

A Study of Platelet Indices in Type 2 Diabetes Mellitus Patients: A Cross-Sectional Study Design

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ABSTRACT

Objective: The aim of the study is to evaluate the reactivity of platelet parameters in a patient suffering from Type 2 diabetes mellitus.

Place and duration of study: The study is conducted at Pak International Medical College Hayatabad Peshawar (PIMC) during march 2021 to march 2022.

Material and Method: Cross sectional hospital based study design is carried out on 300 diabetic patients having type 2 diabetes mellitus which is considered as a test group and compared with 300 normal blood glucose levels containing individuals which is considered as a control group. The blood samples of diabetes patients are analyzed under automated Hematology analyzer Sysmex XN-1000 and complete blood count of patients is analyzed with platelet parameters. Statistical software used for the research test evaluation is SPSS Version 24.

Results: The mean age in year of diabetic patients in this research study is 54.2±5.9 years and control group of patients having age in years is 54.5±5.3 years. Most of the sample patients in this study are suffering from type 2 diabetes mellitus. In this study, the number of males both in test and control group is 335(55.83%) and total number of females is 265(44.1%). In an Overall 300 patients lies in test group in this study, 127 are suffering from any other co-morbid conditions while 173 case samples are not suffering from any complicated state. Platelet parameters also compared between diabetic patients having complications or no complications, Mean of platelet indices are seen higher in diabetic patients having some other complications. The higher values of MPV, PDW and PLCR serve as an indicator in the initial complications of diabetes mellitus in humans and consider as a basic and inexpensive tool to analyze the vascular diseases and its related consequences.

Conclusion: According to our study larger platelet formation and increase in volume of platelet indices causing prothrombotic state in diabetic patients and also develop diabetic vascular complications in an individual. Platelet parameters are considered as vital, clear, easy and non-expensive ways to analyze the thrombotic state in vascular disorders in diabetes patients.

Keywords: Diabetes mellitus, Hematological findings, Glycated hemoglobin HbA1c, Mean platelet volume.

INTRODUCTION

According to WHO, diabetes is considered as the metabolic state of various causes perceived as chronic hyperglycemic condition having inability of producing an insulin which causes abnormal increase in glucose levels in blood stream. Diabetes mellitus affects around 172 million people around the globe and an estimate to affects approximately 366 million individuals by the end of 2030¹. Considering United States and India are the countries having a maximum number of diabetes patients, people suffering with diabetes having greater platelet sensations directly or by promoting glycation process of platelet proteins. Both the metabolic states of insulin resistance and insulin scarcity maximize platelet sensations². Mean platelet volume (MPV) is the sign of mean size and activity of platelet and is found to be greater in diabetic patients and constitutes a chance of getting heart disorders. Platelet distribution width (PDW) is a signal of discrepancy in platelet size. Platelet large cell ratio (PLCR) is positively related to PDW and MPV³. Many other parameters of platelet activity are time taking, costly and using a higher sample volume while MPV, PDW and P-LCR can be easily determined on automated hemograms which are cost effective. Patients having greater platelet count can be easily analyzed with haematological findings and treated with medications on time.

This study suggests that platelet evaluation may be useful in the early detection of long-term complications in diabetic patients, considering that it is a simple and low-cost tool. Platelet function tests are not conducted on the patients to substantiate our findings further. Patients with qualitative disorders and reactive causes for raised platelets were not assessed and will be assessed further.

MATERIAL AND METHODS

This study is conducted in the Pak International Medical College Hayatabad Peshawar (PIMC) and The duration of study is March 2021 to March 2022

Cross sectional hospital based study design is carried out on 300 diabetic patients having type 2 diabetes mellitus which is considered as a test group and compared with 300 normal blood glucose levels containing individuals which is considered as a control group. Exclusion criteria are those male patients with hemoglobin less than 13 gm% and female patients with Hb less than 12 gm%. Any of the subjects that are suffering from any virulence, taking anti-platelet medications like clopidogrel and aspirin are excluded from the study.

Cut off values of platelet parameters are generating by measuring the minimum value of these parameters in diabetic patients. All the test and control samples are interviewed and undergone complete clinical evaluation in association with any micro or macro-vascular complications or of any medicines that they are taking. Glycemic related parameters like blood glucose levels and glycated hemoglobin test are performed after confirmation of diabetic state. The instrument used for the evaluation of glycemic parameters is Roche Hitachi Cobas c311 (Hitachi Ltd, Tokyo, Japan). The blood samples of all diabetic patients are taken with 5ml syringe and mixed in EDTA vacutainers. The samples are then operated under automated Hematology analyzer Sysmex XN-1000 (Sysmex Corporation, Kobe, Japan) and complete blood count analysis of the sample was taken including the platelet parameters (MPV, PDW and P-LCR). Measurements are analyzed using mean and SD values and statistically with Pearson correlation coefficient, to correlate all the parameters with one other. Statistical software used for the research test evaluation is SPSS Version 24.

RESULT

300 type 2 diabetic test samples and 300 control samples having normal parameters of blood glucose is evaluating in this research study.

The mean age in year of diabetic patients in this research study is 54.2±5.9 years and control group of patients having age in years is 54.5± 5.3 years. Most of the sample patients in this study is suffering from type 2 diabetes mellitus. The overall mean duration of diabetes in both test and control group is 4.9±3 years. In this study, the number of males both in test and control group are 335(55.83%) and total number of females are 265(44.1%). The number of males in diabetic group are 154 compared to 181 in non-diabetics group while number of females in diabetic group are 146 compared to 119 in non- diabetics group. In an Overall 300 patients lies in test group in this study, 127 are suffering from any other co-morbid state such as diabetic foot, hypertension, coronary artery disease, diabetic nephropathy or retinopathy, peripheral vascular disease, hypercholesterolemia or increase in triglyceride conditions. 173 case samples are not suffering from any complicated state.

The blood glucose variables i.e FBS, RBS, PPBS and glycated hemoglobin are significantly higher in diabetic group as compared to non-diabetic group. (p value < 0.001).

We have calculated the mean values of The MPV, PDW and P-LCR values in both diabetics and non-diabetics groups. The mean MPV in diabetic cases were 11.9 ± 1.1 fl compared to 9.4 ± 0.7 fl in non diabetics with p value 0.002. Mean PDW and P-LCR in diabetic patients were 15.6 ± 2.6 fl and 38.1 ± 7.9 % compared to non diabetics where it was 10.9 ± 0.8fl and 24.2 ± 2.5% respectively. Our study observed p value of MPV, PDW and P-LCR are highly significant in diabetic patients (p <0.05) (Table 1).

In overall diabetic samples of patients, positive Pearson correlation is observed between between MPV, PDW and P-LCR

with HbA1c, FBS, RBS, PPBS, and complications while no statistical correlation is seen in comparison with duration of diabetes in years. (Table 2).

Diabetic patients were also divided into two groups after Evaluation of samples according to HbA1c level in which out of 300 Type 2 DM cases, there were 70 patients in group A and 230 patients in group B. The mean MPV in group B is

Significantly higher in comparison to group A and significantly higher PDW in group B is observed in our study compared to group A. Our study also observed statistical significant difference between mean P-LCR in group B than group A. Duration of diabetes was not statistically significant between groups A&B (p value 0.752) (Table 3).

Platelet parameters also compared between diabetic patients having complications or no complications, Mean of platelet indices are seen higher in diabetic patients having some other complications. (Table 4)

Table 1: comparative parameters among diabetic cases and non-diabetic controls

Parameters	Diabetic (n = 300) (Mean ± SD)	Non-diabetic (n = 300) (Mean ± SD)	t test (p-value 2 tailed)
HbA1c (%)	8.2 ± 1.2	3.5 ± 0.5	0.003
FBS (mg/dl)	162.4 ± 34.1	85.6 ± 5.2	0.004
RBS (mg/dl)	226.2 ± 43.12	18.3 ± 20.6	0.002
PPBS (mg/dl)	246.8 ± 36.2	148.9 ± 9.4	0.004
MPV (fl)	11.9 ± 1.1	9.4 ± 0.7	0.002
PDW (fl)	15.6 ± 2.6	10.9 ± 0.8	0.003
P-LCR (%)	38.1 ± 7.9	24.2 ± 2.5	0.003

Table 2: Correlation of MPV, PDW and P-LCR with different parameters investigated between diabetic cases

Parameters	MPV (fl)		PDW (fl)		P-LCR (%)	
	Correlation coefficient (r value)	p value	Correlation coefficient (r value)	p value	Correlation coefficient (r value)	p value
HbA1c (%)	0.149	<0.002	0.169	0.001	0.171	0.002
FBS (mg/dl)	0.067	<0.02	0.089	<0.001	0.088	<0.002
RBS (mg/dl)	0.016	<0.002	0.051	<0.04	0.031	<0.02
PPBS (mg/dl)	0.031	<0.04	0.069	<0.02	0.049	<0.06
Duration of diabetes in years	0.131	0.537	0.163	0.554	0.145	0.150
Complications	0.089	<0.04	0.089	<0.02	0.099	<0.001

Table 3: Group A and group B comparison between diabetic cases.

Parameters	Group A Hba1c<6.5% (n = 70) Mean ± SD	Group B Hba1c C 6.5% (n = 230) Mean ± SD	t test p value (2-tailed)
Age (years)	53.4 ± 5.8	55.6 ± 5.7	0.002
Duration of diabetes (Years)	12.3± 1.4	12.5 ± 1.2	0.025
PDW (fl)	15.2 ± 2.6	15.5 ± 2.7	0.025
P-LCR (%)	36.5 ± 8.9	38.9 ± 7.8	0.015
FBS (mg/dl)	139.8 ± 12.6	172.6 ± 36.2	0.003
RBS (mg/dl)	188.5 ± 18.1	225.9 ± 43.1	0.005
PPBS (mg/dl)	222.2 ± 25.2	252.6 ± 40.0	0.002
Duration of diabetes (Years)	3.6 ± 1.8	3.9 ± 1.9	0.752

Table 4: Comparison of selected parameters among diabetic patients with and without complications

Parameters	Complications absent (n = 173) Mean ± SD	Complications present (n = 127) Mean ± SD	t test p value (2-tailed)
MPV (fl)	12.4 ± 1.1	12.6 ± 1.3	0.108
PDW (fl)	14.2 ± 2.3	15.2 ± 2.5	0.099
P-LCR (%)	37.2 ± 7.5	37.8 ± 7.9	0.106
HbA1c (%)	7.2 ± 1.2	7.5 ± 1.3	0.004
FBS (mg/dl)	152.7 ± 25.2	170.1 ± 37.2	0.006
RBS (mg/dl)	224.2 ± 31.2	228.1 ± 44.1	0.008
PPBS (mg/dl)	230.5 ± 27.2	272.4 ± 44.0	0.003
Duration of diabetes (Years)	4.2 ± 1.67	8.1 ± 2.8	0.030

DISCUSSION

Diabetes is not considered a sole disease state but it is a cluster of other metabolic disorders sharing the same attribute of

hyperglycemia. The chronic diabetic state is considered to be lethal for many of the organ system specifically for eyes, kidneys and blood vessels⁴.

Diabetes is now emerging as a prime metabolic state worldwide⁵. In India diabetes spread in a large number of patients which is one of the basic causes of morbidity and mortality affecting badly to middle aged and young individuals⁴. The mean age of onset of diabetes mellitus is 40 years. The core consideration in this disease state is to prevent vascular complications and monitor other diabetic condition. Type 2 diabetes is found more commonly than type 1 diabetic state. Deficiency in insulin availability is the main factor for development of diabetes and it contributes to platelet abnormalities⁶. Platelets of type 2 diabetes patients have increased reactivity and baseline activation which plays a vital role in the formation of vascular complications⁷. Long term hyperglycemic state can cause endothelial dysfunction and vascular complications more frequently. Platelets are discoid cells circulating in blood freely and takes a part in body hemostatis. Higher MPV rate in diabetes patients indicates increase in platelet size causing stimulated thrombopoiesis and making platelet activation⁸. Osmotic swelling due to higher glucose levels causing increase in MPV and poses a shorter lifespan of platelets in diabetic patients⁹. In our study MPV is significantly higher in diabetic group than in non diabetics. PDW is also significantly higher in diabetic test samples compared to controls samples. Similar results observed in studies done by Demirtas et al.^[10], Jabeen et al.^[11] and Dalamaga et al. ^[12] with significantly higher PDW levels among diabetic cases.

PLCR is a new parameter to determine the platelet volume, is also significantly higher in our research study as compared to control group. Papanas et al.^[9] and Demirtas et al.^[10] concluded significantly higher MPV in diabetics with complications than without complications in their study. And Jindal et al.^[13] observed a statistically significant higher PDW and P-LCR in diabetics with complications than without complications as seen in our study design.

According to Ozder and Eker^[14] improvement in diabetic control decreases glycosylated hemoglobin and MPV ratios, improves platelet functions and its activation, and delays vascular complications of diabetes.

CONCLUSION

According to our study larger platelet formation and increase in volume of platelet indices causing prothrombotic state in diabetic patients and also develop diabetic vascular complications in an individual. Large number of platelets can easily be identified in normal hematological report analysis as MPV, PDW and PLCR are the result of automated blood counts. These are the beneficial anticipated components of vascular complication determination. They are considered as vital, clear, easy and non-expensive ways to analyze the thrombotic state in vascular disorders in diabetes patients.

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