PLATELET INDICES IN NEWLY DIAGNOSED PATIENTS OF MYOCARDIAL INFARCTION

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ABSTRACT

OBJECTIVES: To find out the diagnostic role of platelet indices in newly diagnosed patients of myocardial infarction and compare it with normal individuals.

METHODS: The platelet indices were measured in 100 newly diagnosed patients of myocardial infarction admitted in cardiology unit, Lady Reading Hospital (LRH), Peshawar, Pakistan and were compared with 100 normal subjects. Two milliliter of venous blood of each subject was collected in K3-EDTA tubes. Platelet indices were assayed by using Sysmex KX-21, Japan auto-analyzer in clinical laboratory of LRH within 10-20 minutes of collection of blood. The data was analyzed by using SPSS version 20.

RESULTS: There were 85 males and 15 females in cases and 75 males and 25 females in control group. The mean ages in cases and control group were 50.87±11.02 47.31±12.09 respectively. Platelets count was significantly decreased by 19.93% ($p<0.05$) to 233 x109/L in patients as compared to controls where it was 291.27x109/L. Mean platelets volume (MPV) was significantly increased by 19.38% ($p<0.05$) 10.99±1.34fl in cases as compared to control where it was 9.21±0.98 fl. Platelets distribution width was also increased by 14.64% ($p<0.05$) and was 14.17±2.14fl in cases as compared to 12.36±1.86fl in controls. Platelets large cell ratio was also increased by 24.03% ($p<0.05$) and was 28.21±7.84% in cases as compared to 22.83±6.85% in controls. The same results were found when platelet indices were compared separately in males and females.

CONCLUSION: Platelets count was decreased whereas rest of the platelet indices were significantly raised in newly diagnosed cases of myocardial infarction.

KEY WORDS: Myocardial Infarction (MeSH), Platelet Count (MeSH), Mean Platelet Volume (MeSH).

THIS ARTICLE MAY BE CITED AS: Abideen ZU, Salman F, Usman R, Shakireen N, Gul AM. Platelet indices in newly diagnosed patients of myocardial infarction. Khyber Med Univ J 2017; 9(2): 78-82.

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Date Submitted: January 22, 2017
Date Last revised: June 18, 2017
Date Accepted: June 20, 2017

INTRODUCTION

Platelets are non-nucleated cells present in the circulation which are the fragments of cytoplasm derived from megakaryocytes in the bone marrow.[1] These un-activated platelets are discoid in shape.[2] It has been shown that the physiological agonists of platelets (such as thrombin, collagen, thromboxane-A2, adenosine diphosphate adrenaline and serotonin) interact with the specific receptors present on the membrane of platelets and induces the platelet activation leading to change in shape and aggregation which are the key factors in platelet adhesion with the exposed collagen of sub-endothelium and formation of thrombus.[3] Therefore; platelets have been shown to play an important role in the pathogenesis of acute coronary syndrome.[4]

It has been shown that the function of platelets has got a relation with their size. Large sized platelets are more active (metabolically and enzymatically) as compared to the normal sized platelets.[5] Higher mean platelet volume (MPV) has been correlated with slowing of blood flow in the coronary vessels and has also been reported to increase in the unstable angina and myocardial infarction.[6,7] High MPV after acute ischemic cerebro-vascular event has also been found to be correlated with bad outcome (higher risk of recurrent stroke).[8,9]

Some research workers have reported that MPV is a risk factor for myocardial infarction, but not for the prevalence of coronary artery disease.[10,11] In a follow up study, MPV has been shown to anticipate recurrent myocardial infarction (MI)and death, measured at six months after acute MI.[12]

Dundar et al. found in his longitudinal study that MPV is higher in pre-eclampsia as compared to their normotensive counterparts.[13] Platelet indices has also been used and shown to be one of the markers to see the disease activity as well as to see the response to treatment in rheumatoid arthritis along with other conventional markers.[14]

MPV and platelet distribution width (PDW) have been measured in Diabetics having micro and macro vascular compli-

cations and were found to play significant role in categorizing these patients on this basis.[15,16] In a study carried out in USA, elevated MPV has been found as a strong predictor as well as having prognostic value after per-cutaneous coronary intervention similar to that of troponin used for the patients having acute coronary syndrome.[17]

Besides diagnostic value of platelet indices, Rechcinski et al. have shown that MPV, PDW and platelets large cell ratio (P-LCR) are important independent prognostic factors for mortality in patients after MI (long term mortality) and hence platelet volume indices provide valuable contribution to identification of high risk patients.[18]

Majority of the aforementioned studies on platelet indices have been carried out in western population and few in Asian population in different diseases as diagnostic as well as prognostic markers. In Pakistan Zuberi et al. have carried out a study on platelet indices in diabetic patients.[19] No such study so far to our knowledge has been carried out on patients of myocardial infarction in Pakistan.

Rationale of the study: Inappropriate platelet activation plays a prime role in increasing risk of myocardial infarction. There is no accepted ideal measure of platelet activation that would indicate a state of high risk. Evaluation of platelet indices as indicator of their activity could be useful in prediction and prognosis of coronary events.

The aim and objective of the present study were to find out the diagnostic role of platelet indices in newly diagnosed patients of myocardial infarction and compare it with normal individuals.

METHODS

In this case control study, 100 cases and 100 control of either sex were included by convenient sampling. Patients were selected from Cardiology unit Lady Reading Hospital, Peshawar, Pakistan at the time of admission as emergency and controls were selected from normal healthy adult subjects. Sampling technique was convenient sampling. Duration of study was 06 months.

Newly diagnosed cases of acute MI, admitted in coronary care unit (CCU) of Lady Reading Hospital, Peshawar were included in the study. The following WHO criteria were used to diagnose the cases.[21]

"A patient was diagnosed having MI if two (probable) or three (definite) of the following criteria were satisfied:

1. Clinical history of ischemic type chest pain lasting for more than 20 minutes
2. Changes in serial ECG tracings.
3. Rise and fall of serum cardiac biomarkers"

Known cases such as Diabetes mellitus, coronary artery disease, old MI, bleeding, platelet disorders, renal diseases, the patients already receiving anti-platelet drugs or anti-coagulants, were excluded from the study as cases. The same tools were also applied in controls to exclude any disease or history of drug intake.

Approval of the Ethical & Research Committee of Peshawar Medical College was obtained. Consent of the cases and control subjects was obtained from all individuals on specially designed consent proforma. Specially designed study History Proforma was completed for all subjects.

Blood sample was obtained from subjects included in the study in K3-EDTA tube at the time of admission in cardiology unit, Lady Reading Hospital, Peshawar, Pakistan. Blood sample was taken immediately to the Laboratory of the hospital for analysis within 15-20 minutes so that the volume of platelet is not influenced by EDTA.

The platelet indices i.e. Platelet count, Mean platelet volume (MPV), platelet distribution width (PDW) and platelet large cell ratio (P-LCR) were assayed by using Hematology Auto-analyzer (Sysmex KX-21), Sysmex, Japan, in Pathology Department Lady Reading Hospital, Peshawar, Pakistan.

Data was entered and analyzed by SPSS version 20.

Qualitative variables were analyzed by Chi square test and Quantitative variables were analyzed by independent T test. P value <0.05 was taken as significant.

Platelet indices were treated as independent variables whereas myocardial Infarction was treated as dependent variable. Other important variables were age and gender and sedentary life style.

Odds ratio (OR) which is a measure of association between an exposure and an outcome was also calculated.

RESULTS

The cases studied comprised of 100 consecutive patients admitted in Cardiology unit, Lady Reading Hospital, Peshawar, Pakistan who fulfilled the inclusion criteria.

All of them were newly diagnosed patients of S-T segment elevation myo-

TABLE I: COMPARISON OF PLATELET INDICES AMONG CASES AND CONTROLS

Platelet Indices	Cases Mean ±SD	Controls Mean ±SD	P-value	95% CI Lower	95% CI Upper
PC x10 ^{9}/L	233.08±64.57	291.27±70.76	<0.05	-770	-392
MPV (fl)	10.99±1.34	9.21±0.98	<0.05	1.44	2.10
PDW (fl)	14.17±2.14	12.36±1.86	<0.05	1.24	2.36
P-LCR (%)	28.21±7.84	22.83±6.85	<0.05	3.32	7.43

SD=Standard deviation; PC=Platelet count; L =Liter; MPV=Mean platelet volume; PDW=Platelet distribution width; fl= Famto liter; P-LCR= Platelet large cell ratio; CI=confidence interval

TABLE II: GENDER BASED COMPARISON OF PLATELET INDICES AMONG CASES AND CONTROLS

Platelet Indices	Cases (Mean+SD)	Controls (Mean+SD)	P-value	95% CI Lower	95% CI Upper
PC (10^9/L) (Males)	236.14±65.63	293.20±73.49	<0.05	-789	-354
PC (10^9/L) (Females)	215.33±57.14	285.12±62.2	<0.05	-1095	-291
MPV (fl) (Males)	10.89±1.31	9.17±1.08	<0.05	1.34	2.10
MPV (fl) (Females)	11.54±1.40	9.34±0.60	<0.05	1.55	2.85
PDW (fl) (Males)	14.10±2.17	12.28±1.97	<0.05	1.16	2.46
PDW (fl) (Females)	14.56±2.01	12.60±1.48	<0.05	0.84	3.08
P-LCR (%) (Males)	27.72±7.82	22.28±7.37	<0.05	3.05	7.82
P-LCR (%) (Females)	31.00±7.59	24.48±4.70	<0.05	2.59	10.44

SD=Standard deviation; PC=Platelet count; L =Liter; MPV=Mean platelet volume; PDW=Platelet distribution width; fl= Femto liter; P-LCR= Platelet large cell ratio; CI=confidence interval

cardial infarction (STEMI). They were compared with 100 controls of nearly the same age group having no past history of any disease like hypertension, diabetes mellitus or any other metabolic disorder. A proper history proforma was filled in all control subjects as well.

The mean age of cases was 50.87±11.02 years and the mean age of controls was 47.31±12.09 years.

Among gender distribution, 85 % of the total cases were males and 15% were females. Among controls, 75% were males and 25% were females.

The mean platelet count (combined in males and females) in cases was 233.08x109/L and in controls it was 291.27x109/L. The count in cases was significantly decreased by 19.93% (P<0.05) than in controls (Table I). The same result was found in cases when compared separately in males and females (Table II).

The mean platelet volume (MPV) (combined in males and females) in cases was 10.99±1.34 fl as compared to the controls which was 9.21±0.98fl. The mean was significantly higher by 19.38% (P<0.05) when compared with controls (Table I). Odds ratio (OR) was 5.4 (more than one) with a 95% confidence interval (CI) of (1.44-2.10). This confirms that significantly increased MPV is a risk factor for MI. The same result was found in cases when compared separately in males and females (Table II).

The mean Platelet distribution width (PDW) (combined in males and females) in cases was 14.17±2.14fl and in controls it was 12.36±1.86 fl. The mean PDW was significantly raised by 14.64% (P<0.05) in cases as compared to controls (Table I). Odds ratio (OR) was 1.8 (more than one) with a 95% confidence interval (CI) of 1.24–2.36. This shows that significantly increased PDW is also a risk factor for MI. The same result was found in cases when compared separately in males and females (Table II).

The mean Platelet large cell ratio (P-LCR) (combined in males and females) in cases was 28.21±7.84 and it was 22.83±6.85 in controls. It was also statistically significantly higher by 24, 03% (P<0.05) in cases as compared to controls (Table I). The same result was found in cases when compared separately in males and females (Table II).

DISCUSSION

Myocardial infarction (MI) is one of the major consequences of thrombotic lesion in coronary artery disease (CAD). Early diagnosis of MI still needs research despite the considerable advancement in the diagnostic parameters.[20] Platelets play a key role in the development and progression of atherosclerosis and its complications, including MI.[21,22]

Platelet size and its function are interrelated and it has been shown that larger platelets are more reactive than normal platelets. Consequently, larger and hyperactive platelets play a key role in all the consequences of acute thrombotic event in the body.[23]

Activated large size platelets not only secrete thromboxane A2 and ADP but also directly bind to the circulating fibrinogen, via platelet glycoprotein (GP) IIb/IIIa (integrin). The platelet–fibrinogen–platelet integration initiates the process of platelet aggregation and thus, leads to coronary thrombus formation. These findings suggested that in larger platelets, MPV may be useful marker in patients with acute coronary syndrome (ACS).[24]

Automating the field of hematology analyzers have made it possible to determine the parameters that had not previously been measured or used specially related to platelets and doctors were unaware of their importance because these parameters were not printed or ignored in the reports.[25] These parameters include, "platelet indices (mean platelet volume (MPV), platelet distributing width (PDW), and platelet large cell ratio (P-LCR) "which offer valuable information about the morphology and maturity of platelets. MPV is a measurement of the average size and volume of platelets in blood whereas PDW reflects the variability in the platelets size.[26]

It has been shown by many research workers that the MPV is increased in MI and can be used as an independent risk factor for myocardial infarction in patients having coronary artery disease.[11,27]

In our study, platelet indices were measured in newly diagnosed patients of MI which is first study of this type in Pakistan. The differences in mean of mean platelet volume (MPV), Platelet distribution width(PDW) and Platelet large cell ratio (PLC-R) between the cases of MI as compared to healthy controls were statistically highly significant ($P<0.001$) whereas mean platelet count was significantly decreased which might be due to increased rate of platelet expenditure at the site of plaque. This also led to walkout of large sized platelets from the bone marrow. These findings are in accordance with the results of other research workers who have conducted nearly the same type of research in different countries of the world and have shown that MPV and PDW can be used as predictors as well as prognostic markers in cases of MI.[10,28-33]

Our data also conclude that the higher MPV and PDW contribute to the pro-thrombotic state in acute MI and that large sized platelets play a significant role in myocardial infarction as is also pointed out by Abass et al.[27]

The only study which has shown that P-LCR cannot be expressed as marker of platelet reactivity or a risk factor for coronary artery disease is that of Luca GD et al.[34] which is contrary to our study which according to him might be due to advance age and diabetes which were significantly associated with a higher percentage of large platelets in his study.

CONCLUSION

Platelet indices (MPV, PDW and P-LCR) were significantly raised in newly diagnosed subjects of MI, therefore; they can be considered as useful and cheaper early diagnostic markers along with other biomarkers (if available) for acute MI.

RECOMMENDATIONS

Awareness about the importance of platelet indices should be created amongst doctors as well as technicians as they usually ignore them.

It needs further follow up studies in cases of MI to see its prognostic importance after continuation of treatment.

Platelet indices should also be tried in future studies as routine investigation to assess success of thrombolytic medicine or anti-platelet therapy in cases of MI where justified.

In future one could probe it further in a longitudinal study by assessing platelet indices in the patients of stable angina, and tracking them to Post-MI status in patients who do get MI.

ACKNOWLEDGEMENT

I am thankful to Prof. Taj Ali, Lab Incharge LRH, Peshawar and Senior Technician Niaz Muhammad for their valuable support. I am also grateful to Dr. Zahid Jadoon for his help in statistical analysis.

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CONFLICT OF INTEREST

Authors declared no conflict of interest

GRANT SUPPORT AND FINANCIAL DISCLOSURE

NIL

AUTHORS' CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

ZUA: Acquisition of data, drafting the manuscript, final approval of the version to be published

FS: Concept & study design, critical revision, final approval of the version to be published

RU: Analysis and interpretation of data, drafting the manuscript, final approval of the version to be published

NS & AMG: Acquisition of data, final approval of the version to be published

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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