh (positive) n (%)	273 (40.87)	70 (41.92)
A Rh (negative) n (%)	42 (06.29)	11 (06.59)
B Rh (positive) n (%)	87 (13.02)	19 (11.38)
B Rh (negative) n (%)	8 (01.20)	5 (02.99)
AB Rh (positive) n (%)	38 (05.69)	8 (04.79)
AB Rh (negative) n (%)	8 (01.20)	1 (00.60)
0 Rh (positive) n (%)	182 (27.25)	49 (29.34)
0 Rh (negative) n (%)	30 (04.49)	4 (02.40)

There is no statistically significant difference between the percentage frequency distribution of AB0 blood group in pregnant women with GDM and healthy pregnant women ($p>0.05$).

Rhesus factor (Rh factor) was positive in 580 (86.83%) of 668 healthy pregnant women. Rh factor was positive in 146 (87.43%) of 167 pregnant women with GDM. There was no difference between the two groups in terms of Rh factor positivity ($p>0.05$).

DISCUSSION

Approaches to the diagnosis and screening of GDM vary widely. According to IADPSG criteria, the regional and global prevalence of GDM varies. The combined global standardized prevalence of GDM is 14.0%. The regional

standardized prevalence of GDM is lowest in North America and the Caribbean at 7.1%. This prevalence was found to be 7.8% in Europe, 10.4% in South America, 14.7% in Africa, 20.8% in Western Pacific, 27.6% in Southeast Asia and Middle East and North Africa (14). In this study, OGTT data of 1468 pregnant women were obtained and GDM prevalence was found to be 15.94% according to IADPSG criteria.

Considering the prevalence of AB0 blood group phenotypes, blood group 0 is the most common phenotype in most populations. This prevalence is 44% in Caucasians, 49% in Blacks and 43% in Asians. Furthermore, the prevalence of AB0 blood group antigens is 27% for antigen A and 20% for antigen B in Caucasians, compared to 43% for antigen A and 9% for antigen B in Blacks. In Asians, A antigen is 28% and B antigen is 27% (15). The most common phenotype in pregnant women included in this study was blood group A with 47.43%. The second most common phenotype was blood group 0 with 31.73%. In addition, the rate of pregnant women with only B antigen was found to be 14.25%.

Advanced maternal age (≥35 years) is a known risk factor for GDM. Research suggests that GDM occurs from specific metabolic entities and suggests an individualized approach based on early pregnancy characteristics (maternal age, 75-gram OGTT values, obstetric history) (16). The average childbearing age of women is increasing due to improvement in social and economic status, prolonged schooling, work pressure and other reasons. In parallel, the prevalence of GDM in pregnant women shows a sharp upward trend. Similarly, mothers' long-term health concerns, such as those associated with type II DM and metabolic syndrome, are significantly affected by GDM. Moreover, unfavorable pregnancy outcomes and obesity in children after growing up constitute a major hidden risk for the development of DM and other diseases (17). In this study, the mean age of pregnant women with GDM was found to be higher than the mean age of healthy pregnant women.

In a systematic literature analysis examining the association between AB0 blood type and pregnancy complications, “pregnancy”, “AB0 blood type”, “preeclampsia”, “venous thromboembolism”, “eclampsia”, “pulmonary embolism”, “deep vein thrombosis”, A literature review was conducted using the keywords “gestational diabetes”, “postpartum hemorrhage”, “pregnancy-induced hypertension”, “HELLP syndrome” and “intrauterine fetal growth restriction”. The results of the systematic review reported that AB0 status had a consistent effect on the risk of developing pre-eclampsia. No effect of AB0 blood type on the risk of developing gestational diabetes has been reported (9). In another review examining the association between AB0 blood type and pregnancy complications, it was concluded that, in general, AB blood type may be associated with the pathogenesis of GDM in different populations (10).

In a study conducted in Turkey and including 233 GDM patients, it was reported that the 0-blood group significantly increased the risk of postpartum diabetes in women with GDM, the AB blood group showed a relatively mild increase, and the B blood group had the lowest risk. In addition, the Rh-positive blood group may also increase the risk of postpartum diabetes in GDM (11). On the other hand, in a systematic literature consisting of 15 studies, it was determined that individuals with the B blood group were at higher risk for type II DM and those with the 0-blood group had a lower risk of developing type II diabetes (7). In addition, in a retrospective cohort study conducted on 5320 Thai pregnant women, no significant relationship was found between the AB0 blood group and the risk of GDM (12). In this study, which included a total of 835 pregnant women, no significant difference was found between the blood group distributions of pregnant women with GDM and healthy pregnant women. In addition, no significant difference was found in terms of Rh factor positivity.

This study was a single-center study. In addition, although the sample included in the study was large (n=835), the sample size of pregnant women with B Rh (negative) and AB Rh (negative) blood groups was low. These two situations can be considered as limitations of the study. On the other hand, it is a reference for future multicenter studies with larger samples.

CONCLUSION

As a result, no relationship was found between GDM pathogenesis and AB0 blood group phenotypes and Rh factor. The different results in the literature regarding this relationship may be due to the diversity of the sample consisting of different populations. Further research is also needed to understand the mechanisms underlying the possible causal relationship of these different results.

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