



The Study of Correlation between Different Complete Blood Count Parameters in Acute Coronary Syndromes

Abhey Chawla, Mahesh H Karigoudar, Anil K Reddy, Parul, Mahmood Nawaz Khan

1. Demonstrator, Department of Pathology, Maharaja Agrasen Medical College, Agroha, Hisar, Haryana, India. 2. Professor, Department of Pathology, Shri B.M.Patil Medical College and Hospital, Vijayapura, Karnataka, India. 3. Assistant Professor, Department of Pathology, Shri B.M.Patil Medical College and Hospital, Vijayapura, Karnataka, India. 4. Demonstrator, Department of Anatomy, Maharaja Agrasen Medical College, Agroha, Hisar, Haryana, India. 5. Consultant, Department of Pathology, Vijaya Diagnostic, Hyderabad, Telangana, India.

Correspondence Address :

Dr. Abhey Chawla,

House No.736, Sector 15A, Near Shivalik Park, Hisar, Haryana, India.

E-mail: abhey8891chawla@gmail.com

ABSTRACT



: Red Blood Cell (RBC) count, White Blood Cell (WBC) count, Platelets and their indices correlates with increased risk and severity of Acute Coronary Syndrome (ACS).

Aim: To assess various haematological parameters like WBC, Absolute Neutrophil Count (ANC), Absolute Lymphocyte Count (ALC), Neutrophil Lymphocyte ratio (NLR), Mean Platelet Volume (MPV), Platelet Distribution Width (PDW) and all RBC parameters in patients diagnosed with ACS as risk predictors.

Materials and Methods: A prospective hospital based study was carried out on 116 cases with ACS and 116 controls (age and sex matched) from 1st November, 2015 to 30th June, 2017 considering the inclusion and exclusion criteria.

Results: The incidence of ACS in males (72.4%) was more as compared to females (27.6%). The most commonly affected age group was 5th decade. Total WBC count, ANC, ALC, NLR, MCHC, MPV and PDW showed significant association in ACS compared with healthy control group and in concordance with biochemical or electrocardiography results.

Conclusion: The study concludes that Total WBC count, ANC, ALC, NLR, MCHC and PDW parameters can give clinician a helping hand in diagnosis, assessing severity and timely interventions in cases of ACS admitted in intensive care units.

Keywords : Absolute neutrophil count, Absolute lymphocyte count, Neutrophil lymphocyte ratio

INTRODUCTION



Ischemic Heart Disease (IHD) is a group of syndromes with similar pathophysiology resulting from imbalance between myocardial supply and demand (1). According to World Health Organisation, coronary

vascular disease represents one-third of all global deaths. In India, 1/4th of mortalities are due to cardiovascular diseases (2),(3).

Patients with IHD are classified into two groups:

◆ Patients with chronic Coronary Artery Disease (CAD) ◆ Patients with ACS

ACS represents patients with ST-elevation myocardial infarction on their presenting electrocardiogram and non-ST elevation ACS. The latter includes non-ST elevation myocardial infarction and those with unstable angina (4).

High blood cell counts, mainly neutrophil counts, platelet counts, their ratios and various other haematological parameters are strong and independent predictor of cardiovascular disease. As this is indirectly related to inflammation leading to increase in total count, neutrophil count, platelet hypersensitivity and platelet activation, so changes in these parameters will invariably be helpful in diagnosis and risk stratification in IHD (2),(4).

The most sensitive and specific biomarkers of myocardial damage are Troponin T and I, level of both begin to rise within 2-4 hours and reaches peak value at 48 hours. Creatinine kinase enzyme begins to rise within 2 to 4 hours of onset of event and peaks at about 24 hours and comes back to normal within approximately 72 hours (1),(4).

Patients admitted in coronary care units undergo excessive testing usually done in focused attempts to diagnose various coronary events. Despite the important influence of blood elements on the process of formation of arterial thrombus and in various stages of atherosclerosis, these routine haematological parameters which are easily recorded by automated cell counters which are available in most of the laboratories are traditionally not considered as biomarkers for identifying high risk patients.

The purpose of study was to contribute further to improve the efficacy of these haematological parameters as prognostic markers in ACS, which will lead to saving of enormous number of life, even in limited resource setting (5),(6),(7).

After a thorough search of literature, studies have been done in relation to platelets in region of north Karnataka but this study is exclusive in regards for inclusion of parameters of RBCs, WBCs and platelets.

MATERIAL AND METHODS



A prospective hospital based study was carried on 232 subjects from 1st November 2015 to 30th June 2017. There were 116 patients with ACS which were included in the study and compared with 116 normal healthy controls (age and sex matched) having a normal electrocardiogram and no past history of IHD.

The study was undertaken after obtaining approval from ethical committee. After taking the informed consent, all patients were interviewed as per Performa prepared and then complete clinical examination was done. The blood samples were collected from antecubital vein using aseptic precautions and analysed by standard procedure using 6 part differentiated automated Haematology analyser (Sysmex XN1000) (8). Peripheral smear of all cases were studied. Relevant investigations like electrocardiogram and cardiac enzymes were performed.

Inclusion criteria: Patients diagnosed with myocardial infarction and unstable angina was included in study.

Exclusion criteria: Patients of coronary artery disease with haematological malignancies, systemic inflammatory disease and infectious causes, were excluded from study.

Statistical Analysis

For continuous variables, the summary statistics of mean, Standard Deviation (SD) were used. For categorical data, the number and percentage were used in the data summaries. Chi-square (?)/ Freeman-

Halton Fisher-exact test was employed to determine the significance of differences between groups for categorical data. The difference of the means of analysis variables between two independent groups was tested by unpaired t-test. If the p-value was <0.05 , then the results were considered to be statistically significant otherwise it was considered as statistically non-significant. Data were analysed using SPSS software v.23.0. and Microsoft office 2013.

RESULTS



A total of 232 subjects participated in the study, which were divided into 116 case group and 116 in control group, with 84 males and 32 females in case group. Age distributions between male and females were calculated, which indicates that as age increases male to female ratio decreases. In younger age group (3rd decade), it is 4:1 but as age increases, ratio reduces from 2.90:1 to 2.11:1 in 5th decade and 6th decade, respectively ([Table/Fig 1](#)), ([Table/Fig 2](#)).

The mean value for total WBC count ($\times 10^3$ per μl) in case and control group were statistically significant with p-value <0.001 at 5% level of significance. Mean values in study and control group came out to be giving statistically significant p-value <0.001 in both ANC and ALC. One of the important parameter which was derived in our study was Neutrophil to Lymphocyte ratio (NLR), had significant p-value of <0.001 ([Table/Fig 3](#)).

In present study, various other RBC parameters which were also evaluated, like Haematocrit (%) (HCT), Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH) (g/dL), p-value of all these parameters was statistically non-significant. But out of all RBC parameters, a MCHC (g/dL) was significant with p-value <0.001 ([Table/Fig 4](#)).

PDW (fl) and MPV (fl) were two of platelet parameters considered in this study. The p-value of these both platelet parameters (MPV, PDW) was statistically significant ([Table/Fig 5](#)).

DISCUSSION



Extensive research in the past decade has led to establishing atherosclerosis as an inflammatory disease, which has opened potential for new parameters in predicting Coronary Heart Disease (CHD). Although myocardial infarction is traditionally considered an older patients disease which are above 45 years but now-a-days lot of younger men and women are also getting affected. There is an increase in the prevalence of heart disease among specific ethnic groups like Asian Indian origin, these people are at risk of myocardial infarction at a much younger age as compared to rest of the world population due to association with complex coronary artery abnormalities. In this context, potentially 80% of cardiovascular disease cases are preventable due to modifiable risk factors but still mortality continues to rise, mainly because of ineffective and insufficient preventive measures ([4](#)), ([9](#)), ([10](#)), ([11](#)).

Almost all of the cellular elements of blood like WBCs, RBCs and Platelets are involved in pathogenesis of atherosclerosis and its complications. These cellular elements not only plays a role in development of CHD, but can also help in predicting any recurring event and even death in previously diagnosed CHD patients ([4](#)).

In the present study, overall male to female ratio was 2.6:1, but among the various age groups between males and females, as age increases it was noted male to female ratio has decreased. In younger age group (3rd decade) it was 4:1 but as age increases ratio reduced to 1.57:1 (>70 years). The most affected group were in 5th and 6th decade with least were in 3rd decade (8.2%) ([Table/Fig 1](#)), ([Table/Fig 2](#)). It is widely accepted that post-menopausal women lose the protective action of endogenous oestrogen on vascular endothelium, which lead to increased risk of CAD which was comparable with the findings of present study. An average age of onset of CVD is younger among Indians than the rest of the world. Affected age for the developed world is >45 years but in Indian setup affected age is between 35 to 64 years, which correlates with this study where 75.8% of subjects were between 4th to 6th decades of life ([12](#)). Study subjects above 70 years accounted for 15.5% of present case subjects. In present study mean age for case group was 57.91 \pm 11.36 years and 57.99 \pm 11.64 years in control group.

The prevalence of CVD is higher in males than females though the mortality due to CVD is higher among females. The Framingham study showed that women have a lower incidence of CAD than men do, until the age of 75 years (12),(13).

The leukocyte count has been correlated with CHD since 1920s. Large number of studies has been conducted in CHD free populations over several decades to show positive correlation between leukocyte count and risk of CHD (14).

Not just high neutrophil count but also lymphopenia also contributes to worse clinical outcome with ST-elevation myocardial infarction. Thus, NLR has emerged as an effective indicator of inflammatory state in various clinical studies (15). NLR has also emerged as an indicator of early and late clinical outcomes in patients of ST-elevation myocardial infarction undergoing primary percutaneous coronary intervention (16).

In various studies done by Demir K et al., (17), Zhang GY et al., (18), Selcuk H et al., (19), Erkol A et al., (20), Bajari R et al., (21) have shown that NLR is not only an independent predictor of presence of CAD but also can be helpful in long term mortality prediction (17),(18),(19),(20),(21). Present study results as shown in (Table/Fig 6), were also indistinguishable from these studies between coronary pathology and NLR.

Total WBC counts, ANC, ALC, NLR were showing significant association with ACS. The result represents a strong correlation with presence of neutrophils. These neutrophils release proteolytic neutral proteases which lead to detachment of endothelial cells from vessel walls along with adherence of platelets to sub-endothelial collagen. In activated stage, neutrophils also release large amount of chemotactic agent Leukotriene B4 and also many inflammatory mediators (22),(23).

In RBC parameters like Hb, HCT, RBC, MCV, MCH, MCHC were studied and only MCHC was the only affected parameter which was significantly correlating in the case group but the possible mechanism is not well understood, it was proposed in literature that MCHC has to be considered as an inflammatory marker (24).

In platelet parameters, MPV and PDW both were statistically significant in ACS patients. These results were comparable to other studies done in literature (25),(26),(27),(28). Main mechanism is the result of inflammatory cytokines and acute cellular response due to inflammation. Though few studies also showed no significant correlation between platelet parameters. Larger studies are required to further validate the results.

Limitation

Larger sample size studies are required to substantiate the results. The present study has not segregated smokers/non-smokers and parameters of lipid profile were not considered. Follow-up of patients and outcome has to be considered. Platelets with qualitative disorders and causes of reactive platelets were not assessed.

CONCLUSION



The study concluded that various complete blood count parameters were analysed in patients with ACS and found to be statistically significant except MCHC. These parameters should be utilised for prognostication and timely management of patients admitted in ICU diagnosed with ACS as they are readily available and inexpensive.

Future recommendations

- ◆ For routine CBC haematology report in addition, we recommend to include ANC, ALC, NLR, MPV and PDW for the patients admitted in intensive care unit for reason of CVD.
- ◆ Awareness and utility of these new parameters to the residents and critical care specialists for timely intervention in ACS patient management for better outcome.

◆ NLR can also be used for risk stratification in cases of previously diagnosed IHD patients.

REFERENCES

1. Schoen FJ, Mitchell RN. The Heart. In Kumar V, Abbas AK, Aster JC (editors). Robbins and Cotran Pathologic Basis of Disease. 9th ed. South East Asia: Elsevier. 2014;p.523-78.
2. Anand IS, Chhabra ST, Ischemic heart disease. In: Munjal YP, Sharma SK, Agarwal AK, Gupta P, Kamath SA, Nadkar MY et al. API textbook of Medicine.10th ed. Gurgaon. Jaypee Brothers Medical Publishers;2015:p.890-897.
3. Cardiovascular diseases (CVDs); WHO fact sheet [Internet]. 2015 [cited 2017 Oct 07]; Available from <http://www.who.int/mediacentre/factsheets/fs317/en/>
4. Loscalzo J, Antman EM, Ischemic Heart Disease. In: Kasper S, Fauci A, Hauser SL, Longo DL, Jameson JL and Loscalzo J(editors). Harrison's principles of internal medicine. 19th ed New York: McGraw-Hill 2015.p1578-92.
5. Lassale C, Curtis A, Abete I, van der Schouw YT, Verschuren WM, Lu Y. Elements of the complete blood count associated with cardiovascular disease incidence: findings from the EPIC-NL cohort study. Scientific Reports. 2018;8(1):3290.
6. Turner SJ, Ketch TR, Gandhi SK, Sane DC. Routine hematologic clinical tests as prognostic markers in patients with acute coronary syndromes. Am. Heart J. 2008;155(5):806-16.
7. Fajar JK, Mahendra AI, Tamara F, Mahdi BA, Heriansyah T, Rohman MS. The association between complete blood count and the risk of coronary heart disease. T \u2666 rkiyeKlinikleri. Tip BilimleriDergisi. 2019;39(1):56-64.
8. Jury C, Nagai Y, Tatsumi. Collection and handling of blood. In Bain BJ, Bates I, Laffan MA, Lewis SM (editors). Dacie and Lewis Practical Haematology. 11th ed. International: Elsevier Churchill Livingstone. 2012:p1-9
9. Egred M, Viswanathan G, Davis GK. Myocardial infarction in young adults. Postgraduate Medical Journal. 2005;81(962):741-45.
10. Ozdemir S, Barutcu A, Gazi E, Tan YZ, Turkon H. The relationship between some complete blood count parameters and myocardial perfusion: A scintigraphic approach. World J Nucl Med. 2015;14:197-201.
11. N \u2666 ez J, Sanchis J, Bod \u2666 V, N \u2666 ez E, Mainar L, Heatta AM, et al. Relationship between low lymphocyte count and major cardiac events in patients with acute chest pain, a non-diagnostic electrocardiogram and normal troponin levels. Atherosclerosis. 2009;206(1):251-57.
12. Bhatnagar D, Durrington PN, Sutton GC. Coronary risk factors in people from the Indian subcontinent. The Lancet. 1995;345(8955):982-83.
13. Reddy KS, Satija A. The framingham heart study: Impact on the prevention and control of cardiovascular diseases in India. Progress in Cardiovascular Diseases. 2010;53(1):21-27.
14. Madjid M, Fatemi O. Components of the complete blood count as risk predictors for coronary heart disease. Tex Heart Inst J. 2013;40:17-29.
15. N \u2666 ez J, N \u2666 ez E, Bod \u2666 V, Sanchis J, Mi \u2666 ana G, Mainar L, et al. Usefulness of the neutrophil to lymphocyte ratio in predicting long-term mortality in ST segment elevation myocardial infarction. Am J Cardiol. 2008;101(6):747-52.
16. Naz S, Ali Z, Akhtar B. Neutrophil lymphocyte ratio in coronary artery disease. PJHMS. 2014;8(1):69-71.
17. Demir K, Avci A, Altunkeser BB, Yilmaz A, Keles F, Ersecgin A. The relation between neutrophil-to-lymphocyte ratio and coronary chronic total occlusions. BMC Cardiovascular Disorders. 2014;14(1):130.
18. Zhang GY, Chen M, Yu ZM, Wang XD, Wang ZQ. Relation between neutrophil to lymphocyte ratio and severity of coronary artery stenosis. Genet Mol Res. 2014;13(4):9382-89.
19. Selcuk H, Dinc L, Selcuk M, Maden O, Temizhan A. The relation between differential leukocyte count, neutrophil to lymphocyte ratio and the presence and severity of coronary artery disease.

OJIM. 2012;2(03):163-69.

20. Erkol A, Turan B, Oduncu V, Kiliğedik A, Karabay CY, Akgön T, et al. Neutrophil to lymphocyte ratio in acute ST-segment elevation myocardial infarction. *The American Journal of the Medical Sciences*. 2014;348(1):37-42.
21. Bajari R, Tak S. Predictive prognostic value of neutrophil-lymphocytes ratio in acute coronary syndrome. *Indian Heart J*. 2017;69(1):S46-50.
22. Adam AM, Rizvi AH, Haq A, Naseem R, Rehan A, Shaikh AT, et al. Prognostic value of blood count parameters in patients with acute coronary syndrome. *Indian Heart J*. 2018;70(2):233-40.
23. Tsai IT, Wang CP, Lu YC, Hung WC, Wu CC, Lu LF, et al. The burden of major adverse cardiac events in patients with coronary artery disease. *BMC Cardiovasc Disord*. 2017;17(1):1-13.
24. Huang YL, Hu ZD. Lower mean corpuscular haemoglobin concentration is associated with poorer outcomes in intensive care unit admitted patients with acute myocardial infarction. *Ann Transl Med*. 2016;4(10):190.
25. Chu SG, Becker RC, Berger PB, Bhatt DL, Eikelboom JW, Konkle B, et al. Mean platelet volume as a predictor of cardiovascular risk: A systematic review and meta-analysis. *J Thromb Haemost*. 2010;8(1):148-56.
26. Khode V, Sindhur J, Kanbur D, Ruikar K, Nallulwar S. Mean platelet volume and other platelet volume indices in patients with stable coronary artery disease and acute myocardial infarction: A case control study. *Journal of Cardiovascular Disease Research*. 2012;3(4):272-75.
27. Manchanda J, Potekar RM, Badiger S, Tiwari A. The study of platelet indices in acute coronary syndromes. *Annals of Pathology and Laboratory Medicine*. 2015;2(1):A30-35.
28. Yuksel M, Yildiz A, Oylumlu M, Akyuz A, Aydin M, Kaya H et al. The association between platelet/lymphocyte ratio and coronary artery disease severity: inconsistency between forms of the disease. *Anatol J Cardiol*. 2015;15:640-47.

TABLES AND FIGURES



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