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Mean Platelet Volume in Patients with Type 2 Diabetes Mellitus and Vascular Complications: A Comparative Study

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Abstract

Background: Type 2 diabetes mellitus (T2DM) is a common metabolic illness linked to serious vascular consequences, such as coronary artery disease, acute ischaemic stroke, and diabetic retinopathy. As a potential biomarker for platelet activation and its role in T2DM-related vascular problems, Mean Platelet Volume (MPV) has attracted attention.

Methods: This study enrolled 120 T2DM patients between January 2021 and June 2022, a period of 18 months. Group A (T2DM with vascular issues) and Group B (T2DM without vascular complications) were used to stratify the study population. To determine differences between the two groups, this study used automated hematology analyzers to quantify MPV levels and perform statistical analysis.

Results: According to current research, patients in Group A had MPV levels that were considerably greater than those in Group B (p 0.05). Patients with AICVA had the highest MPV levels, followed by those with CAD and DR, according to subgroup analyses within Group A. Despite not being statistically significant, these trends offer important information.

Conclusion: In conclusion, MPV may be a useful biomarker for determining the likelihood of vascular problems in T2DM. However, to prove its therapeutic importance and utility in everyday practice, prospective trials are crucial. The prompt therapy and prevention of T2DM-related vascular problems could be aided by early detection of high MPV levels, eventually enhancing patient care and outcomes.

Keywords: Type 2 Diabetes Mellitus, Mean Platelet Volume, Vascular Complications, Coronary Artery Disease, Acute Ischemic Cerebrovascular Accident, Diabetic Retinopathy

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Introduction

Diabetes mellitus is a widespread global health issue that is defined by persistent hyperglycemia brought on by impaired insulin production, insulin action, or both [1]. Type 2 Diabetes Mellitus (T2DM) is the most common type of diabetes, accounting for about 90% of all instances of the disease globally [2]. T2DM is linked to a wide range of problems, which have significant effects on both the patient as an individual and the healthcare system as a whole.

1. T2DM has a tendency to cause and exacerbate vascular problems, which considerably increase the morbidity and mortality of those who have the condition. These vascular complications cover a wide range of diseases, each with its own pathophysiological bases and clinical presentations. Coronary Artery Disease (CAD), Acute Ischemic Cerebrovascular Accident (AICVA), and Diabetic Retinopathy (DR) are three of the most well-known vascular consequences linked to T2DM and place a significant burden on patients and healthcare resources.

1. Coronary Artery Disease (CAD): CAD is a well-known T2DM complication and one of the leading global causes of cardiovascular morbidity and mortality [3]. The development of atherosclerotic plaques within the coronary arteries, which may ultimately result in the constriction or occlusion of these crucial conduits, is the hallmark of CAD. The effects of CAD range from myocardial infarction (heart attack), a potentially fatal event indicated by the sudden blockage of a coronary artery, to angina pectoris, characterized by chest pain or discomfort [4].
2. Acute Ischemic Cerebrovascular Accident (AICVA): Another dangerous vascular consequence associated with T2DM is AICVA, often known as stroke. This disorder is brought on by a sudden interruption in blood supply to the brain, frequently as a result of cerebral artery obstruction (ischemic stroke) or cerebral blood vessel rupture (hemorrhagic stroke). AICVA is well known for having the potential to result in severe neurological abnormalities, which can include everything from cognitive and speech problems to motor and sensory impairments [5].
3. Diabetic Retinopathy (DR): DR is an eye-specific microvascular consequence of type 2 diabetes (T2DM). The retina, the light-sensitive tissue in the back of the eye, has delicate blood vessels that are gradually damaged. Proliferative retinopathy, which can cause serious vision impairment or blindness if neglected, is the final stage of DR's progression after mild nonproliferative retinopathy [6].

T2DM and these vascular problems are intertwined, necessitating a complex strategy for their prevention, diagnosis, and therapy. The discovery of biomarkers that can help with risk classification, early detection, and monitoring of these problems is a crucial component of this quest. In this situation, the parameter known as Mean Platelet Volume (MPV), which measures the size of circulating platelets, has emerged as a potentially useful biomarker.

Megakaryocyte-derived platelets, which are tiny cellular fragments, are essential for hemostasis and thrombosis. In the development of atherothrombotic events including myocardial infarction and ischemic stroke, platelet activation and aggregation are crucial processes [7]. With bigger platelets often being more hemostatically active and prone to

aggregation, there is emerging evidence that MPV may serve as an indication of platelet activation [8-10].

The assumption that variations in platelet function and activation may contribute to the etiology of these issues is the basis for examining MPV in the context of T2DM and its vascular consequences. Increased platelet activation and aggregation may be related with elevated MPV levels, which may increase the risk of atherothrombotic events linked to CAD and AICVA. In order to fully understand its possible implications in the context of retinal vascular alterations, it is also necessary to investigate the effect of MPV on DR, a microvascular complication.

The link between MPV and vascular problems in T2DM, notably CAD and AICVA, has been the subject of numerous investigations. According to these findings, patients who experience these issues have greater MPV levels than those who don't [9][10]. However, there isn't much information in the literature about the connection between MPV and DR, therefore more research is required.

This study aims to thoroughly assess MPV levels in a cohort of T2DM patients, comparing those with vascular complications (including CAD, AICVA, and DR) to those without such complications. This is because MPV may have clinical significance in predicting and understanding vascular complications in T2DM. Current main goal is to determine whether MPV has the potential to be a useful biomarker for identifying people at risk of T2DM-related vascular problems, which will eventually help to improve risk assessment and patient management.

Materials and Methods

Design of the Study and Participants

This prospective observational study began in January 2021 and lasted for 18 months, ending in June 2022. 120 patients with a clinical diagnosis of Type 2 Diabetes Mellitus (T2DM) made up the study cohort. These people were chosen from current hospital, thus there is a wide range of age, gender, and T2DM disease duration represented.

This study divided the patients into two groups in order to clearly define the effects of vascular problems on Mean Platelet Volume (MPV) in T2DM.

- 60 T2DM patients with documented vascular complications, such as Coronary Artery Disease (CAD), Acute Ischemic Cerebrovascular Accident (AICVA), or Diabetic Retinopathy (DR), made up Group A (T2DM with Vascular Complications). These problems were confirmed based on thorough clinical evaluations, laboratory tests, and/or pertinent imaging examinations.
- Group B (T2DM without Vascular Complications): Group B included 60 more T2DM patients who did not exhibit any signs of vascular complications upon clinical assessment.

Data Collection To guarantee accuracy and dependability, current data collection method was precise and standardized. Prior to their involvement in the study, all individuals gave their

informed consent. For each patient, this study methodically recorded a variety of clinical and demographic factors, such as:

- Age: Age was expressed in years and was a significant demographic factor.
- Gender: The ratio of male to female participants as well as their numbers was noted.
- T2DM length: The number of years following the original diagnosis was used to determine the length of T2DM.
- Conditions: Each group's prevalence of comorbid conditions such obesity, dyslipidemia, and hypertension was evaluated and recorded as a percentage.

Mean Platelet Volume (MPV) measurement

Each participant had fasting venous blood samples taken in order to calculate MPV levels. Standard venipuncture methods were used to collect blood samples, minimizing stress to the platelets. To avoid clot formation, these samples were put in ethylenediaminetetraacetic acid (EDTA) anticoagulant tubes. Then, utilizing automated hematological analyzers that produced accurate and consistent findings, MPV values were collected.

Analytical Statistics

To identify any significant differences between the two study groups, a comprehensive statistical analysis of the obtained data was performed. Depending on how the data were distributed, continuous variables such as age and the length of T2DM were summarized as medians with interquartile ranges or means with standard deviations. Gender and comorbidities were two categorical factors that were provided as percentages.

The following statistical techniques were used to evaluate the main research question about the connection between MPV and vascular problems in T2DM:

- The means of continuous variables, such as MPV levels, were compared between Group A (T2DM with vascular complications) and Group B (T2DM without vascular complications) using the Student's t-test, a parametric test.
- Mann-Whitney U test: The Mann-Whitney U test was used as a non-parametric option to compare MPV levels between the two groups when the data distribution did not adhere to the assumptions of normality.

Results

The study population's clinical and demographic characteristics are outlined in Table 1. 120 individuals made up current cohort, and they were equally split between Group B (T2DM without vascular issues) and Group A (T2DM with vascular complications). The mean ages, gender distributions, and T2DM durations of the two groups were comparable. Although present in both groups, comorbidities such obesity, dyslipidemia, and hypertension were not significantly different.

The MPV values for Groups A and B are shown in Table 2, along with the findings of the statistical analysis. Notably, current study showed that the MPV levels in the two groups differed statistically significantly ($p < 0.05$). When compared to patients in Group B (T2DM

without vascular issues), those in Group A (T2DM with vascular difficulties) had greater MPV levels.

To further explore differences in MPV levels across Group A patients with various vascular problems, this study performed a subgroup analysis (Table 3). AICVA patients had the highest MPV levels (10.5± 1.0 fL), followed by CAD patients (10.3 ±0.9 fL) and DR patients (10.0± 0.8 fL), according to the findings. The patterns indicate potential variations in MPV levels among various vascular problems in T2DM, even though these differences did not achieve statistical significance.

Table 1: Demographic and Clinical Characteristics of Study Population

Characteristics	Group A (with complications)	Group B (without complications)
Age (years)	58.4 ± 7.2	57.9 ± 6.8
Gender (Male/Female)	32/28	34/26
Duration of T2DM (years)	8.5 ± 3.2	8.2 ± 3.0
Comorbidities (%)	65%	60%

Table 2: Mean Platelet Volume (MPV) Levels

Group	MPV Levels (fL)	p-value
Group A (with complications)	10.2 ± 0.9	< 0.05
Group B (without complications)	9.7 ± 0.8	

Table 3: Subgroup Analysis of MPV Levels in Group A (with complications)

Vascular Complication	MPV Levels (fL)
Coronary Artery Disease	10.3 ± 0.9
Acute Ischemic Cerebrovascular Accident	10.5 ± 1.0
Diabetic Retinopathy	10.0 ± 0.8

Discussion

Mean Platelet Volume (MPV) may serve as a biomarker in people with Type 2 Diabetes Mellitus (T2DM) and vascular problems, according to current study. The results highlight the role of platelet activation in the pathogenesis of vascular problems associated with type 2 diabetes, including coronary artery disease (CAD), acute ischemic stroke (AICVA), and diabetic retinopathy (DR).

When compared to T2DM patients without difficulties (Group B), patients with vascular issues (Group A) had higher MPV levels, which may indicate that greater platelet activation and size are involved in the prothrombotic environment linked to these complications. These results are consistent with earlier studies that found higher MPV levels in T2DM patients with CAD and AICVA [9][10]. Higher MPV, which indicates platelet activation, has been

associated with enhanced platelet reactivity and a greater propensity for thrombus formation, predisposing people to atherothrombotic events [11-15].

Additional information is provided by the subgroup analysis within Group A, which shows that patients with AICVA had the highest MPV levels, followed by those with CAD and DR. Although these differences did not reach statistical significance, they do offer important trends that should be investigated in more extensive investigations. The increased MPV levels in this category may be explained by the high risk of thrombotic events associated with AICVA, which is characterized by cerebral artery blockage [8,10,14,15].

Current findings raise intriguing issues about the possible clinical applicability of MPV as a prognostic or diagnostic biomarker for vascular problems associated with T2DM. Elevated MPV might be used to identify patients who are more likely to experience these issues in a quick and affordable manner. Early intervention in people who are at high risk may be able to slow the onset and progression of CAD, AICVA, and DR. However, more study is required to confirm the usefulness of MPV in this situation.

While current study provides insightful information, a number of limitations should be taken into account. Current capacity to determine causation or evaluate the prognostic value of MPV for upcoming vascular events is constrained by the cross-sectional design. It is necessary to conduct longitudinal studies to clarify the timing of the development of problems and MPV rise. Additionally, current study did not take into consideration possible confounders like antiplatelet drugs that could affect MPV levels. Future research should thoroughly cover these aspects.

Current paper discusses the less known connection between MPV and this microvascular complication of T2DM in the context of DR. Further study should concentrate on clarifying the methods by which MPV may contribute to the pathophysiology of retinal injury given the complex vascular alterations in DR.

Conclusion

The relationship between raised MPV levels and the occurrence of vascular problems in T2DM has been underlined by current study, in its conclusion. Although these results show promise for MPV's potential use as a biomarker, they still need to be confirmed in bigger, prospective trials. For T2DM patients at risk of CAD, AICVA, and DR, recognising high MPV as a risk factor may make it possible to develop more individualised risk assessments and therapeutic approaches. In the end, a greater comprehension of MPV's function in T2DM-related vascular problems may have significant effects on clinical procedures and patient outcomes.

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