A STUDY OF MEAN PLATELET VOLUME IN ACUTE CORONARY SYNDROME

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ABSTRACT

BACKGROUND

Acute coronary syndrome is one of the leading causes of death and disability in developed as well as developing countries. Platelets have a major role in the pathogenesis of acute coronary syndrome (ACS), where plaque rupture is followed by platelet activation and thrombus formation. Increased mean platelet volume (MPV), which indicates larger and reactive platelets, is thought to be associated with myocardial damage in patients with acute coronary syndrome. The primary aim of this was to investigate significance of mean platelet volume in acute coronary syndrome.

METHODS

100 individuals were included in this study of which 50 were cases selected based on the inclusion and exclusion criteria. 50 were age and sex matched individuals having a normal ECG and no past history of ischemic heart disease were considered as controls. Venous samples would be drawn at the time of admission before initiation of treatment and sent for complete blood count.

RESULTS

Mean age of cases was 54.85±7.59 years and that of controls was 57.32±7.32 years. The sex distribution amongst cases and controls was equal i.e. 31 males and 19 females in each group. The primary aim of the study was to compare the mean platelet volume between individuals with acute coronary syndrome and the controls. It was noted that mean MPV in cases was 9.722±0.7517 which was higher than controls 7.896±0.5002 and the difference was statistically significant p<0.00001.

CONCLUSIONS

MPV can be useful as an additional cost-efficient test in conjunction with other markers in the early prediction of ACS in the emergency room.

KEYWORDS

Mean Platelet Volume (MPV), Acute Coronary Syndrome (ACS)


BACKGROUND

Acute coronary syndrome is one of the leading causes of death and disability in developed as well as developing countries. Acute coronary syndrome (ACS) consists of a spectrum of diseases ranging from unstable angina to Transmural myocardial infarction. We now recognize that almost all ACS events result from coronary atherosclerosis, generally with superimposed coronary thrombosis caused by rupture or erosion of an atherosclerotic plaque, resulting in partial or total occlusion of vessel lumen by thrombus.1,2 ST elevation MI (STEMI) indicates complete occlusion of vessel lumen by thrombus with complete cessation of coronary blood flow. Non ST elevation MI (NSTEMI) indicates partial or incomplete occlusion of vessel by a thrombus. Platelets are enucleate cells measuring approximately 1-2 μm in length with an average lifespan of 8-10 days. The platelets are formed via cytoplasmic fragmentation of bone marrow-derived megakaryocytes. Platelets have a major role in the pathogenesis of acute coronary syndrome (ACS), where plaque rupture is followed by platelet activation and thrombus formation. Compared to smaller platelets, large platelets are more adhesive and aggregative since they are metabolically and enzymatically more active. Large platelets contain higher levels of P-selecting and glycoprotein IIIa which are pro-coagulatory surface proteins.3-5 Thus in ACS, prothrombotic tendency of atherosclerotic plaque increases proportionality with increase in mean platelet volume (MPV) and is also associated with increased risk of intracoronary thrombus formation in acute myocardial infarction.6 Hence increased MPV, which indicate larger and reactive platelets, is thought to be associated with myocardial damage in patients with acute coronary syndrome.

Mean platelet volume is a measurement that describe the average size of the platelet circulating in the blood. Within the individual, platelets are heterogeneous in size and density. MPV is a potential marker of platelet reactivity.
Normal value of MPV is 7.4 - 10.4 fl. Platelet parameters especially MPV could be an important and reliable marker in early detection of ACS when other markers are not easily available. The aim of this study was to investigate significance of mean platelet volume in acute coronary syndrome.

**METHODS**

This is a case control study. This study was conducted in Department of Cardiology, Karnataka Institute of Medical Sciences, Hubli. This study was conducted for total duration of 6 months from January to June 2019. Informed consent was obtained from all participants. Total of 100 individuals were included in this study where 50 were cases and 50 were controls. Age and sex matched individuals having a normal ECG and no past history of ischemic heart disease were considered for the study as controls. At least 2 ml of blood was extracted through venipuncture and was collected using a EDTA (ethylene diamine triacetic acid) vacutainer at the time of admission before initiation of antiplatelet therapy and was processed by Prokan PE-6000 plus automated haematology analyser. The result generated by the machine for platelet count and mean platelet volume were recorded.

**Inclusion Criteria**

Any patient between the age group of 30-70 years, presenting with complaints of chest pain with changes in ECG and with elevated cardiac biomarkers with evidence of any of the epicardial coronaries blockade of >50% proven by coronary angiography were included in the study. Complete blood count was performed in these individuals at the time of presentation.

**Exclusion Criteria**

Patients with known cases of hereditary disorders of large platelets, blood dyscrasias, liver disease, renal disease, malignancy, sepsis, blood transfusion recently (within 6 weeks), major operations, trauma recently (within 6 weeks) Usage of drugs causing thrombocytopenia such as hydroxyurea, antineoplastic agents, and inhibitors of the platelet integrin αIIbβ3, anticoagulants, infections causing thrombocytopenia were excluded from the study. The difference in average MPV value among ACS cases and controls was evaluated using student’s t test.

**RESULTS**

Mean age of cases was 54.85±7.59 years and that of controls was 57.32±7.32 years. The sex distribution amongst cases and controls was equal i.e. 31 (62%) males and 19 (38%) females in each group.

The primary aim of the study was to compare the mean platelet volume in individuals with acute coronary syndrome and controls and it was noted that mean MPV in cases was 9.722±0.7517 which was higher than controls 7.896±0.5002 and the difference was statistically significant p=0.00001. Additionally, Platelet distribution width (PDW) was also calculated between cases (13.442±2.1095) and control (12.858±0.9871) and it showed a statistical significance p=0.0397. However, no statistical significance p=0.0792, was seen between cases and controls for platelet count. Statistical significance was seen between STEMI and controls for MPV (p<0.00001) and PDW (p=0.0422). Statistical significance was seen between NSTEMI and controls for MPV (p<0.00001). However, no statistical significance was seen for PDW (p=0.0805). Secondary aim of the study was to compare the MPV within the cases i.e. STEMI and NSTEMI. No statistical significance was noted for MPV (p=0.1303) and PDW (p=0.4153) between STEMI and NSTEMI.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Cases (n=50)</th>
<th>Controls (n=50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>31 (62%)</td>
<td>31 (62%)</td>
</tr>
<tr>
<td>Female</td>
<td>19 (38%)</td>
<td>19 (38%)</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>50</td>
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</tbody>
</table>

Table 1. Sex Distribution of Cases and Controls

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Cases (n=50)</th>
<th>Controls (n=50)</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes Mellitus</td>
<td>15 (30%)</td>
<td>17 (34%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systemic Hypertension</td>
<td>18 (36%)</td>
<td>17 (34%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>17 (34%)</td>
<td>14 (28%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol Consumption</td>
<td>12 (24%)</td>
<td>18 (20%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Risk Factors Amongst Cases and Controls

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cases (n=50)</th>
<th>Controls (n=50)</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPV(FL)</td>
<td>9.722±0.7517</td>
<td>7.896±0.5002</td>
<td>-1.2951</td>
<td>0.0792</td>
</tr>
<tr>
<td>PDW(FL)</td>
<td>13.442±2.1095</td>
<td>12.858±0.9871</td>
<td>-1.7731</td>
<td>0.0397</td>
</tr>
</tbody>
</table>

Table 3. Comparison of Platelet Count and Platelet Indices Between Cases and Controls

<table>
<thead>
<tr>
<th>Parameter</th>
<th>STEMI (n=32)</th>
<th>NSTEMI (n=18)</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPV(FL)</td>
<td>9.8125±0.7667</td>
<td>7.986±0.5002</td>
<td>-1.2904</td>
<td>&lt;0.00001</td>
</tr>
<tr>
<td>PDW(FL)</td>
<td>13.3556±1.8765</td>
<td>12.858±0.9871</td>
<td>-1.4727</td>
<td>0.0942</td>
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Table 4. Comparison of Platelet Indices Between STEMI and NSTEMI

<table>
<thead>
<tr>
<th>Parameter</th>
<th>STEMI (n=32)</th>
<th>NSTEMI (n=18)</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPV(FL)</td>
<td>9.8125±0.7667</td>
<td>7.986±0.5002</td>
<td>-1.1386</td>
<td>0.1303</td>
</tr>
<tr>
<td>PDW(FL)</td>
<td>13.3556±1.8765</td>
<td>12.858±0.9871</td>
<td>0.2152</td>
<td>0.4153</td>
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</tbody>
</table>

Table 5. Comparison of Platelet Indices Between STEMI and NSTEMI Groups

**DISCUSSION**

In the present study, mean age of cases was 54.85±7.59 years and that of controls was 57.32±7.32 years. We have observed that mean MPV in cases was 9.722±0.7517 which was higher than controls 7.896±0.5002 and the difference was statistically significant p<0.00001. Platelet distribution width (PDW) was also calculated between cases and control and it showed a statistical significance p=0.0397. However, no statistical significance p=0.0792, was seen between cases and controls for platelet count. Statistical significance was seen between STEMI and controls for MPV (p<0.00001) and PDW (p=0.0422). Statistical significance was seen between NSTEMI and controls for MPV (p<0.00001). However, no statistical significance was seen for PDW (p=0.0805). Secondary aim of the study was to compare the MPV within the cases i.e. STEMI and NSTEMI. No statistical significance was noted for MPV (p=0.1303) and PDW (p=0.4153) between STEMI and NSTEMI.
9.5611±0.8067. No statistical significance was noted for MPV (p=0.1303) between STEMI and NSTEMI.

In Biradar SB et al. study, the mean age of the cases was 55±10 years. Whereas in study by Randheer et al. the mean age was 55.09±11.13 years. In Gargi et al., the mean age of the case group in the study was 58.45 ± 11.64 years. In Yaghoubi A et al. study conducted in 2010 in Iran, MPV increased significantly in MI patients compared to the controls (p<0.001). Varol E et al. study, also found that MPV was increased in ACS compared to controls (9.4+/−1.0 versus 8.3+/−1.4 fl; p<0.001). In G. Ranjani et al. study, mean platelet volume was significantly higher in patients with AMI (9.8±0.86) compared with healthy control (8.2±0.56) p<0.001. In Ahamed H et al. study, Mean platelet volume (MPV) was found to be higher among ACS patients (9.4868±0.85270) as compared to control (7.430±0.72172) and it was significant with a P value <0.05. Cemin R et al. and Yilmaz et al. also found that MPV was significantly higher in patients with ACS groups than control. A study done to find out the association with MPV and ACS by Randheer et al. evaluated 215 patients and results showed that Mean platelet volume (MPV) was found to be higher among ACS patients as compared to non-ACS, 11.44±1.23 vs. 9.91±1.27 fl (p-value<0.001). These findings were consistent with the present study. In contrast to present study, a retrospective case-control study on ACS patients, conducted by Bhayana A et al. showed MPV was same for both cases and controls (8.04) and no significant statistical difference was found between mean PDW of cases and controls. In study by Biradar et al. it was observed that significant increase in MPV and PDW between STEMI and controls (p=0.000 and p=0.000 respectively) which was consistent with the current study. Similar findings were noted in Pervin S et al. study for PDW and MPV. In the present study, no statistical significance was noted for MPV between STEMI and NSTEMI (p=0.1303), which was consistent with the study by Yekele S et al. However, contrast to this was seen in study by Ahamed H et al., where mean value of MPV in STEMI is 10.32±0.77932 which was greater than the mean value of MPV in NSTEMI which was 9.22±0.52743 and it was statistically significant (P<0.05).

CONCLUSIONS

MPV was found to be higher in patients with ACS than those in control group. Larger platelets may play a specific role in infarction and is probably a risk factor for developing coronary thrombosis and MI. MPV can be useful as an additional cost-efficient test in conjunction with other markers in the early prediction of ACS in the emergency room and can be used for risk stratification of MI.

REFERENCES


