Is Mean Platelet Volume to Platelet ratio a promising indicator of diabetic regulation in type 2 diabetes mellitus?

Tuba T. Duman[1], Gulali Aktas[1], Burcin Atak[1], Mehmet Z. Kocak[1]

1 *Bolu Abant Izzet Baysal University Hospital, Department of Internal Medicine, Turkey*

Abstract

Aims: Type 2 diabetes mellitus (T2DM) is associated with great disease burden since it has high prevalence, morbidity and mortality rates. Platelets (PLT) are directly or indirectly involve in the processes of chronic complications in T2DM. Beside serving as a marker of platelet activation, mean platelet volume (MPV) is also considered as an inflammatory indice. A MPV to PLT ratio (MPR) is introduced as a novel inflammatory predictor and a marker of worse outcome, recently. We aimed to study MPR levels of type 2 diabetic patients in present report. **Methods**: Subjects older than 18 years old and with type 2 diabetes mellitus treated in outpatient internal medicine clinics of our university hospital during June 2017 to December 2017 were included. Medical data of the patients obtained from computerized database of the institution analyzed retrospectively. General characteristics and laboratory parameters of the participants, were compared to those in healthy controls. **Results**: We found significantly increased MPR in diabetic subjects compared to healthy volunteers (p=0.02). Moreover, MPR and fasting blood glucose (r=0.264, p<0.001), and MPR and HbA1c (r=0.234, p=0.003) were significantly and positively correlated (r=0.234, p=0.003). **Conclusion**: We suggest that, elevated MPR in otherwise healthy subject should courage physicians for prompt evaluation for type 2 DM. Correlations between MPR and fasting plasma glucose and HbA1c need validation with further studies with larger population.

Keywords: Type 2 diabetes mellitus, Mean platelet volume to platelet ratio, HbA1c, Inflammation.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is associated with great disease burden since it has high prevalence, morbidity and mortality rates. Poor glycemic control promotes chronic complications of T2DM via endothelial dysfunction [1]. Platelets (PLT) are directly or indirectly involve in the processes of chronic complications in T2DM [2, 3]. Larger platelets are more active and more tend to aggregate compared to smaller non-reactive platelets [4,5]. Platelets with altered size and shape have been suggested as associated with higher risk of diabetic complications [6].

Mean platelet volume (MPV) is the size of circulating thrombocytes measured by automated blood analyzers. It is considered as a marker of platelet activation and moreover, as an inflammatory indice. A MPV to PLT ratio (MPR) is introduced as a novel inflammatory predictor and a marker of worse outcome, recently. An elevated MPR was reported as an independent risk factor for vascular access failure in hemodialysis population [7]. Moreover, MPR was significantly increased in patients with sepsis [8].

Since hemogram parameters supposed as novel inflammatory predictors in various conditions, we aimed to study MPR levels of type 2 diabetic patients in present report.

METHODS

Subjects older than 18 years old and with type 2 diabetes mellitus treated in outpatient internal medicine clinics of our university hospital during June 2017 to December 2017 were included. Medical data of the patients obtained from computerized database of the institution analyzed retrospectively. Healthy population after a routine check-up in our clinics were enrolled as control group. Subjects with established malignancy, infectious or inflammatory diseases, pregnancy were excluded.

General characteristics of the participants, such as, age, gender, height, weight and waist circumference, smoking and drinking status, were recorded. The weight in kilograms was divided by the square of height in meters to calculate body mass index (BMI). Diabetic complications, if any present, were noted. Laboratory parameters of the study population; fasting blood glucose, creatinine, total cholesterol, LDL-cholesterol HDL-cholesterol, triglyceride and albumin levels in serum, urinary albumin excretion level,

∗Corresponding author:
Tuba T. Duman
Bolu Abant Izzet Baysal University Hospital, Department of Internal Medicine, 14280, Golkoy, Bolu, Turkey
Email:
doktortuuba[at]gmail.com

glycated hemoglobin (HbA1c) and hemogram parameters, such as, the count of white blood cell (WBC), hemoglobin (Hb), hematocrit (Htc), mean platelet volume (MPV) and platelet count (PLT) were obtained and recorded from institutional database and patient files.

For statistical analysis, SPSS statistic programme (SPSS 15.0; IBM Inc., Chicago, IL, USA) was used. Kolmogorov-Smirnov test conducted to determine variables either as homogenously or non-homogenously distributed. While homogenously distributed variables were compared by t-test and expressed as mean ± standard deviation, non-homogenous variables were expressed as median (minimum – maximum) and conducted with Mann-Whitney U test. Chi-square test was conducted to compare categorical variables between study groups. The p values lower than 0.05 were considered as statistically significant.

RESULTS

Study group was consisted of 151 subjects with type 2 DM and control group was included 44 healthy volunteers. Mean age of the study and control groups were 57 ± 10 and 45 ± 12 years, respectively. Patients with type 2 DM were significantly older than control subjects (p<0.001).

While 82 (54%) were women and 69 (46%) were men in study group, 31 (70%) were women and 13 (30%) were male in healthy controls. Study and control groups were not different from each other in terms of sex (p=0.06).

Body weight (p<0.001), circumference of waist (p<0.001), BMI (p<0.001), systolic (p<0.001) and diastolic (p<0.001) blood pressures, were significantly different between study and control groups.

Although HDL-cholesterol (p<0.001) was significantly lower and fasting plasma glucose (p<0.001) and triglyceride (p<0.001) were significantly elevated and in study group compared to controls, total-cholesterol (p=0.47) and LDL-cholesterol (p=0.72) levels were not significantly different between groups.

Despite Hb (p=0.5), Htc (p=0.38), and Plt (p=0.07) levels were similar in study and control groups, MPR was significantly elevated in diabetic subjects compared to controls (p=0.02).

In Pearson's correlation analyze, MPR was significantly and correlated with both fasting plasma glucose (r=0.264, p<0.001) and HbA1c (r=0.234, p=0.003) levels.

In ROC analyze, a MPR value greater than 0.03 had 70% sensitivity and 52% specifity in selecting subjects with type 2 DM.

DISCUSSION

The most important finding of present study is that MPR is associated with type 2 DM and even more, it is positively correlated with fasting plasma glucose and HbA1c levels.

In a study in patients with ST elevation myocardial infarction, authors found that MPR was associated with one-year non-fatal re-infarction [9].

Cho et al reported that MPR was superior in diagnosis of hepatocellular carcinoma than MPV [10]. On the other hand, another study suggested that MPR of breast cancer patients was not different from the healthy controls [11].

We shall discuss the underlying mechanism of elevated MPR in type 2 diabetic subjects. Authors considered type 2 DM as a metabolic disorder characterized with continuous, low grade inflammation. It has been showed in literature that MPV was increased in many inflammatory conditions [12-14]. Moreover, type 2 DM is associated with greater MPV values compared to healthy subjects [15]. It has been suggested a negative correlation between MPV and platelet count [16]. An increase in MPV due to inflammatory microenvironment in type 2 DM, and an inverse association between MPV and platelet count both may cause greater MPR in diabetic subjects compared to controls.

Authors compared platelet count and MPV of the subjects with acute coronary syndrome and stable angina and found that platelet count was lower and MPV was lower in stable angina subjects compared to the patients with acute coronary syndrome [17].

Although MPV was not, MPR was suggested to predict mortality of 4 years for myocardial infarction independently by Azab et al [18]. Association between MPR and inflammatory diseases have been studied recently and elevated MPR reported in hepatosteatosis [19] and in irritable bowel syndrome [20].

Retrospective study design is the first and small study population is the second important limitation of our study. Lack of MPR values after successful treatment of well controlled diabetic subjects, which might confirm association between HbA1c and MPR, could be the third limitation. However, results of present study are important since it is the first in literature that suggested association between type 2 DM and MPR.

In conclusion, we suggest that elevated MPR in otherwise healthy subject should courage physicians for prompt evaluation for type 2 DM. Correlations between MPR and fasting plasma glucose and HbA1c need validation with further studies with larger population.

REFERENCES

1. Pereira de Melo L, Antunes de Campos E. "O grupo facilita tudo": significados atribuídos por pacientes portadores de diabetes mellitus tipo 2 a grupos de educação em saúde. *Revista Latino-Americana de Enfermagem.* 2014; 22(6).
2. Balasubramaniam K, Viswanathan GN, Marshall SM, Zaman AG. Increased atherothrombotic burden in patients with diabetes mellitus and acute coronary syndrome: a review of antiplatelet therapy. *Cardiology research and practice.* 2012; 2012:909154.
3. Jindal S, Gupta S, Gupta R, *et al*. Platelet indices in diabetes mellitus: indicators of diabetic microvascular complications. *Hematology (Amsterdam, Netherlands).* 2011; 16(2):86-89.
4. Endler G, Klimesch A, Sunder-Plassmann H, *et al*. Mean platelet volume is an independent risk factor for myocardial infarction but not for coronary artery disease. *British journal of haematology.* 2002; 117(2):399-404.
5. Farias MG, Dal Bó S. Importância clínica e laboratorial do volume plaquetário médio. *Jornal brasileiro de patologia e medicina laboratorial.* 2010; 46(4):275-281.
6. Pabon Osuna P, Nieto Ballesteros F, Morinigo Munoz JL, *et al*. [The effect of the mean platelet volume on the short-term prognosis of acute myocardial infarct]. *Revista espanola de cardiologia.* 1998; 51(10):816-822.
7. Shin DH, Rhee SY, Jeon HJ, Park JY, Kang SW, Oh J. An Increase in Mean Platelet Volume/Platelet Count Ratio Is Associated with Vascular Access Failure in Hemodialysis Patients. *PloS one.* 2017; 12(1):e0170357.
8. Ates S, Oksuz H, Dogu B, Bozkus F, Ucmak H, Yanit F. Can mean platelet volume and mean platelet volume/platelet count ratio be used as a diagnostic marker for sepsis and systemic inflammatory response syndrome? *Saudi medical journal.* 2015; 36(10):1186-1190.
9. Bolat I, Akgul O, Cakmak HA, *et al*. The prognostic value of admission mean platelet volume to platelet count ratio in patients with ST-segment elevation myocardial infarction undergoing primary percutaneous coronary intervention. *Kardiologia polska.* 2016; 74(4):346-355.
10. Cho SY, Yang JJ, You E, *et al*. Mean platelet volume/platelet count ratio in hepatocellular carcinoma. *Platelets.* 2013; 24(5):375-377.
11. Okuturlar Y, Gunaldi M, Tiken EE, *et al*. Utility of peripheral blood parameters in predicting breast cancer risk. *Asian Pacific journal of cancer prevention: APJCP.* 2015; 16(6):2409-2412.
12. Aktas G, Cakiroglu B, Sit M, *et al*. Mean platelet volume: a simple indicator of chronic prostatitis. *Acta Medica Mediterranea.* 2013; 29:551-554.

13. Aktas G, Alcelik A, Tekce BK, Tekelioglu V, Sit M, Savli H. Red cell distribution width and mean platelet volume in patients with irritable bowel syndrome. *Przeglad gastroenterologiczny.* 2014; 9(3):160-163.

14. Dagistan Y, Dagistan E, Gezici AR, *et al*. Could red cell distribution width and mean platelet volume be a predictor for lumbar disc hernias? *Ideggyogyaszati szemle.* 2016; 69(11-12):411-414.

15. Cakir L, Aktas G, Enginyurt O, Cakir SA. Mean Platelet volume increases in type 2 diabetes mellitus independent of HbA1c level. *Acta Medica Mediterranea.* 2014; 30:425-428.

16. Lozano M, Narvaez J, Faundez A, *et al*. [Platelet count and mean platelet volume in the Spanish population]. *Medicina clinica.* 1998; 110(20):774-777.

17. Ranjith MP, Divya R, Mehta VK, Krishnan MG, KamalRaj R, Kavishwar A. Significance of platelet volume indices and platelet count in ischaemic heart disease. *Journal of clinical pathology.* 2009; 62(9):830-833.

18. Azab B, Torbey E, Singh J, *et al*. Mean platelet volume/platelet count ratio as a predictor of long-term mortality after non-ST-elevation myocardial infarction. *Platelets.* 2011; 22(8):557-566.

19. Kosekli MA, Erkus E, Kocak MZ. Mean Platelet Volume to Platelet ratio as a promising marker of hepatosteatosis. *EXPERIMENTAL BIOMEDICAL RESEARCH.* 2018; 1(2):55-59.

20. Atak BM, Erkus E, Duman TT, Kocak MZ, Kosekli MA. Mean Platelet volume to platelet and red cell distribution width to platelet ratios in Irritable Bowel Syndrome. *EXPERIMENTAL BIOMEDICAL RESEARCH.* 2018; 1(2):60-63.