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Original Research Article

Association of Mean Platelet Volume with Hba1c in Type 2 Diabetes Mellitus

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Abstract:

Background: Diabetes mellitus is a serious worldwide health issue that is progressively impacting people everywhere. Diabetes is a chronic, broad-spectrum metabolic disorder that requires continuous medical care, in which the organism cannot adequately benefit from carbohydrates, fats, and proteins due to insulin deficiency or defects in the effect of insulin. Due to altered platelet shape and function, platelets may be a causal factor in the micro and macrovascular disorders that diabetic individuals are more likely to acquire.

Aim: The present study aims at to assess the relationship between HbA1c levels and platelet activity (MPV) in type 2 diabetics taking Oral and Insulin therapy.

Materials and Methods: From the Assam Medical College's outpatient department and wards, 80 persons with type 2 diabetes were selected, 40 of whom were using oral hypoglycemic agents alone, and 40 of whom were combining insulin and oral hypoglycemic agents. Data were analyzed using SPSS (Version 23), with statistical significance set at $p < 0.05$.

Results: MPV was found to be significant with HbA1c≥6.5% in both the OHA without Insulin and OHA with Insulin groups ($p<0.001$). But MPV was not significant with HbA1c<6.5% in both the groups ($p<0.331$).

Conclusion: Values of MPV are increased in patients with HbA1c≥6.5% and are significantly higher in diabetic patients treated with OHA without Insulin than in those patients on OHA with insulin therapy. Higher MPV and higher HbA1c levels were shown to be strongly positively correlated in our study, when the HbA1c levels were ≥6.5%. This result emphasizes the link between elevated platelet activation and inadequate glycemic management, indicating that hyperglycemia causes changes in platelet size and function.

Keywords: Diabetes Mellitus, Mean Platelet Volume (MPV), Oral Hypoglycemic agents, Insulin, HbA1c.

Introduction

A chronic metabolic disorder called diabetes is characterized by elevated levels of blood sugar or blood glucose either by insulin resistance or inadequate insulin production. [1] Diabetes mellitus is rapidly becoming an epidemic in India, with almost 62 million people afflicted with the condition. According to recent predictions by Wild et al., by 2030, there will be 366 million, up from 171 million in 2000, the individuals with diabetes is predicted to double globally, with biggest increase occurring in our nation. [2]

Diabetes can cause macrovascular and microvascular consequences which are linked with substantial morbidity. Every year, over 3 million people die from cardiac events caused by either hyperglycaemia or diabetes mellitus, or both. Cardiovascular illnesses account for 60% of all diabetes fatalities. Adverse coronary events occur at a considerably earlier age in diabetics, and the frequency is about identical in men and woman. Platelets may be involved as a causative agent with respect to altered platelet morphology and function and MPV was found to be significantly higher in diabetic patients [3], thereby playing role in the micro- and macrovascular complications of diabetic patients. [4]

The American Diabetes Association suggests using glycated hemoglobin (HbA1c) as a substitute for fasting blood glucose for diabetes diagnosis. HbA1c is a crucial indicator of long-term glycemic control, chronic hyperglycemia, and the risk of long-term diabetes complications. The American Diabetes Association (ADA) suggested using HbA1c with a cut-point of ≥6.5% to diagnose diabetes instead of criteria based on fasting plasma glucose (FPG) of ≥7.0 mmol/L. [5] This illness has

potential to seriously damage blood vessels, heart, kidneys, nerves and eyes over time. MPV is an indication of platelet activity and size. The conditions under which platelets are produced in the bone marrow determine their size and volume. The age of circulating platelets has nothing to do with MPV. Most patients have extremely stable platelet values. [5] MPV typically falls between 7.2 and 11.7 femtoliters (fl). [6] This study investigates the association between MPV and glycemic control, represented by HbA1c in Type 2 Diabetes Mellitus patients on Oral Hypoglycemic agents with and without Insulin therapy. Even though many studies have been conducted to prove the association of MPV with diabetes, present study is the first of its kind in making an attempt to know the effect of insulin and oral hypoglycaemic therapy on MPV in Type 2 diabetics.

Materials and Methods

The present study was a hospital based comparative cross-sectional study carried out taking 40 Type 2 DM patients on Oral Hypoglycaemic Drugs without Insulin and 40 Type 2 DM patients on Oral Hypoglycaemic Drugs with Insulin attending the Medicine or Diabetology OPD or admitted in the Medicine ward of Assam Medical College and Hospital during a period of one year. All the cases fulfilled the inclusion criteria.

Study Population: Adults ≥18 years[7] with Type II Diabetes Mellitus taking treatment for a minimum duration of 6 months and attending the Medicine and Diabetology OPD or admitted in the Medicine ward.

Case definition: Adults ≥18 years diagnosed as Type II Diabetes Mellitus for at least 6 months and are taking treatment in the form of Oral Hypoglycaemic Drugs with and without Insulin therapy.

Sample Size: Considering the Mean MPV (fl) in Type II Diabetes Mellitus patients taking Insulin therapy and Oral Hypoglycaemic Drugs to be 10.0±0.7 and 9.0±0.6 respectively,[8] and to estimate a difference of 0.5fl in MPV between the two groups, sample size for the present study was calculated and rounded off to be 40 in each group with 95% confidence and 90% power.

Inclusion Criteria:

- Diagnosed cases of Type II Diabetes Mellitus subjects according to ADA criteria and age ≥18 years [7]
- Diagnosed cases of Type II Diabetes Mellitus subjects on treatment with Oral Hypoglycemic Agents with and without Insulin therapy for a minimum duration of 6 months

Exclusion Criteria:

- Patients with type 1 diabetes or any other type of Diabetes other than Type II DM
- Patients with inborn diseases of Platelet disorders and Haemoglobinopathies
- Patients taking anti-platelet medications
- Patients refusing consent

Ethical Clearance: was obtained from the Institutional Ethics Committee (Human), Assam Medical College, Dibrugarh.

Methods:

1. Adults fulfilling the inclusion criteria were identified. Written consent were taken from them. A detailed history was taken regarding the following points and recorded in the pre-structured proforma.

- Duration since diagnosis and treatment
- Presenting complaints

2. Detailed clinical examination were done and the findings were recorded in the pre-structured proforma.

3. Investigations like HbA1C and MPV were performed.

4. Duration and type of treatment taken by the subject.

5. Sample collection- To reduce variances brought on by sample aging, samples were taken in hemogram tubes containing EDTA and evaluated within an hour of collection. At room temperature, the samples were kept.

6. Analysis of Mean Platelet Volume- Sysmex XN-550 Automated Haematology Analyser. [9]

7. Analysis of HbA1C- Bio-Rad D-10 Hemoglobin testing system [10]

Statistical analysis: Microsoft Excel 2010 and the computer application Statistical Package for Social Sciences (SPSS for Windows, version 20.0. Chicago, SPSS Inc.) Were used to conduct the statistical analysis of the data. The student t test was used to compare the mean ± standard deviation of continuous measurement results.

The Chi square test and Fischer's exact test were used to analyse discrete data, which were expressed as numbers (%) when the cell counts were less than five or zero. The 5% level of statistical significance (p value <0.05) was used for all analyses.

Results: MPV and HbA1c tests were done in 40 Diabetic patients taking Oral hypoglycemic agents and 40 diabetic patients taking Oral hypoglycemic drugs with Insulin after obtaining informed consent from them and the data were analysed.

Table 1: Mean Age Comparison

Variable	OHA without Insulin			OHA with Insulin			p value*
	Number	Mean	±S.D.	Number	Mean	±S.D.	
Age Group (in years)	40	54.33	9.99	40	54.85	10.57	0.820
*Student t Test; The p-value is not significant at 5% level of significance							

Table 2: Gender Distribution

Gender	OHA without Insulin		OHA with Insulin		p value*
	n	%	n	%	
Male	23	57.50	22	55.00	0.822
Female	17	42.50	18	45.00	
TOTAL	40	100.00	40	100.00	
n : Number of Cases; % : Percentage *Chi-square Test; The p-value is not significant at 5% level of significance					

Table 3: Mean BMI Comparison

Variable	OHA without Insulin			OHA with Insulin			p value*
	Number	Mean	±S.D.	Number	Mean	±S.D.	
BMI (Kg/m^2)	40	25.64	3.35	40	25.37	2.66	0.694
*Student t Test; The p-value is not significant at 5% level of significance							

Table 4: Comparison of MPV in OHA without insulin and OHA with insulin

MPV (fl)	OHA without Insulin			OHA with Insulin			p value*
	Number	Mean	±S.D.	Number	Mean	±S.D.	
<7.2	1	6.00	-	4	6.60	0.49	–
7.2–11.7	39	11.58	1.07	36	10.53	1.31	<0.001*
TOTAL	40	11.44	1.37	40	10.14	1.73	0.014*
*Student t Test; The p-value is significant at 5% level of significance							

Table 5: Comparison of MPV according to HbA1c (%)

HbA1c (%)	OHA without Insulin			OHA with Insulin			p value*
	Number	Mean	±S.D.	Number	Mean	±S.D.	
<6.5	3	11.24	0.35	8	9.8	2.34	0.331
≥6.5	37	13.2	1.37	32	11.42	1.53	<0.001
*Student t Test; The p-value is significant at 5% level of significance							

Discussion

In patients with Type 2 Diabetes Mellitus (T2DM), this study offers strong evidence of a significant correlation between high Mean Platelet Volume (MPV) and inadequate glycemic control, as determined by HbA1c.

In the present study, mean age (years) was found to be 54.33±9.99 in the OHA without Insulin group and it was 54.85±10.57 in the OHA with Insulin group.

Among the OHA without Insulin group, 57.5% were males and 42.5% were females. Among the OHA with Insulin group, 55% were males and 45% were females.

In OHA without Insulin group, mean BMI was 25.64±3.35 and it was 25.37±2.66 in the OHA with Insulin group.

This findings were compared to those of Şahpaz et al. where the mean age in oral without insulin group was 57.5±11.1 whereas mean age in OHA with Insulin group was 59.7±11.2 which was slightly higher than our study findings. The ratio of males among the OHA without Insulin group was higher (41% males and 59% females) and also higher in the OHA with Insulin group (38% males and 62% females). The mean BMI was 24.1±1.6 in the Oral group whereas it was 23.9±1.7 in the Insulin group. [9]

Mean Platelet Volume in Diabetics on Oral Hypoglycaemic Drugs with and without Insulin:

In our study, the MPV in the OHA without Insulin group was found to be 11.44±1.37 fl, which was significantly greater than that of the OHA with Insulin group 10.14±1.73 fl; p=0.014.

Similarly, higher values of MPV were found in the oral group than the insulin group (8.08 and 7.03; p<0.05) in study done by Pradeep et al. [11] Also, in study done by Şahpaz et al. [8], the MPV was found to be more in oral group (10.0±0.7fl) than Insulin group (9.0±0.6fl) (p=<0.05).

In the study done by Rukmani Prabha [12], the

MPV was found to be 11.03±0.43 fl in the oral group which was greater than the insulin group (10.5±0.35 fl) ($p<0.001$).

Thus, with our study these findings were consistent.

MPV in relation to HbA1c

In our study, there was significantly lower MPV in patients with HbA1c<6.5% than in patients with HbA1c≥6.5% in both OHA without Insulin (11.24±0.35 and 13.2±1.37) and OHA with Insulin groups (9.8±2.34 and 11.42±1.53). Also, MPV was higher in the OHA without Insulin group. There was significant difference between MPV and HbA1c≥6.5% ($p<0.001$). In the study done by Pradeep et al. [11], MPV was significantly lower in patients with HbA1c<6.5% (some patients on oral hypoglycemic agents) than in patients with HbA1c≥6.5%. This finding is not consistent with our study.

Conclusion

It was observed in our study that in contrast to patients whose glycaemic control was just adequate (i.e., only on oral hypoglycaemic medications), the study group with good glycaemic control (i.e., on oral hypoglycaemic with insulin treatment) had low MPV. By maintaining a low level of MPV over time, insulin treatment may have a favourable direct or indirect effect on MPV, which might account for this outcome. Poor eating habits and ignorance of the diet and exercise routines that diabetics should follow may have contributed to the high percentage of diabetics in the current research with HbA1c values ≥6.5%. In order to minimize vascular injury in primary care, we suggest that MPV be utilized as a straightforward and affordable test to track the development of DM. In individuals with diagnosed Type 2 diabetes, starting insulin therapy early helps to maintain low MPV and decrease risk of future vascular events in addition to controlling blood glucose levels. Since our institution is a Government Medical College and institution, selection bias may have influenced the results. As a result, the findings are not generalizable to the community, and there is a strong need for more analytical research using the general population as the sample.

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