Journal of Cardiovascular Disease Research
ISSN: 0975-3583, 0976-2833 VOL13, ISSUE 06, 2022

Assessment Of The Correlation Between Lipid Profile And Mean Platelet Volume In Subjects Residing In India: A Cross-Sectional Study

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Conflict of Interest: None
Type o study: Original Research Paper
Date of submission: 12 August 2022
Date of acceptance: 30 August 2022
Date of publication: 10 September 2022

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ABSTRACT

Background: Mean Platelet Volume (MPV) assess the average platelet size and which is a vital factor for assessing atherosclerosis. The platelet's functions are included clot retraction, procoagulant activity, secretion, aggregation, shape change and spreading, and adhesion. Assessment of MPV can be done by ABX pentra automated analyzer utilizing electrical impedance. Cholesterol levels are predictors of atherosclerosis.

Aims and Objectives: The present study was conducted to assess the correlation of Lipid profile parameters including Triglycerides, VLDL, HDL, LDL, and total cholesterol to mean platelet volume.

Materials and methods: In 48 study subjects without a history of platelet disorder, alcohol, and medication causing platelet decrease, the correlation between Lipid profile parameters including Triglycerides, VLDL, HDL, LDL, and total cholesterol to mean platelet volume was done. The data collected were subjected to statistical evaluation and the results were formulated.

Results: The results of the study have shown that an inverse correlation was seen in HDL and mean platelet volume. Hence, the methods adopted to increase HDL will lead to reduced MPV with a decrease in atherosclerosis risk. Also, a positive, but, statistically non-significant correlation was seen in triglycerides and VLDL to MPV. A negative and non-significant correlation of LDL and total cholesterol was seen to MPV.

Key Words: MPV, Lipid profile, HDL, triglycerides, VLDL.

Introduction

A measure of platelet functions having a positive correlation of β-thromboglobulin, platelet factor 4, thromboxane A2 release, platelet aggregation, and platelet activity is MPV (Mean Platelet Volume). In normal subjects, mean platelet volume is inversely related to platelet count where near-constant values of platelet mass are seen. Thrombocytes or platelets are irregular and small clear cells having a diameter of 2-3 μm derived from precursor megakaryocytes fragmentation which are derived from pluripotent stem cells. Thrombopoiesis is primarily regulated by thrombopoietin which helps in maintaining constant platelet mass. Thrombopoietin acts in correlation with interleukins including IL-11, IL-6, and IL-3. However, these cytokines are not vital for the maturation of megakaryocytes.[1]

During aging, sialic acid levels decrease in platelets with increased IgG accumulation that removes the old platelets. Aging platelets are primarily removed by macrophages in the spleen. Hepatic macrophages also play a vital role in the removal of aging platelets owing to larger blood flow in the liver. Platelets are incapable of producing protein on their own. However, on affected by trauma or vascular injury, these platelets produce fibrin plug by going through various reactions like aggregation, shape change, granule content release, and adhesion.[2]

In the bone marrow, platelets fragments to megakaryocytes. The volume and size of platelet known as mean platelet volume is determined by the ecology responsible for their production. The aging of platelets during circulation doesn't affect the mean platelet volume. Parameters related to the platelets are quite stable in most subjects. However, MPV is raised in subjects having underlying conditions leading to increased platelet production including transient hypoplasia recovery (cytotoxic chemotherapy), pre-eclampsia, myeloproliferative disorders, disseminated intravascular coagulation, and/or immune thrombocytopenia. Reduced MPV is seen in conditions that decrease platelet production including Bone Marrow aplasia.[3]

Correlation of MPV is seen with the platelet functions that is a vital risk factor for atherosclerosis. Increased platelet function is well established in acute ischemic stroke. Increased risk of Myocardial infarction is also associated with high platelet reactivity and mean platelet volume. MPV is also suggested to be a biomarker and determinant of Platelet function. In vitro studies have shown more reactivity by small platelets compared to large platelets.[4] The present study was conducted to assess the correlation of Lipid profile parameters including Triglycerides, VLDL, HDL, LDL, and total cholesterol to mean platelet volume.

Material and methods

The present descriptive cross-sectional clinical study was conducted to assess the correlation of Lipid profile parameters including Triglycerides, VLDL, HDL, LDL, and total cholesterol to mean platelet volume. The study was conducted after obtaining clearance from the concerned Ethical committee. The study population was comprised of the subjects visiting

the Outpatient Department of Medicine of the institute. The study included 148 subjects from both genders included in the study by simple random sampling method.

The inclusion criteria for the study were subjected older than 18 years, subjects from both genders, all socioeconomic statuses, and the subjects who were willing to participate in the study. The exclusion criteria were alcoholics, subjects on medications that reduce platelet counts, and subjects with hereditary disorders affecting platelets. After explaining the detailed study, informed consent was taken from all the subjects in both written and verbal form.

After final inclusion in the study, detailed history was taken, and physical examination was done for all the subjects. The parameters assessed in the present study were demographics including diet, lifestyle, occupation, religion, rural/urban, gender, and age. The clinical parameters assessed were waist: hip ratio, BMI, and blood pressure, and hematologic parameters like Mean Platelet Volume (MPV), Platelet Count, Differential leukocyte count (DLC), Total leukocyte count (TLC), and mean hemoglobin. The biochemical parameters assessed were Complete lipid profile, Serum electrolytes, Glucose (fasting and postprandial), SGOT, SGPT, Albumin, Total protein, Bilirubin, creatinine, and mean serum urea.

To assess the mean platelet volume, 5ml intravenous blood was collected under the aseptic and sterile condition from the antecubital vein in a test tube having anticoagulant which was subjected to ABX pentra automated analyzer utilizing electrical impedance. When platelet aggregates were seen, the samples were excluded. Mean platelet volume was considered when they were in the range of 7.8-11fl. Abnormally high values were considered with a value of 11.1fl.

The collected data were subjected to the statistical evaluation using SPSS software version 21 (Chicago, IL, USA) and one-way ANOVA and t-test for results formulation. The data were expressed in percentage and number, and mean and standard deviation. The level of significance was kept at $p<0.05$.

Results

The present descriptive cross-sectional clinical study was conducted to assess the correlation of Lipid profile parameters including Triglycerides, VLDL, HDL, LDL, and total cholesterol to mean platelet volume. The 148 study subjects were within the age range of 45-66 years. On assessing the mean platelet volume and its correlation with hemoglobin, it was seen that the person correlation value seen was -0,52 and sig. A 2-tailed value of -0.512 was seen. With the hemoglobin, the correlation value with MPV was -0.52 and sig. 2-tailed value of -0.512 (Table 1). A non-significant negative correlation was seen between hemoglobin and MPV. On assessing this correlation to MPV to total leucocyte counts was on person correlation was .751 and for the sig. 2-tailed was -0.24 which shows the negative and non-significant correlation of MPV to total leucocyte count (Table 1).

A negative and statistically significant correlation was seen between mean platelet volume and HDL having the values of person coefficient and sig. 2-tailed values of -.179 and 0.24 respectively. For mean platelet volume and VLDL (very low-density lipoprotein), it was seen that the values of person coefficient and sig. 2-tailed values were .097 and .224 respectively showing a non-significant positive correlation. The negative and statistically non-significant correlation was seen between LDL and MPV with respective values of Pearson correlation

and sig. 2-tailed as -.011 and .874 respectively. A positive correlation between MPV and triglycerides was seen which was statistically non-significant having values of Pearson correlation and sig. 2-tailed of .100 and .221 respectively. An insignificant negative correlation in the present study was seen between total cholesterol and Mean Platelet Volume with Pearson correlation and sig. 2-tailed values of -.001 and .971 respectively (Table 2).

The present study also assessed the correlation between mean platelet volume and platelet count in the study subjects, and the results are depicted in Table 3. It was seen that Pearson correlation and sig. 2-tailed values for this correlation were -.173 and -.034 respectively. These results show that a negative correlation was seen in Mean platelet volume and platelet count. This correlation was statistically significant (Table 3).

Discussion

The present descriptive cross-sectional clinical study was conducted to assess the correlation of Lipid profile parameters including Triglycerides, VLDL, HDL, LDL, and total cholesterol to mean platelet volume. The 148 study subjects were within the age range of 45-66 years. On assessing the mean platelet volume and its correlation with hemoglobin, it was seen that the person correlation value seen was -0,52 and sig. A 2-tailed value of -0.512 was seen. With the hemoglobin, the correlation value with MPV was -0.52 and sig. 2-tailed value of -0.512. A non-significant negative correlation was seen between hemoglobin and MPV. On assessing this correlation to MPV to total leucocyte counts was on person correlation was .751 and for the sig. 2-tailed was -0.24 which shows the negative and non-significant correlation of MPV to total leucocyte count. These results were consistent with the results of Greisenegger S et al[5] in 2004 and Toryila JE et al[6] in 2009 where authors have reported a similar correlation between hemoglobin and leucocyte counts.

The study results showed that a negative and statistically significant correlation was seen between mean platelet volume and HDL having the values of person coefficient and sig. 2-tailed values of -.179 and 0.24 respectively. For mean platelet volume and VLDL (very low-density lipoprotein), it was seen that the values of person coefficient and sig. 2-tailed values were .097 and .224 respectively showing a non-significant positive correlation. The negative and statistically non-significant correlation was seen between LDL and MPV with respective values of Pearson correlation and sig. 2-tailed as -.011 and .874 respectively. A positive correlation between MPV and triglycerides was seen which was statistically non-significant having values of Pearson correlation and sig. 2-tailed of .100 and .221 respectively. An insignificant negative correlation in the present study was seen between total cholesterol and Mean Platelet Volume with Pearson correlation and sig. 2-tailed values of -.001 and .971 respectively. These results were in agreement with the results of Li Jy et al[7] in 2014 and Khemka R et al[8] in 2014 where authors have reported a similar correlation of cholesterol and MPV was shown by the authors as in the present study.

The present study also assessed the correlation between mean platelet volume and platelet count in the study subjects, and the results are depicted in Table 3. It was seen that Pearson correlation and sig. 2-tailed values for this correlation were -.173 and -.034 respectively. These results show that a negative correlation was seen in Mean platelet volume and platelet count. This correlation was statistically significant. These results were similar to the results of Tsiara S et al[9] in 2003 and Huo Y et al[10] in 2004 where a similar correlation between mean platelet count and MPV was shown by the authors as in the present study.

Conclusion

Within its limitations, the present study concludes that an inverse correlation was seen between HDL and mean platelet volume. Hence, the methods adopted to increase HDL will lead to reduced MPV with a decrease in atherosclerosis risk. Also, a positive, but, statistically non-significant correlation was seen in triglycerides and VLDL to MPV. A negative and non-significant correlation of LDL and total cholesterol was seen to MPV. However, the present study had a few limitations including a small sample size, short monitoring time, and geographical area biases. Hence, more longitudinal studies with a larger sample size and longer monitoring period will help reach a definitive conclusion.

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TABLE

Parameter (n=148)	**Mean Platelet Volume**	**Values**
Mean Platelet Volume		**Hemoglobin**
Pearson correlation	1	-0.52
Sig. 2-tailed		-0512
Hemoglobin		
Pearson correlation	-0.52	1

Sig. 2-tailed	-0512	
Mean Platelet Volume		**Total Leucocyte Count**
Pearson correlation	1	-0.24
Sig. 2-tailed		.751
Total Leucocyte Count		
Pearson correlation	.751	1
Sig. 2-tailed	-0.24	

Table 1: Correlation of MPV with hemoglobin and total leucocyte count in study subjects

Parameter (n=148)	**Mean Platelet Volume**	**Values**
Mean Platelet Volume		**HDL**
Pearson correlation	1	-.179
Sig. 2-tailed		0.24
HDL		
Pearson correlation	-.179	1
Sig. 2-tailed	0.24	
Mean Platelet Volume		**VLDL**
Pearson correlation	1	.097
Sig. 2-tailed		.224
VLDL		
Pearson correlation	.097	1
Sig. 2-tailed	.224	
Mean Platelet Volume		**LDL**
Pearson correlation	1	-.011
Sig. 2-tailed		.874
LDL		
Pearson correlation	-.011	1
Sig. 2-tailed	.874	
Mean Platelet Volume		**Triglycerides**
Pearson correlation	1	.100
Sig. 2-tailed		.221
Triglycerides		
Pearson correlation	.100	1
Sig. 2-tailed	.221	
Mean Platelet Volume		
Pearson correlation	1	-.001
Sig. 2-tailed		.971
Total Cholesterol		
Pearson correlation	-.001	1
Sig. 2-tailed	.971	

Table 2: Correlation of MPV with cholesterol and associated factors in study subjects

Parameter (n=148)	**Mean Platelet Volume**	**Values**
Mean Platelet Volume		**Hemoglobin**
Pearson correlation	1	-.173
Sig. 2-tailed		-.034
Platelet Count		
Pearson correlation	-.173	1
Sig. 2-tailed	-.034	

Table 3: Correlation of MPV with Platelet count in the study subjects