

## Assessment of mean platelet volume in type 2 diabetes mellitus

Ashim Manta<sup>1</sup>, Cheng Khaw Weingken<sup>2\*</sup>, Dimpee Lahkar<sup>3</sup>

<sup>1</sup>Demonstrator, <sup>2,3</sup>Post Graduate Trainee, Dept. of Pathology, Assam Medical College, Dibrugarh, Assam, India

\*Corresponding Author: Cheng Khaw Weingken

Email: ckweingken@gmail.com

Received: 24<sup>th</sup> May, 2018

Accepted: 17<sup>th</sup> November, 2018

### Abstract

In the present century, Diabetes mellitus (DM) is a major public health problem worldwide. There is an increased activity of platelets in diabetes mellitus, which in due course of time might lead to vascular complications. The present study was carried out with an aim to evaluate the Mean Platelet Volume (MPV) in patients with type II DM by comparing with a healthy control group. We also looked for any correlation between MPV and HbA1c, fasting blood glucose (FBS) and post prandial blood glucose (PPBS). A total of 60 cases were included in the study, among which 30 were diabetic patients and 30 were non-diabetic controls. A statistically significant positive Pearson correlation was seen between MPV and HbA1c levels (p-value= <0.001) among the diabetic patients. However, there was no statistical correlation of MPV with FBS, and PPBS in the diabetic group.

**Keywords:** MPV, Diabetes Mellitus, HbA1c, FBS, PPBS.

### Introduction

Diabetes mellitus (DM) is emerging as a major public health problem worldwide. Genetic, environmental and pro-inflammatory factors play an important role in the pathogenesis of Type 2 Diabetes.<sup>1</sup> There is an increased activity of platelets as well as coagulation proteins in Diabetes Mellitus.<sup>2</sup>

It has been suggested by various studies that increased activity of platelets in due course of time leads to vascular complications in diabetic patients.<sup>3,4</sup> Researchers have also found that one of the causal factor in the development of myocardial infarction, thromboembolism and stroke is an increased Mean Platelet Volume (MPV).<sup>5</sup> It has also been suggested that in type 2 DM, cardiovascular complication may be associated with HbA1c<sup>6</sup> and MPV.<sup>7,8</sup>

The present study was carried out with an aim to evaluate the MPV in patients with type II DM by comparing with a healthy control group and also to look for any correlation between MPV and HbA1c, fasting blood glucose and post prandial blood glucose.

### Materials and Methods

The present study was carried out in the department of Pathology, Assam Medical College, Dibrugarh. Duration of study was from July to September 2017. This was a prospective study carried on 30 cases of type 2 diabetic patients and 30 healthy controls. Informed consent was taken from the patients. All the 30 cases as well as 30 controls were evaluated for the following tests; complete blood counts including MPV, fasting blood glucose, post prandial blood glucose, and HbA1c levels.

### Sample Collection

Blood was collected from the antecubital vein with sterile disposable needle and syringe. Required amount of blood was collected in EDTA vial and was labeled accordingly. The samples were kept in room temperature

and all the samples were processed within 4 hours of collection.

Complete blood count was done by the Sysmex XS 800i (5 part automated haematology analyser). Complete blood count includes the following parameters; haemoglobin concentration, white blood cell count, differential count, red blood cell count, packed cell volume or hematocrit, mean corpuscular volume (MCV), mean haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), red cell distribution width (RDW), platelet count and mean platelet volume (MPV).

For blood glucose estimation, samples were collected in sodium fluoride vials. Estimation of blood glucose was done by the hexokinase method. For estimation of HbA1c, samples were collected in EDTA vial and were analysed by HPLC machine.

Statistical analysis: Statistical evaluation was done using Student's t test and Pearson correlation coefficient (r value as the coefficient). Data were expressed as mean +/- standard deviation. A p-value of <0.05 was considered significant.

### Results

In the present study, a total of 60 cases, comprising of 30 diabetic patients and 30 non-diabetic healthy controls, were included. Among the diabetic patients, there were 18 male and 12 female cases, whereas among the controls there were 14 males and 16 females. The mean age of the diabetic cases was 49.9 years, whereas that of the controls was 47.6 years. For the diabetic population, mean MPV was 11.3 +/- 1.6, while that of the control group was 12.14 +/- 1.36 (p-value = < 0.05). The mean FBS among the diabetic population was 157.65 +/- 6.09, while that of the control group was 80.68 +/- 3.52 (p-value = < 0.0001). The mean PPBS among the diabetics was 253.7 +/- 5.8, while the mean PPBS among controls was 128.3 +/- 4.1 (p-value = < 0.0001). For the diabetic population, the mean HbA1c was 9.87 +/-

2.69, while that of the controls was 5.73 $\pm$ 0.35 (p-value= $<$ 0.0001). (Table 1)

In the present study, a statistically significant positive Pearson correlation was seen between MPV and HbA1c levels (p-value= $<$  0.001) among the diabetic patients. However, no statistical correlation was found between MPV and FBS (p-value=0.31), PPBS (p-value=0.34) in the diabetic group. (Table 2)

**Table 1: Various parameters with their mean values among diabetics and control**

Parameters	Diabetic	Non-diabetic	P value
Age	49.9	47.6	—
Males	18 (60%)	14 (46.6%)	—
Females	12 (40%)	16 (53.3%)	—
MPV	11.3 $\pm$ 1.6	12.14 $\pm$ 1.36	$<$ 0.05
FBS	157.65 $\pm$ 6.09	80.68 $\pm$ 3.52	$<$ 0.0001
PPBS	253.7 $\pm$ 5.8	128.3 $\pm$ 4.1	$<$ 0.0001
HbA1c	9.87 $\pm$ 2.69	5.73 $\pm$ 0.35	$<$ 0.0001

**Table 2: Comparison of MPV to various parameters**

Characteristic		r-value	p-value
MPV	HbA1c	0.61	$<$ 0.001
MPV	FBS	-0.19	0.31
MPV	PPBS	-0.18	0.34

## Discussion

Diabetes mellitus is a group of metabolic disorders with the common feature of hyperglycemia, resulting from defects in insulin secretion, insulin action, or both. Persistent hyperglycemia causes long term complications of diabetes. Macrovascular disease causes atherosclerosis among diabetics, and it predisposes the patient to myocardial infarction, stroke and lower extremity ischemia. The effects of microvascular disease are profound mostly in the retina, kidney and peripheral nerves.<sup>1</sup>

MPV measures the average size of platelets in a volume of blood. In patients of myocardial infarction, an increase in MPV has been observed.<sup>9</sup>

In our study, the mean platelet volume was lower among the diabetic population than that of the controls, which was in contrast to the studies conducted by Shah et al,<sup>10</sup> Ates et al.<sup>11</sup> Hekimsoy et al,<sup>12</sup> Demirtunc et al,<sup>13</sup> Zuberi et al,<sup>5</sup> Jindal et al.<sup>14</sup> Papanas et al,<sup>8</sup> and Thomas et al.<sup>15</sup> A reason for this difference might be because of ongoing treatment of the diabetic population. However, Akinsegun A et al.<sup>16</sup> found MPV, similar to our finding.

Our study revealed, a statistically significant positive Pearson correlation between MPV and HbA1c levels (p-value= $<$  0.001). Similar result was reported by Demirtunc et al.<sup>13</sup> However, there was no correlation between MPV and FBS (p-value=0.31), and PPBS (p-value=0.34) in the present study. Hasan Z et al.<sup>17</sup> and Yenigün et al.<sup>18</sup> also did not find any association between MPV and FBS and PPBS in their studies.

One major limitation of our study was a relatively smaller sample size. Further studies should be carried out with greater number of cases and longer duration of follow

up of the patients, to highlight more on the association of mean platelet volume and diabetes mellitus.

## Conclusion

The present study revealed, a statistically significant positive Pearson correlation between MPV and HbA1c. Hence, MPV can be used to monitor disease progression of Diabetes and might also be used as a potential prognostic marker of cardio-vascular complications in diabetes.

## Acknowledgement

The authors are grateful to Mr. Chakrapani Hazarika for the statistical analysis and also to the technical staff for the help and support.

**Conflict of Interest:** None.

## References

- Maitra A. The endocrine system. Robbins & Cotran, Pathologic basis of disease. South East Asia edition, Vol 2; Elsevier; 2014
- Carr ME. Diabetes mellitus: A hypercoagulable State. *J Diabetes Complications* 2001;15(1):44-54.
- Torun AN, Eren MA, Ulaş T, Demir M, Arslan I, Sabuncu T. Mean Platelet Volume in Various Degrees of Disturbed Carbohydrate Metabolism. *Turk J Endocrinol Metab* 2012;16:6-9.
- Vinik AI, Erbas T, Park TS, Nolan R, Pittenger GL. Platelet dysfunction in type 2 diabetes. *Diabetes Care* 2001;24:1476-85.
- Zuberi BF, Akhtar N, Afsar S. Comparison of mean platelet volume in patients with diabetes mellitus, impaired fasting glucose and non-diabetic subjects. *Singapore Med J* 2008;49:114-6.
- Andersson C, van Gaal L, Caterson ID, Weeke P, James WP, Coutinho W, Finer N, Sharma AM, Maggioni AP, Torp-Pedersen C. Relationship between HbA1c levels and risk of cardiovascular adverse outcomes and all-cause mortality in overweight and obese cardiovascular high-risk women and men with type 2 diabetes. *Diabetologia* 2012;55:2348-55.
- Han JY, Choi DH, Choi SW, Kim BB, Ki YJ, Chung JW, Koh YY, Chang KS, Hong SP. Stroke or coronary artery disease prediction from mean platelet volume in patients with type 2 diabetes mellitus. *Platelets* 2013;24:401-6.
- Papanas N, Symeonidis G, Maltezos E, Mavridis G, Karavageli E, Vosnakidis T, Lakasas G. Mean platelet volume in patients with type 2 diabetes mellitus. *Platelets* 2004;15:475-8.
- Khandekar MM, Khurana AS, Deshmukh SD. Platelet volume indices in patients with coronary artery disease and acute myocardial infarction: an Indian scenario. *J Clin Pathol* 2006;59:146-9.
- Shah Shah B, Sha D, Xie D, Emile R, Mohler ER, Berger JS. The Relationship between Diabetes, Metabolic Syndrome, and Platelet Activity as Measured by Mean Platelet Volume: The National Health and Nutrition Examination Survey, 1999-2004. *Diabetes Care* 2012;35(5):1074-8.
- Ates O, Kiki I, Bilen H, Keles M, Koçer I, Kulaçoğlu DN, et al. Association of Mean Platelet Volume With The Degree of Retinopathy in Patients with Diabetes Mellitus. *Eur J Gen Med* 2009;6(2):99-102.
- Hekimsoy Z, Payzin B, Ornek T, Kandogan G. Mean platelet volume in Type 2 diabetic patients. *J Diabetes Complications* 2004;18(3):173-6.

13. Demirtunc R, Duman D, Basar M, Bilgi M, Teomete M, Garip T. The relationship between glyceemic control and platelet activity in type 2 diabetes mellitus. *J Diabetes Complications* 2009;23(2):89-94.
14. 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):86-9.
15. Thomas AK, Udaya KM, Suraksha BR, Thej MJ, Madheri R, Harendra KML, Venkataswamy L. Mean platelet volume in type 2 diabetes mellitus. *J Lab Physicians* 2012;4(1):5-9.
16. Akinsegun A. 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;18:42.
17. Hasan Z, Zubair Hasan. Assessment of Mean Platelet Volume in Type 2 Diabetes Mellitus and Prediabetes. *Natl J Lab Med* 2016;5(3):PO54-PO7.
18. Yenigün EC, Okyay GU, Pirpir A, Hondur A, Yıldırım İS. Increased [16] mean platelet volume in type 2 diabetes mellitus. *Dicle Tıp Dergisi* 2014;41(1):17-22.

**How to cite this article:** Manta A, Weingken CK, Lahkar D. Assessment of mean platelet volume in type 2 diabetes mellitus. *Indian J Pathol Oncol* 2019;6(2):182-4.