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Original Article

Platelet indices and ABO blood groups as predictive biomarkers for diabetes mellitus complications

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Abstract

Macrovascular and microvascular complications of diabetes mellitus are the main reasons for the high mortality and morbidity rates, as well as the decreased quality of life amongst patients with type II diabetes mellitus. This study aimed to evaluate platelet indices and blood group typing in type II diabetic patients and the changes in the values of these parameters in correlation with diabetes mellitus chronic diabetic complications. This cross-sectional study was carried out at the Azadi Teaching Hospital, Laboratory Department and Diabetes Center in Duhok governorate. Three mL of blood was collected from diabetic patients and put into EDTA tubes. Platelet parameters, including platelet count, platelet distribution width, mean platelet volume, platelet-large cell ratio, and platelet crit were obtained. ABO and Rh blood group typing was done using standard slide method. Diabetic patients were categorized into two groups; without and with documented and registered diabetes complications. Statistical analysis was done using software SPSS version 26.0 and OpenEpi Version 3.0.1 programs. The mean age of diabetic patients in this study was 50.694±10.318 years. The mean values of platelet indices apart from platelet counts were significantly higher among diabetic patients with complications than those without complications. Platelet parameter except platelet count were significantly higher amongst patients with diabetes related complications and suggests that these indices are reliable predictors for the development of complications in patients with type 2 diabetes mellitus and can be used as a simple, low-cost to-use method. Blood group O was significantly associated with diabetes-related complications.

Keywords: diabetes, blood groups, platelet indices, chronic complications

Introduction

Type 2 diabetes mellitus (T2DM) is a long-lasting metabolic condition that affects millions of individuals internationally and is related to several long-term complications, including cardiovascular diseases. Inadequate glucoregulation is a key factor that contributes to these complications and is associated with high rates of morbidity and mortality [1].

Type 2 Diabetes Mellitus (T2DM) is characterized by a multifactorial origin, which encompasses a combination of genetic factors and environmental conditions [2].

Long-term hyperglycemia can induce glucotoxicity, which in turn supports the development and progression of type 2 diabetes mellitus [3].

The presence of chronic hyperglycemia, alongside various metabolic disturbances in patients suffering from diabetes mellitus, can lead to detrimental effects on several organ systems. This can result in the development of serious and life-threatening health complications, with microvascular complications such as retinopathy, nephropathy, and neuropathy being particularly significant, as well as macrovascular complications that can double to quadruple the risk of cardiovascular diseases [4].

Diabetes represents a disorder that is both pro-inflammatory and prothrombotic, identified by variations in platelet indices and increased reactivity of platelets [5]. Activated platelets increase the risk of macrovascular complications in diabetic patients, including cardiovascular diseases, stroke, and arterial disease, in addition to microvascular complications such as neuropathy, nephropathy, and retinopathy. This condition renders diabetic patients two to three times more susceptible to experiencing a stroke or heart attack [6, 7].

Earlier studies have revealed a correlation between the duration and severity of T2DM and various platelet parameters [8], and several diabetes-related complications [9]. Thus, the purpose of this investigation was to analyze and establish the correlation between platelet indices and specific microvascular and macrovascular complications in individuals diagnosed with type 2 diabetes at Azadi Teaching Hospital.

Material and methods

This cross-sectional study was done at Azadi teaching hospital in Duhok city, North of Iraq, over two months from 10th October to 25th December, to study the prevalence of complications among type 2 diabetic patients as well as to explore a role of platelet indices in predicting the development of these complications. 250 type II diabetic patients were selected and recruited in the study, and those with type 1 diabetes and gestational diabetes were excluded from the study. Consent was taken from heads of departments for the collection of clinical data from patients' case sheets, while peripheral blood indices and ABO blood grouping were done in laboratory department using EDTA tubes for blood sample collection after obtaining consent from participants or their accompanying relatives. 3 mL of venous blood taken under completely aseptic precautions from each participant after obtaining consent from participants and put into ethylenediaminetetraacetate acid anticoagulant tubes (EDTA), for measurement of glycated hemoglobin using automated chemistry analyzer Cobas 6000 (Roche), complete blood count by automated blood count analyzer (Coulter, Sweden) and blood group typing with standard slide method using anti-A, anti-B and anti-D reagents.

Statistical analysis

Some data were extracted from patients' files, while platelet indices, ABO blood group typing were performed in laboratory department, these collected data were entered to an excel sheet, then exported to Statistical Package for the Social Sciences (SPSS v. 26.0; SPSS Inc., Chicago, IL, USA). Data were expressed as mean±standard deviation (±SD). The independent t-test and chi-square test were employed to assess the differences in the values of platelet indices concerning the presence or absence of diabetes-associated complications. OpenEpi Version 3.0.1 program was also used for the analysis of the relationship between blood groups and the risk of development of chronic complications. All interpretations were regarded as statistically significant when p-value was <0.05.

Ethical consideration

This research was carried out following the acquisition of ethical approval from the Research Ethics

Table 1: Comparison of clinical and hematological parameters in patients with and without diabetes-related complications.

Variables	Uncomplicated	Complicated	t test	P-value
Platelet	236.42±41.88	230.73±45.18	0.9892	0.3247
MPV	9.887±1.568	10.511±1.383	3.2715	0.0014
PDW	14.877±1.856	15.439±2.173	2.4769	0.0147
P-LCR	29.127±6.503	32.232±6.698	3.6690	0.0004
PCT	0.2340±0.0582	0.2414±0.0575	0.9516	0.3433
HbAIC	8.1268±1.8029	8.4611±1.5644	1.5562	0.1372
Age	46.00±6.78	53.78±11.01	6.1903	0.0001

Note: RBC – red blood cell; WBC+ – white blood cell count; RDW – red cell distribution width; MPV – Mean platelet volume; PDW – platelet distribution width; P-LCR – platelet large cell ratio; PCT – plateletcrit.

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Results

This study included 250 previously diagnosed patients with type 2 DM, with documented records in Azadi teaching hospital and who visited the diabetes center periodically for follow-up and management of the disease and diabetes-related complications, females made up about 130(52%) of the participants and the remaining 120(48%) were males.

The mean age of the enrollees was 50.694± 10.3183 years, and the range was 34–80 years. Of whom, 136 (54.4%) had diabetes-related complications and the remaining 114 (45.6%) did not have any documented complications at the time of data collection. Out of the 250 participants, 130 (52%) were females and 120 (48%) were males.

Patients were divided into two groups based on the absence or presence of diabetes-related complications (Table 1). 71 (52.20%) of patients had only one complication and the reminders 65 (47.80%) had more than one reported complication at the time of data collection.

Comparison between the two groups as shown in Table 1 revealed significant differences in patients' age and some of the peripheral blood parameters between those with and without complications (WB count, RDW, MPV, PDW, P-LCR) with a p-value of <0.05. However, no significant differences were seen between the two groups regarding RBC count, platelet count, platelet crit, and glycated hemoglobin levels.

On the other hand, the relationship between blood group types and chance of developing diabetes-related complications showed a significant association between blood group O and risk of complications with a p-value of 0.0179. However, no significant relationship was observed between the rhesus blood group and the risk of developing complications, p-value 0.696 (Table 2).

Discussion

In this study, the mean age of the patients was 50.694±10.3183 years, the mean age of our patients is slightly lower than 56.96±8.99 years reported by [9], 54.3±8.5 years by [10], 59.3±12 years by [11], the possible explanation is the emerging high prevalence of obesity, unhealthy diet and life style as well as physical inactivity together with increased stress and lower socioeconomical states of the people in our region. The mean age of patients with reported diabetes complication was 53.78±11.01 years and those who had no complication was 46.00±6.78 years. The mean age of patients with diabetes related complications was higher than patients without complications, finding is comparable to that reported by Ramnik *et al*. [12].

In the current study women ratio was slightly higher than men, finding is similar to that of Khanna *et al*. [9] this may be because obesity is more common in women, as well as the impact of psychological disturbance like stress and that men are more involved in the outdoor works and most of the diabetic women are stay-at-home parent and they can attend the hospital earlier than men.

In our study platelet count was not significantly different between the two groups of diabetic patients, this finding is similar to those stated by Gokul *et al*. [13] and Taderegew *et al*. [10], but otherwise was different from that reported by Ramnik *et al*. [13] and Gamage *et al*. [14].

An increase in the meal values for each of MPV, PDW, and P-LCR levels was significantly associated with the presence of diabetes-related complications. The outcome corresponds with the findings of previous studies carried out by Khanna *et al*. [9], Desai *et al*. [15], Dwivedi and Davangeri [16], Walinjkar *et al*. [17],

Table 2: Blood group type and type II diabetes mellitus complication.

BG	Positive complication (136)	Negative complication (114)	Yates Chi square	P-value
AB	17	15	0.001223	0.4861
B	27	24	0.005912	0.4694
O	46	24	4.404	0.01793
A	46	51	2.668	0.05121
Rhesus type	123	104	0.1525	0.6962

Pujani *et al*. [18] and Taderegew *et al*. [10]. No significant variations in PCT were found between diabetic individuals with complications and those without. This result is in agreement with the research conducted by Taderegew *et al*. [10] and Gamage *et al*. [14].

Regarding the analysis of the correlation of blood group type for the diabetic patients, previous local research has also shown that people with O blood type are more likely to develop diabetes compared to those with other blood group types [19]. The current research additionally indicated that people with blood group O were more prone to developing complications than individuals with other blood groups, a conclusion that is in agreement with the results from Mohammed & Amin [20]. Nonetheless, the result differs from the conclusions drawn in other researches [11, 21–23]. However, it demonstrated comparable outcomes concerning the association between Rhesus blood group and diabetes complications from other studies [21, 23].

Conclusion

According to the findings of the current study, some platelet indices including; MPV, PDW, and P-LCR were significantly higher in type 2 DM patients with complications compared to those without complications, showing these indices can be applied as a simple, low-cost, practically non-invasive and readily accessible method to understand approach for assessing platelet dysfunction and as better prognostic indicators for early detection of diabetes- related complications. ABO blood group showed a significant correlation with the development of diabetes mellitus chronic complications, despite the fact that the mechanism behind such an association is not very clear or defined.

Conflict of interest

The authors declare no conflict of interest.

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