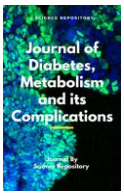

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Research Article

Mpv for Predicting Gestational Diabetes Mellitus

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ABSTRACT

Objective: In this study we aimed to compare blood count parameters such as; mean platelet volume (MPV), platelet count (PC), and platelet distribution width (PDW), white blood count (WBC), hemoglobin (HMG), hematocrit (HCT), lymphocyte (LYM), neutrophil (NEU), PC/MPV, PC/LYM, PC/WBC, NEU/LYM rates; between healthy pregnant women and pregnant women with Gestational Diabetes Mellitus (GDM) whether these parameters have a predictive value of GDM.

Methods: A retrospective case control study was performed and a total of 202 pregnant women including 78 pregnant women with GDM (38.6%) and 124 healthy pregnant women (61.4%; the control group) were fallen under the study. Prior medical histories had no particularity.

Results: The result of compared parameters between GDM and Control Groups; there was no significant difference between any variables except age ($p=0.024$; $p<0.05$).

Conclusion: If blood samples are evaluated under healthy conditions (rapidly collection, transfer and studying) we concluded that blood count parameters would not be useful for predicting the diagnosis of GDM.

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Introduction

Gestational diabetes mellitus (GDM) is defined as glucose intolerance diagnosed for the first time in pregnancy [1]. According to different definitions and diagnostic criteria used, pregnant women are affected by 4-18% [2]. The correct definition and treatment of diabetes mellitus during pregnancy is very important due to perinatal morbidity and mortality as well as the long-term complications of mother and fetus [3]. For this reason, the diagnosis of GDM is very important for mothers and their babies.

Diabetes is a systemic disease that affects the normal physiological function of many systems, one of them is hematopoietic system [4]. There are different levels of insulin resistance and chronic low-grade inflammation, which triggers vascular damage, dysfunction and platelet activation in GDM patients [5, 6]. As a result of the contact of platelets with the damaged endothelium, coagulation system becomes activated, which results both platelet consumption and bone marrow production [7]. On the other hand; MPV values are increased with this condition which can be triggered by insulin and its platelet turnover effect; it can also be explained by osmotic swelling of platelets by the hyperglycemia [8]. The average platelet volume (MPV), an easy and cost-effective parameter obtained from routine blood counts, which is often used to assess platelet morphology and can be used as an indicator of platelet activity [9]. Younger platelets, which are larger than older ones, are metabolically and enzymatically more active and the increase of MPV may be the direct sign of thrombocyte synthesis and activation. On the other hand; the platelet count (PC), the PC to MPV ratio, and platelet distribution width (PDW) are the other platelet function parameters [10-12]. In this study; we compared MPV, PC, PDW, white blood count (WBC), hemoglobin (HMG), hematocrit (HCT), lymphocyte (LYM), neutrophil (NEU), PC/MPV, PC/LYM, PC/WBC, NEU/LYM rates between GDM and healthy pregnant women to evaluate prediction of GDM.

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Materials and methods

The study was included 202 pregnant women who were at the 24 and 28 weeks of pregnancy and applied to our University of Health Sciences, Bakirkoy Dr. Sadi Konuk Training and Research Hospital, Department of Obstetrics and Gynecology in between November 2017 and December 2018. This study is a case-control study which was performed retrospectively. The patient population (n=202) was composed of 78 pregnant women with GDM (38.6%) and 124 healthy pregnant women (61.4%; the control group). The findings were accordingly compared for these two groups. Gestational age was determined by reference to the last menstrual period and/or first trimester obstetric ultrasonographic data.

The exclusion criteria were; having previously been diagnosed with GDM or current DM, preeclampsia and other hypertensive disease history before or during pregnancy, having a chronic disease such as any malignant disease, heart disease, myeloproliferative disease, anemia, hemoglobinopathy, chronic inflammatory disease, autoimmune disease, acute or chronic infection, acquired and inherited coagulation disorder. We screened the patients who had singleton prengancy in the 24-28 weeks of gestational period and were applied 75 g Oral Glucose Tolerance Test (OGTT) in our clinic. After 8 hours fasting plasma glucose was measured, 75 gr OGTT was given to all cases. 1 hour and 2 hour later blood glucose levels were measured. 75 g OGTT test results were evaluated according to ADA (American Diabetes Association) criteria. The diagnosis of gestational diabetes is made at 24 to 28 weeks of gestation when one or more plasma glucose values meets or exceeds the fasting ≥92 mg/dL (5.1 mmol/L), or first our ≥180 mg/dL (10.0 mmol/L), or second hour ≥153 mg/dL (8.5 mmol/L) [13]. Blood samples were collected at the time of oral glucose tolerance test. Approximately 2 ml of peripheral venous blood was taken from each patient and the samples were studied within 2 hours by using XN-10 model of XN-1000 blood counter.

Statistical Analysis was performed with the NCSS 11 (Number Cruncher Statistical System, 2017 Statistical Software) Program and the MedCalc Statistical Software version 18 (MedCalc Software bvba, Ostend, Belgium; http://www.medcalc.org; 2018). Frequency, percentage values were given for categorical variables. Mean, standard deviation, median, minimum and maximum values were given for continuous variables. Normal distribution test of continuous variables was performed with Kolmogorov Smirnov test. The Mann Whitney U test was used for the independent two groups in the variables that did not realize the normal distribution assumption. $p<0.05$ was considered statistically significant.

Results

Total 202 singleton pregnancies (30.27±5.88 years old) included in the study. 78 of these were GDM and 124 were classified as the control group. When age, gestational week, fasting blood glucose ,75 gr OGTT 1st hour and 75 gr OGTT 2nd hour levels were examined, they were statistically higher in GDM group according to the control group. As shown in (Table 1), no statistical significance was found at the other parameters than age and known parameters used for diagnosis of diabetes.

Table 1: Comparison of Variables by GDM and Control Group.

	Control	**GDM**	**p**
	(n=124) **Mean+SD** **Med.(Min.-Max.)**	**(n=78)** **Mean+SD** **Med.(Min.-Max.)**	
Age (years)	29.53±5.68 30-(18-44)	31.45±6.03 31-(19-43)	0.024[a]
GW (week)	25.13±2.29 25-(18-35)	25.87±2.18 26-(22-31)	0.022[b]
Fasting Plasma Glucose (mg/ dL)	76.91±7.61 75.7-(62.1-91.6)	92.23±18.67 92.7-(64.8-151.1)	p<0.001[b]
75 gr OGTT 1. Hour (mg/ dL)	140.53±23.04 143-(73-178)	178.82±34.46 183.5-(93-250)	p<0.001[a]
75 gr OGTT 2. Hour (mg/ dL)	116.04±18.13 117-(60-150)	136.29±27.35 140-(59-205)	p<0.001[a]
WBC (10e3/ uL)	10.7±2.35 10.77-(4.82-18.15)	10.87±2.12 10.63-(6.19-16.48)	0.793[b]
HMG (g/ dL)	11.4±1.1 11.45-(6.6-13.9)	11.36±0.98 11.35-(8.3-13.3)	0.826[a]
HCT (%)	34.45±2.74	34.36±2.77	0.817[a]

	34.65-(24.1-42.1)	34.45-(26.6-39.8)	
PC (10e3/ uL)	250.73±60.97 244.5-(115-427)	250.91±62.3 245.5-(88-419)	0.983[a]
MPV (fL)	10.9±0.92 10.8-(9.1-13.1)	10.65±0.88 10.6-(8.8-13)	0.071[b]
PDW (fL)	13.11±2.15 12.7-(9.3-19.2)	12.66±2.19 12.3-(8.9-19.8)	0.123[a]
LYM (%)	2.03±0.51 1.95-(0.85-4.07)	2.01±0.48 1.9-(1.24-3.76)	0.707[b]
NEU (%)	7.8±1.89 7.72-(3.24-12.61)	8.03±1.75 7.9-(3.58-12.98)	0.371[a]
PC/LYM	128.56±36.1 126.12-(47.44-279.43)	128.37±33.46 124.57-(55-213.57)	0.971[a]
PC/WBC	24.13±6.38 23-(12.29-46.09)	23.44±5.51 23.17-(11.03-35.86)	0.744[b]
PC/MPV	23.39±6.76 23.29-(9.2-43.57)	23.86±6.82 22.9-(7.15-43.3)	0.636[a]
NEU/LYM	3.99±1.13 3.77-(2.09-8.98)	4.15±1.08 4.05-(1.61-6.98)	0.130[b]

[a]Independent SampleT test

[b]Mann Whitney U test

$p<0.05$

GW, gestational week; WBC, white blood count; HMG, haemoglobin; HCT, hematoctrit; PC, platelet count; MPV, mean platelet volume; PDW, platelet distribution width; LYM, lymphocyte; NEU, neutrophil.

Discussion

Complete blood count parameters including platelet indices can not predict GDM according to our study results. But; there are many studies on this subject in literature. Study outcomes are different and controversial. Some of them observed that MPV values were significantly higher in GDM group than the control group, some of them found that MPV values were lower in GDM group, while some studies reported that there was no relationship between two groups for MPV value. A study of Yang et al. WBC, NEU, LYM, and PC values were found to be significantly higher in pregnant women with GDM, while the values of MCV and MPV were significantly lower than the control group. Based on these findings; They concluded that hematological cells are potential predictors of GDM [14]. Gorar et al. found that MPV levels were significantly lower in the GDM than in the non-GDM group. Comparing healthy pregnant women with GDM group, there were no difference in blood count values other than MPV [15].

Kebapçılar et al. exemined the relationship between platelet count and MPV values in GDM and control group. Unlike our study; the MPV values of GDM patients were found significantly higher than the controls. On the other hand, there was no significant difference in platelet count between two groups [16]. Maconi et al. aimed to evaluate the hematological changes between healthy and pathological pregnancy. MPV values of GDM patients were found to be significantly increased compared to healthy pregnant women, while the other platelet parameters were the same [17]. Other studies showed that neither PC nor MPV values were different between GDM and control group similar to our study results [18-20]. Zou and et al. studied a systematic review and meta-analysis which included 1361 patients with GDM and 1911 healthy pregnant women. Pregnant women with GDM had higher MPV values than the control group in studies which were performed in the last trimester of pregnancy, the results were not conclusive in the first and second trimester. The patients in our study were in the second trimester so our results are compatible with the results of this meta-analysis. However; due to not only the using of the varied diagnostic criteria but also the heterogeneity of the patient groups that included in the studies; there was a potential bias. Consequently; outcomes were not clear in this meta-analysis [18] .

Similar to our study; Erdoğan et al. observed no significant difference between groups in terms of MPV, RDW, platelet count [19]. When the literature is reviewed, many studies have been performed on this subject in our country. In developing countries such as us; it is important to diagnose complicated pregnancies such as GDM and preeclampsia by using the blood count parameters which are easily available and

accessible in all health care centers for cost effectivity and early diagnosis [12]. Platelet indices measurement should be make with precision. Because platelet values are affected by ; anticoagulants, like ethylenediaminetetraacetic acid (EDTA), which is used for the blood sampling, storage temperature and time until processing. Because of this reason; the platelets may swell, and their size may grow up. MPV increases especially when stored in EDTA tubes and this effect variate depending on the storage duration. Other hematological parameters are also affected by these factors [21].

In our hospital blood samples are collected rapidly, transferred and studied through many regulations for recent years. We concluded that the outcomes of the study did not find any significant difference between GDM and healthy pregnancies; after these factors have been eliminated. Even if blood samples are evaluated under healthy conditions, we think that hematological parameters and platelet indices cannot be used for prediction of GDM. Nevertheless; the retrospective form of our study and the small number of patient population are the limitations of our study. Thus; there is a need for standardized, prospective studies on the larger patient populations.

Conflicts of interest

Authors declares no conflict of interest.

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