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ORIGINAL RESEARCH

Platelet volume indices as predictive biomarkers in type 2 diabetic patients

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Abstract
Background: To study platelet volume indices as predictive biomarkers in type 2 diabetes.
Materials & methods: A total of 100 patients were enrolled. 50 were diabetic patients and 50 were non diabetics. Complete history was taken. Statistical analysis was performed by SPSS software. Student's t-test was done. A $P < 0.05$ was considered statistically significant.
Results: A total of 100 subjects were enrolled. MPV was significantly increased in diabetic patients with complications (11.02) than diabetics without complications(9.02) than non diabetic group ($P < 0.001$).
Conclusion: MPV and PDW are predictive biomarkers of diabetes.
Keywords: biomarkers, type 2 diabetes, MPV.

Introduction

Diabetes mellitus (DM) is the most challenging problem in today's world. [1] It is a complex disease characterized by chronic hyperglycemia, metabolic abnormalities, and long-term macro- and micro-vascular complications involving the blood vessels, eyes, kidneys, and nerves. [2] Diabetes mellitus has been growing rapidly as a worldwide public health problem. According to International Diabetes Federation (IDF) estimation, as of 2019, 463 million (8.8%) adults had DM worldwide. This global prevalence is estimated to be increased to 700 million (10.9%) by the end of 2045. It is estimated that the middle and low-income countries will bear the brunt of the diabetes epidemic to the extent of 80% of the global burden. [3]

Platelets play an important role in atherosclerosis and coronary artery disease progression. Several standard easily available complete blood count parameters such as mean platelet volume (MPV), platelet-large cell ratio (P-LCR) and platelet distribution width (PDW) have been associated with platelet function and young or more active platelets. Platelet indices change in relation to cardiovascular risk factors, including type 2 diabetes mellitus (T2DM). In patients undergoing PCI, MPV is associated with the severity of coronary artery disease and is an independent predictor of major cardiac events, in both T2DM and non-T2DM patients. [4-6] In patients with acute myocardial infarction, MPV has been associated with higher mortality during follow-up especially in diabetic patients. [7] Further, an increase of MPV over time in patients undergoing percutaneous coronary intervention (PCI) could be a predictor of mortality. [8] Mean platelet volume (MPV) is an indicator of average size and activity of the platelets and is reported to be high in diabetes mellitus and is considered as a risk factor for heart disease. Similarly platelet distribution width (PDW) is an indicator of

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variation in platelet size which may be a sign of active platelet release. Platelet large cell ratio (P-LCR) is directly related to PDW and MPV. [9] Hence, this study was conducted to study platelet volume indices as predictive biomarkers in type 2 diabetes.

Materials & methods

A total of 100 patients were enrolled. 50 were diabetic patients and 50 were non diabetics. Complete history was taken. Blood samples were collected and complete laboratory investigations were done. Hb, platelet count, MPV, PDW, and P-LCR were also recorded. Plasma glucose levels were measured by the glucose oxidase method. HbA1c level were analysed. Statistical analysis was performed by SPSS software. Student t-test was done. A $P < 0.05$ was considered statistically significant.

Results

A total of 100 subjects were enrolled. MPV was significantly increased in diabetic patients with complications (11.02) than diabetics without complications (9.02) than nondiabetic group ($P < 0.001$). There was a statistically significant difference of PDW between diabetics with complications (14.54), diabetics without complications (13.67) and nondiabetic groups ($P < 0.001$). However, no statistically significant difference was observed in P-LCR among all the three study groups.

Table 1: comparison of platelet volume indices in diabetes and control group

Groups	n	MPV		PDW		P- LCR	
		mean	mean	mean	mean	mean	mean
DM with complication	20	11.02	1.69	14.54	3.26	25.33	10.35
DM without complication	30	9.02	1.65	13.67	2.97	24.33	9.26
Normal	50	8.20	0.98	15.32	1.06	24.32	5.87
p- value		<0.001*		<0.001*		0.78	

*: significant

Discussion

Diabetes is a growing health problem associated with increased risk of micro- and macro-vascular complications. [10] With the easy availability of various blood tests such as platelet volume indices (PVI), efforts are made to identify and prove their utility to act as biomarkers for early detection of diabetic complications. The chronic hyperglycemia and attendant metabolic deregulation of DM resulting in long-term diabetes-related complications in multiple organ systems of the body. [11]These complications are responsible for the majority of morbidity and mortality associated with the disorder which impairs the quality of life of the patient and imposes significant cost implications for the patient, relatives, and the healthcare system. [12]Hence, this study was conducted to study platelet volume indices as predictive biomarkers in type 2 diabetes.

In the present study, a total of 100 subjects were enrolled. MPV was significantly increased in diabetic patients with complications (11.02) than diabetics without complications (9.02) than nondiabetic group ($P < 0.001$). A study by Taderegew MM et al, studied that one hundred seventeen (33.2%) of participants were suffering from at least one microvascular complications. The mean platelet volume (MPV), platelet distribution width (PDW), and platelet-large cell ratio (P-LCR) were significantly increased in DM patients with complications as compared to without complications (13.57±2.17fl vs. 11.76±1.93fl), (16.57±2.49fl vs. 14.97±2.41fl) and (28.09±7.58% vs. 24.19±6.46%), respectively (all are $P<0.001$). In multivariate logistic regression analysis, MPV (AOR=1.68, 95% CI: 1.37–2.05), PDW (AOR=1.37, 95% CI: 1.15–1.63), P-LCR (AOR=1.07, 95% CI: 1.01–1.14), age

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(AOR=1.07, 95% CI: 1.01–1.12), and duration of DM (AOR=1.31, 95% CI: 1.18–1.46) were significantly associated with the presence of microvascular complications. MPV, PDW, and P-LCR were significantly higher among type 2 DM patients with microvascular complications. [13]

In the present study, there was a statistically significant difference of PDW between diabetics with complications (14.54), diabetics without complications (13.67) and nondiabetic groups ($P < 0.001$). However, no statistically significant difference was observed in P-LCR among all the three study groups. Another study by Sus I et al, studied 718 patients, 222 (30.9%) had T2DM; 61% of patient underwent PCI for SCAD, the rest for NSTE-ACS or STEMI. Prior to PCI, MPV, PDW and P-LCR were not higher in T2DM patients irrespective of the indication for PCI. At a follow-up time of 69 (46-98) days, platelet indices were not different between TD2M+ and T2DM-, except from MPV (11.0 vs. 10.6, p=0.02) which were higher in TD2M patients with SCAD. Intraindividual variability of platelet indices was not different in diabetics, but MPV, PDW and platelet count decreased over time (3.5% and 8.4% respectively) in diabetics with STEMI (p=0.02). [14] Human platelets are anucleate discoid cells that circulate in the bloodstream and participate in hemostasis. In response to stimuli generated by the endothelium of blood vessels, platelets change shape, adhere to subendothelial surfaces, secrete the contents of intracellular organelles, and aggregate to form a thrombus. [15] Higher MPV in diabetic patients indicates larger platelet size suggesting stimulated thrombopoiesis and augmented platelet activation. [16] Platelet hyperactivity is accompanied by an increased production of thromboxaneA2, serotonine, thromboglobulin or a decreased synthesis of prostacycline. One possible mechanism of increased MPV in DM is osmotic swelling due to raised blood glucose and perhaps due to a shorter life span of platelets in diabetic patients. [17]

Conclusion

MPV and PDW are predictive biomarkers of diabetes.

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