Pathology

Diagnostic Importance of Platelet Parameters in Patients with Coronary Artery Disease and Acute Myocardial Infarction

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Abstract: In urban Indian population due to various emerging etiological factors such as stress and unhealthy lifestyle, risk of getting coronary artery disease (CAD) in young patients is increasing. Platelets play an important role in pathogenesis of atherosclerosis. Larger platelets are hemodynamically active; they are etiological agents forming thrombosis in arteries. The present study deals with the correlation of platelet volume indices (PVI) in patients with CAD and healthy controls. We observed that, cases were almost equally distributed in 3rd to 5th decade of life. Males outnumbered females. Values of PVI – Mean Platelet Volume (MPV) and Platelet Large Cell Ratio (P-LCR) were highly significant in patients with coronary artery disease compared to healthy controls. Cut off obtained for mean MPV 9.4fL and P-LCR 40 %. PVI are simple, effortless and cost effective tool, generated as a byproduct of hematoanalyzers, can be used in predicting development of CAD sometime in near future.
Keywords: Platelet Volume Indices, Mean Platelet Volume, Platelet Large Cell Ratio, Coronary Artery Disease.

INTRODUCTION

Blood contains three types of cells with many vital functions. Red blood cells are oxygen carriers supplying body tissues, white blood cells help the body fighting infections while platelets form a plug, preventing us from bleeding to death, helping in the clot process formation.

The usual adult human has a platelet count = 1.5 - 4.5 lakhs/cmm[1]. Automated cell counters have made the platelet count and platelet volume indices - MPV, PDW and P-LCR routinely available in most clinical laboratories [2-5]. However, there is a scope to make better use of the platelet parameters generated in coronary heart disease.

Coronary artery disease, now considered as modern epidemic is mainly caused by atherosclerosis and its complications [6]. Platelets play an important role in its pathogenesis. Platelet volume indices (PVI) are a useful means of identifying larger platelets, which are hemodynamically more active and are a risk factor for developing coronary thrombosis, leading to myocardial infarction. Larger platelets are enzymatically and metabolically more active and have a higher potential thrombotic ability as compared with smaller platelets. The MPV can reflect changes in either the level of platelet stimulation or the rate of platelet production. The PDW is a measure of platelet anisocytosis. P-LCR (platelet large cell ratio) is defined as the ratio of large platelets to total platelets. Hence increased P-LCR indicates increased number of large platelets [7]. PVI are an important, simple, effortless and cost-effective tool that should be used more extensively to predict impending acute events [8].

AIM

To evaluate platelet indices in patients with coronary artery disease and normal healthy controls

OBJECTIVES

To study, determine, compare and evaluate the role of platelet volume indices in patients with coronary artery disease and normal healthy controls.

MATERIALS AND METHODS

The study was designed as a prospective, case control study carried out from July 2015 to September 2017, in a tertiary care hospital. Total number of cases included was 107 CAD cases and 107 healthy controls. Patients visiting emergency medical unit of the hospital with an acute coronary event and patients with persistent chest pain visiting the OPD of the hospital comprised the case group. Pregnant females, patients with moderate to severe anaemia, patients with any diagnosed malignancy /critically ill patients and patients on antiplatelet drugs such as aspirin and clopidogrel were excluded. None of the controls had positive family history of CAD, no past medical history of hypertension, diabetes mellitus and/or CAD. All the cases were aged more than 30 years. The patients whose EDTA bloods samples were clotted or values of platelet volume indices were not obtained were excluded from the study.

Sample was obtained by Phlebotomy procedure under aseptic precautions. Hemoglobin, platelet count, platelet volume indices (MPV, PDW and P-LCR) were obtained by automated hematoanalyzer.

Statistical analysis

ANOVA test, Chi square test was used. p values of <0.05 was taken as significant.

OBSERVATION & RESULTS

Platelet volume indices (MPV, PDW and P-LCR) of 107 cases were compared with the healthy controls. Maximum number of cases (39) was in age group 51-60 years, followed by 41-50 years (33). Minimum age for coronary artery disease observed in the present study was 30 years (6 cases), out of which 4 suffered from myocardial infarction and 2 suffered from unstable angina. Mean age of cases was 46.59±9.56 years.

All healthy controls were in the age group 30-60 years. Maximum number of controls was in the age group 31-40 years followed by 41-50 years. 12 were of 30 years age. Mean age group was 41.77±9.36 years.

73 males and 34 female suffered from coronary artery disease. (Chart 1) There was equal number of males and females in the healthy control group.
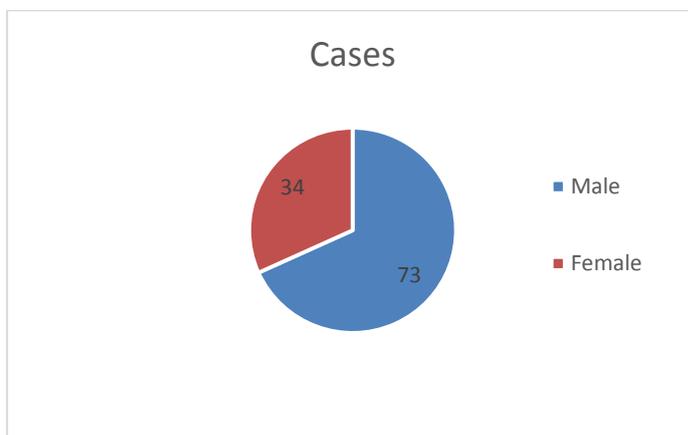

Chart-1: Male female ratio of cases

Out of 73 males who suffered from CAD, maximum number were in the age group 31- 40 years, while that of females in the age group 51-60 years. Young age group of males and old age group of females is affected by coronary artery disease in the present study. Out of 34 females, 27(79.4%) were in the age group 40-60 years.
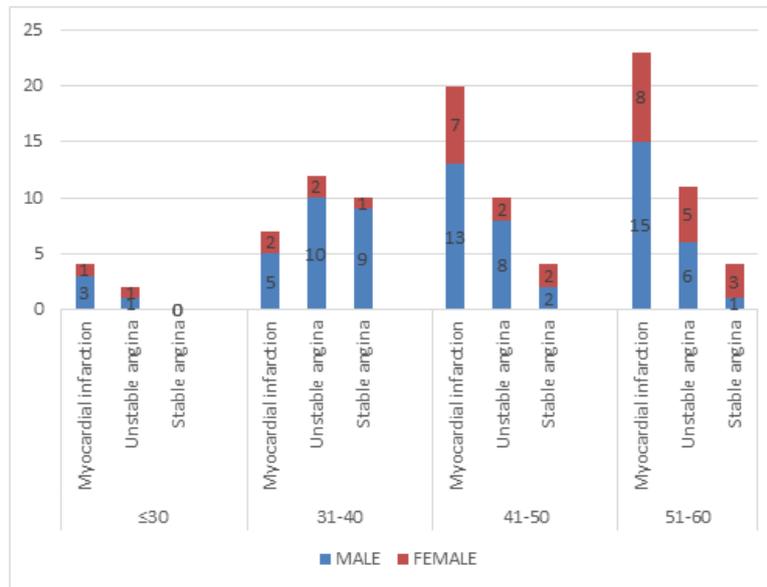
Chart-2: Age and sex wise distribution of myocardial infarction, unstable angina and stable angina

Risk of getting coronary artery disease is more in females ageing more than 40 years as compared to females less than 40 years (CHART-2).

83(44%) cases had MPV more than 9.4 fL, while no control (0%) was found to have MPV more than 9.4fL. 60(56%) cases had MPV less than 9.5 fl, while all controls (100%) had MPV less than 9.5 fL .Six (33.3 %) patients with stable angina showed MPV more than 9.4fL as compared to 32 patients (59.2 %) with myocardial infarction, while no control showed such high value (Table-1).

Table 1: Range of MPV (fL) In Cases and Controls

MPV RANGE	Myocardial infarction	Unstable Angina	Stable angina	Controls
5.5-6.4	0	0	0	8
6.5-7.4	6	1	3	58
7.5-8.4	6	7	3	31
8.5-9.4	10	18	6	10
9.5-10.4	13	7	5	0
10.5-11.4	11	2	0	0
11.5-12.4	3	0	1	0
12.5-13.4	2	0	0	0
13.5-14.4	3	0	0	0
TOTAL	54	35	18	107

Table-2: Range of PDW (fL) In Cases and Controls

PDW RANGE	Myocardial infarction	Unstable Angina	Stable angina	Controls
7.5-9.4	4	0	0	0
9.5-11.4	1	0	0	0
11.5-13.4	1	0	0	0
13.5-15.4	3	5	2	30
15.5-17.4	39	26	14	77
17.5-19.4	6	4	2	0
TOTAL	54	35	18	107

All controls were in the range 13.5 -17.4 fL, while diverse range of PDW is seen amongst cases (7.5-19.4 fL). Maximum number of cases is in the range 13.5-19.4 fL. (Table-2)

Table 3: Range of P-LCR (%) Values in Cases and Controls

P-LCR RANGE	Myocardial infarction	Unstable Angina	Stable angina	Controls
1.1-10	0	0	1	8
10.1-20	6	2	1	78
20.1-30	10	14	6	19
30.1-40	12	13	8	2
40.1-50	12	6	1	0
50.1-60	8	0	1	0
60.1-70	5	0	0	0
70.1-80	1	0	0	0
TOTAL	54	35	18	107

Maximum number of cases is within the P-LCR range of 30.1-40 %, 34 cases (31.8 %) showed P-LCR more than 40%, with no controls showing such high value. All controls P-LCR level falls below 40 %.Maximum P-LCR (%) in cases was 76.5 while minimum was found to be 9.8, mean being 35.77±13.4.Maximum P-LCR (%) in controls was 33 while minimum was found to be 7.7, mean being 16.85±5.16. Mean P-LCR in patients with myocardial infarction is 39.9 %, in patients with unstable angina 31.8 % while in patients with stable angina it is 31.1 %, these values are raised in comparison with the mean P-LCR of controls (16.85 %).

6 (11.1 %) patients suffering from myocardial infarction showed high P-LCR value, i.e. more than 60 %, which was not showed by patients suffering from stable and unstable angina. 36 cases (66.7 %) of myocardial infarction showed high P-LCR value, i.e. more than 40% with no control showing such high value(Table-3).
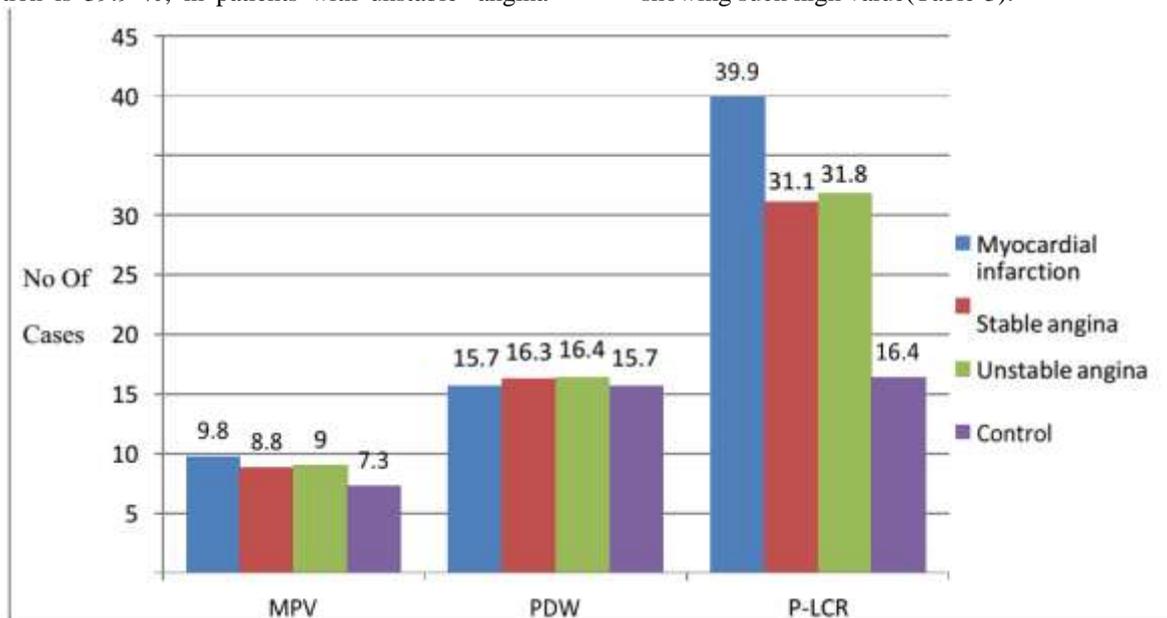

Chart-3: Comparison of platelet volume indices with controls

Mean platelet volume in patients with myocardial infarction is higher than that of the controls as well as than that of patients with unstable angina and stable angina. Platelet distribution width is similar in cases and controls. Platelet large cell ratio is highest in patients with myocardial infarction. Comparing P-LCR of controls to patients with myocardial infarction, stable angina and unstable angina gives an idea of pathological significance of large platelets in coronary artery disease. (CHART-3)

DISCUSSION

Coronary artery disease is spreading as an epidemic in the Indian population as our new lifestyle sets in. Platelets, a very simple parameter to study in a routine laboratory investigations, plays a vital role in stopping the oozing wounds but at the same time in our coronaries, if atherosclerotic, occludes it and causes ischemic events in the heart. Several scholars studied the effects of platelet on heart, especially atherosclerotic coronaries. Platelets are metabolically active when their size is large [8]. The present study of platelet volume indices was performed on 107 cases of coronary artery disease, including myocardial infarction and 107 healthy controls.

Maximum number of cases was in the age group 51-60 years, while minimum age for coronary

artery disease observed in the present study was 30 years.

When we compared the age and gender wise distribution of CAD, it was observed that males outnumbered females. In males, the disease started at younger age group as compared to females and was almost equally distributed in 3rd to 5th decade of life. While in females there was a significant increase in disease frequency in 4th and 5th decade as compared to 3rd decade. There were 79.4% females in the age group 40-60 years as compared to 20.6 % females below the age of 40 years (Chart-2). The older age of onset of CAD in women compared with men is thought to be due to the protective role of circulating estrogens on the vascular endothelium [9].

In present study the overall mean MPV in cases was 9.4 fL, the range being 6.5-14.3 fL. The mean MPV observed in healthy controls was 7.4 fL, which ranged from 6.0-9.1 fL. Disease wise study revealed mean MPV (fL) of 9.8±1.8 fL in patients with myocardial infarction, 9.0±0.8 fL in unstable angina while 8.8±1.3 fL instable angina patients (Table-1). Comparing the values of MPV in cases and controls gives p Value of <0.001 which is significant. In a study done by Khandekar *et al*.[8] the mean MPV observed in patients with MI was 10.4 fL and instable angina was 9.37 fL, as compared to controls which was 9.2 fL, giving a significant p value. Mercan *et al*. [10] in year 2010 studied platelet volume indices of 69 cases of myocardial infarction, 73 of unstable angina and 72 of stable angina and compared with 45 healthy controls. The mean MPV in patients with MI, stable angina and unstable angina was 9.9, 9, 7.5 fL respectively and in controls 7.2 fL. Both these studies support our findings. Khandekar *et al*,[8] Manchanda *et al*.[11]suggested that mean MPV value of more than 9.6 fL to be a significant risk factor for developing CAD and MI, in our study we observed MPV value of more than 9.4 fL is significant for developing CAD.

The overall maximum PDW in cases was 19.7 fL, mean being 16.01±1.88 fL, while in controls it was 16.7 fL, mean being 15.67±0.49 fL. Comparing the values, we got the p value of 0.073 which is insignificant. The disease wise mean PDW observed were 15.7 fl in MI, 16.4 fl in unstable angina, and 16.3 fl instable anginas (Table-2). Sharma *et al*. [12] studied PDW of 110 cases and compared it with 110 controls, the mean PDW of MI cases was 14.7 fL.

Pipliwal *et al*.[13] studied P-LCR in 60 cases of MI and compared it with 60 cases of controls, mean P-LCR in their study was 35.8% while in our study it is 39.9% (Table-3). This value is comparable with present study. Various studies done

by Khandekar *et al*.[8], Desai *et al*.[14], Rigvardhan *et al*.[15] and Rajnith *et al*.[16]mean P-LCR is 29.4 %, 28.6%, 27.3% and 29.5 % respectively which is in concordance with our study.

CONCLUSION
- From the analysis of the present study, we conclude that the platelet volume indices- MPV and P-LCR were raised in coronary artery disease as compared to the healthy controls.
- Among CAD group, MI showed significantly high values of MPV and P-LCR.
- Our data suggests that the increased mean platelet volume contributes to the prethrombotic state in acute ischaemic syndromes.
- The present study finds that there is no significance of platelet distribution width (PDW) in coronary artery disease.
- As age increases, risk of getting coronary artery disease increases, so diagnostic intervention after 40 years of age can be useful in preventing the disease onset.
- Females in premenopausal age are prone to the disease so diagnostic tests performed at this age may prevent development of the disease.
- Platelet volume indices are an important, simple, effortless and a cost effective tool, generated as a byproduct of automated hematoanalyzers, useful in predicting the development of coronary artery disease sometime in near future.
- Though we have analysed various platelet indices and found their relevance with the CAD, further detailed analysis in relation to onset of symptoms and change in values of PVI at specific time interval would be more relevant. This will prove more beneficial in understanding the changing scenario and significance of PVI in this group of patients.

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