Study of Mean Platelet Volume in Type 2 Diabetes Mellitus with Special Reference to MicrovascularComplications

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Abstract:

Background and Objectives: According to International Diabetic Federation 2014 Atlas, India has highest diabeticcases when compared to other south Asian countries, with 66.8 million.80% of patients with diabetes mellitus die a thrombotic death. The increased platelet activitymay play role in the development of vascular complications of diabetes. MPV is an indicator of the average size and activity of platelets. The study aims to compare theMPV of diabetic patients and non-diabetics, to see if difference in MPV in diabetic patients with and without microvascular complications, and to determine the correlation of MPV with glycemic control and Lipid Profile.

Methods: A case control study of 50 Diabetic and 50 Non Diabetic subjects above 40 years of age belonging to the community, who came as IP/OPto the Department of Medicine of GMC Hospital, Bettiah. were selected based on the inclusion criteria. An MPV greater than 7.5fl was considered abnormal.

Conclusions: In this study of 50 diabetic and 50 non- diabetic it was found that Mean platelet volume is more in diabetics (cases) when compared with non-diabetics (controls).Worsening of Blood sugar control and complications like macroalbuminuria increased the MPV. The MPV could be used for early detection of microvascularcomplications and for follow up of blood sugar control.

Keywords: FBs, MPV, HDL.

Introduction

Diabetes is a mysterious illness." This statement made in antiquity by Aerates of Cappadocia is still valid today that is 1900 years later, in the sense that the cause of complications of diabetes remains a mystery [1]. Diabetes mellitus is a pandemic metabolic and complex disease which involves different systems of body. The interactions between environmental and genetic factors are responsible for development of type-2 diabetes mellitus [2]. According to International Diabetic Federation 2014 Atlas, India have highest diabetic cases when compared to other south Asian countries, with 66.8 million. It is associated with devastating complications which influences the quality of life, mortality and morbidity.80% of patients with diabetes mellitus die a thrombotic death. 75% of these deaths aredue to cardiovascular complication and remainder due to cerebrovascular events and peripheral vascular complication [3]. Diabetics suffer from accelerated atherosclerosis too. Vascular endothelium the primary defence against thrombosis is abnormal in diabetes, which plays a role in enhanced activation of platelets and clotting factors seen in diabetes [3]. Platelets play a major role in integrity of normal haematopoiesis, and mean platelet volume (MPV) is an indicator for its function [4]. The large platelets contain more dense granules are more potent than smaller platelets and hence more thrombogenic[4]. Both the size and number of granules in platelets in circulation are under independent hormonal control and do not change during the life span of the platelet [5, 6, 7]. Increase in MPV has been documented in patients with metabolic syndrome, stroke and diabetes mellitus (DM) [8]. Altered platelet morphology and function have been reported inpatients with DM, and MPV was found to be significantly higher in diabetic patients. [9, 10] Many studies have shown that increased MPV is one of the risk factors for myocardial infarction, cerebral ischemia and transient ischaemic attacks [11]. Larger plateletsare haemostatically more active and are a risk factor for developing coronary thrombosis, leading to myocardial infarction. Elevated MPV is associated with a worse outcome for acute ischaemic cerebrovascular events independent of other clinical parameters. This study is relevant considering the fact that in a country like India, MPV can be used as an important, effortless, simple and cost – effective tool for predicting the possibility of impending acute events.

Objectives

To compare MPV in diabetic patients with and without microvascular complications To correlate MPV with the Lipid Profile (Triglycerides, Total cholesterol, HDL &LDL).

Materials and Method

A comparative two group study, Data was collected from patients fulfilling the inclusion and exclusion criteria attending either outpatient department /or in patient department reporting to, GMCH, Bettiah. West Champaran Prior approval for the study protocol was obtained from institutional ethical committee. After explaining the need for relevant investigations, and role in further management, patients were included in this study. Informed written consent was obtained from patient or responsible attendant before including the patient in the study.

Out of 100 patients 50 diabetes and 50 non – diabetes controls attending opd /in patient at, GMC Hospital. Study duration of Two years.

Inclusion Criteria

- Patients who have given written informed consent.

- Patients (including both male & female) with age > 40 years with a known history/freshly detected Type-2 Diabetes Mellitus.
- The diagnosis of Type -2 Diabetes Mellitus was made by symptoms in history & was confirmed by fasting blood glucose, postprandial glucose, Hb1AC and controls were non-diabetic.

Exclusion Criteria

- Platelet count <100 and >450 x10³/μL.
- Patients on antiplatelet drugs, steroids, antiviral drugs, statins, oral contraceptives.
- Haemoglobin < 10 gms.

It is a case – control study ,The study was carried out in 50 patients who were newly or already diagnosed to have type 2 diabetes mellitus and 50 non diabetic controls without any coronary artery disease

All diabetic and non –diabetic subjects underwent complete clinical examination with special reference to any micro vascular complications aswell as any drugs taken. MPV in the above target groups was done as a part of complete blood count using an automatic blood counter. An MPV of > 7.5 fl was considered to be elevated

Automated haemoanalyser (SYSMEX) (ERBA EM 360) for analysis of FBS, PPBS, FLP. ETC

Results

50 Diabetic and 50 Non-Diabetic subjects above 40 years of age belonging to the community in and around Bettiah district, who came as IP/OP to the Department of Medicine, were selected based on the inclusion criteria. Both Diabetic and Non-Diabetic cases were further subdivided into age groups, i.e. 40- 50; 51-60; 61-70 and greater than 70. Further each age group was divided into male and female gender. The results were tabulated and analysis of the data discussed.

Table 1: Age (in years) distribution between Cases & controls

Age (in years)			Total Number
	Case (n=50)	Controls (n=50)	(Case + Controls)
40-50	16	18	34
51-60	20	23	43
61-70	12	9	21
>70	2	0	2
Total Number (n=100)	50	50	100

Table 2: gender distribution of cases andcontrols

Gender	Case(n=50)	Controls (n=50)	Total Number (Case + Controls)
Male	25	25	50
Female	25	25	50
Total Number (n=100)	50	50	100

Table 3: mean platelet volume with durationof diabetes mellitus in cases

Duration OfDm (Years)	MPV (fl)			Total Number Cases (n=50)
	7.5-9.5	9.6-11.5	>11.6	
0-5	10	14	4	28
6-10	4	12	0	16
11-15	2	1	0	3
>15	0	3	0	3
Total Number (n=50)	16	30	4	50

Out of the 50 Diabetic cases a MPV of 9.6-11.5fL was maximally seen with duration of diabetes between 0-5 years (n=14) and 6-10 years (n=12). A MPV > 11.6 fL was seen when the duration of diabetes was between 0-5 yearsin only 4 cases.

Table 4: mean platelet volume with total cholestrol in cases

Total Cholestrol (mg/dl)	MPV (fl)			Total Number Cases (n=50)
	7.5-9.5	9.6-11.5	>11.6	
<100	0	2	0	2
101-150	9	14	0	23
151-200	3	9	4	16
>200	4	5	0	9
Total Number (n=50)	16	30	4	50

that 30 out of 50 cases had a MPV of 9.6-11.5 fl. Out of these 2 had total cholesterol between <100mg/dl, 14 had total cholesterol between 101-150mg/dl, 9 had total cholesterol between 151-200mg/dl and 5 cases had total cholesterol >200 mg/dl. 16 cases out of 50 had a MPV of 7.5-9.5 fl. Out of these 9 had total cholesterol between 101-150 mg/dl, 3 had total cholesterol between 151-200mg/dl and 4 had total cholesterol >200 mg/dl. The number of cases where the total cholesterol was > 200mg/dl was 9 only.

Table 5: mean platelet volume with hdl in cases

HDL (mg/dl)	MPV(fl)			Total Number Cases (n=50)
	7.5-9.5	9.6-11.5	>11.6	
<25	0	0	0	0
26-45	11	21	4	36
46-60	5	9	0	14
Total Number (n=50)	16	30	4	50

that 30 out of 50 cases had a MPV of 9.6-11.5 fl. Out of these 21 had HDL between 26-45 mg/dl, 9 had HDL between 46-60mg/dl. 16 cases out of 50 had a MPV of 7.5-9.5 fl. Out of these 11 cases had HDL between 26- 45mg/dl and 9 had LDL between 151-200mg/dl. 36 cases had HDL below 45mg/dl.

MPV correlated with age, the duration of Type 2 Diabetes Mellitus, fasting blood sugar, postprandial sugar, Hb1AC, 24 hours urinary protein, triglycerides, total cholesterol, HDL. Of these s variables only triglycerides was statistically significantly correlatedto MPV.

Discussion

According to International Diabetic Federation 2014 Atlas, India have highest diabetic cases when compared to other south Asian countries, with 66.8 million. The primary defence against thrombosis, the vascular endothelium is abnormal in diabetes, with increased activation of platelets and clotting factors. Platelets play a major role in thrombosis and mean platelet volume (MPV) is an indicator of its function. Larger platelets contain more dense granules and are more thrombogenic. Increase in MPV (Mean >6.5fl) has been documented in patients with metabolic syndrome, stroke and diabetes mellitus (DM) [8]. The increase in MPV indicates a transformation to a more activated platelet. The present study was done to determine if platelets are activated in Type 2 Diabetes Mellitus and their association with microvascular complications. The study included 100

patients out of which 50 cases had Type 2 Diabetes Mellitus and 50 age and sex matched controls. A detailed history, examination and investigations were done for each patient. In the present study, age distribution was between 40-70 years with mean age of casesand controls being 56.62 ± 8.26 years vs. 54.72 ± 7.87 years respectively which were comparable. They were 50 male and 50 female in both cases and controls group. HbA1C levels (P=0.001). No statistical correlation was seen between MPV and the duration of DM, BMI and the vascular complications in the diabetic group. In the diabetic group, the mean MPV in subjects with complications (8.35 ± 0.73 fl) were higher than that ofsubjects without complications (8.2 ± 0.74 fl) but independent student t-test did not show any statistical significance ($P = 0.145$). Zuberi B F et.al. studied a total of 612 patients and allocated them to three groups of 204 patients each, referred to as DM group, IFG group and non-DM group. These included 337 (55.1%) males and 275 (44.9%) females. MPV in the DM group was 9.34 fl, in the IFG Group 8.98 fl, and in the non-DM group 8.63 fl. Comparison of MPVvalues for the three groups showed statistically significant intergroup and intragroup differences, with a p-value of 0.00. [9]

In this study the Mean platelet volume in Diabetics and Non-Diabetics was 10.124 ± 1.02 and 7.448 ± 0.35 respectively and was found to be statistically significant with a p value of <0.0001. The difference between Kodiatte study and this study, being inthe mean values of MPV, which are higher in this study. Hekimsoy Z et. al. [10] studied MPV in diabetics. MPV was measured in 145 consecutive Type 2 Diabetic patients and 100 nondiabetic control subjects. [11] MPV was significantly higher in diabetics compared to nondiabetic healthy controls [10.62+/-1.71 fl vs. 9.15+/-0.86 fl (P=.00)], respectively; the study done by Hekimsoy Z et. al. iscomparable to our study. Turgutalp K. et. al. [12] conducted a preliminary study on the Mean platelet volume and related factors in patients at different stages of diabetic nephropathy. The MPV levelswere investigated in healthy participants (group 1, n = 157), patients with Type 2 Diabetes Mellitus without complications (group 2, n = 160), diabetic patients with clinical proteinuria (group 3, n = 144), and in patients with chronic kidney disease due to DN (group 4, n = 160). The MPV level was higher in all diabetic patients than that in normal participants (P < 0.05). The MPV values had a positive correlation with the serum creatinine and proteinuria, and a negative correlation with the glomerular filtration rate ([GFR] P < 0.001). Unbol M. et. al. [13] studied the relationship between mean platelet volume withmicroalbuminuria and glycemic control. The MPV in Type 2 Diabetes Mellitus is not only influenced by the increased Bloodsugar values, but also by the lower levels of HDL-C. Microalbuminuria and Macroalbuminuria when present also increase the value of the MPV. The MPV therefore could be used as an early indicator of poor control of blood glucose, both fasting and post-prandial and a predictor of microvascular complications.

Conclusion

Out of 50 cases, 26 (52%) patients had neuropathy, 17 (36%) patients had retinopathy and 50 (100%) patients had nephropathy, based on the proteinuria findings. 6(12 %) patients had ECG changes in the form of T wave inversion suggestive ofIHD. The MPV was increased in cases with lower HDL-C (<45mg/dl)

The MPV therefore could be used as an early indicator of poor control of blood glucose, both fasting and post-prandial and a predictor of microvascular complications.

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