

Mean Platelet Volume as an Indicator of Glycemic Control in Type 2 Diabetes Mellitus

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ABSTRACT

Objective: To study platelet counts (PC), mean platelet volume (MPV) and glycated HbA1 in type 2 Diabetes mellitus (T2DM).

Study Design: Case control study

Place and Duration of Study: This study was conducted at the Department of Medicine, Indus Medical College Hospital, Tando Muhammad Khan, Sindh from March to November 2015

Materials and Methods: A sample of 150 subjects; comprising of Group A- controls (n=50), Group B- controlled diabetics (n=50) and Group C- (n=50) uncontrolled diabetics. DM was diagnosed according to American Diabetes Association. Permission was taken from ethics review committee of institute. Only willing subjects were included after they signed consent proforma voluntarily. Blood pressure, BMI, Blood glucose, Platelet counts, MPV and HbA1c were determined Data was typed on Microsoft excel, and then pasted SPSS 22.0 sheet for statistical analysis. Chi square test, one way ANOV, post-Hoc Tukey Cramer and Pearson's association was used for analysis of data variables. All data was analyzed at Confidence interval of 95% (≤ 0.05)

Results: MPV was raised in Diabetics in particular with uncontrolled glycemic index as shown in table II. MPV showed negative correlation with platelets was found with MPV ($r = -0.27, p = 0.03$). MPV was positively correlated with glycated HbA1 ($r = 0.78, p = 0.0001$). HbA1c as high as 14.3% was noted in uncontrolled diabetics.

Conclusion: The present study reports raised Mean platelet volume in Diabetics in particular uncontrolled diabetics. MPV showed positive correlation with HbA1c and negative correlation with platelet count.

Key Words: Mean Platelet Volume, Platelets, Glycated HbA1 Diabetes mellitus

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INTRODUCTION

Diabetes mellitus (DM) is one of the most common endocrinopathy characterized by chronic hyperglycemia as a result of relative or absolute insulin deficiency.¹ International Diabetes Federation (IDF) has reported a rise of diabetics from 285 million in 2010 to 439 million in 2030.² The epidemic of diabetes is quite particular to Pakistan and it now ranks sixth regarding diabetes burden.³

Pakistan National Diabetes Survey (PNDS) disclosed in their report that for each recognized patient of DM, there remain 2 undiagnosed cases of DM and 3 cases of impaired glucose tolerance (prediabetes) approximately.⁴ Target organs of hyperglycemia induced damage in diabetics include nerves, eyes, heart, blood vessels and renal tissue.⁵

Diabetics show a deviation away from normal which has been reported. Mean platelet volume (MPV) is a clinical measure of platelet function and size,⁶ which is related to megakaryocytic ploidy. Degree of megakaryocytic dispersion and fragmentation determines the size of platelet known as MPV. Increased MPV is attributed to cytokine stimulation such as thrombopoietin, IL-6 and IL-11.⁷

Increased MPV is reported in diabetic patients and is considered as a risk factor for micro vascular complications.^{8,9} Hence diabetics are prone to thrombogenic tendency and vascular events. Increased thrombogenicity is produced by the granules with fresh mediators inside newly released platelets.

Many studies had reported MPV as an independent factor for risk of atherogenesis, thrombosis and embolism.¹⁰⁻¹⁴

Glycated hemoglobin A (HbA1c) is an established indicator of glycemic control¹⁰ and MPV may be compared with it to set a new clinical indicator which is cheap and easily generated by using automated hematology analyzers.¹¹

Therefore present case control study investigated the platelet counts, mean platelet volume and glycated HbA1 at our tertiary care hospital to probe into its validity as a test of glycemic control and a risk factor in diabetic patients.

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MATERIALS AND METHODS

The present case control study was planned at eh Diabetic clinic, Department of Medicine, Indus Medical College Hospital, Tando Muhammad Khan, Sindh from March to November 2015. A sample of 150 subjects was selected as per criteria. Subjects were divided into 3 groups; Group A- controls (n=50), Group B- controlled diabetics (n=50) and Group C- (n=50) uncontrolled diabetics. Only those patients were included who were diagnosed according to American Diabetes Association criteria.⁵ Duration \geq 5years and age >25 and <60 years were predetermined criteria of inclusion. Subjects with diabetic nephropathy, bleeding tendency, unknown duration of DM and taking anti platelet drug were strictly excluded. Permission was taken from ethics review committee of institute. Only willing subjects were included after they signed consent proforma voluntarily. Glycemic index was determined by HbA1C. Formula "Weight (kg)/Height (m²)" was used for calculating BMI. Systemic blood pressure was determined by mercury sphygmomanometer. Systolic BP ≥ 140 mmHg or diastolic BP ≥ 90 mmHg was criteria for diagnosing systemic hypertension.¹²

Preferably ante cubital vein was used for blood sampling. Glucose oxidase method and Hitachi 902, Roche (USA) analyzer were used for glucose and HbA1c detection.⁶

Data was typed on Microsoft excel, then pasted SPSS 22.0 sheet for statistical analysis. Chi square test, one way ANOV, post-Hoc Tukey Cramer and Pearson association was used for analysis of data variables. All data was analyzed at Confidence interval of 95% (≤ 0.05)

RESULTS

Demographic characteristics of study subjects are shown in table I. The mean \pm SD age was noted as 49 ± 11.7 , 47.36 ± 5.98 and 47.64 ± 9.01 years among 3 groups ($p \geq 0.09$). Of 150 study subjects, male and female in groups A, B and C were found as 23, 21, 25 and 27, 29, 25 respectively. Systolic blood pressure (SBP) was noted as mean \pm SD in three groups as 120.8 ± 6.2 , 151.4 ± 19.3 and 156.1 ± 16.1 mmHg respectively and diastolic blood pressure (DBP) as 79.8 ± 6.29 , 130.60 ± 21.4 and 131.1 ± 19.1 mmHg in groups A, B and C respectively. Blood glucose was noted as 112.3 ± 19.6 , 230.5 ± 70.89 and 265.0 ± 92.5 mg/dl in groups A, B and C respectively ($p < 0.001$). The BMI calculated was found as 27.3 ± 5.35 , 27.81 ± 5.37 and 28.38 ± 3.9 kg/m² in groups A, B and C respectively. Mean duration of DM was found as 10.56 ± 4.13 and 11.3 ± 2.69 years in groups A and B respectively. Platelet count; MPV and HbA1c are shown in table II. Graph 1 shows the MPV among 3 groups. MPV was raised in Diabetics in particular with uncontrolled glycemic index as shown in table II. MPV showed negative

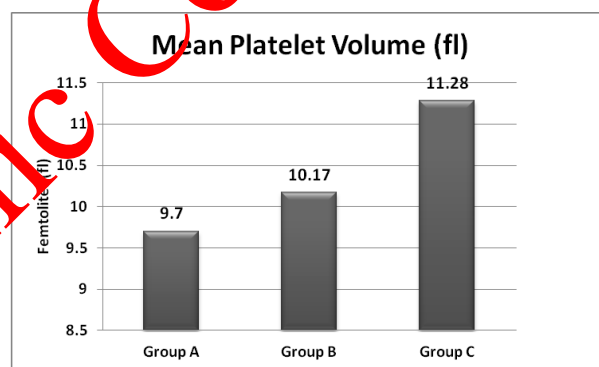
correlation with platelets was found with MPV ($r = -0.27$, $p=0.03$). MPV was positively correlated with glycated HbA1 ($r = 0.78$, $p= 0.0001$) (table II). Uncontrolled diabetics showed HbA1c as high as 14.3%, this indicates bad glycemic control.

Table No. I. Platelet count, Mean Platelet volume (MPV) and Glycated HbA1 among controls and Diabetic subjects (n=150)

	Group A	Group B	Group C	p-value
Platelet counts (x103/ μ l)	304 \pm 67.4	384 \pm 91.5	395 \pm 89.9	0.001
MPV (fl)	9.7 \pm 0.6	10.17 \pm 0.8	11.28 \pm 1.1	0.0001
HbA1c	5.15 \pm 0.6	6.0 \pm 0.5	9.93 \pm 1.6	0.0001

Table No.2. Pearson's correlation of MPV with platelet counts and HbA1c (n=150)

	Platelet counts	HbA1c
r-value	0.27	0.78
P-value	0.03	0.0001



Graph No.1. Mean Platelet volume among 3 groups

DISCUSSION

The present study is the first research being reported from our tertiary care hospital. The present study reported raised MPV in Diabetics particularly in those having HbA1c $>7\%$ (uncontrolled glycemic index). Platelets counts were raised in Diabetic patients compared to controls as shown in table I. MPV showed negative correlation with platelets was found with MPV ($r = -0.27$, $p=0.03$). MPV was positively correlated with glycated HbA1 ($r = 0.78$, $p= 0.0001$) (table II). Uncontrolled diabetics showed HbA1c as high as 14.3%, this indicates bad glycemic control. The findings of present study in supported by previous studies which had reported raised MPV in diabetics.⁹⁻¹¹ MPV is reported as new risk factor for atherogenesis in diabetics. Various atheroma associated diseases such as brain stroke, transient ischemic stroke, acute myocardial infarction (AMI) and micro vascular complication of DM.^{13,14}

The present study reports raised MPV and HbA1c in uncontrolled diabetics compared to controls (table I). Our findings are in agreement to previously cited studies.⁹⁻¹¹

Bavbek et al¹⁵ and Dolasik et al¹⁶ reported increased platelet stickiness and raised MPV in diabetics with micro vascular complications and findings support present study. Positive association of MPV with glycated HbA1c of present study is supported by previous study of Dalamaga et al¹⁷ Another previous study also has reported positive correlation of MPV with glycated HbA1¹⁸ this is also in agreement to present findings. Papanas et al¹⁹ has reported a positive correlation between MPV, HbA1c and diabetic micro vascular complications, this is consistent to our present study.

However, Papanas et al.¹⁹ did not find any correlation of MPV with glycated HbA1 which is in contradistinction to present study. Raised MPV is a consistent finding to previous studies.²⁰

Positive correlation of MPV of present study is supported by previous studies also.^{21,22} A recent study has reported positive association of raising MPV with progressive diabetic nephropathy. Another previous study reported positive correlation of MPV with HbA1c.²³

In view of above discussion, it is postulated that the MPV might be used as a clinical indicator and predictor of glycemic control and diabetic micro vascular complications, but this needs further authentication with large scale prospective studies. Another grave finding is very bad glycemic control as indicated by very high HbA1c of 14.3%, this indicates bad glycemic control. Another bad finding was none of psychiatric patients was aware of their blood glucose and blood cholesterol. MPV may be used as indicator glycemic control in addition to HbA1c but this needs further large scale, prospective studies to be conducted.

CONCLUSION

The present study reports raised Mean platelet volume in Diabetics in particular uncontrolled diabetics. MPV showed positive correlation with HbA1c and negative correlation with platelet count.

Conflict of Interest: The study has no conflict of interest to declare by any author.

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