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Original Research Article

STUDY THE CORRELATION BETWEEN MEAN PLATELET VOLUME AND HBA1C IN TYPE 2 DIABETES MELLITUS

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ABSTRACT

Background: Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance and hyperglycemia. Mean platelet volume (MPV) has been proposed as a potential marker for vascular complications in diabetes. This study aimed to investigate the relationship between MPV and glycated hemoglobin (HbA1c) levels in patients with T2DM.

Materials and Methods: This case-control study included 50 patients with T2DM with more than five years duration of diabetes (cases) and 50 healthy individuals (controls). Demographic data, MPV, and HbA1c levels were collected for all participants. The correlation between MPV and HbA1c was analyzed in the case group using Pearson's correlation coefficient.

Results: The mean MPV was significantly higher in the T2DM group compared to the control group (10.8 ± 1.2 fL vs. 9.5 ± 0.9 fL, $p < 0.001$). In the T2DM group, a positive correlation was observed between MPV and HbA1c levels ($r = 0.62$, $p < 0.001$).

Conclusion: The findings suggest that elevated MPV is associated with higher HbA1c levels in patients with T2DM. MPV may serve as a potential marker for glycemic control and vascular complications in T2DM patients. Further research is warranted to explore the clinical implications of this relationship.

Keywords: Type 2 diabetes mellitus, mean platelet volume, glycated hemoglobin, HbA1c, vascular complications.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance and hyperglycemia, affecting millions of people worldwide.[1] The condition is associated with an increased risk of micro- and macrovascular complications, which significantly contribute to morbidity and mortality.[2] Effective management of T2DM relies on maintaining optimal glycemic control, typically assessed through measurement of glycated hemoglobin (HbA1c) levels.[3]

In recent years, attention has been drawn to the potential role of platelets in the pathophysiology of diabetic vascular complications.[4] Mean platelet volume (MPV), a measure of platelet size and activity, has emerged as a possible marker for vascular risk in various conditions, including diabetes.[5] Elevated MPV has been associated with increased platelet reactivity and a higher risk of thrombotic events.[6]

Several studies have suggested a relationship between MPV and glycemic control in patients with T2DM.[7,8] However, the nature and strength of this association remain unclear, with conflicting results reported in the literature.[9] Understanding the relationship between MPV and HbA1c could provide valuable insights into the mechanisms linking platelet function, glycemic control, and vascular complications in T2DM.

This study aims to investigate the correlation between MPV and HbA1c levels in patients with T2DM, comparing MPV values between diabetic patients and healthy controls. By elucidating this relationship, we hope to contribute to the growing body of evidence regarding the potential utility of

MPV as a marker for glycemic control and vascular risk in T2DM.

MATERIAL AND METHODS

This case-control study was conducted at SNMC Bagalkote, Karnataka, from January to May 2024. The study protocol was approved by the Institutional Ethics Committee of SNMC Bagalkote, and all participants provided written informed consent before enrollment.

The study population consisted of two groups: 50 patients with type 2 diabetes mellitus (T2DM) who had been diagnosed for more than five years (case group) and 50 healthy individuals (control group). Participants in the case group were recruited from the outpatient department of endocrinology at SNMC Bagalkote. The control group comprised age- and sex-matched healthy volunteers from the local community. Exclusion criteria for both groups included pregnancy, history of malignancy, acute or chronic inflammatory diseases, and use of antiplatelet medications.

Demographic data, including age, gender, and body mass index (BMI), were collected from all participants using a standardized questionnaire. Medical history and current medications were also recorded for the T2DM group. Blood samples were collected from all participants after an overnight fast of at least 8 hours.

Mean platelet volume (MPV) was measured using an automated hematology analyzer (Sysmex XN-1000, Sysmex Corporation, Kobe, Japan) as part of a complete blood count. Glycated hemoglobin (HbA1c) levels were determined using high-performance liquid chromatography (Bio-Rad D-10 Hemoglobin Testing System, Bio-Rad Laboratories, Hercules, CA, USA).

Statistical analysis was performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. The Student's t-test was used to compare MPV values between the T2DM and control groups. Pearson's correlation coefficient was calculated to assess the relationship between MPV and HbA1c levels in the T2DM group. A p-value < 0.05 was considered statistically significant.

RESULTS

He mean age was similar in both groups (56.4 years for T2DM vs. 54.9 years for controls), with no significant difference ($p = 0.375$). The gender distribution was roughly equal in both groups, with no significant difference ($p = 0.688$). T2DM patients had significantly higher BMI compared to controls (27.8 vs. 24.6 kg/m², $p < 0.001$). The average duration was 8.7 years for the T2DM group (not applicable for controls). Significantly higher in the T2DM group compared to controls (8.2% vs. 5.4%, $p < 0.001$). Significantly higher in the T2DM group compared to controls (10.8 fL vs. 9.5 fL, $p < 0.001$). [Table 1]

Table 2 shows the statistical relationship between MPV and HbA1c in the T2DM group. A positive correlation was found ($r = 0.62$) This correlation was statistically significant ($p < 0.001$) The r-value of 0.62 indicates a moderate to strong positive correlation. [Table 2]

Table 3 breaks down MPV values based on different HbA1c ranges in the T2DM group. [Table 3]

Table 1: Demographic and Clinical Characteristics of Study Participants

Characteristic	T2DM Group (n=50)	Control Group (n=50)	P value
Age (years)	56.4±8.7	54.9±7.8	0.375
Gender (M/F)	28/22	26/24	0.688
BMI (kg/m²)	27.8±3.9	24.6±3.2	**<0.001**
Duration of diabetes (years)	8.7±2.6	NA	NA
HbA1c (%)	8.2±1.5	5.4±0.4	**<0.001**
MPV (fL)	10.8±1.2	9.5±0.9	**<0.001**

Table 2: Correlation between MPV and HbA1c in T2DM Group

Variable	Correlation coefficient (r)	P value
MPV vs HbA1c	0.62	**<0.001**

Table 3: MPV Values Stratified by HbA1c Levels in T2DM Group

HbA1c Range (%)	No. of patients	Mean MPV (fL)
<7	12	9.9±0.8
7-8	15	10.5±0.9
8.1-9	13	11.2±1
>9	10	11.8±1.1

DISCUSSION

The present study investigated the relationship between mean platelet volume (MPV) and glycated hemoglobin (HbA1c) levels in patients with type 2 diabetes mellitus (T2DM). Our findings demonstrate a significant positive correlation between MPV and HbA1c levels, suggesting that platelet size and activity may be associated with glycemic control in T2DM patients.

The observed higher MPV values in T2DM patients compared to healthy controls (10.8 ± 1.2 fL vs. 9.5 ± 0.9 fL, $p < 0.001$) are consistent with several previous studies. Demirtunc et al. reported similar

findings, with MPV values of 10.5 ± 0.9 fL in diabetic patients compared to 9.1 ± 0.8 fL in controls ($p < 0.001$).[7] Likewise, Oɜder et al. found significantly higher MPV values in T2DM patients (8.7 ± 1.0 fL) compared to those with normal glucose tolerance (7.9 ± 0.8 fL, $p < 0.001$).[8]

The positive correlation between MPV and HbA1c levels ($r = 0.62$, $p < 0.001$) observed in our study aligns with the findings of Ulutas et al., who reported a correlation coefficient of 0.39 ($p < 0.001$).[10] Similarly, Shimodaira et al. found a positive association between MPV and HbA1c ($\beta = 0.134$, $p = 0.044$) in their multivariate analysis.[11] These consistent findings across studies support the hypothesis that poor glycemic control may be associated with increased platelet size and activity.

However, it is important to note that not all studies have found a significant correlation between MPV and HbA1c. Hekimsoy et al. reported no significant difference in MPV between diabetic patients and controls, and no correlation between MPV and HbA1c levels.[12] These discrepancies highlight the need for further research to elucidate the complex relationship between glycemic control and platelet function.

The mechanisms underlying the association between MPV and glycemic control in T2DM are not fully understood. One proposed explanation is that chronic hyperglycemia may lead to osmotic swelling of platelets, resulting in increased MPV.[13] Additionally, hyperglycemia-induced oxidative stress and inflammation may contribute to altered platelet production and turnover.[14]

The clinical implications of our findings are potentially significant. Elevated MPV has been associated with an increased risk of vascular complications in diabetes.[15] Thus, MPV could serve as an additional marker for assessing vascular risk in T2DM patients. Moreover, the correlation between MPV and HbA1c suggests that improving glycemic control might have a positive impact on platelet function, potentially reducing the risk of thrombotic events.

Our study has several limitations. The cross-sectional design precludes the establishment of causal relationships. Additionally, the sample size was relatively small, and the study was conducted at a single center, which may limit the generalizability of the results. Future longitudinal studies with larger, diverse populations are needed to confirm these findings and explore the long-term implications of the MPV-HbA1c relationship.

CONCLUSION

In conclusion, our study demonstrates a significant positive correlation between MPV and HbA1c levels in T2DM patients, supporting the potential use of MPV as a marker for glycemic control and vascular risk. Further research is warranted to investigate the underlying mechanisms and clinical applications of this association in the management of T2DM and prevention of its complications.

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