Original Research Article

Role of Platelet Indices for Predicting Vascular Complications in Type II Diabetics

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Abstract

Background: Diabetes mellitus is one of the most common diseases with hyperglycemia as the main etiological factor. Elevated blood sugars in the body are a predisposing factor for thrombosis. Vascular complications are a cause of the morbidity in diabetics. Mean Platelet Volume and Platelet Distribution Width are the platelet indices which are elevated in a thrombogenic state. Thus we have evaluated the role of these two parameters in type II diabetics. *Aims:* • To calculate the Mean platelet volume and Platelet distribution width in both controls and cases • Correlate these indices with HbA1c, duration of diabetes and the presence of vascular complications in diabetics. *Settings and Design study:* Prospective. *Methods and Material:* A one year prospective study was done. 150 subjects were included divided into cases and controls. Cases were again divided into those with vascular complications (23) and those without vascular complications (52). Platelet indices were studied with special emphasis on Mean platelet volume and Platelet distribution width among both cases and controls. These were compared with glycosylated hemoglobin, duration of diabetes and presence of vascular complications. *Statistical analysis used:* SPSS. *Results:* Mean platelet volume and Platelet distribution width were elevated in diabetics when compared to non-diabetics and the increase was more relavant in those with complications. Statistical significance was seen with Mean platelet volume but not with Platelet distribution width. *Conclusion:* Our study thus highlights the differences in platelet indices among diabetics and non diabetics with emphasis on those with vascular complications.

Keywords: Mean Platelet Volume; Platelet Distribution Width; Diabetes; Complications.

Introduction

Diabetes, a metabolic disease is associated with hyperglycemia which is a predisposing factor for thrombosis.[1] Morbidity is due to the vascular complications for which platelet dysfunction and their hyper reactivity play a significant role [2]. MPV and PDW are the platelet indices for assessing

the functional activity of the platelets [3,4]. Mean platelet volume is a reflection of changes in platelet stimulation or production. Platelet distribution width is an indicator of platelet heterogeneity after they get activated [5].

Aims and Objectives

To calculate the MPV and PDW in both controls and cases

- Co relate these indices with HbA1c, duration of diabetes and the presence of complications in diabetics

Materials and Methods

- Study design: Prospective
- Sample size: 150:

  75 non diabetics

  75 diabetics (22 with complications+53 without complications)
- Selection criteria for cases

Inclusion criteria: Fasting sugar above 126mg/dl

Exclusion criteria: Fasting sugar below 110mg/dl

- Selection criteria for controls

Inclusion criteria: Fasting sugar below 110mg/dl

Exclusion criteria: Fasting sugar above 126mg/dl

- Detailed clinical history including the duration of diabetes was taken.
- Sysmex, an automated hematology analyser was used to analyse the samples.
- Hemogram with platelet indices were recorded.
- Biochemical analysis for the fasting glucose and HbA1c were noted.
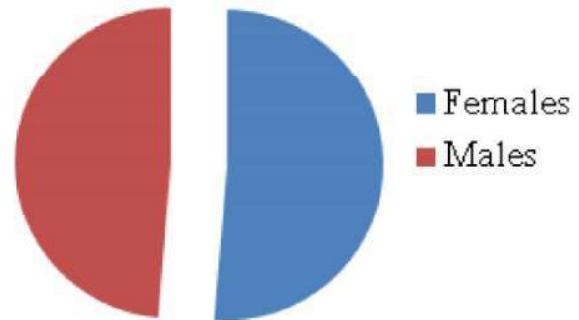- Statistical analysis was done using SSPS software.

Results

- *Age distribution*

Age distribution

- 11-20
- 21-30
- 31-40
- 41-50
- 51-60
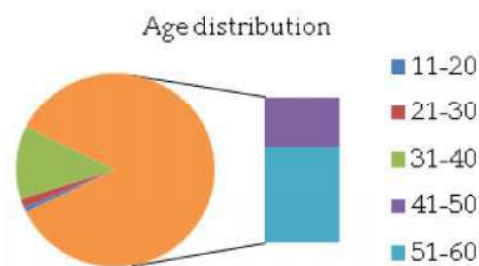
- *Sex distribution*

  M:F- 1:1.05

Sex Distribution

- Females
- Males

- *Mean platelet count in both groups*

The mean platelet count was almost the same in both cases and controls with a slight decrease in the diabetics but with no statistical significance. (Table 1).

- *Mean platelet count in diabetics with and without complications*

The mean platelet count was decreased in the diabetics with complications than those without complications but there no statistical significance. (Table 2).

- *Comparison of various parameters among diabetics and non-diabetics*

Among diabetics, there was a significant statistical significance in the *HbA1c and mean platelet volume* which was not seen in non diabetics.

The platelet distribution width was slightly elevated in diabetics but the p value was not significant. (Table 3).

- *Comparison of various parameters among diabetics with and without complications in relation to HbA1c*

Out of all the parameters, statistical co-relation was seen in the mean fasting glucose, duration of diabetes and mean platelet volume with HbA1c. (Table 4).

- *Comparison of various platelet indices among diabetics with and without complications*

Platelet count was decreased, Platelet distribution width and mean platelet volume were elevated in diabetics with complication when compared to those without complications. (Table 5).

Statistical significance was seen only in the mean platelet volume only.

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Table1: Mean platelet count in both groups

	Diabetics (n=75)	Non Diabetics (n=75)	P-value	Statistical significance
Mean Platelet count	2.820.65±	2.890.66±	0.225	No

Table 2: Mean platelet count in diabetics with and without complications

	Diabetics With complications	Diabetics Without complications	P-value	Staistical significance
Mean platelet count	2.42±0.55	2.65±0.66	0.295	No

Table 3: Comparison of various parameters among diabetics and non-diabetics

Parameter	Diabetics	Non-diabetics	P-value	Statistical significance
HbA1C	9.58±2.56	5.59±0.61	0.002	Yes
Platelet count	2.89±0.55	2.51±0.66	0.18	No
Platelet distribution width	19.14±0.78	18.69±10.85	0.075	No
Mean platelet volume	9.79±1.83	7.58±1.26	0.0015	Yes

Table 4: Comparison of various parameters among diabetics with and without complications in relation to HbA1c

	HbA1C<7% 20(with complications)	HbA1C>7% 55 (without)	P-value	Significance
Mean fasting glucose	1405.3±	175+14.7	0.003	Yes
Mean platelet count	2.420.55±	2.65+0.66	0.295	No
Platelet distribution width	17.10.5±	18.6+9.35	0.1018	No
Mean platelet volume	7.810.45±	9.05+1.70	0.0032	Yes
Duration of diabetes	6.53.5±	21.5+10.5	0.0019	Yes

Table 5: Comparison of various platelet indices among diabetics with and without complications

Parameter	With complications	Without complications	P-value	Statistical significance
Platelet count	2.810.55±	2.61+0.66	0.16	No
Platelet distribution width	17.810.78±	16.9+10.85	0.098	No
Mean platelet volume	10.791.95±	8.50+1.30	0.0012	Yes

Discussion

Diabetes mellitus refer to a group of metabolic diseases which share the common underlying feature of hyperglycemia. Metabolic dysregulation due to chronic hyperglycemia is associated with secondary damage in multiple organ systems the kidneys, eyes, nerves, and blood vessels. Macrovascular and microvascular complications are a major cause of morbidity in diabetics. Macrovascular disease involves both large- and medium-sized muscular arteries whereas capillary dysfunction in target organs is seen is seen in microvascular disease. The clinical conditions associated with macrovascular disease are increased risk of myocardial infarction due to accelerated atherosclerosis leading to stroke, and lower-extremity gangrene. Retina, kidneys, and peripheral nerves are the end organs affected

in microvascular disease resulting in diabetic retinopathy, nephropathy, and neuropathy, respectively. Pathogenesis of long-term diabetic complications is implicated by the following three distinct pathways: Formation of Advanced Glycation End Products: by the nonenzymatic reactions between intracellular glucose-derived dicarbonyl precursors and amino group of both intracellular and extracellular proteins.

Activation of Protein Kinase C: due to intracellular hyperglycemia, diacetyl glycerol is synthesized de novo ladeing to activation of protein kinase C which further is the cause of the synthesis of the proangiogenic molecule, vascular endothelial growth factor (VEGF) which leads to neovascularisation as in diabetic retinopathy.

Intracellular Hyperglycemia with Disturbances in Polyol Pathways: GSH regeneration is reduced

and the susceptibility of cells to oxidative stress is increased [6]. Diabetes mellitus is a prothrombogenic state with enhanced platelet activity and this exaggerated platelet aggregation has been implicated with micro and macrovascular complications [7]. Mean platelet volume is an indicator of platelet function, the larger ones have dense granules and exhibit high thrombotic potential [8].

Platelet hyper reactivity is a predisposing factor for endothelial dysfunction and impaired fibrinolysis. Hyperactive platelets thus play a crutial role in the pathogenesis of thrombotic complications in diabetes [9].

The proposed theory for the increase in MPV was hyperglycemia associated osmotic swelling as there will be non enzymatic glycation of proteins on the surface of platelets [10].

In our study, the mean platelet volume was 10.79+1.95 in diabetics with complications and 8.50+1.30 in diabetics without complications. Our results co related with those done by Gupta et al. [11], Yeniguin et al. [11] and Jindal et al. [12]. The PDW value was 17.84+0.78 in those with complications and was 16.9+10.85 in those without complications. The value was increased though not with statistical significance. Similar findings were observed in the studies done by Sonali Jindal et al. [12].

Platelet count was decreased in diabetics when compared to controls and also reduced further in those with complications but there was no statistical significance in cordance with the studies done by Yenguin et al. [13] and Bhanukumar et al.[14].

HbA1c was elevated in diabetics than the controls, 9.58+2.51 and 5.59+0.61 with a co relation between MPV and duration of diabetes. In diabetics with complication the HbA1c was co relating with MPV and duration of diabetes. These findings were comparable with those done by Yengiun et al. [13].

Conclusion

- Our study thus highlights the differences in platelet indices among diabetics and non diabetics with emphasis on those with vascular complications.

- Mean platelet volume has a statistically significant co relation with HbA1c, duration of diabetes and also vascular complications.

- Thus MPV can thus be evaluated as a tool for predicting the outcome in diabetics and to a lesser extent PDW can also be useful.

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