

Traversing the Association between Platelet indices and Blood sugar levels in Type 2 Diabetes Mellitus patients

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Abstract:

Background: Diabetic individuals have a greater risk for vascular diseases. Atherothrombosis are noted in diabetes which includes increased atherosclerosis, coagulopathy, and platelet reactivity. Platelet count and Platelet distribution width being considered as the best markers for thrombotic potentials and are used as indicators for vascular complications in diabetes. Our aim was to explore the association between platelet indices and blood sugar levels in Type 2 Diabetes Mellitus patients in comparison with controls. Earlier prediction of microvascular events using platelet indices and preventing complications is the purpose of this study. **Materials & Methods:** This cross-sectional study was conducted among patients from a district hospital after obtaining consent. Ethical committee clearance was obtained. Our study included 80 subjects of both sexes, 40 diabetics and 40 non-diabetics from the age group of 25 years and above. Subjects who were severely ill, on dialysis, with malignancies, liver pathologies, hematological disorders, acute or chronic infection, on drugs, pregnant/menstruating women, smokers and alcoholics were excluded from the study. The platelet count, Platelet distribution width (PDW), Mean Platelet volume (MPV) of the subjects were done and their fasting blood sugar (FBS), Postprandial Blood sugar (PPBS) and HbA1c were determined. Statistical Analysis was done using student t-test and Pearson's correlation coefficient (SPSS system version 15.0). **Results:** In diabetic individuals there is significant increase in PDW and MPV with rise in blood sugar levels whereas there is no such change among control groups. Weak correlation was found between FBS with MPV among cases. **Conclusion:** This study provided a glimpse that platelet indices which are cost effective can be used as best early predictors of thrombotic events in diabetic individuals thereby preventing complications.

Keywords: diabetes, fasting blood sugar, mean platelet volume, platelet count

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Introduction:

Diabetic patients were found to be in a prothrombotic state. As an add-on to this state, these individuals have heightened platelet reactivity which is associated with increased risk of

vascular complications.¹ This hyperglycemic state paves way for an activated megakaryocyte-platelet system leading to formation of larger platelets and also promotes glycation of platelet proteins.³ This leads to the production of thrombotic factors pushing the patient towards thrombotic state and

paving way for cardiovascular diseases, stroke and microvascular events.

Platelet indices like Platelet distribution width (PDW), Mean platelet volume (MPV), platelet count are the best markers of thrombotic potential. MPV is an index of platelet size which reflects the functional activity of platelets and PDW denotes the variation in platelet size.⁶

Any alteration in the platelet function and activity has a massive effect in diabetic individuals.

Materials & Methods:

Study design:

This is a cross-sectional study and was conducted among patients in a district hospital. Our study included 80 subjects, among them 40 diabetic patients from outpatient department were taken as cases and 40 apparently healthy individuals and non-diabetics were taken as control group.

The individuals were in the age group of 25 years and above of both genders.

Inclusion & Exclusion criteria:

Under diabetic group, Type II Diabetic patients with FBS>126 mg/dl and PPBS>200mg/dl and HbA1c >6.5% (according to ADA 2022) were recruited. In control group apparently healthy individuals, no history of chronic diseases or not on any medications were included.

Subjects who were severely ill, those on dialysis, with malignancies, liver pathologies, anemia, hematological disorders, chronic kidney disease, with acute or chronic infection, those on drugs like antiplatelets, antihypertensives and statins, pregnant women, menstruating women, smokers, and alcoholics were excluded from the study.

Methodology:

Ethical clearance was obtained for the study from Institutional Ethical Committee. Informed consent was obtained from the subjects.

After thorough clinical examination, blood samples were collected from the subjects in an EDTA containing tube and parameters such as platelet count, Platelet distribution width (PDW), PDW/PLT ratio, Mean Platelet volume (MPV) were done using fully automated analyzer -Model Beckman Coulter AU480 and their fasting blood sugar (FBS), Postprandial Blood sugar (PPBS) and HbA1c were determined using Beckman Coulter DxH820.

Statistical analysis:

Statistical analysis was performed using student t test and Pearson's correlation coefficient for comparison with SPSS 15.0 version.

Results:

Significant rise in MPV and PDW was found among diabetic individuals whereas mean platelet count is decreased as shown in Table II.

The mean platelet count showed no significant difference among cases and controls. PDW/Platelet ratio was found to be not significant in our study.

Further analysis showed a weak and insignificant correlation between PDW and FBS, MPV and FBS among cases. There is no significant correlation with platelet count and PDW/PLT ratio (Table III).

On the other hand, there is negative correlation between PDW and FBS ($r=-0.038, p=0.816$) and MPV with FBS ($r=-0.204, p=0.206$) among control group.

Table I: General Characteristics of the Study Subjects

Variables	Cases (n=40)		Control (n=40)	
	Mean	SD	Mean	SD
Age (years)	47.72	10.370	46.05	11.651

In total, 41 male and 39 female individuals participated in our study.

Table II: Comparison of Platelet Indices and Blood Sugar Levels in Study Subjects

Parameters	Cases (Type II DM)		Controls (Non -diabetics)		p value	Statistical inference
	Mean	SD	Mean	SD		
Platelet count (x10 ⁹ L)	278.98	53.113	280.98	48.294	p=0.861	Not significant
Platelet distribution width (%)	16.85	0.421	12.27	0.834	p=0.006*	Significant
Mean Platelet volume(fL)	10.54	2.8160	7.83	1.002	p=0.018*	Significant
PDW/Platelet ratio	0.0678	0.1114	0.0705	0.0095	p=0.25	Not significant

*p value <0.05 will be considered statistically significant

Table III: Comparison of Blood Sugar Levels among Cases and Control

Variables	Cases (n=40)			Control (n=40)		
	Mean	SD	p value	Mean	SD	p value
FBS (mg/dl)	161.25	49.26	0.0001<0.05 Significant	104.8	10.66	0.0001<0.05 Significant
PPBS (mg/dl)	261.18	69.67	0.0001<0.05 Significant	158.75	22.45	0.0001<0.05 Significant
HbA1c (%)	8.16	1.58	0.0001<0.05 Significant	6.09	0.91	0.0001<0.05 Significant

*p value <0.05 will be considered statistically significant

Table IV: Correlation of Platelet Indices with Blood Sugar Levels among Diabetic Individuals

Platelet indices	FBS (Mean-161.25 mg/dl)	p value	PPBS (Mean-261.18 mg/dl)	p value
	r value		r value	
Platelet count (x10 ⁹ L)	-0.047	0.775	-0.124	0.445
PDW (%)	0.251	0.118	0.233	0.148
MPV (fL)	0.012	0.939	0.120	0.459
PDW/PLT ratio	-0.269	0.093	-0.307	0.054

*p value <0.05 will be considered statistically significant

Discussion:

Diabetes mellitus, the endocrine disorder due to either insulin deficiency or insulin resistance is a global burden affecting more than 400 million population worldwide. Hyperglycemia is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems, especially the eyes, kidneys, nerves, micro and macrovascular system. It is a metabolic disorder causing derangement in carbohydrate, fat and protein metabolism.⁶ The metabolic effects of diabetes can have adverse effect on platelet function.

Platelets are disc shaped cells formed in the bone marrow from the megakaryocytes. These non-nucleated cells play a pivotal role in haemostasis. Hyperglycemia causes non-enzymatic glycation of platelet proteins which reduces the fluidity of the membrane which triggers the activation of platelets.³ Platelets which are hyperactive have a greater tendency to participate in thrombotic events.⁴ Hyperglycemia also has osmotic effect on platelets.³

Platelets can be the best markers in diabetic individuals to know their way towards thrombotic state. The activity of platelets and their aggregation potentials which are the prime

components of atherogenesis and thrombosis can be measured by indices like MPV.¹¹

In our study platelet function indicators such as MPV and PDW had an upper hand in diabetic subjects than healthy individuals. Also, from the result we can see there is weak and insignificant correlation between MPV and FBS in diabetic subjects. No correlation was found in control group. This can be due to the reason of hyperactivation of platelets leading to increased production of large sized platelets, which increases the mean platelet volume. Increased PDW has also been noted in our study among diabetics.³ Platelets of diabetic subjects show heightened reactivity being the lead in development of vascular events.⁶

In general chronic infection leads to rise in platelet count and MPV and diabetes being an inflammatory state justifies that.⁶ In contrast to platelet indices which showed weak correlation, the platelet count was found to be negatively correlated with FBS and PPBS in our study which needs larger sample size in our study population in near future.

Conclusion:

The study shows higher MPV and PDW in diabetics when compared with control which indicates



increased platelet size and activity that can play a role in vascular events. Platelet indices can be a boon since they are simple and low-cost parameters and reflects the treacherous side of diabetic complications.

Limitations:

Our study did not include the specific duration of diabetes. Larger sample size will be included in the future study to find the effect of blood sugar levels on platelet count. Certain parameters like plateletcrit and platelet large cell ratio will also be done in future.

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Conflict of interest: Nil

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