

Evaluation of Platelet Parameters in Patients of Acute Coronary Syndrome

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KEYWORDS

Acute coronary syndrome, Platelet parameters, Cardiac biomarkers, ECG changes.

ABSTRACT

Introduction:

Platelets play a vital role in pathogenesis of cardiovascular diseases. Platelet activation occurs before an acute coronary event, which leads to thrombus formation. Platelet which are large in size are more active metabolically and enzymatically. Large platelets produce more thromboxane A₂ and glycoprotein receptors (IIb/IIIa) which also leads to development of thrombus and increase risk of Acute Coronary Syndrome (ACS). ACS includes acute myocardial infarction, unstable angina and sudden cardiac death. It is a chronic process accompanied by a cascade of platelets which result into development of thrombus formation. Platelet size and its activity correlate with platelet indices such as Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW). Increase in MPV and PDW indicate thrombus formation and facilitates early detection of acute myocardial infarction.

Aim and Objective:

Evaluation platelet parameters such as platelet count, mean platelet volume and platelet distribution width in patients of ACS and their correlation with cardiac biomarkers, clinical details and ECG findings.

Methodology:

Blood samples of cases of ACS were collected immediately after the admission in EDTA vacutainer and were analysed in five part haematology analyser. Platelet parameters were compared with clinical details, ECG findings and cardiac biomarkers.

Results:

The study included 150 cases of Acute Coronary Syndrome (ACS) with 50 age and sex matched controls. Commonest age group was 51-60 years with male preponderance. Platelet count ranged from 1.5 – 3.3 lacs/cumm with mean value of 1.7 lacs/cumm which was lower than that of control group. Mean value of MPV and PDW were higher in ACS cases than that of controls. Mean value of PC was lower while MPV and PDW were higher in Troponin I positive cases than that of Troponin I negative cases and controls. Mean PC count was lower and Mean MPV and PDW showed higher values in ST elevation myocardial infarction.

Conclusion:

Platelet parameters plays a significant role in early diagnosis of ACS and initiation of antiplatelet therapy thereby prevention of full blown acute coronary syndrome. It is a screening test to differentiate ACS from noncardiac chest pain as well as severity and prognosis of ACS..

Introduction:

ACS includes acute myocardial infarction, unstable angina and sudden cardiac death. It is a chronic process accompanied by a cascade of platelets which results into development of thrombus formation. Platelet activation leads to formation of larger platelets which are more active metabolically and enzymatically leading to formation of thrombus which increases risk of ACS. Platelet size and its activity correlate with platelet indices such as MPV and PDW. Increased values of Platelet parameters lead to prothrombotic stages accelerating the process of myocardial infarction.

The study was conducted in a tertiary care centre to evaluate platelet parameters in cases of ACS and their correlation with clinical details, cardiac biomarkers and ECG findings.

Aim and Objective:

Evaluation platelet parameters such as platelet count, mean platelet volume and platelet distribution width in patients of acute coronary syndrome and their correlation with cardiac biomarkers, clinical details and ECG findings.

Methodology:

The study was a two years cross sectional study of platelet parameters in cases of ACS and was carried out in the haematology section of department of Pathology in a tertiary care hospital during a period from April 2022 to May 2024.

Blood samples of cases of ACS were collected immediately after the admission in EDTA vacutainers and were analysed in five part haematology analyser. Platelet parameters were analyzed in relation to clinical symptoms, ECG findings and cardiac biomarkers.

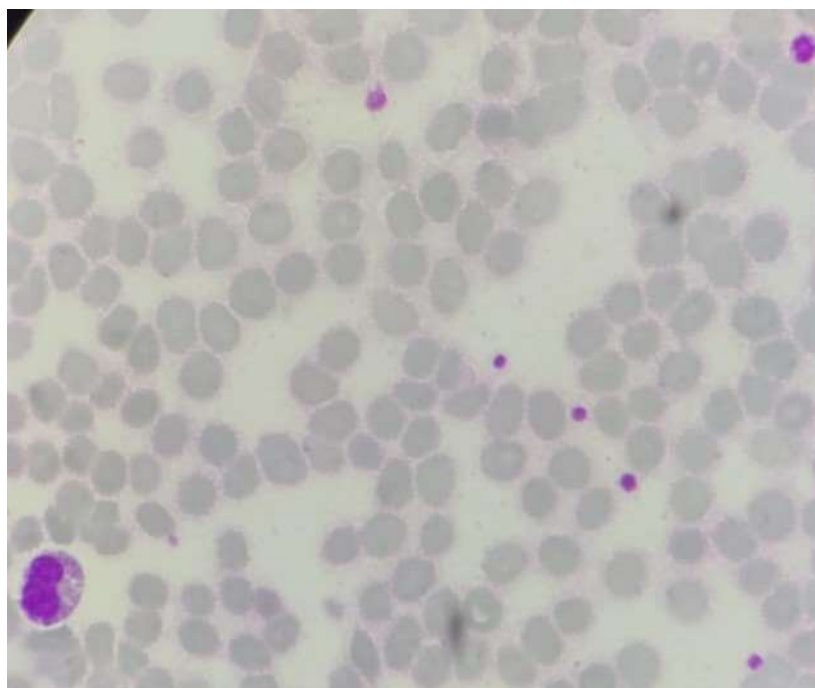
The study was conducted after obtaining ethical clearance from institutional ethical clearance committee.

Observation:

The study involved 150 cases of ACS with 50 age and sex matched controls. Commonest age group was 51-60 years followed by 61-70 years with mean age of 60.2 years. Male preponderance was observed. Commonest clinical presentation was chest pain (94%), followed by sweating (70%) and breathlessness (50%). ACS comprised of ST Elevation Myocardial Infarction (STEMI) – (74.66%), Non-ST Elevation Myocardial Infarction (NSTEMI) – (20%) and Unstable Angina (UA) – (5.33%).

Platelet Count (PC) ranged from 1.5 – 3.3 lacs/cumm with mean value of 1.7 lacs/cumm which was lower compared to control group i.e. 2.9 lacs/cumm and it was statistically significant. Mean value of MPV was higher in cases i.e. 12.24 fL than that of control i.e. 9.14 fL, this indicated statistically significant result with t test ($p < 0.0001$). Also, Mean value of PDW was higher 16.8 fL in cases than that of control i.e. 9.93 fL, this indicated statistically significant result with t test ($p < 0.0001$). The observation was confirmed with peripheral smear findings which revealed larger platelets with raised PDW.

Figure 1: Peripheral smear showing large platelets on the background of RBCs and Leucocytes (Leishman stain 1000x)



A raised Troponin I levels was detected in 112 cases out of 150 cases (74.66%). Mean value of PC was lower while MPV and PDW were higher in Troponin I positive cases than that of Troponin I negative cases and controls which was statistically significant with T test ($p < 0.0001$).

Table 1: Distribution of mean values of platelet parameters (PC, MPV and PDW) in Troponin positive, Troponin negative cases and controls.

Parameters (Mean value)	Troponin positive cases (n= 112)	Troponin negative cases (n = 38)	Controls (n=50)
PC in lacs/cumm (1.5-3.31 lacs/cumm)	1.72	2.01	2.92
MPV in fL (7-11.5 fL)	12.5	11.3	9.14
PDW in fL (8-16 fL)	17.1	13.4	9.93

CKMB levels were raised in 117/150 cases (78%) with mean value of 49.9 IU/L.

Table 2: Distribution of mean values of platelet parameters (PC, MPV and PDW) in CKMB (+ve), CKMB (-ve) cases and controls.

Parameter (Mean value)	CKMB (+ve) (n= 117)	CKMB (-ve) (n= 33)	Controls (n=50)
PC in lacs/cumm	1.75	1.97	2.92
MPV in fL	12.5	12.2	9.14
PDW in fL	16.7	14.6	9.93

The t test was significant ($p < 0.0001$) between CKMB +ve cases, CKMB -ve cases and controls separately

ECG changes: In present study, documented data retrieved from 150 patients showed 112 (74.6%) patients having ST elevation myocardial infarction, 30 (20%) patients had non ST elevation myocardial infarction and 8(5.33%) patients had unstable angina.

Table 3: Distribution of ECG changes with Mean values of PC,MPV and PDW.

Parameter (Mean value)	STEMI (n = 112)	NSTEMI (n = 30)	UA (n= 08)	One Way ANOVA test (p value)
PC in lacs/cumm	1.79	1.81	2.01	<0.04
MPV in fL	13.3	12.0	10.9	<0.03
PDW in fL	16.3	16.2	15.1	<0.0001

One way ANOVA test, the p value was statistically significant in PC, MPV and PDW. Mean PC count was lower and Mean MPV and PDW showed higher values in STEMI.

Discussion:

The present study was a two years cross sectional study of platelet parameters in cases of ACS and was carried out in the haematology section of department of Pathology in a tertiary care hospital during a period from April 2022 to May 2024.

Platelets play important role in etiology of ACS, activation of platelets leading to abnormal platelet function is an important cause of ACS. Bigger platelets are more active and have high levels of Thromboxane A2 and Procoagulants and are more adhesive which impact platelet functioning. Thus, patient's platelet count and platelet size are linked to high mortality rate¹.

In this study, it was found that 45 (30%) patients were from 51 -60 years of age group out of 150 cases of acute coronary syndrome. Mohammed Imran khan², Aizaz fatima³, Surya Tiwari⁴, Malepati et al⁵, Pal et al⁶ and R Bugiardini⁷ in 2024 have documented maximum cases of acute coronary syndrome patients of similar age group.

Male predominance was observed in our study, i.e. 102 males (68%) against 48 females (32%). Similar observation was noted in various studies like Ekta Paramjit, S Sudhamani, Anita Sharan et.al, Kumar V, Melhotra S, Ahuja Ret RC, Shratch et al ^{8,9,10}.

In our study, majority of the patients of ACS presented with the complaints of chest pain (94%), followed by sweating (70%), followed by breathlessness (50%). The other presenting symptoms were giddiness (30%) and palpitations (25%)

Brian A Bergmark, Njambi Mathenge, Piera A Merlini et al. have reported 90% Of acute coronary syndrome cases presented with complaints of chest pain followed by sweating (50%), breathlessness (42%)¹¹.

In present study, documented data retrieved from 150 patients showed 112 (74.6%) patients having ST elevation myocardial infarction, 30 (20%) patients had non-ST elevation myocardial infarction and 8(5.33%) patients had unstable angina.

Our study showed increase platelet indices in patient with ACS compared to controls. MPV and PDW were significantly higher in STEMI compared to NSTEMI and UA. Increase MPV leads to prothrombotic state and bigger platelet may have significant influence in pathogenesis of myocardial infarction. MPV is an index of platelet associated activity. Increase MPV indicates large platelet size which indicates platelet hyperactivity, accelerating formation of thrombus and leading to major cardiovascular events. The mean value of MPV among cases was higher, i.e. 12.24 fL than that of controls. i.e. 9.148 fL. Malepati et al.,⁵ Pal et al.,⁶ Abbas et al ¹² and Akula et al.¹³ have found a similar observation in cases of acute coronary syndrome.

Cardiac Biomarkers have importance in diagnosis of ACS. Among this cardiac troponin and CKMB are most sensitive and specific marker of MI. CKMB is rapidly released after MI and peaks in 12-24 hours and comes to baseline within 48-72 hrs. Hence it has limited value in early and late diagnosis of acute MI. Our results revealed a significant positive correlation between CKMB levels, MPV and PDW suggesting that this platelet parameters can play important role in predicting MI risk when values of CKMB are raised.

A strong positive correlation observed between cardiac troponin I levels, MPV and PDW in patients of ACS. The connection between platelet activity indicated by MPV and PDW and myocardial damage in ACS is highlighted by this positive association. While troponin continue to be a best ACS biomarker, MPV may provide supplementary data on platelet reactivity and thrombotic risk. The integrated strategy helps in risk assessment and therapy choices which enhance patient care.

Conclusion:

Platelet parameters is a simple, cost effective and easily available important tool in predicting outcome of cases of acute coronary syndrome. Deranged platelet parameters in cases of acute coronary syndrome showed statistical significance, which proves its utility as a biomarker for acute coronary syndrome. Platelet parameters play an important role in early diagnosis of acute coronary syndrome and initiation of antiplatelet therapy thereby prevention of full blown acute coronary syndrome. It can be used as a screening test to differentiate ACS from noncardiac chest pain as well as severity and prognosis of acute coronary syndrome. Platelet parameters can be used as a preliminary test to identify increase in risk for ACS along with other supportive clinical investigations

Bibliography:

- 1) Bobescu E, Covaciu A, Rus H, Radoi M, Badea M, Moga SN, et al. Correlation of cardiovascular risk factors and biomarkers with platelet reactivity in coronary artery disease. *Am J Ther.* 2019 Sep 1;26(5): e563-9.
- 2) Van der Meijden PE, Heemskerk JW. Platelet biology and functions: new concepts and clinical perspectives. *Nat Rev Cardiol.* 2019;16:166-79.
- 3) Nagareddy PR, Noothi SK, Flynn MC, Murphy AJ. It's reticulated: the liver at the heart of atherosclerosis. *J Endocrinol.* 2018;238:R1-11.
- 4) Kaplan ZS, Jackson SP. The role of platelets in atherothrombosis. *Hematology Am Soc Hematol Educ Program.* 2011;2011:51-61.
- 5) Malepati B, Hanifah M, Prasath A. Mean platelet volume in acute coronary syndrome. *Indian J Appl Res* 2016;6:369–71.
- 6) Pal R, Bagarhatta R, Gulati S, Rathore M, Sharma N. Mean platelet volume in patients with acute coronary syndromes:A supportive diagnostic predictor. *J Clin Diagn Res* 2014;8:MC01–4.
- 7) Ruggeri ZM. Platelets in atherothrombosis. *Nat Med* 2002; 8:1227-34.
- 8) Ridvan M, Cengiz D, Imdat D, Muntecep A, Murat A. Mean platelet volume in acute coronary syndrome. *Van Tip Dergisi:* 2010; 17(3):89-95
- 9) Kumar V, Melhotra S, Ahuja Ret RC and Viash AK, Platelet and Acute Coronary syndrome *J Fam Med.*2016; 3(4): 1063
- 10) Liaw CC, Huang JS, Chen JS, et al. Using vital sign flow sheets can help to identify neoplastic fever and other possible causes in oncology patients: a retrospective observational study. *J Pain Symptom Manage* 2010;40: 256–65.
- 11) Safdar B, Spatz ES, Dreyer RP, et al. Presentation, clinical profile, and prognosis of young patients with myocardial infarction with nonobstructive coronary arteries (MINOCA): results from the VIRGO study. *J Am Heart Assoc* vol 399,2022, 1347-58.
- 12) Abbas A, Yasir T, Saeed Y et al. Investigation of platelet count and indices in coronary artery disease among Sudanese patients. *J. Med. Dent. Sci.*2016;15(1):35-38.
- 13) Akula S.P., Krishana V.S.K., Krishna J.R. A study of platelet indices in acute myocardial infarction: an observational study. *J. Med. Dent. Sci.* 2017;16(6):10–13