OPEN ACCESS Freely available online

Internal Medicine: Open Access

Research Article

Prediction of Microvascular Complications with Mean Platelet Volume in T2DM Patients

Prachi Jain*

Department of Cardiology, Tsinghua University, Beijing, China

ABSTRACT

Diabetes is most common metabolic disorder characterized by chronic hyperglycemia associated with long-term macro and micro-vascular complications involving the blood vessels, eyes, kidneys, and nerves. It has become a global health crisis with 422 million people suffering from it and its incidence is rapidly rising in middle-and low-income countries. Diabetes-related complications are responsible for morbidity. Many people have them at the time of diagnosis. DM is characterized by prothrombotic state of platelets due to the persistent hyperglycemia and insulin resistance.

Keywords: Diabetes; Hyperglycemia; Insulin resistance; Protein kinase C

INTRODUCTION

The hyperglycemia, dyslipidemia and insulin resistance in diabetes causes endothelial and predicate injury, making it a prothrombotic state. Formation of glycation end products, activation of protein kinase C and disturbances in polyol pathways are the possible mechanisms by which increased glucose induces vascular abnormalities [1]. Increased platelet activation is suggested to be involved in the pathogenesis of vascular complications.

Platelet activation triggers thrombus formation thromboembolism with release of PDGF and VEGF that accelerate the progression of vascular lesions. Platelets with altered morphology are found in diabetics [2]. Platelets are larger with denser granules which are enzymatically and functionally hyperactive. They secrete more pro-aggregators molecules.

Mean Platelet Volume (MPV) is a blood parameter used for measuring platelet size. Larger platelets have higher MPV. It can be done easily in the laboratory with CBC. It could alert us regarding endothelial dysfunction and help predict microvascular complications [3].

Microvascular complications, retinal lesions, proteinuria and micro albuminuria, have been described as factors that are predictive of cardiovascular and cerebrovascular morbidity and mortality among diabetic subjects. Hence, if detected early, microvascular complications would alert us regarding the increased risk of cardiovascular and cerebrovascular complications. Thus, microvascular complications were chosen to be studied in this study.

Aim of study

This study has been done:

- To compare Mean Platelet Volume in type 2 Diabetes Mellitus patients with good glycaemic control with that of poor glycaemic control.
- To study the association between mean platelet volume and microvascular complications of diabetes.
- To assess the relation between mean platelet volume, glycaemic control, gender, BMI, duration of diabetes and HbA1c.

MATERIALS AND METHODS

80 diabetic patients from OPD and IPD were studied. A detailed history was taken. Patients were evaluated for microvascular complications (retinopathy, proteinuria). Mean Platelet Volume, fasting blood glucose, Post-prandial blood glucose, HbA1c, and Sr. Creatinine were obtained.

Glycosylated Hemoglobin (A1c) ≥ 6.5% or Fasting Blood Glucose (FBG) ≥ 126 mg/dl, fasting should be for at least 8 hours or 2-hour serum glucose ≥ 200 mg/dl during an oral glucose tolerance test or a random serum glucose ≥ 200 mg/dl with symptoms of hyperglycemia was taken as diagnosing criteria in this study [4].

Correspondence to: Prachi Jain, Department of Cardiology, Tsinghua University, Beijing, China, E-mail: wyhaan7@uhn.cn

Received: September 06, 2021; **Accepted:** September 20, 2021; **Published:** September 27, 2021

Citation: Jain P (2021) Prediction of Microvascular Complications with Mean Platelet Volume in T2DM Patients. Intern Med. S8: 001.

Micro albuminuria, (hallmark of diabetic nephropathy) was examined using spot urine Albumin Creatinine Ratio (ACR). Patients with ACR of <20 mg/g for men and <30 mg/g for women were categorized as micro albuminuria negative and those with >20 mg/g and >30 mg/g respectively as micro albuminuria positive.

Diabetic Retinopathy was defined by direct ophthalmoscopy examination. Patients with at least 2 micro aneurysms and/or retinal hemorrhage, and/or other signs of retinal damage were diagnosed as having retinopathy [5].

After baseline evaluation, the patients were divided into 2 groups based on HbA1c levels.

- Diabetics with good control(patients HbA1c<7%)
- Diabetics with poor glycemic control (patients with HbA1c >7%)

All the parameters were compared between both the groups. These groups were further sub grouped based on the presence or absence of complications. The MPV in each group were compared. All parameters were then subjected to statistical analysis [6].

Inclusion criteria

Newly detected type II diabetes mellitus patients or Known type II diabetes mellitus patients on treatment with OHA/Insulin and able and willing to participate in the study. Male and female patients of age >30 years [7].

Exclusion criteria

- Type I diabetes mellitus
- Pregnancy
- Females with (Hb<10 g%) and males with (Hb<12 g%).
- Patients on antiplatelet, antithrombotic or on drugs causing bone marrow suppression.
- Patients with diagnosed malignancy.
- Patients with known chronic kidney disease and coronary artery disease.

Patients with UTI, hematologic diseases, hepatic or cardiac failure and chronic illness like RA. Patients with cardiac valve replacement, Patients with thrombocytosis and thrombocytopenia. History of blood transfusion in last 14 days. Patients with that are on medication altering the platelet function [8].

RESULTS

In this study, in good glycemic control group, majority belonged to 51-60 years age class interval with a mean age of 49.09 years and majority in poor glycemic control group belonged to same age class interval with a mean age of 51.27 years. Similarly, in good glycemic control group males and females were equally distributed (50.00%) and majority in poor glycemic control group were females (54.00%) (Table 1).

S.no	Parameter	Good glycemic control group (n=30)	Poor glycemic control group (n=50)	P-value
1	Age (years)	49.09 ± 9.79	51.27 ± 9.12	0
2	Gender (m/f)	15/15	23/27	1
3	BMI (kg/m2)	27.21 ± 4.74	28.08 ± 3.85	0
4	MPV	7.76 ± 0.46	10.18 ± 0.83	<0.0001
5	FBS (mg/dl)	120.63 ± 22.32	162.20 ± 29.09	<0.0001
6	PPBS (mg/dl)	169.49 ± 44.09	241.58 ± 51.74	<0.0001
7	Duration of diabetes (years)	6.63 ± 3.61	7.45 ± 3.50	0

Table 1: Parameters of study participants.

Majority in good glycemic control group belonged to 101-120 mg/dl FBS class interval (30%) with a mean FBS of 120.63 mg/dl and majority in poor glycemic control group belonged to >140 mg/dl FBS class interval (82%) with a mean FBS of 162.20 mg/dl. Similarly, in good glycemic control group, majority belonged to ≤ 150 mg/dl PPBS class interval (50%) with a mean PPBS of 169.49 mg/dl and majority in poor glycemic control group belonged to 201-250 mg/dl PPBS class interval (38%) with mean PPBS of 241.48 mg/dl [9]. In duration of diabetes distribution, it was observed that, majority in both good and poor glycemic control group belonged to 6-10 years duration of diabetes.

In case of MPV distribution, it was observed that, in good glycemic control group and poor glycemic control group, a mean MPV of 7.76 ± 0.46 fL and 10.18 ± 0.83 fL was noted respectively (P=<0.0001). The data subjected to statistical unpaired test reveals. There is a strong positive correlation between FBS, PPBS, HbA1c levels, duration of diabetes and MPV levels.

While analyzing MPV distribution, it was observed that in proteinuria +ve group had a mean MPV of 10.26 fL and in proteinuria -ve group, a mean MPV of 8.62 fL (P=<0.0001) was observed. Also, it was observed that, mean MPV in retinopathy +ve group is 10.46 fL ± 0.93 and mean MPV in retinopathy -ve group is 8.78 fL ± 1.18. (P=<0.0001). This reveals the existence of statistically significant association between MPV distribution and retinopathy status (P<0.05) as well as with proteinuria status. So, higher MPV values are seen in diabetic patients with micro vascular complications than those without complications [7].

DISCUSSION

Diabetes and its complications result into a heavy burden on our health services and their economy. The microvascular complications occur due to increased prothrombotic and atherosclerotic potential in diabetes especially when it is prolonged and poorly controlled. In this study we aimed to find out the platelet indices in T2DM and their association with the presence of microvascular complications, and with the regulation and duration of hyperglycemia in patients.

Insulin has been shown to antagonize the effect of platelet agonists like collagen, adenosine diphosphate, epinephrine and platelet activating factor. Platelets have insulin binding site and it is assumed that insulin reduces platelet responses against aggregant factors including thrombin, ADP and platelet activating factor [8]. Thus it is found that insulin resistance results in platelet dysfunction. In our study, we found that MPV was significantly higher in diabetics with poor glycemic control than with good glycemic control. It reinforced the fact that poor glycemic control and longer duration may increase the risk of diabetic complications.

MPV is an indicator of average size and activity of platelets. Larger platelets are more active enzymatically and metabolically and have higher thrombotic ability as compared to small sized platelets which are depicted by increased MPV.

The relationship between the duration of diabetes and MPV levels was also statistically significant since P<0.05. In simple terms, for every 1-year increase in duration of diabetes there is a 9.0 fl increase in MPV among the study subjects. This is in contrast to the studies done by Gasparyan, et al. and Kodiatte, et al., which showed no significant relation between MPV and duration of diabetes [5,6].

The relationship between the HbA1c levels and MPV levels was statistically significant since P<0.05. This means as HbA1c levels increases MPV levels also increases in a direct and linear fashion in our study subjects [4,8]. This observation was similar to the studies done by Kodiatte, et al. This proves that increased platelet volume and activity results from hyperglycemic states [6]. In simple terms, for every 1% increase in HbA1c level there is a 5.1 fl increase in MPV among the study subjects.

Westerbacka, et al. also observed results similar to this study. Vinik, et al. showed clear link between MCV and vascular complications [8,9]. Therefore, early screening of this parameter may be helpful in early detection and prevention of the complications.

CONCLUSION

The relationship between the FBS and PPBS with MPV levels was statistically significant since P<0.05. In simple terms, for every 100 mg/dl increase in FBS or PPBS there is a 7.96 fl increases in MPV among the study subjects. MPV was significantly higher in diabetic individuals having microvascular complications. Mean Platelet Volume change is found to be statistically associated with uncontrolled diabetes i.e., poor glycemic control and hence MPV may be considered as marker of platelet activation.

REFERENCES

1. Jindal S, Gupta S, Gupta R, Kakkar A, Singh HV, Gupta K, et al. Platelet indices in diabetes mellitus: indicators of diabetic microvascular complications. Hematol. 2011;16(2):86-89.
2. Kakouros N, Rade JJ, Kourliouros A, Resar JR. Platelet function in patients with diabetes mellitus: From a theoretical to a practical perspective. Int J Endocrinol. 2011;2011:742719.
3. Ulutas KT, Dokuyucu R, Sefil F, Yengil E, Sumbul AT, Rizaoglu H, et al. Evaluation of mean platelet volume in patients with type 2 diabetes mellitus and blood glucose regulation: A marker for atherosclerosis? Int J Clin Exp Med. 2014;7(4):955.s
4. Akinsegun A, Olusola DA, Sarah JO, Olajumoke O, Adewumi A, Majeed O, et al. Mean platelet volume and platelet counts in type 2 diabetes: Mellitus on treatment and non-diabetic mellitus controls in Lagos, Nigeria. Pan Afr Med J. 2014;18.
5. Gasparyan YA, Ayvazyan L, Mikhailidis PD, Kitas DG. Mean platelet volume: A link between thrombosis and inflammation? Curr Pharm Des. 2011;17(1):47-58.
6. Kodiatte TA, Manikyam UK, Rao SB, Jagadish TM, Reddy M, Lingaiah HK, et al. Mean platelet volume in type 2 diabetes mellitus. J Lab Physician. 2012;4(1):5-9.
7. Alhadas KR, Santos SN, Freitas MM, Viana SM, Ribeiro LC, Costa MB. Are platelet indices useful in the evaluation of type 2 diabetic patients. J Bras Pathol Med Lab. 2016;52:96-102.
8. Westerbacka J, Yki-Järvinen H, Turpeinen A, Rissanen A, Vehkavaara S, Syrjälä M, et al. Inhibition of platelet-collagen interaction: An *in vivo* action of insulin abolished by insulin resistance in obesity. ArterioscIerThrombVascBiol. 2002;22(1):167-172.
9. Vinik AI, Erbas T, Park TS, Nolan R, Pittenger GL. Platelet dysfunction in type 2 diabetes. Dia Care. 2001;24(8):1476-1485.