

Corelation between Mean Platelet Volume and Platelet Count: An Extensive Study in 500 Healthy Adult Population

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Abstract

Introduction: Platelet plays an important role in atherosclerosis, the major cause of unstable coronary syndromes. Despite an increasing volume of literature which suggests that platelet volume measurement might be useful in the diagnosis of disorders of thrombopoiesis, platelet parameters have not been utilised by the clinicians. The clinical utility of newer haematological parameters such as platelet indices has been explored in recent years. Mean platelet volume (MPV) is an indicator of platelet activation and it has been reported to increase in acute myocardial infarction and acute coronary syndromes. *Material & methods:* The present study is to determine the relationship between mean platelet volume and platelet count, and also to assess the normal range for mean platelet volume in 500 healthy adults in Indian population. *Result:* The range of platelet count in the normal subjects was $26 - 490 \times 10^3/\text{ul}$ with a mean of $194 \times 10^3/\text{ul}$. The range for platelet volume was $6 - 10.9\text{fl}$ with a mean of 7.4fl . It was found that the platelet count and mean platelet volume were found to be inversely proportional to each other. *Conclusion:* Hence from our study we found the mean volume to be 7fl and mean platelet count was $194 \times 10^3/\text{ul}$. The count and volume showed an inverse relationship. Patients having a low platelet count had a higher MPV and patients with high platelet count had a low MPV. The patients having a MPV beyond 11.7fl should be evaluated carefully especially for occlusive arterial diseases.

Keywords: Mean Platelet Volume; Platelet Count; Healthy Population.

Introduction

Platelets have an important role to play in atherosclerosis, one of the major causes of unstable coronary syndromes [1,2]. Platelet volume is measured by instruments that assess the particle size. A large amount of literature is available to indicate that the assessment of platelet volume may aid in the diagnosis and management of various conditions involving thrombopoiesis and platelet synthesis. In spite of this availability the potential of platelet parameters have not been completely tapped by the clinicians [2,3]. The clinical utility of newer haematological parameters such as platelet indices has been explored in recent years [5,6,7]. The size of the platelets varies in

presumed normal individuals. Platelet volume differs not only with the count or number but also with the type of anticoagulant in which the blood is collected, and the time of sample collection along with the duration between collection and analysis, and the method used to measure cell size [8]. Platelets are larger in patients with immune thrombocytopenic purpura and are smaller in patients with acute leukaemia. It was found that platelet count varied inversely with platelet volume [2,6,9]. MPV reflects the platelet activity and an increased MPV can be associated with thrombogenic tendencies along with associated increase in cardiovascular risk. Mean platelet volume (MPV) is a reliable indicator of platelet activation and synthesis and it has been shown to increase in conditions such as acute myocardial infarction leading to high mortality rates and also acute coronary syndromes [9,10]. Obtaining reliable measurements of platelet size and volume has been problematic. The major sources of error were seen in blood collected in EDTA and also cooling blood specimens from 37°C to

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room temperature. Both these parameters showed an increase in MPV [3]. The platelet count varies with the age and sex of the patient, being higher in women as compared to men. Also significant differences in platelet count have also been noted with different ethnic populations [5]. The present study is to determine the relationship between mean platelet volume and platelet count, and also to assess the normal range for mean platelet volume in a cohort of 500 healthy adults in Indian population.

Materials & Methods

We conducted a retrospective study of 500 adult healthy individuals. The study was carried out between January and March 2017. The platelet count and mean platelet volume was measured in these individuals. The study group comprised of 500 normal adults between the age group of 19-59 years of both sexes. Subjects with chronic illness such as hypertension, diabetes mellitus, atherosclerosis, thyroid disease, dyslipidaemia, haematological disease, autoimmune disease were excluded from the study. Correlation between the platelet count and mean platelet volume was done using the collected data. Correlation with age, sex was also conducted.

Results

Among 500 participants in the study conducted, 283 were males and 217 were females with a mean age of 39. Table 1 shows the distribution of male and females in this study. Majority of them were found to be within the age group of 19-59 years.

The range of platelet count in the normal subjects was $26 - 490 \times 10^3/\text{ul}$ with a mean of $194 \times 10^3/\text{ul}$. The range for platelet volume was $6 - 10.9\text{fl}$ with a mean of 7.4fl . The mean of platelet count and volume are given in Table 2 & 3. The relation between platelet count and size of platelet was not random. A progressive but non-linear decline in MPV was observed with progressively higher platelet count.

The platelet count was found to higher in younger women as compared to men of the same age. The platelet count decreased with age and was found to be significantly lower in males as compared to females of the same age (Table 4 & 5). The mean platelet volume was found to be inversely proportional to the platelet count. The MPV was found to be higher in females as compared to males. The MPV showed a decreasing trend in males with age. In our study males in the age group of 55-60 showed a significantly lower MPV which was inversely proportional to the platelet count (Table 5 & 6).

Table 1: Distribution of Males and Females in this study

| Males | Females | Total |
|-------|---------|-------|
| 283 | 217 | 500 |

Table 2: Mean Platelet Parameters in Males

| Age (years) | N | Platelet Count ($10^3/\text{ul}$) | Mean Platelet Volume (fL) |
|-------------|----|-------------------------------------|---------------------------|
| 18-25 | 32 | 185.781 | 7.196 |
| 26-30 | 32 | 203.593 | 7.25 |
| 31-35 | 45 | 215.377 | 7.393 |
| 36-40 | 53 | 201.434 | 7.356 |
| 41-45 | 50 | 194.08 | 7.42 |
| 46-50 | 27 | 188.888 | 7.444 |
| 51-55 | 34 | 190.147 | 7.641 |
| 56-60 | 10 | 140.272 | 7.018 |

Table 3: Mean Platelet Parameters in Females

| Age (years) | N | Platelet Count ($10^3/\text{ul}$) | Mean Platelet Volume (fL) |
|-------------|----|-------------------------------------|---------------------------|
| 18-25 | 16 | 222.937 | 7.125 |
| 26-30 | 37 | 193.783 | 7.481 |
| 31-35 | 31 | 185.645 | 7.403 |
| 36-40 | 27 | 176.925 | 7.485 |
| 41-45 | 31 | 200.193 | 7.554 |
| 46-50 | 29 | 189.483 | 7.622 |
| 51-55 | 37 | 179.485 | 7.242 |
| 56-60 | 09 | 191.667 | 7.544 |

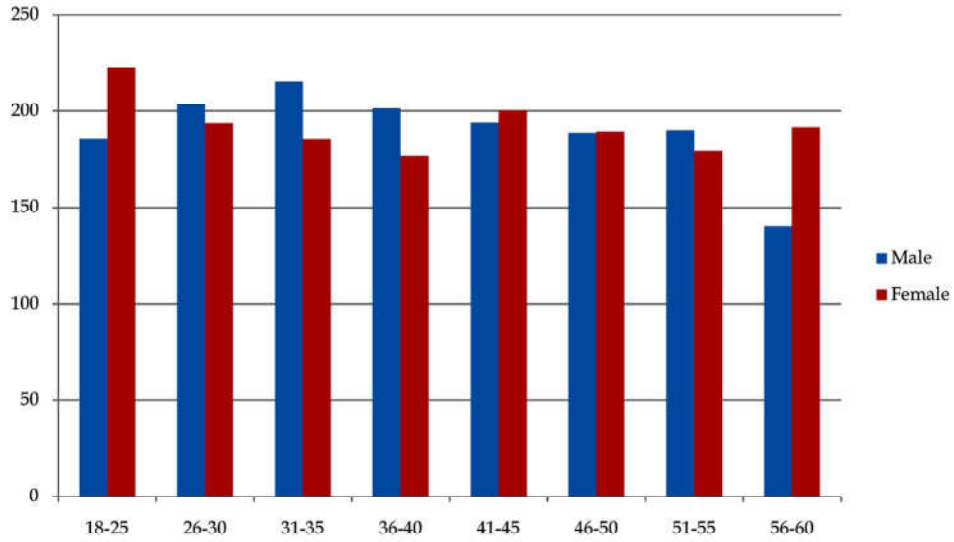


Table 4: Platelet Count in Males and Females

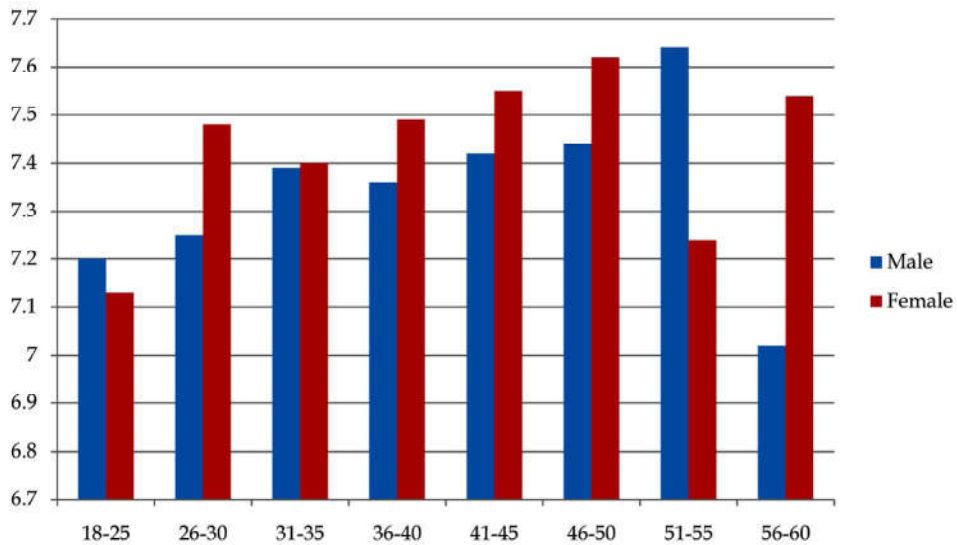


Table 5: Mean Platelet Volume (MPV) in Males and Females

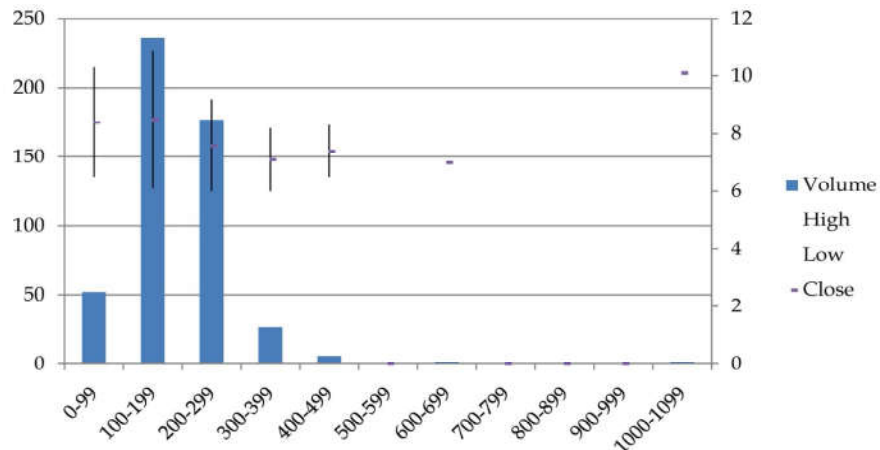


Table 6: MPV & Platelet count Correlation

The mean platelet count was found to be $194 (10^3/\text{ul})$. The mean of MPV was found to be 7.4fl. It was found that the platelet count and mean platelet volume were found to be inversely proportional to each other (Table 6).

Discussion

In the current study we have tried to analyse the relationship between platelet count and mean platelet volume in 500 healthy who did not have any significant past medical history. Giles et al was one of the first persons to record mean platelet volume. He conducted his study on 5000 blood samples and showed that around 90- 95% of adults who had been admitted to the hospital, showed a MPV which varied from 7 to 10.5fl [12].

Platelets which are large in size are produced from activated megakaryocytes in the bone marrow, these are likely to be more reactive than their normal sized counterparts. The calculation of platelet volume is machine based and the mean is calculated as the average of all the platelet assessed [1,2,3]. MPV increases with an increase in the production of platelets and these newer platelets are immature and appear larger in size. Hence an increase in MPV can be used as a reliable marker of platelet activation, and can be used to evaluate cardiovascular risk [4,5,15].

The platelet count in normal individuals and population varies considerably. There exists a relationship between platelet size and number which was first postulated in 1974. Circulating platelets vary considerably both in size and functional activity. Larger platelets are younger, reactive and produce more thrombogenic substances [14,15,16]. Automated blood cell counters provide us a platelet count and indices with respect to the size of the platelet. A low platelet volume is associated with a higher platelet count. The platelet count and volume are inversely proportional to each other [6,7,8]. The platelet mass is relatively constant when the platelet count are in the normal range. Fluctuations arise only when there is increase or decrease in the platelet size.

Our current study shows that 95% of the individual's reflecting a real population based healthy cohort, had a MPV of 7- 7.5fl. In the current study, correlation analysis revealed that there was a significant inverse relationship between the count and volume which was already well documented by various authors.

Platelet count seemed to vary somewhat with age. The study showed that females in the age group of 18-

25 had a higher platelet count as compared to males of the same age. The platelet count remained on the higher side with increasing age as compared to male who showed a drop in the count with progressing age [4,12,18]. In both sexes there was an inverse relation between count and volume. The MPV was marginally higher in men and increased progressively with age showing a peak at 51-55yrs [4,5,6].

The stability of these parameters in the normal population helps to distinguish platelet abnormalities when they exist. It has been seen that patients with thrombocytopenia resulting from peripheral destruction have an increased MPV [16,18,19]. This is in contrast to those patients whose thrombocytopenia is hypoproliferative in nature where the MPV is decreased. Those patients whose thrombocytopenia is due to increased destruction have a low platelet count, but a greater percentage of them are younger, larger and have a better functional capacity.

Conclusion

Hence from our study which included 500 healthy Indian adults, we found the mean volume to be 7fl and mean platelet count was $194 \times 10^3/\text{ul}$. MPV between 7 and 7.5 fl was found in 95% of the study population and platelet count between $140-194 \times 10^3/\text{ul}$. The count and volume showed an inverse relationship. Patients having a low platelet count had a higher MPV and patients with high platelet count had a low MPV. The patients having a MPV beyond 11.7 fl should be evaluated carefully especially for occlusive arterial diseases.

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