



Research Paper

An observational study to evaluate platelet parameters in patients with type 2 diabetes and impact of glycemic control, duration of diabetes and chronic diabetic complications

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Abstract:

Objective: The main objective of the study was to evaluate platelet parameters in patients with type 2 diabetes and impact of glycemic control, duration of diabetes and chronic diabetic complications.

Materials and Method: This was a prospective descriptive and comparative carried out among patients with DM who visited the OPD of KPC medical college and hospital, Kolkata. Both genders of patients who were more than 18 years of age and within the inclusion criteria were included in this study. Total 240 patients were initially screened for the retrospective analysis among which 120 were diabetic patients (Group A) and 120 were non diabetic patients (Group B). Based on HbA1c value diabetic group I.e., group B further divided into Group BI (HbA1c<6.5%) and Group BII (HbA1c>6.5%). By using an automated blood counter platelet counts and MPV were measured in the above subjects.

Result: Demographic values like age, gender, height, weight and BMI were almost similar in both the groups and the difference were statistically nonsignificant. Parameters like duration of diabetes ($p < 0.005$), BMI ($p=0.026$), FBS ($p < 0.005$), PPBS ($p < 0.005$), HbA1c ($p < 0.005$), platelets ($p=0.48$), MPV ($p < 0.005$) were higher in group BII. Between the two groups platelet parameters including MPV shows a statistically significant increase in diabetics group. no statistical correlation was seen between MPV and BMI, duration of diabetes, whereas a statistically significant correlation observed with MPV and HbA1c, FBS and PPBS. No statistical correlation was seen between MPV and CAD, Dyslipidemia, Hypertension, diabetic foot, retinopathy and Neuropathy.

Conclusion: This study concludes that subjects with diagnosed diabetes were having increased MPV as compared to nondiabetic subjects. The current findings indicate that in middle-aged and older population, MPV might be a potential risk factor of diabetes.

Keyword: diabetes mellitus, glycated haemoglobin, mean platelet volume, cardiovascular complications

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I. INTRODUCTION:

Diabetes mellitus (DM) has routinely been described as a metabolic disorder characterised by hyperglycemia that develops as a consequence of defects in insulin action, insulin secretion or both. Type 2 diabetes encompasses individuals who have insulin resistance (IR) and usually relative (rather than absolute) insulin deficiency [1]. The pathogenic hallmark of DM involves the vasculature leading to both macrovascular and microvascular complications [2]. Chronicity of hyperglycemia is associated with long-term damage and failure of various organ systems, mainly affecting the eyes, nerves, kidneys and heart [1].

According to diabetes atlas (7th edition), the global prevalence of diabetes is estimated at 415 million (8.8%), which is predicted to rise to 642 million in the next 25 years [3]. In India, there are about 69.2 million people with diabetes and are expected to cross 123.5 million by 2040 [3]. Moreover, worldwide approximately 193 million diabetics remain undiagnosed predisposing them to the development of several long-term complications of untreated chronic hyperglycemia [3]. Although intensive glycemic control lowers the incidence and progression of microvascular complications, the morbidity associated with this complications is still increasing [4]. Several landmark studies such as United Kingdom Prospective Diabetes Study (UKPDS) have demonstrated that strict glycemic control does limit microvascular disease while attempts to improve macrovascular outcomes through glucose lowering interventions still remain shrouded with controversy [5].

Platelet volume is describes as a marker of the platelet activation and function, by hematology analysers is measured as mean platelet volume (MPV). Procoagulant proteins such as glycoprotein IIIa and P-selectin, generally expressed by platelets on their surfaces [6]. With respect to altered platelet morphology and function platelets may be involved as a causative agent of developing micro- and macro-vascular disease and increased risk among diabetic patients [7,8]. Platelets from subjects with diabetes may play a pivotal role in the development of diabetic complications as it show hyper-reactivity (i.e., easily triggered by a stimulus) [9,10]. A reliable index of platelet size is Mean platelet volume (MPV). With the functional status of platelets, MPV correlates well. The main objective of the study was to evaluate platelet parameters in patients with type 2 diabetes and impact of glycemc control ,duration of diabetes and chronic diabetic complications.

II. MATERIALS AND METHOD:

This was a prospective descriptive and comparative study carried out among patients with DM who visited the OPD of KPC medical college and hospital, Kolkata. Both genders of patients who were more than 18 years of age and within the inclusion criteria were included in this study. Major inclusion criteria was patients already diagnosed with Type 2 DM and control patients who were diagnosed as non-diabetic after proper investigation. Both diabetic and non-diabetic patients were without known coronary or cerebrovascular or any other vascular disease. Main exclusion criteria for selection was female patients below with haemoglobin 12g% and male patients with haemoglobin below 13g% (nutritional anemias can be a reason for reactive thrombocytosis and hence increased MPV), with abnormal hematocrit, and/or abnormal platelet number, and/or abnormal white blood cell count, diagnosed with any malignancy and any pregnant or lactating women.

A predesigned proforma were used to fetch the data form the clinical records of the patients. For the sake of confidentiality and privacy no personal identifiers (names, contact number, mail ID, address and any other private information) were collected. Data was anonymous and handled confidentially during all phases of research activities. This study was conducted in accordance with the Declaration of Helsinki [11].

Total 240 patients were initially screened for the retrospective analysis among which 120 were diabetic patients (Group A) and 120 were non diabetic patients (Group B). Based on HbA1c value diabetic group i.e., group B was further divided into Group BI (HbA1c<6.5%) and Group BII (HbA1c>6.5%). By using an automated blood counter, platelet counts and MPV were measured in the above subjects. All serum tests were done in pathology department of the study center or from a NABL accredited pathological laboratory.

To analyse all data we used SPSS software version 16.0. As the means \pm standard deviation continuous variables were shown. From all the data captured in pre designed format mean and standard deviations were calculated for time varying variables and or categorical variables percentages were calculated for further analysis. P value <0.001 was considered as significant.

III. RESULT:

Table 1 depicts comparison of physical characteristics between controls and diabetic subjects. Demographic values like age, gender, height, weight and BMI were almost similar in both the groups and the difference were statistically nonsignificant. Between the two groups platelet parameters including MPV shows a statistically significant increase in diabetics group.

Table 1: Comparison of physical characteristics between controls and diabetics

Variables	Group A control (N=120)	Group B diabetics (N=120)	t value	P value
Age (years)	49.3 \pm 5.8	51.4 \pm 6.2	0.874	0.41
Male (N%)	62 (52%)	65 (54%)	0.947	0.72
Height (m)	1.71 \pm 0.16	1.73 \pm 0.12	1.738	0.18
Weight (kg)	65.2 \pm 9.1	65.7 \pm 10.7	1.94	0.09
BMI (kg/m ²)	24.16 \pm 3.4	24.8 \pm 3.3	0.108	0.89
Fasting blood sugar (mg/dL)	77.6 \pm 12.11	151.6 \pm 72.5	9.128	< 0.005
Post prandial blood sugar (mg/dL)	132.1 \pm 54.69	251.7 \pm 93.65	11.181	< 0.005

HbA1c (%)	5.89 ± 0.612	9.11 ± 2.41	11.305	<0.001
Hemoglobin (gm%)	14.7 ± 4.9	14.6 ± 1.44	3.422	0.07
Platelets (X 10 ⁹ /L)	270.71 ± 70.1	275.46 ± 80.12	8.297	0.26
Mean platelet volume (fl)	7.37 ± 0.73	8.19 ± 0.645	8.297	< 0.001

Table 2 depicts Comparison of diabetic study population between group BI and group BII. Parameters like duration of diabetes (p< 0.005), BMI (p=0.026), FBS (p< 0.005), PPBS (p< 0.005), HBA1c (p< 0.005), platelets (p=0.48), MPV (p< 0.005) were higher in group BII.

Table 2: Comparison of diabetic study population between group BI and group BII

Characteristics	Group BI (HbA1c<6.5%) (N=17)	Group BII (HbA1c>6.5%) (N=103)	P Value
Duration of diabetes (Year)	5.1 ± 4.23	8.2 ± 3.28	< 0.005
BMI (kg/m ²)	23.2 ± 2.6	25.21 ± 3.9	0.026
FBS(mg/dl)	86.26 ± 12.84	162.5 ± 47.73	< 0.005
PPBS(mg/dl)	149.9±46.8	270.1±89.11	< 0.005
HbA1c (%)	6.58±0.41	9.13±3.1	< 0.005
Platelets (X10 ⁹ /L)	290.11±66	276.1±84	0.48
MPV(fl)	7.89±0.69	8.15±0.73	< 0.005

Table 3 depicts Correlation of MPV to the various parameters studied like BMI, duration of diabetes, HbA1c, FBS and PPBS. However, no statistical correlation was seen between MPV and BMI, duration of diabetes, whereas a statistically significant correlation observed with MPV and HbA1c, FBS and PPBS (table 3).

Table 3: Clinical correlation of MPV to the various parameters studied

MPV	BMI	Duration of diabetes	HbA1c	FBS	PPBS
r	0.061	0.184	0.547	0.472	0.513
p	0.598	0.122	<0.001	<0.001	<0.001
Statistical inference	Non-significant	Non-significant	Highly significant	Highly significant	Highly significant

Table 3 depicts Correlation of MPV to the various parameters studied like retinopathy, neuropathy, CAD, diabetic foot, dyslipidemia and hypertension. However, no statistical correlation was seen between MPV and CAD, Dislipidemia, Hypertension, diabetic foot, retinopathy and Neuropathy.

Table 4: Correlations relationship between MPV Vs other variables

MPV	Retinopathy	Neuropathy	CAD	Diabetic foot	Dyslipidaemia	Hypertension
r	0.209	0.087	-0.142	-0.321	0.073	-0.069
p	0.030	0.354	0.163	0.006	0.771	0.584
Statistical inference	Significant	Non-significant	Non-significant	Non-significant	Non significant	Non significant

IV. DISCUSSION:

In current study MPV were significantly high in diabetes subjects as compare to the non-diabetic ones and the similar results were also observed in few older studies [12-17]. In the pathogenesis of vascular complications role for the increased platelet activity were established in our study as higher values of MPV were observed among the diabetic subjects with micro and macro vascular complications such as retinopathy, neuropathy, CAD, diabetic foot, dyslipidemia and hypertension.

High-risk patients, according to American Diabetes Association (ADA), is the one who is overweight or obese (BMI \geq 25 kg/m² or \geq 30 kg/m²) and has one or more additional risk factors such as family history of diabetes, history of gestational diabetes, high risk race or ethnicity [18]. International Diabetes Federation (IDF) has proposed strategy for diabetes prevention in high risk population involving following approaches - identification of high risk individuals, evaluation of risk and interventions for prevention [18,19]. Approximately, 50% of people with diabetes remain undetected and has already developed complications at the time of diagnosis [20].

Control of diabetes play an important role on its effect on MPV. In current study MPV value were significantly higher among diabetes subjects whose HbA1c was $>$ 6.5% as compare to diabetic subjects whose HbA1c were $<$ 6.5%). Therefore, it may be concluded that the hyperactivity of the platelet

function decreases by glycemic control and thus may prevent or delay diabetic vascular complications. Even in previous studies findings regarding correlation of MPV and HbA1c are in lines with the findings of the current study [21,22].

In recent years, much attention has been focused on the management of microvascular complications such as stroke and acute coronary syndromes. It is well recognised that vascular complications in a given tissue are often accompanied by evidence of pathophysiology in other vascular territories [23]. Researchers such as Krentz et al. and Al-wakeel et al. have observed that both macrovascular and microvascular complications develop simultaneously in diabetes [24,26]. On the contrary, Matheus and Gomes described the diabetes patients with early and aggressive coronary artery disease (CAD) without evidence of nephropathy, retinopathy or classical risk factors of CAD [26].

Limitation of our study includes small population size, single center and not measuring factors which influence platelet like rheumatic diseases and thyroids were not measured. In other population includes with long follow-up period these findings need to be verified.

V. CONCLUSION:

This study conclude that subjects with diagnosed diabetes were having increased MPV as compared to nondiabetic subjects. The current findings indicate that in middle-aged and older population, MPV might be a potential risk factor of diabetes. For determining diabetes-induced macrovascular complications in patients with type 2 diabetes mellitus measuring MPV could be a beneficial marker.

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