CORRELATION BETWEEN GLYCOSYLATED HEMOGLOBIN AND PLATELET ACTIVITY AMONG PATIENTS WITH TYPE 2 DIABETES MELLITUS

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ABSTRACT

Objective: To determine the correlation between glycosylated hemoglobin level and platelet activity among patients with type 2 diabestes mellitus (T2DM).

Methodology: This study was conducted in the Department of Medicine, Khyber Teaching Hospital, Peshawar from January to June 2012. Through a Comparative Cross Sectional Study Design, a total of 80 patients with T2DM were selected from Medical Wards and OPDs and were grouped into those with glycated hemoglobin (HbA1c) levels < 7% (Group A, n=33) and those with HbA1c ≥ 7% (Group B, n=47 patients). Both the groups were compared with regards to MPV and HbA1c.

Results: The mean age of patients was 47.41 ± 6.74 years. In group A there were 45.5% (15) males and 54.5% (18) females. In group B there were 48.9% (23) males and 51.1% (24) female patients. MPV was significantly higher in group B as compared to group A (9.21±0.76 fl vs. 8.29±0.46 fl; P < 0.001). Among the group B patients, a positive statistical Pearson's correlation was seen between MPV and HbA1c levels (r = 0.589; p < 0.001). However, no statistical correlation was seen between MPV and the duration of DM and BMI.

Conclusion: There is a significant association between poor glycemic control and increased platelet activity in patients with uncontrolled T2DM.

Key Words: Glycosylated hemoglobin (HbA1c), Mean platelet volume (MPV); Type 2 Diabetes Mellitus

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INTRODUCTION

Over the past few decades, diabetes Mellitus (DM) has attracted both medical and public health concerns. Its prevalence varies from 3.5 to 5.0%. The 3rd edition of the International Diabetes Federation (IDF) Atlas suggests 4.0% prevalence with 1.71 million people in the age range 20 to 79 years have diabetes, of whom 85% are conventionally believed to be having Type 2 diabetes[1]. The epidemic is particularly acute in South East Asia[2], whereby Pakistan has the highest growth, the overall glucose intolerance {DM+ Impaired glucose tolerance (IGT)} being estimated to be around 22% in urban and 17% in rural areas[3].

Diabetes mellitus is associated with accelerated atherosclerosis leading to coronary, cerebrovascular, retinal and peripheral arterial diseases. Platelet activation plays a key role in the initiation and progression of atherothrombosis[4] and platelet activation and aggregation play a fundamental role in thrombotic complications associated with type 2 DM[5].

Hyperglycemia plays an independent and important role in the prothrombotic state associated with DM[6, 7]. Induction of hyperglycemia and hyper-insulinemia in healthy subjects without diabetes has been seen to increase platelet reactivity[8]. Consistent with this observation, well-controlled DM has been associated with decreased platelet reactivity[9].

The mean platelet volume (MPV) is a marker of platelet activation. Although there are other methods of assessing platelet function, but they are more expensive or time-consuming[10]. The determination of platelet size by quantification of the MPV, using automated hemograms, is simple and inexpensive[11]. Increase in MPV has been recognized in patients with the metabolic syndrome, stroke and DM[12]. Moreover, studies have shown that increased MPV is one of the risk factors for myocardial infarction, cerebral ischemia and transient ischemic attacks[13].

A significant association between poor glycemic control and increased platelet activity in patients with T2DM has been reported. In one study done in Turkey, MPV was significantly higher in patients with DM than in controls (p-value=.002) with a significant positive correlation between MPV and HbA1c levels in diabetic patients[14].

Very few studies are conducted on the association of raised MPV with poorly controlled DM.[15]. By doing this simple test, we can identify the diabetic patients with high risk of complications even at periphery.

METHODOLOGY

This cross-sectional (correlation) study was carried out in the Department of Medicine, Khyber Teaching Hospital, Peshawar ranging over a period of six months, from 1st January, 2012 to 30th June, 2012. A sample size of 80 was taken, using correlation coefficient of +0.39(14), between HbA_1C and MPV, with 95% confidence interval and 95% power of test. Male and female patients between 35-65 years of age with at least five years history of DM and on anti diabetic medications were included in the study.

A detailed history was taken from the patients and those with T2DM who were taking antiplatelet medications like aspirin and clopidogrel, patients with history of idiopathic thrombocytopenic purpura or Iron deficiency anemia, and patients with a history of hypertension, coronary or cerebrovascular events and cyanotic congenital heart diseases were excluded from the study.

After administrative permission, approval from Ethics committee and informed consent from the patients, consecutive patients with DM attending the medical OPD, fulfilling the inclusion criteria, were selected by non-probability sampling. Three (3) cc of whole blood was drawn from ante-cubital venipuncture under aseptic technique and collected into tubes containing tripotassium EDTA. The collected specimen of blood was immediately sent to hospital laboratory for MPV measurement as part of full blood count on a Sysmex auto-analyzer. HbA_1C was measured from the same blood sample in the clinical chemistry laboratory using Hitachi Modular P system. Results were recorded in the specified proforma along with other demographic variables. Exclusion criteria were strictly followed to control confounders and bias in the study results.

Data was entered and analyzed by SPSS version 15.0. Frequency/percentages were calculated for qualitative variable like gender. Mean $\pm$ standard deviation of quantitative variable like age, HbA1c and MPV were calculated. Pearson's correlation coefficient was applied to see the relationship between HbA1c and MPV. P value of ≤ 0.05 was considered significant. Results are given in form of tables and graphs.

RESULTS

In this study 80 adult patients with T2DM, fulfilling the inclusion criteria were selected. The selected patients were divided into two groups based on their glycemic control. Group A consisted of 33 patients having good glycemic control, as defined by HbA1c levels of < 7%, and group B consisted of 47 patients having poor glycemic control, as defined by HbA1c levels ≥ 7%.

The mean age of group A was 45.94±5.88 years, whereas that of group B was 48.45±7.17 years and the mean age of total 80 patients was 47.41 ± 6.74 years.

Mean and SD of age, male to female ratio, Mean and SD of duration of the disease, RBS, HbA1c, and MPV and their comparison between two groups are shown in table 1.

Table 1: Comparison of various parameters between groups A and B

Characteristic	Group A	Group B	P value
Numbers	33	47	--
Age (years)	45.94 ± 5.88	48.45 ± 7.17	--
Male (%)	15 (45.5%)	18 (54.5%)	--
Female (%)	23 (48.9%)	24 (51.1%)	--
Mean duration of DM (in months)	91.97 ± 20.19	89.66 ± 18.50	0.697
Body mass index (Kg/m2)	25.02 ± 2.42	25.12 ± 2.45	0.428
Random blood sugar (mg/dL)	147.21 ± 18.47	233.08 ± 60.68	<0.001
Platelets count			
(× 109 /L)	269.79 ± 70	277.46 ± 81.13	0.256
HbA1c (%)	6.07±0.44	8.47±0.87	<0.001
Mean platelet volume (fl)	8.29±0.46	9.21±0.76	<0.001

Table 2: Correlation of MPV to various parameters studied

Characteristic		r value	p value
MPV	BMI	– 0.147	0.325
MPV	Duration of DM	– 0.117	0.432
MPV	HbA1c	0.589	<0.001

Among the group B patients, a positive statistical Pearson's correlation was seen between MPV and HbA1c levels (r = 0.589; P < 0.001). However, no statistical correlation was seen between MPV and the duration of DM and BMI (Table# 2).

DISCUSSION

The prevalence of diabetic microvascular complications is higher in people with poor glycemic control, longstanding DM, obesity and associated hypertension[15].

In our study, MPV was significantly higher in patients with poor glycemic control as measured by an HbA1c >7% with significant association between HbA1c and MPV. The same findings have been reported in other studies [14, 16]. Previous studies in our country have shown that MPV was increased in diabetic and IFG populations[15]; the present study further augments the findings.

In our study, the mean platelet count in the uncontrolled diabetics (group B) was higher than that of controlled diabetics (group A). This was similar to studies done by Zuberi[15] and Kodiatte[16]. Other studies by Hekimsoy[17] had observed the opposite findings. Hence the MPV could be dependent on variables like mean platelet survival and platelet production rate. Furthermore, no association of MPV was seen with duration of DM and body mass index (BMI). Similar findings were seen in other studies[14, 17].

There were obvious limitations to our study, being single centered and comprising a small sample size. We were not able to assess qualitative platelet disorders.

CONCLUSION

Our study suggests that a significant association between poor glycemic control and increased platelet activity in patients with uncontrolled T2DM. MPV, which is simple and cost effective tool to monitor control and progression of DM, may be used as a useful predictive marker of cardiovascular complications in DM.

REFERENCES

1. Sicree R, Shaw J, Zimmet P. Diabetes and impaired glucose tolerance, the global burden. In: Gan D, editor. The diabetes atlas. 3rd ed. Brussels: International Diabetes Federation; 2006. p. 10-8.
2. Pardeepa R, Mohan V. The changing scenario of the diabetes epidemic: implications for India. Indian J Med Res 2006;116:121-32.
3. Shera AS, Jawad F, Maqsood A. Prevalence of diabetes in Pakistan. Diabet Res Clin Pract 2007;76:219-22.
4. Davì G, Patrono C. Platelet activation and atherothrombosis. N Engl J Med 2007:357;2482-94.
5. Haouari EL, Rosado J. Platelet signaling abnormalities in patients with type 2 diabetes mellitus: a review. Blood Cells Mol Dis 2008;41:119-23.
6. Schneider DJ. Factors contributing to increased platelet reactivity in people with diabetes. Diabet Care 2009;32:525-7.
7. Lemkes BA, Hermanides J, Devries JH, Holleman F, Meijers JC, Hoekstra JB. Hyperglycaemia: a prothrombotic factor? J Thromb Haemost 2010;8:1663-9.
8. Vaidyula VR, Boden G, Rao AK. Platelet and monocyte activation by hyperglycemia and hyperinsulinemia in healthy subjects. Platelets 2006;17:577- 85.
9. Yngen M, Norhammar A, Hjemdahl P, Wallén NH. Effects of improved metabolic control on platelet reactivity in patients with type 2 diabetes mellitus following coronary angioplasty. Diab Vasc Dis Res 2006;3:52-6.
10. Michelson AD. Methods for the measurement of platelet function. Am J Cardiol 2009;103:20-6.
11. Boos CJ, Lip GY. Assessment of mean platelet volume in coronary artery disease - what does it mean? Thromb Res 2007;120:11-3.
12. Tavil Y, Sen N, Yazici HU. Mean platelet volume in patients with metabolic syndrome and its relationship with coronary artery disease. Thromb Res 2007;120:245-50.
13. Khandekar MM, Khurana AS, Deshmukh SD. Platelet volume indices in patients with coronary artery disease and acute myocardial infarction: an Indian scenario. J Clin Pathol 2006;59:146-9.
14. Demirtunc R, Duman D, Basar M, Bilgi M, Teomete M, Garip T. The relationship between glycemic control and platelet activity in type 2 diabetes mellitus. J Diabetes Complications 2009;23:89-94.
15. Zuberi BF, Akhtar N, Afsar S. Comparison of mean platelet volume in patients with diabetes mellitus, impaired fasting glucose and non-diabetic subjects. Singapore Med J

2008:49:114-6.

16. Kodiatte TA, Manikyam UK, Rao SB. Mean platelet volume in type 2 diabetes mellitus. J Lab Physicians 2012;4:5-9.

17. Hekimsoy Z, Payzinb B, Ornek T, Kandogan G. Mean platelet volume in Type 2 diabetic patients. J Diabetes Complications 2004;18:173-6.

CONTRIBUTORS

IM participated in planning of study, and manuscript writing. IH supervised the study and helped in manuscript writing. AB and ZM helped in data management. All authors contributed significantly to the final manuscript.