Evaluation of Platelet Count and Mean Platelet Volume (MPV) and their importance in Type2 Diabetes Mellitus patients

Archana Rajan, A. R. Subhasree , B. O. Parijatham
Department of Pathology, Sree Balaji Medical College and Hospital (SBMCH), BIHER-Bharath University, Chromepet, Chennai-600044

Abstract

Among the 100 Type 2 diabetic patients, 60 were males and 40 were females indicating that Type 2 diabetes occur predominantly in males than that of the females. The mean age of the Type 2 diabetic population was 55.07 years whereas the mean age of the non-diabetic population was 51.19 years. The mean FBS of Type 2 diabetic patients were 200.38mg/dl and that of the non diabetics was 98.81mg/dl. Results of the study showed that group1 (normoglycemics) patients had a mean age of 46 yrs. The Male : Female ratio is 1.07:1. The mean platelet count is determined as 2.5x10^9 and MPV was found to be 8.05. Group 2 Type 2 prediabetic patients had a mean age of 56 yrs and the Male : Female ratio is 1.2:1. Then the mean platelet count is determined as 2.5x10^9 and MPV was found to be 8.85. Group 3 diabetic patients had a mean age of 55 yrs and the Male: Female ratio is 1.5:1. The mean platelet count is determined as 2.9 x10^9 and MPV was found to be 9.2. MPV showed an increasing trend from group1 (8.055), followed by group (2 8.855) and then group 3 (9.199) similar to that of platelet count (2.476,2.540,  2.917 in respective 1, 2, and 3 groups). This study revealed
that both the mean platelet count and platelet volume were relatively higher in Type 2 diabetics than in non-diabetes indicating that both the parameters can be used to predict vasculopathy in Type 2 Diabetes mellitus.

Key words: Platelet Count, Mean Platelet Volume, Type2 Diabetes Mellitus

INTRODUCTION

Diabetes mellitus is a group of complex metabolic disorders characterized by hyperglycemia. Hyperglycemia in diabetes can result from defects in insulin secretion, insulin action or both. According to WHO, there are as many as 346 million people suffering from diabetes worldwide; of which India (19 million) and China (16 million) are the largest contributors. In the U.S, Diabetes is the primary cause of ESRD, acute onset blindness and non-traumatic lower extremity amputation. Patients with poor glycemic control, longer duration of diabetes, associated hypertension and obesity have higher chances of developing micro vascular complications. Persistent hyperglycemia can lead to formation of advanced glycation end products, activation of protein kinase C, oxidative stress, disturbances in polyol pathway and overload of hexosamine pathways which can aggravate vascular complications. Diabetes mellitus is now a known growing global pandemic. It increases the risk of developing coronary, cerebrovascular, peripheral artery diseases and micro vascular complications involving the blood vessels, eyes and kidneys up to 4 fold. Platelet parameters like high platelet count and high Mean Platelet Volume have been observed in Type 2 Diabetic patients. Increased platelet activity is emphasized to play a role in the development of vascular complications in diabetes. MPV is a marker of the platelet function and its activation. Therefore the aim of the current study is to determine the correlation of Platelet count and Mean platelet volume (MPV) with Fasting blood sugar (FBS) and HbA1c and thereby identify factors which may be monitored to provide a better patient care.
MATERIALS AND METHODS

This is a case – control study of 100 Type 2 Diabetes mellitus patients and 100 non-diabetic controls attending SBMCH, Chennai, during the study period of May 2014-June 2015. This study was approved by the Ethical Committee of SBMCH. Inclusion criteria for cases were: Patients with fasting blood sugar >126mg/dl. Exclusion criteria for cases were: Non diabetics and Type 1 diabetics. Subjects with Hb<12gm% was excluded as anaemias which could have caused reactive thrombocytosis and in turn high MPV. Inclusion criteria for controls were: Subjects with FBS <126mg/dl. Exclusion criteria for controls were: Diabetics on oral hypoglycemic drugs. Sample collection: Fasting blood samples were collected in the morning in EDTA vacutainers and the samples were run for sugar and complete blood counts using automated analyser. Type 2 Diabetic patients were divided into 3 groups based on FBS (as per American Diabetic Association) as follows: Type 2 Diabetic patients Group1 consisted of Normoglycemics with 70-100mg/dl, Type 2 Diabetic patients Group2 consisted of Impaired fasting glucose)-101-126mg/dl, Type 2 Diabetic patients Group3 (Diabetes) study population of Type 2 Diabetic patients was further divided into 2 categories based on HbA1c values and they are: Group A consisted of HbA1c>6.5%and the Group B had HbA1c<6.5%. Platelet count and mean platelet volume were compared among the various groups. Data were analysed and mean and percentage were determined.

RESULTS

Type 2 diabetes and nondiabetes in the sample population, normoglycemics, Impaired fasting glucose and Type 2 Diabetic patients, male and female ratio and mean age., mean platelet count and platelet volume in the three FBS based groups (1-3), HbA1c based mean age, M:F ratio, Platelet count and MPV in the two groups (A-B), are detailed in tables 1-3 and figures 1.1- 1.4. Among the 100 Type 2 diabetic patient, 60 were males and 40 were females. The mean age of the Type 2 diabetic population was 55.07 years whereas the mean age of the non-
diabetic population was 51.19 years
(Table,1.1.Figs.1.1&1.2).

<table>
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<th>Gender</th>
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<th>Non Diabetics</th>
<th>Total</th>
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<tr>
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<td>54</td>
<td>114</td>
</tr>
<tr>
<td>Females</td>
<td>40</td>
<td>46</td>
<td>86</td>
</tr>
<tr>
<td>Total patients</td>
<td>100</td>
<td>100</td>
<td>200</td>
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</table>

Figure1-1: Type 2 diabetic patients: Distribution of mean age in Groups1,2 and 3 respectively. Note that group 2 consisted of the largest number of patients followed by group 3 and then group 1 among the 100 patients. Figure1-2: Male to female ratio of Type 2 diabetic patients in the study population. Note that males were predominantly type 2 diabetes than that of the females.
The mean FBS of Type 2 diabetic patients is 200.38mg/dl and that of the non diabetics was 98.81mg/dl. Results of the study also showed that Normoglycemics Group 1 patients consisted of 70-100mg/dl whereas Impaired fasting glucose Group 2 Type 2 Diabetic patients consisted of 101-126 mg/dl and the Type 2 Diabetic patients group 3 possessed >126mg/dl. Note that Group 1 consisted of patients with 70-100mg/dl, mean prediabetic age was 46.62, M:F ratio 1.07:1, platelet count 2.476 and MPV 8.055 and it is therefore considered as Normoglycemics. Group 2 patients had 101-126 mg/dl, mean Type 2 Diabetic age was 55.76, M: F ratio 1.2:1, platelet count 2.540 and MPV 8.855 and these indicate an early onset of impaired fasting glucose in Type 2 Diabetic patients. Group 3 possessed >126mg/dl, mean Type 2 Diabetic age 55, M:F ratio 1.5:1, platelet count 2917 and MPV 9.199 and these indicate a well set impaired fasting glucose in Type 2 Diabetic patients. MPV showed an increasing trend from group 1 (8.055), followed by group 2 (8.855) and then group 3 (9.199) similar to that of platelet count (2.476, 2.540, 2.917 in respective 1, 2, and 3 groups). Normoglycemics age group was 47 and M:F ratio was 1.07:1, . Impaired fasting glucose Type 2 Diabetic Group 2 patients average age was 55 and M:F ratio was 1.2:1. Group 3 diabetic patients mean age was 55.07, M:F ratio 1.5:1.

<table>
<thead>
<tr>
<th>FBS</th>
<th>AGE</th>
<th>M:F RATIO</th>
<th>PLATELET COUNT</th>
<th>MPV</th>
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<td>70-100mg/dl</td>
<td>46.62</td>
<td>30:28</td>
<td>2.476</td>
<td>8.055</td>
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<td>Normoglycemics</td>
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<td>101-126 mg/dl</td>
<td>55.76</td>
<td>23:19</td>
<td>2.540</td>
<td>8.855</td>
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<tr>
<td>&gt;126mg/dl</td>
<td>55.07</td>
<td>60:40</td>
<td>2.917</td>
<td>9.199</td>
</tr>
</tbody>
</table>
Figure 1-3: Type 2 Diabetes: Distribution of Platelet count based on FBS. Figure 1-4: Type 2 Diabetes Distribution of MPV based on FBS. Note that MPC and MPV was the highest in group 3 followed by group 2 and then group 1.

| Table 1-3: Type 2 Diabetes mellitus patients/ non-diabetic controls: Platelet count and MPV in the two groups (A-B) based on HbA1c |
|---------------------------------|-----------------|
|                                 | PLATELET COUNT  | MPV      |
| HbA1C<6.5%(Group A)             | 2.806           | 8.724    |
| HbA1C>6.5%(Group B)             | 2.967           | 9.194    |

The mean platelet count in Group 1 was 2.476,2.540 in Group 2 and in Group 3 it was 2.917. The MPV in the 3 groups were 8.055,8.855 and 9.199 respectively. The mean platelet count in Group A (HbA1c<6.5%) was 2.806 and was 2.967 in Group B (HbA1c>6.5%). The MPV in both the groups were 8.724 and 9.194 respectively. MPC and MPV was the highest in group 3 followed by group 2 and then group 1.
DISCUSSION

Our studies have shown that Type 2 diabetic was more prevalent in males (60%) than in females (40%) among the sample populations at Chennai. We also report that the male to female ratio of Type 2 diabetic patients in the study population were predominantly type 2 diabetes than that of the females. In contrast, the prevalence of diabetes was reported to be 57% higher among female than in males of the Zuni Indians and also in the American Indians. While they were similar amongst the male and female members of some population (King , Rewers.1997, Will et al., 1997, Burrows et al, 2000). Religion, food, customs and traditions, dance, lifestyle differences within the country and in the world are believed to contribute to the high prevalence of diabetes(8-12). Occurrence of identified diabetes has increased in 18-79 years old women since the 1980s-2009 whereas prevalence of identified diabetes among men has decreased during 2009-2014. The prevalence of diabetes was 6.8 per 1000 for men and 6.5 per 1,000 for women in 2014, in USA. The prevalence of identified diabetes considerably greater than before for women aged 18–44 years and those aged 45–64 years. The prevalence of identified diabetes was shown to be inconsistent for women aged 65–79 years and for men at any age (8- 12). A similar
such a detailed study in the population in India is needed for a comparison and understanding of the diabetes. We also need to plan and study to determine whether or not the physical idleness and physical inactivity of our people is associated with diabetes and to determine the gestational diabetes risk factor among the female population as India is not only endemic to the diabetes but a world capital for the diseases.

The present study has shown that the mean age of the Type 2 diabetic population was 55.07 years while the mean age of the non-diabetic population was 51.19 years. Middle-aged and fully grown older adults are known to be always at the highest risk for developing type 2 diabetes. In contrast, 45 to 64 years old adults were found to have the diabetes type - 2. Newer cases of type 1 /type 2 diabetes were detected in 20 years old people. 45 to 64 years old people were also developing diabetes at a faster rate than that of adults aged 65 years old. The prevalence of the diabetes was reported to be doubled from 6.9 to 12.1 per 1000 In adults aged 65–79 years during1980 to 2014. In contrast, in adults aged 45–64 years, prevalence of the diabetes was inconsistent during the 1980s, but showed an increase from 1991 to 2002, and then reached a plateau from 2002 to 2014.

Among aged 18–44 years old adults, prevalence of diabetes showed significant increase from 1980 to 2003, followed by a little change during 2003 to 2006, then significantly decreased from 2006 to 2014. Centers for Disease Control and Prevention 1600 Clifton Rd. Atlanta, GA 30329-4027, USA 800-CDC-INFO (800-232-4636) TTY: (888) 232-6348 - Contact CDC-INFO). The current study has shown that the Group1 consisted of patients with 70- 100mg/dl and it is considered as Normoglycemics. Moreover that the Group 2 patients had 101-126 mg/dl indicating early impaired fasting glucose in Type 2 Diabetic patients whereas the Group 3 possessed >126mg/dl indicating the well set Impaired fasting glucose in Type 2 Diabetic patients.

Platelets may help in hemostasis by formation of primary plug formation. Thrombin, collagen, epinephrine and ADP are the pro-aggregatory stimuli which help platelets to form thrombus. Large platelets are more reactive, aggregable and produce more thromboxane A2, leading to vascular occlusions. Mean platelet volume is a measure of the size and activity of the platelets.
Our study revealed a correlation between increased MPV and platelet count in patients with HbA1c >6.5%. Our studies also revealed an increased mean platelet count and mean platelet volume in diabetics than in non-diabetics. MPC and MPV was the highest in well established impaired fasting glucose type 2 diabetes group 3 with followed by group 2 than in pediatric normoglycemics group 1. The mean platelet count was 2.476 in Group 1, 2.540 in Group 2 and was 2.917 in Group 3 and the MPV in the 3 groups were 8.055, 8.855 and 9.199 respectively. The mean platelet count (HbA1c<6.5%) was 2.806 in Group A and was 2.967 in Group B. MPV in both the groups were 8.724 and 9.194 respectively. MPC and MPV was the highest in group 3 followed by group 2 and then group 1. MPV showed an increasing trend from group1 (8.055), followed by group (2 8.855) and then group 3 (9.199) similar to that of platelet count (2.476, 2.540, 2.917 in respective 1, 2, and 3 groups). Normoglycemics age group was 46.62 and M:F ratio was 30:28, . Impaired fasting glucose Type 2 Diabetic Group 2 patients average age was 55.7 and M:F ratio was 623:19. Group 3 diabetic patients mean age was 55.07, M:F ratio 60:40. Thomas & Udaya Kumar (2012) and Sharpe and Trinick (1993) studied that in Diabetes, platelet become more aggregable and hence MPV increases making it a prognostic marker of thrombotic complications. This was in contrast to the study done by Akinbami and ade Akinola Olusole (2014) who suggested that overall MPV was lower in diabetics when compared to the controls. Demirtunc et al (2009) reported a close relation between poor glycemic control and increased MPV and platelet counts. Beckman and Greger 2002 concluded that diabetic patients should receive preventive interventions which will reduce the risk of atherosclerosis.

Type 2 diabetes possibly will result from a combination of factors consisting of way of life, health problems, family history and environmental issues. If the person is over 45 years of age, a descendant of a high-risk ethnicity, have overweight or obese, and a sedentary lifestyle may be expected to have the diabetes soon or later. Occurrence of vascular disease, high blood pressure, low HDL, elevated levels of triglycerides are the indicators of development of diabetes. 85.2 % of diabetes are known to be either overweight or obese (The American Diabetes Association) and if the patient reduce
their over-weight, chances are there to delay the development of type 2 diabetes or prevent the disease. All these indicate that we need to concentrate our research on the early detection of the diabetes, improve methods of treatment and take all precautions to prevent the occurrences of the disease in our society. That both the parameters can be used to predict vasculopathy in Type 2 Diabetes mellitus.

REFERENCES


2) Beckman JA, Greger M. Diabetes and atherosclerosis: epidemiology, pathophysiology and management. JAMA 2002;287(19):2570-2581


