

Original Research Article

## The Relation between Mean Platelet Volume and Coronary Artery Disease in Type 2 Diabetes Mellitus Patients

Ekrem Aksu<sup>1</sup>, Deniz Avci<sup>2</sup>, Gurkan Cikim<sup>3</sup>

<sup>1</sup>Necip Fazil City Hospital, Department of Cardiology, Kahramanmaraş/Turkey.

<sup>2</sup>Kayseri Training and Research Hospital, Department of Internal Medicine, Kayseri/Turkey.

<sup>3</sup>Necip Fazil City Hospital, Department of Biochemistry, Kahramanmaraş/Turkey.

Corresponding Author: Ekrem Aksu

Received: 9/05/2016

Revised: 21/05/2016

Accepted: 23/05/2016

### ABSTRACT

**Aim:** In our study, we prospectively compared mean platelet volume values along with other metabolic parameters in Type 2 Diabetes Mellitus patients according to whether they have a previous diagnosis of coronary artery disease and aimed to reveal the relation between development of coronary artery disease and mean platelet volume.

**Material and Methods:** Type 2 diabetes mellitus patients who admitted outpatient clinics of diabetes and internal medicine at Kayseri Training and Research Hospital and outpatient clinic of cardiology at Kahramanmaraş Necip Fazil City Hospital were included. These patients were evaluated for if they have a previous diagnosis of coronary artery disease or not. Patients whom didn't have diagnosis of CAD were grouped as Group 1, and patients whom have previous diagnosis of CAD were grouped as Group 2.

**Results:** Mean platelet volume, which was the main parameter of our study, was found  $8.78 \pm 1.45$  fl in Group 1 and  $9.99 \pm 1.16$  fl in Group 2. These values between the two groups were statistically significant ( $p < 0.001$ ).

**Conclusion:** We believe that mean platelet volume might be a good predictor for coronary artery disease development in Type 2 diabetes mellitus. In the light of this study, we conclude there is a need for more extensive studies to validate that it is a useful test to determine increased risk of coronary artery disease in patients with Type 2 diabetes mellitus.

**Keywords:** Mean Platelet Volume, Coronary Artery Disease, Type 2 Diabetes Mellitus.

### INTRODUCTION

Type 2 diabetes mellitus (DM) is a real state of vasculopathy in terms of causing diffuse atherosclerotic vascular disease, inflammatory environment and predisposition of thrombogenesis. Coronary artery diseases (CAD) which is the main complication of DM, is the prominent cause of death in type 2 DM patients and it is responsible for 34 % of all over mortality in the world. <sup>(1)</sup> The developments of macrovascular and microvascular complications start many years (1-12 years)

before the diagnosis of diabetes. Macrovascular complications often, and even microvascular complications exists on the time of diagnosis. Primary prevention could be provided if the causes of disease determined at an early stage and changeable risk factors are removed. <sup>(2)</sup> It is important to estimate the risk factors for cardiovascular disease in diabetic patients in order to provide protective precautions in a time manner and treatment planning.

Recent studies showed that mean platelet volume could be an independent

risk factor for coronary artery disease. In our study we compared diabetic patients depending on whether they have a previously diagnosed coronary artery disease; on the purpose of showing the relation between these parameters and coronary artery disease by analyzing mean platelet volume (MPV) and other metabolic parameters.

## **MATERIALS AND METHODS**

Type 2 diabetes mellitus patients who applied outpatient clinics of diabetes and internal medicine at Kayseri Training and Research Hospital and outpatient clinic of cardiology at Kahramanmaraş Necip Fazil City Hospital were included. These patients were evaluated for whether they have a previous diagnosis of CAD. Patients didn't have diagnosed of CAD were grouped as Group 1 (n=91), and patients previously diagnosed of CAD were grouped as Group 2 (n=114).

**Laboratory examination:** Biochemical markers [Fasting blood sugar (FBS), blood urea nitrogen (BUN), plasma creatinine levels, aspartate aminotransferase (AST), alanine aminotransferase (ALT), total cholesterol, low density lipoprotein (LDL), high density lipoprotein (HDL), and triglyceride], complete blood count (CBC) and glycosylated hemoglobin (HbA1C) levels were evaluated. Groups were compared on the basis of these markers.

Because of its possible effects on accuracy of the study and value of MPV, patients whom had renal failure or suspicious test results for liver function were excluded from the study. Patients whom had diagnosis of any inflammatory disease were not included in the study.

### **Statistical analyses**

Shapiro-Wilk Test and histograms were used to evaluate normal distribution of continuous variables. Continuous variables were counted as mean, standard deviation, median or percentiles (25-75). Normally distributed variables were analyzed with Student T test and non-normally distributed

variables were analyzed with Mann-Whitney U test. Statistical significance level was taken as  $p < 0.05$ . SPSS 21.0 package program (Statistical Package for Social Sciences; SPSS Inc., Chicago, Illinois) was used for the statistical analysis of the data.

## **RESULTS**

Patients in the study were classified into two groups. Group 1 was diabetic patients without a history of any ischemic heart disease, and Group 2 was diabetic patients with ischemic heart disease history.

The mean ages of Group 1 and Group 2 was  $56.14 \pm 9.46$  and  $58.18 \pm 6.98$ , respectively. There was no statistical difference between these two groups in terms of mean age ( $p = 0.089$ ). There was statistically significant difference between two groups in terms of gender (Table 1).

MPV, which was the main parameter of our study, was found  $8.78 \pm 1.45$  fl in Group 1 and  $9.99 \pm 1.16$  fl in Group 2. These values between the two groups were statistically significant ( $p < 0.001$ ).

The average total cholesterol level was  $212.31 \pm 34.21$  mg/dl in Group 1 and  $191.36 \pm 41.18$  mg/dl in Group 2. The difference between two groups was statistically significant ( $p = 0.01$ ).

While the average LDL cholesterol level was  $129.45 \pm 29.88$  mg/dl in Group 1, it was  $115.32 \pm 35.65$  mg/dl in Group 2. The difference between two groups was statistically significant ( $p = 0.03$ ).

The average HDL cholesterol level was  $43.51 \pm 11.49$  mg/dl in Group 1, it was  $42.21 \pm 2.07$  mg/dl in Group 2 ( $p = 0.452$ ).

The median of triglyceride level was 158.0 (119.0-247.0) mg/dl in Group 1, it was 158.50 (119.0-247.0) mg/dl in Group 2 ( $p = 0.819$ ).

The median of HbA1C level was 7.5 (6.50-10.40) in Group 1 and 8.5 (6.87-10.37) in Group 2 ( $p = 0.216$ ).

The comparisons between groups in terms of other variables were summarized in Table 1.

**Table 1: The comparison of cases in diabetic patients according to heart disease**

| Variables                              | Reference values | Total                          | Group 1 (DM)                  | Group 2 (DM+CAD)                | P value |
|--|------------------|--------------------------------|-------------------------------|---------------------------------|---------|
| Age (year) <sup>#</sup>                |                  | 57.27±8.22<br>n=205            | 56.14±9.46<br>n=91            | 58.18±6.98<br>n=114             | p=0.089 |
| FBG (mg/dl) <sup>*</sup>               | (70-110)         | 196.94 (126.25-256.0)<br>n=204 | 193.46 (123.75-253.0)<br>n=90 | 199.68 (127.25-229.25)<br>n=114 | p=0.353 |
| Creatinine (mg/dl) <sup>#</sup>        | (0.5-1.3)        | 0.76±0.17<br>n=203             | 0.75±0.18<br>n=89             | 0.77±0.17<br>n=114              | p=0.465 |
| AST (U/L) <sup>#</sup>                 | (<45)            | 20.45±5.58<br>n=201            | 20.08±4.98<br>n=87            | 20.73±6.0<br>n=114              | p=0.416 |
| ALT (U/L) <sup>#</sup>                 | (<45)            | 22.19±7.51<br>n=20             | 23.01±7.76<br>n=88            | 21.55±7.28<br>n=114             | p=0.172 |
| Total cholesterol (mg/dl) <sup>#</sup> | (0-200)          | 200.37±39.63<br>n=193          | 212.31±34.21<br>n=83          | 191.36±41.18<br>n=110           | p<0.001 |
| LDL cholesterol (mg/dl) <sup>#</sup>   | (0-135)          | 121.35±39.96<br>n=192          | 129.45±29.88<br>n=82          | 115.32±35.65<br>n=110           | p=0.003 |
| HDL cholesterol (mg/dl) <sup>#</sup>   | (40-60)          | 42.77±11.81<br>n=191           | 43.51±11.49<br>n=82           | 42.21±2.07<br>n=109             | p<0.452 |
| Triglyceride (mg/dl) <sup>*</sup>      | (35-150)         | 158.0 (123-235.0)<br>n=193     | 158.0 (119.0-247.0)<br>n=83   | 158.50 (119.0-247.0)<br>n=110   | p<0.819 |
| HbA1c                                  | (<6.5)           | 8.0 (6.6-10.4)<br>n=151        | 7.5 (6.50-10.40)<br>n=81      | 8.5 (6.87-10.37)<br>n=70        | p=0.216 |
| MPV (fl) <sup>#</sup>                  | ()               | 9.46±1.43<br>n=205             | 8.78±1.45<br>n=91             | 9.99±1.16<br>n=114              | p<0.001 |
| Categoric Variables                    |                  | n (114/71)                     | n(44/47)                      | n(52/62)                        |         |
| Gender M/F (%)                         |                  | %46.77/%53.3                   | %48.4/%51.6                   | %46.8/%53.2                     | p=0.714 |

FBG: Fasting Blood Glucose, AST: Aspartate Amino Transferase, ALT: Alanine Amino Transferase, MTV: Mean Platelet Volume  
# Values are expressed in parametric tests. \* Values are expressed in nonparametric tests.

## DISCUSSION

According to the results of the Turkish Diabetes Epidemiology Study (TURDEP) prevalence of type 2 diabetes reported 7.2% between ages of 20-60, and 20% over sixty years of age. On the basis of population census at year 2000, there have been 4.9 million diabetic patients however two-thirds of them could be diagnosed. (3) Increase of the prevalence in type 2 diabetes mellitus causes more morbidity and mortality due to complications as a result. Chronic complications such as accelerated atherosclerosis, nephropathy, neuropathy and retinopathy still remain a problem both for patients and physicians. Coronary artery disease which is the one of most important complication of diabetes is the leading cause of death in type 2 DM and is responsible for 34% of death all over the world. Relative risk of cardiovascular disease is 2-4 times greater in type 2 diabetic patients than general population. Diabetes mellitus and atherosclerosis are concurrently progressing diseases. Diabetes mellitus accelerates ordinary course of atherosclerosis and causes more diffuse atherosclerotic lesion and more coronary vascular involvement. (1) Primary prevention could be provided if the causes of disease determined at an early

stage and changeable risk factors are removed. (2) It is important to estimate the risk factors for cardiovascular disease in diabetic patients in order to provide protective precautions in a time manner and treatment planning. The classically known risk factors of coronary vascular diseases can't completely explain the known changes of pathogenesis, prevalence and severity of disease. Recent studies exposed the new risk factors involved in physiopathology of coronary artery disease. (4) In our study we aimed to evaluate mean platelet volume, which is described as an independent risk factor for CAD in recent studies, (5) with other metabolic parameters thus to show the relation between these parameters and coronary artery disease.

Platelets play the key role in development of atherosclerosis and its acute complications. Their physical and chemical features depend on their size. Mean platelet volume is an approved marker for platelet activation alone itself. (6) Bigger platelets contain more granules and more platelet derived materials; hence they are more prone to adhesion and aggregation. It is situated that cytoplasm of bigger platelets contains overly calcium, thromboxane A2, serotonin, PF-4 and β-thromboglobulin and

also these platelets show increase in adhesive molecule expression which is known as a maker of platelet activation. <sup>(7-9)</sup>

In the study carried out by Gulcan et al it was shown that mean platelet volume could be used as a marker for determination of atherosclerosis risk and an indicator for early diagnosis of atherosclerosis in patients with metabolic syndrome. <sup>(10)</sup>

In a retrospective study carried out by Hacıoglu et al, it was shown that mean platelet volume could be an independent risk factor for development of cardiovascular complications in type 2 diabetic patients without cardiovascular disease and it could be an indicator for risk evaluation of cardiovascular diseases for patient follow up. <sup>(11)</sup>

In the study carried out by Tavil et al it was found that MPV was higher in DM patients with accompanying CAD than patients whom didn't have DM or CAD. In this study it was reported that mean platelet volume is related with coronary artery disease in diabetic patients. <sup>(12)</sup>

In this study by using MPV values and other metabolic parameters which was aimed to show the relation between these parameters and coronary heart disease in diabetic patients, we found that total cholesterol and LDL cholesterol levels were statistically more significant in type 2 DM patients than type 2 DM patients with accompanying CAD. This statistically significant difference was thought to be due to higher ratios of antilipidemic treatment at DM patients with accompanying CAD. However there was no significant difference for triglyceride and HDL cholesterol levels between groups. MPV, which was the main parameter of our study, was found  $8.78 \pm 1.45$  fl in Group 1 and  $9.99 \pm 1.16$  fl in Group 2. These values between the two groups were statistically significant ( $p < 0.001$ ). In the light of these results, we believe that mean platelet volume might be a good predictor to show the risk of coronary artery disease which was the most important mortality and morbidity cause in patients with diagnosis of Type 2 DM.

We believe that mean platelet volume might be a good predictor for coronary artery disease development in Type 2 diabetes mellitus. In the light of this study, we conclude there is a need for more extensive studies to validate that it is a useful test for determining increasing risk of coronary artery disease in Type 2 diabetes mellitus patients.

## CONCLUSION

We believe that MPV might be a good predictor to show CAD development in patients with type 2 DM. In the light of this study, we conclude there is a need for more extensive studies to validate that it is a useful test to determine increased risk of CAD in patients with Type 2 diabetes mellitus.

## REFERENCES

1. Zipes DP, Libby P, Bonow RO, et al. Braunwald's Heart disease A textbook of cardiovascular medicine 7th edition. Elsevier Saunders. Philadelphia 2005: 1355-266.
2. Kültürsay H. Lipit düşürücü tedavi Koroner Kalp Hastalığı primer ve sekonder koruma 2001; 335-58.
3. Satman I, Yilmaz T, Sengül A, et al. Population-based study of diabetes and risk characteristics in Turkey: results of the Turkish diabetes epidemiology study (TURDEP). Diabetes Care. 2002; 25:1551-6.
4. Solberg LA, Enger SC, Hjermann I, et al. Risk factors for coronary and cerebral atherosclerosis in Oslo Study. In: Gotto AM, Smith LC, Allen B AD AL. Atherosclerosis V. New York, NY: Springer Verlag; 1980:57-62.
5. Sansanayudh N, Anothaisintawee T, Muntham D, et al. Mean platelet volume and coronary artery disease: a systematic review and meta-analysis. Int J Cardiol. 2014 Aug 20; 175:433-40.
6. Li D, Turner A, Sinclair AJ. Relationship between trombosit phospholipit and mean trombosit volume in healthy man. Lipids. 2002; 37:901-6.
7. Park Y, Schoene N, Haris W. Mean platelet volume as an indicator of

- platelet activation: methodological issues. Platelets. 2002; 13:301-6.
8. Mathur A, Robinson MS, Cotton J, et al. Platelet reactivity in acute coronary syndrome: evidence for differences in platelet behaviour between unstable angina and myocardial infarction. Throm Haemost. 2001; 85:989-94.
  9. Islamoglu Y, Ertas F, Acet H, et al. The association between mean platelet volume and coronary collateral circulation. European Review for Medical and Pharmacological Sciences. 2013; 17:276-9.
  10. Gülcan AR, Karakaş MS, Akdemir B, et al. Metabolik sendromlu hastalarda ortalama trombosit hacminin subklinik ateroskleroz ile ilişkisi. Turk Kardiyoloji Dernegi Arsivi. 2014; 42: 22-8.
  11. Hacıoğlu MB, Altunoğlu EG, Erdenen F, et al. Diyabetik ve Diyabetik Olmayan Koroner Arter Hastalarında Fibrinojen ve Ortalama Trombosit Hacminin Aterosklerozdaki Yeri. İstanbul Med J 2014; 15:161-5.
  12. Tavil Y, Sen N, Yazici H, et al. Coronary heart disease is associated with mean platelet volume in type 2 diabetic patients. Platelets. 2010; 21:368-72.

How to cite this article: Aksu E, Avci D, Cikim G. The relation between mean platelet volume and coronary artery disease in type 2 diabetes mellitus patients. Int J Health Sci Res. 2016; 6(6):50-54.

\*\*\*\*\*

**International Journal of Health Sciences & Research (IJHSR)**

**Publish your work in this journal**

The International Journal of Health Sciences & Research is a multidisciplinary indexed open access double-blind peer-reviewed international journal that publishes original research articles from all areas of health sciences and allied branches. This monthly journal is characterised by rapid publication of reviews, original research and case reports across all the fields of health sciences. The details of journal are available on its official website ([www.ijhsr.org](http://www.ijhsr.org)).

Submit your manuscript by email: [editor.ijhsr@gmail.com](mailto:editor.ijhsr@gmail.com) OR [editor.ijhsr@yahoo.com](mailto:editor.ijhsr@yahoo.com)