Correlation between MPV and Lipid Profile in Eastern India: A Cross Sectional Study

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ABSTRACT

MPV measures the average size of platelets and is an emerging risk factor of atherosclerosis. The functions of platelets include adhesion, shape change and spreading, aggregation, secretion, procoagulant activity and clot retraction. Mean Platelet Volume can be simply analyzed by the ABX pentra automated analyzer using electrical impedance. There are many markers of atherosclerosis. The present study aims to find a correlation of MPV with Total Cholesterol, LDL, HDL, VLDL, Triglyceride.

Aims and Objectives: To determine the correlation between MPV and Lipid Profile (Total cholesterol, LDL, HDL, VLDL, Triglyceride).

Materials and methods: 150 patients of Department of General Medicine participated in the study. The patients were selected by simple random sampling. Inclusion and exclusion factors were considered. Patients above 18 years of age were selected. Patients taking medications that reduce platelets, alcoholics and those having hereditary disorders of large platelets were excluded.

Results: MPV is inversely correlated with HDL. Thus methods applied to increase HDL in general population will lead to decrease in MPV and lower risk of atherosclerosis. There is a positive correlation of MPV with VLDL and Triglyceride, but the correlations are not statistically significant. There is a negative correlation of MPV with LDL and Total Cholesterol, but the correlations are not statistically significant.

Key Words: MPV, Lipid profile, HDL

INTRODUCTION

Platelet size, measured as mean platelet volume (MPV), is a marker of platelet function and is positively associated with indicators of platelet activity, including aggregation and release of thromboxane A₂, platelet factor 4, and β-thromboglobulin[1,2]. In normal individuals the platelet count is inversely proportional to MPV; platelet mass (the product of MPV and platelet count) is a near constant.

Platelets, or thrombocytes (from Greek θρόμβος, “clot” and κύτος, “cell”), are small, irregularly shaped clear cell fragments (i.e. cells that do not have a nucleus), 2–3 μm in diameter,[³] which are derived from fragmentation of precursor megakaryocytes.

Megakaryocytes arise from pluripotent stem cell that develops into 2 types of precursors, burst-forming cells and colony-forming cells, both of which express the CD34 antigen [⁴]. Thrombopoietin (TPO), the primary regulator of thrombopoiesis, is currently the only known cytokine required for megakaryocytes to maintain a constant platelet mass (though TPO is not increased on platelet destruction). TPO is thought to act in conjunction with other factors, including IL-3, IL-6, and IL-11, although these cytokines are not essential for megakaryocyte maturation[⁴].

When aging, platelets contain decreased levels of sialic acid and they accumulate surface IgG which function in removal of old platelets[⁵]. Senescent platelets are removed primarily by macrophages in the spleen, although the larger blood flow...
through the liver allows severely damaged platelets to be removed more quickly by hepatic macrophages.\[6\]

Although platelets are incapable of de novo protein synthesis they are very active metabolically and respond rapidly to vascular injury or trauma by undergoing a series of reactions (adhesion, release of granule contents, shape change and aggregation), which ultimately result in the formation of a platelet–fibrin plug.

Platelets bud off megakaryocytes in the marrow. Platelet size and volume (e.g. Mean Platelet Volume) depends on the circumstances of their production in the marrow. MPV is not related to aging of platelets in the circulation. Platelet parameters are very stable in most patients. MPV is increased in conditions with increased platelet production eg. immune thrombocytopenia, disseminated intravascular coagulation, myeloproliferative disorders, pre-eclampsia and recovery from transient hypoplasia (cytotoxic chemotherapy). MPV is decreased in conditions associated with under production of platelets e.g. Bone marrow aplasia.

Mean Platelet Volume (MPV) correlates with the functional status of platelets and is an emerging risk marker for atherosclerosis.\[7\] There is evidence that platelet function is accentuated in acute ischemic stroke.\[8\]. Increased mean platelet volume (MPV), indicating higher platelet reactivity, is associated with an increased risk of myocardial infarction.

MPV appears to be a marker, or even a determinant, of platelet function. Large platelets are more reactive than small platelets in vitro. Large platelets differ from normal or small platelets in the following ways:\[9\];

i. They preferentially and more rapidly aggregate to platelet agonist including ADP, collagen and adrenaline.

ii. They produce more prothrombotic and vasoactive factors including arachidonic acid metabolites (e.g. Thromboxane A2), serotonin, β thromboglobulin and ATP.

iii. They contain more dense granules.

iv. They have higher LDH activity.

v. They are associated with a decreased bleeding time (BT; a measure of in vivo haemostatic function) \[9\].

vi. MPV correlates with platelet aggregation, whether measured in platelet rich plasma or whole blood.

vii. Large platelets also express increased levels of adhesion molecules. eg. P- selectin, GPIIb/IIa although the surface density of these glycoproteins is usually constant independent of platelet volume.\[10\]

**DURATION OF STUDY**

One year

**STUDY POPULATION**

150 patients of Department of General Medicine after taking Ethical clearance and signing consent form.

**INCLUSION CRITERIA**

1. Gender: Males/Females
2. Age Range: 18 years and above
3. Socioeconomic group: All

**EXCLUSION CRITERIA**

1. Known cases of hereditary disorders of large platelets.
2. Medications that reduce platelets
3. Alcoholic

**SAMPLING**

SIMPLE RANDOM SAMPLING

**CONTROLS REQUIRED**

No

**STUDY DESIGN**

Descriptive Cross Sectional study

**PARAMETERS TO BE STUDIED**

1. Sociodemographic parameters: Mean Age, percentage of patients, male/female, of urban/rural area, different religion, and different occupation, sedentary or active life style and type of diet intake.

2. Clinical parameters

   Blood pressure, BMI, Waist Hip Ratio

3. Hematological parameters: Mean Hemoglobin (Hb), Total leukocyte count (TLC), Differential leukocyte count (DLC), Platelet Count, and Mean Platelet Volume (MPV).

4. Biochemical parameters: Mean serum urea, creatinine, Bilirubin, Total protein, Albumin, SGOT, SGPT, Glucose (fasting and post prandial), Serum electrolytes, Complete lipid profile

**Method of MPV Measurement**

A Blood sample was collected from the antecubital vein using a 5cc syringe and transferred to an EDTA vacutainers. The samples were then taken to the laboratory after storage at room temperature for 2 hours but before 4 hours of collection and analyzed using the ABX pentra automated analyzer using electrical impedance to measure the mean platelet volume. After the analysis the same sample was taken to the central laboratory and a peripheral smear was done to look for platelet aggregates. If platelet aggregates were found then such cases were excluded from the study.

**STUDY SETTING**

Indoors and Out Patient Department of General Medicine, R. G. Kar Medical College and Hospital, Kolkata which is a tertiary care referral centre
The normal range of Mean Platelet Volume measured in EDTA blood is 7.8-11 fl. Values of 11.1 fl and above are considered as abnormally high [11].

DATA ANALYSIS
The Statistical software namely SPSS 20.0, Stata 8.0, MedCalc 9.0.1 and Systat 11.0 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

STATISTICAL METHODS
Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups.

Limitation
Small sample size

RESULTS AND ANALYSIS
The maximum number of patients belonged to age group 56 to 65 years (38%), the second highest number belonged to age group 46 to 55 years (32%) and minimum number were in the under 25 group.
In the study population 56% are male and 44% are female.

Table 1: Correlation of MPV with Haemoglobin

<table>
<thead>
<tr>
<th>Mean Platelet Volume</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemoglobin</td>
<td>.054</td>
<td>.514</td>
<td>150 150</td>
</tr>
</tbody>
</table>

Comments: There is a negative correlation of MPV with Hemoglobin and the correlation is not statistically significant.

Table 2: Correlation of MPV with Total Leucocyte Count

<table>
<thead>
<tr>
<th>Mean Platelet Volume</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Leucocyte Count</td>
<td>-.026</td>
<td>.753</td>
<td>150 150</td>
</tr>
</tbody>
</table>

COMMENTS: There is a negative correlation of MPV with Total Leucocyte Count and the correlation is not statistically significant.

Table 3: Correlation of MPV with HDL

<table>
<thead>
<tr>
<th>Mean Platelet Volume</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDL</td>
<td>-.181*</td>
<td>.026</td>
<td>150 150</td>
</tr>
</tbody>
</table>

*. Correlation is significant at the 0.05 level (2-tailed).

COMMENT: There is a negative correlation of MPV with HDL and the correlation is statistically significant.

Table 4: Correlation of MPV with VLDL

<table>
<thead>
<tr>
<th>Mean Platelet Volume</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLDL</td>
<td>.099</td>
<td>.226</td>
<td>150 150</td>
</tr>
</tbody>
</table>

COMMENTS: There is a positive correlation of MPV with VLDL and the correlation is not statistically significant.
Biswaroop et.al: Correlation between MPV and lipid profile in eastern india: a cross sectional study

Table 5: Correlation of MPV with LDL

<table>
<thead>
<tr>
<th>Mean Platelet Volume</th>
<th>LDL</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>.013</td>
<td>.876</td>
<td>150</td>
</tr>
</tbody>
</table>

COMMENT: There is a negative correlation of MPV with LDL and the correlation is not statistically significant.

Table 6: Correlation of MPV with Triglycerides

<table>
<thead>
<tr>
<th>Mean Platelet Volume</th>
<th>TRIGLYCERIDES</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.100</td>
<td>1</td>
<td>.223</td>
<td>150</td>
</tr>
</tbody>
</table>

COMMENT: There is a positive correlation of MPV with Triglycerides and the correlation is not statistically significant.

Table 7: Correlation of MPV with Total Cholesterol

<table>
<thead>
<tr>
<th>Mean Platelet Volume</th>
<th>Total Cholesterol</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-.003</td>
<td>1</td>
<td>.973</td>
<td>150</td>
</tr>
</tbody>
</table>

COMMENT: There is a negative correlation of MPV with Total Cholesterol and the correlation is not statistically significant.

Table 8: Correlation of MPV with Platelet Count

<table>
<thead>
<tr>
<th>Mean Platelet Volume</th>
<th>Platelet Count</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-.171*</td>
<td>1</td>
<td>.036</td>
<td>150</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed).

COMMENT: There is a negative correlation of MPV with Platelet Count and the Correlation is statistically significant.

DISCUSSION

When correlating MPV with clinical and laboratory parameters, MPV had statistically insignificant correlations with Hemoglobin (p=0.514), Total Leukocyte Count (p=0.753), VLDL (p=0.226), LDL (p=0.876), Triglyceride (p=0.223) and Total Cholesterol (p=0.973).

MPV had a negative correlation with HDL (Pearson coefficient = -0.181) and the correlation is significant at the 0.05 level (2-tailed) (p value=0.026).

MPV had a negative correlation with Platelet Count (Pearson coefficient = -0.171) and the correlation is significant at the 0.05 level (2-tailed) (p value=0.036). This finding correlates with findings of previous studies where it is shown that as platelet mass remains constant in a given person, the platelet count decreases as the MPV increases (Platelet Mass = MPV × Platelet Count).

CONCLUSION

Platelets contribute to atherosclerotic complications and lead to thrombus formation [12].

This study has shown that MPV has inverse correlation with HDL. Thus, interventions targeted towards increasing HDL in population will lead to decreased MPV and thus decreasing the incidence of atherosclerotic diseases.

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Conflict of Interest - No

CONTRIBUTION OF AUTHORS

1. Mukherjee Biswaroop - Concept and Study Design, writing the paper
2. Mallik Sreya - Data Collection and writing the paper
3. Maitra Somnath - Statistical Analysis, writing the paper and being the Corresponding Author
REFERENCES